DISEASES of the MAMMARY GLAND

LEBLANC - NUNN

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BY

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PREFACE BY THE TRANSLATOR.

THE subject-matter of these pages has already appeared in the *Veterinary Journal* for 1903. The diseases of the Mammary Gland of the Cow are at the present moment a matter of serious attention to sanitary authorities, it being universally admitted that in certain conditions the milk is unfit for human food. M. Leblanc's work is one recognised as a text-book on this subject on the Continent, and it was suggested to me by my friend Professor W. Owen Williams, President of the Royal College of Veterinary Surgeons, that I should translate it into English. This I did, and at the suggestion of Messrs. Baillière, Tindall & Cox it was brought out in monthly parts in the *Veterinary Journal*, but several professional friends having expressed their approval of it, it is now offered in the form of a book.

The text of the original work has been strictly adhered to, the only alteration being the rendering of certain French idioms into English. I must acknowledge the courtesy of the Author for the kind way in which he gave permission to translate his book, and for the use of the original Illustrations; also to the Publishers, MM. Asselin & Houzeau, for the liberal spirit they have shown in assisting to place a valuable work within the reach of English-speaking Veterinary Surgeons.

JOSHUA A. NUNN.

LONDON, *May* 1904.

PREFACE BY THE AUTHOR.

I HAVE the honour to present this small work on the Diseases of the Mammary Gland to the Veterinary Profession. For several years I have paid special attention to the study of these Diseases, and almost all the pathological conditions described have come under my own observation, enabling me to confirm the work of those authors who have preceded me, and whose writings I have freely made use of, in particular those of Professor Mathis.

My friend and colleague, M. V. Ball, has written most of the Chapter on Tumours, and my readers will agree with me that I could not have had a more competent collaborator.

I must also convey my best thanks to my Publishers, MM. Asselin & Houzeau, for the care and trouble they have taken in bringing out this little work.

P. LEBLANC.

LYONS.

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ANATOMY.

THE mammæ are the glandular organs of the mammiferæ that secrete milk for the sustenance of the young animal. Their number, situation, size, and shape varies in the different species. It is proposed first to give a general description of the organs, and afterwards describe the variations that occur in the different domestic animals.

The mammæ are present in both sexes, but only developed in the female, the number, situation, connection, and shape differing in each species of animal. They are composed of (1) skin; (2) a subcutaneous layer of cellular and adipose tissue; (3) an elastic and fibrous layer; (4) the parenchyma of the gland proper.

1. The skin calls for no special remarks.
2. The cellular adipose tissue is merely the connective tissue that unites the gland to the skin. It gives off processes into the gland tissue, together with the fibrous elastic layer. This layer does not extend below the teat.
3. The elastic fibrous layer is in connection with the cellular adipose one, and forms a separate envelope for each gland. The larger the gland the greater is the number of elastic fibres present. In the mare this envelope is of a yellow colour, in the other domestic animals nearly white.
4. *Parenchyma.*—The mammæ are racemose glands composed of a series of lobules, which in their turn are made up of

culs de sac and acini. The lobules are in connection with the excretory canals, which at first are intra, afterwards extra lobular. The lobules are united to each other by a connective stroma, in which the vessels ramify.

5. The excretory apparatus consists of (*a*) lactiferous ducts; (*b*) galactopherous sinuses or reservoirs; (*c*) the excretory or mammary canals.

The lactiferous ducts commence in the gland vesicles, and unite, ultimately emptying into the galactopherous sinuses. The galactopherous sinuses are cavities at the base of the teat, into which the lactiferous ducts converge. They are lined by a fine mucous membrane, that is, arranged in more or less well-developed folds.

The teats are the organs designed for the support of the young by suction of the milk, and are well adapted for that purpose. They are hollow, sometimes with one large tube, in other cases with a number of smaller ones running parallel to each other. Above the tubes open into the galactopherous sinuses, and at the extremity of the teat by one or more openings externally. The opening of the tubes is surrounded by the skin, and bundles of connective elastic and muscular tissue are disposed in rings round it. This tissue, by reason of its tone and elasticity, fulfils the part of a sphincter, preventing the escape of the milk, and thus allowing it to accumulate in the sinuses.[1]

MAMMÆ OF THE MARE.

The mare has two mammæ situated in the inguinal region, with two conical shaped teats, provided at the free extremity with two orifices. The skin is thin and black or marbled, and covered with fine hair. Each gland is attached to the abdomen by two suspensory ligaments formed of elastic fibrous tissue. The lactiferous ducts open into the galactopherous sinuses, that are always two, and sometimes even more in number, and which communicate with each other.

MAMMÆ OF THE COW.

The mammæ of the cow are composed of four quarters, from

[1] J. Barrier. Dictionn. de Bouley et Reynal, art. Mamelles, page 368.

each of which depends a long teat. The four quarters are united together in pairs, and are arranged symmetrically. In some cows there are two supplementary teats on the posterior portion of the gland. Usually these are unprovided with a duct or gland tissue, but in certain cases they are fully developed, being provided with an excretory duct, and giving a few drops of milk.

The duct in the cow is straight, and the teat in the form of a truncated cone, about two and a half to three inches long. It is devoid of hair, sebaceous or sudoriparous glands.

There is a single galactopherous sinus into which all the lactiferous ducts empty themselves. The lining mucous membrane of the sinus is arranged in folds, and at the bottom of each are small acini. There are a considerable number of muscular fibres arranged around the excretory canal, and extending some way up the base of the sinus. The mucous membrane lining the excretory canal has no glands, and is of the squamous variety.

In the teat are a number of circular muscular fibres round the canal, that have been described as sphincters.

Each teat has a large venous system connected in front with the subcutaneous abdominal, laterally with the external pudic, and posteriorly with the perineal vein.

There are numerous lymphatic vessels that are connected with a large ganglion situate on the posterior quarter of the gland.

MAMMÆ OF THE EWE.

There are two glands in the ewe, with two long cone-shaped teats, each with a single orifice.

Over the sides the skin forms a pocket abundantly furnished both with sebaceous and sudoriparous glands. The teats have fine wool on them.

At the free end of the teat are a number of large sebaceous glands arranged round the opening of the canal.

MAMMÆ OF THE GOAT.

The goat has two well-developed mammæ, with two large and long teats, that are inclined forwards. They are devoid of hair, and the aponeurotic layer is wanting.

MAMMÆ OF THE SOW.

In the sow the mammæ extend along each side from the inguinal region to the chest—five or six on either side, and each with a short broad teat. The gland is devoid of hair; there are two, sometimes three, orifices, and numerous small galactopherous sinuses. There is a sphincter muscle round each lactiferous canal, which divides them from each other.

MAMMÆ OF THE CARNIVORA.

They much resemble those of the sow. The bitch has five on each side, with short truncated teats, with usually six orifices. There is no galactopherous sinus, the lactiferous canals running direct into each other. The excretory duct is surrounded with bands of muscular fibres.

The cat has four mammæ on each side, two pectoral and two ventral. Each teat has two openings, and, as in the mare, large sebaceous glands on each side.

The pectoral glands of the carnivora are supplied with blood by the external and internal thoracic arteries.

HISTOLOGY.

As before mentioned, the mammæ are made up of a number of small lobules, resembling bunches of grapes, united together with a fibrous stroma.

FIG. 1.—Lobules during lactation (Arloing).

Each gland studied separately comprises excretory canals and secretory *culs de sac.*

Secretory Culs de Sac.—The acini are round or pyriform, and measure from one-tenth to one-twentieth of a millimetre. They consist of a basement membrane, Ball's cells, and glandular cells. The basement membrane is very thin and of a hyaline structure. The cells of Ball cover this membrane, they are contracted, and discharge the milk after secretion.

The glandular cells are arranged in a single layer on the internal face of this membrane, and define a

central cavity in which the secretion accumulates. In a section of a lobule it is easy to demonstrate acini in full activity, the cells being swollen and rounded, and, besides, others in a state of com-

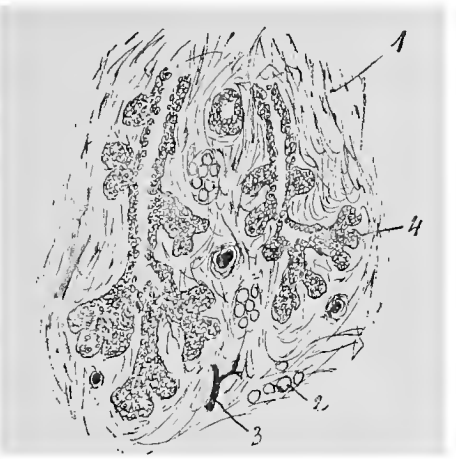

FIG. 2.—Section of virgin mammary gland. 1, connective tissue; 2, fat lobules; 3, blood-vessels; 4, excretory cul de sac and canalicula (Arloing).

parative repose, the cells being prismatic and compressed, with the nuclei ovoid and flat.

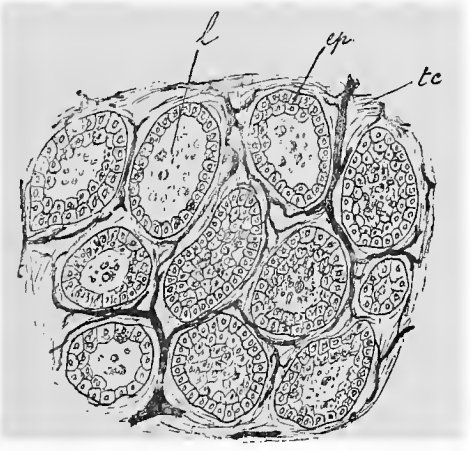

FIG. 3.—Section of active mammary gland. *tc*, stroma of connective tissue and blood-vessels; *ep*, secretory epithelium; *l*, milk globules (Arloing).

The mammary epithelium much resembles that of the sudo-

riparous glands, as both secrete a serous fluid and fatty granules at the same time.

The Secretory Canals.—The milk secreted in the acini is collected by the intralobular canals, which unite to form the interlobular ones, and these in their turn form the galactopherous canal.

1. *The Intralobular Canals* are formed of basement membrane thicker than that of the acini, cells of Ball and an epithelial lining forming a single layer. The epithelium is cylindrical, containing no fatty granules, but a large nucleus that fills up most of the cell.
2. *The Interlobular Canals*, on section, have not a regular cylindrical lumen, like the intralobular, the lining membrane being arranged in folds. They are formed of the same elementary tissues as the former.
3. *The Galactopherous Canals* pass to the sinus, and are formed of a fibrous sheath, a basement membrane, cells of Ball, and an epithelial lining.

Connective Stroma.—The stroma are formed of connective tissue containing but few cells. In the lobule it is exceedingly fine, the *culs de sac* being only separated from each other by the blood-vessels.

The artery supplying the lobule runs along the interlobular canal, also the veins, but in the reverse direction, and the capillaries form a rich plexus round the acini.

The *Lymphatics* are divided into two groups—those belonging to the galactopherous canals and those to the gland.

A. The lymphatics of the galactopherous canals are large, and seated in the fibrous layer that surrounds them. anastomosing with each other, and those of the teat and gland. This fact explains the frequency of glandular complications after injuries to the teat.

B. The lymphatics of the gland are all perilobular. They are composed of lymphatic capillaries and sacs communicating with each other.

C. The mammary nerves have been but little studied, and we are ignorant as to the way they terminate.

DEVELOPMENT OF THE MAMMÆ.

The mammæ are formed from the two types of cutaneous gland—viz., tubular and racemose. The first stage of development consists of local hypertrophy of the mucous layer of the epidermis, which is depressed into the subjacent dermis, forming a depression known as the *glandular area.* The primary cellular mass gives out prolongations which divide it and form it into the mammæ. The *teat* is formed from the glandular area, and may be done in two ways—*first*, by the edges of the glandular area being elevated and forming the teat; *secondly*, the depression of the glandular area, instead of becoming more marked by the elevation of the edges, disappears, and in this way the glandular area rises up to form a projection, which eventually becomes the teat.—(*Roule.*)

PHYSIOLOGY.

WHILE the animal remains virgin no change takes place in the gland ; it remains as an accessory organ, and as such may continue during life, but when impregnated it enlarges, sometimes to a very considerable extent, and becomes œdematous. This œdema in the cow frequently extends to the umbilicus and up between the thighs, obliterating the normal limits of the organ, the teats appearing to be buried in the surrounding tissue.

This increase in volume, with its accompanying tension, is sometimes termed *mammary congestion*. It is a physiological process, and is often very marked, more especially when the animal is young. or, in other words, when the gland is less prepared for the exercise of its functions. Being entirely a physiological phenomenon, we do not propose to enter into further discussion, as it is not accompanied with any trouble, although it is a valuable indication that the gland is entering into a state of activity.

Shortly after parturition the tension and œdema disappear, and the gland returns to the form and dimensions it retains during the period of lactation.

The tension is caused by the enormous influx of blood required for the proper performance of its function, and the veins not being prepared for the return current, stasis takes place, the most marked symptoms being the œdema, which is absorbed when they, "the veins," dilate, and the return flow is fairly established.

The blood carries to the gland the necessary materials for secretion, certain of these being simply filtered, such as water, albumen, and salts ; others, on the contrary, are formed by the cells, viz., caseine, fat, and sugar, the resulting product being the milk.

The first milk is known as *colostrum*, which has purgative properties attributed to it. Amongst primaparæ and animals whose mammæ have never been active it is scanty, but abundant in multiparæ.

Milk is intended by nature to be the sole food for the young, and its composition varies in the different species :—

	Cow.	Goat.	Ass.	Woman.
Water,	86·33	86·85	89·01	87·24
Solids,	13·77	13·52	10·99	9·42
Caseine,	3·23	2·53	3·57	2·91
Albumen,	0·50	1·26		
Butter,	4·50	4·34	1·85	2·67
Sugar of milk,	4·93	3·78	5·05	3·15
Salts,	0·61	0·65		0·14

The secretion lasts for a variable time in different species, according to the requirements of the young. Guinea-pigs are able to move about an hour after birth, and to eat ordinary food in two days. In milking animals the secretion lasts long beyond the requirements of the young animal; being induced artificially by the handling of the teats.

THE MAMMÆ AS EXCRETORY ORGANS—MORBID SECRETIONS.

Before puberty the gland remains dormant, and in both young and very old animals it is small, consisting of a mass of connective tissue in which the gland elements exist, but in an undeveloped condition. It becomes active just before parturition, increasing in size, becoming round, and dropping down, a large proportion of the blood that was required for the growth of the fœtus being diverted to the udder and utilised in the secretion of milk, which is now required for the nourishment of the newly-born animal.

As was the case while *in utero*, the young animal lives the same life as the mother, many causes that affect her health being remitted to the offspring. Like the blood, the milk becomes the vehicle for injurious products formed in the body of the mother, either by abnormal physiological or pathological processes.

Even if the gland itself is incapable of elaborating deleterious excretions, it without doubt allows some that are present in the blood to pass through it, and plays an important part in the process of elimination, the milk being capable of receiving certain constituents which normally are foreign to it,—viz., soluble and odoriferous matters and micro-organisms.

1. *Soluble Matters.*—Any one who has had to do with milking cows is aware that the quality of the milk is liable to variations according to the condition of the animal.

There is no occasion to mention a state of disease, as no one

will deny that under such conditions the milk will undergo changes.[1]

There are, however, other less known factors to be remembered.

Of these *feeding* is the most important. This is proved by the well-known fact that if sucking sows get too heating or tonic food the young pigs are liable to disorders, which cease when the mother is put on to a more hygienic *régime*, proving that the milk possesses certain irritating properties. The same is seen with the calf, and if the milk from such a cow is used for invalids or infants it is very soon followed by colic, indigestion, and diarrhœa.

Permanent Housing has equally well-marked effects.

Work influences the quality and the quantity of the milk more than its taste. Volpe has shown that after work there is a loss of 1·120 butter, 0·44 caseine and albuminoids, and 0·55 sugar per cent.; also that the milk is slightly acid.[2]

Œstrum has an effect on the milk. In many cases it has a strong smell, and in the case of nymphomaniacs the meat has a disagreeable odour, which, however, is removed by cooking, and in which the milk usually participates. Cornevin in his treatise "Traite de Zootechnie," mentions that calves sucking mothers that were in season became attacked with diarrhœa.

It is well known that certain drugs are eliminated by the mammæ, their presence being detected in the milk, communicating to it their taste and properties. Guinard has detected certain bitter and purgative agents; Baum, tartar emetic; Klingemann, alcohol; Fubini and Bonani, atropine; Gunther and Harms, camphor, ether, turpentine, assafœtida, and chloroform; Hertwig and Spinola, aloes and arsenic; Fubini, strychnine, salicylic acid, carbolic acid, lead salts, mercury, iodine, and the alkaloids of opium.

2. *Aromatic Substances.*—The milk of animals fed on certain plants, especially garlic and turnips, is tainted with the characteristic smell, also that of goats in certain localities in which wild thyme abounds.

[1] Gaffky has reported three cases of infectious enteric in man caused by milk contaminated by excreta from a cow suffering from hæmorrhagic enteritis. In America a peculiar disease, known as "lait," is recognised amongst cows, stated to be caused by drinking sea-water. It is said to be communicated to human beings through the milk of affected animals, and is characterised by weakness of the limbs. Veræffent, des Kais gesundh. No. 33 der Thierarzt. 1886, No. 30.

[2] Volpe. Centralb. fur Allgem. gesundheil. 1886.

Cows fed on the refuse pulp from beetroot sugar factories give milk of a mawkish unpleasant taste, and certain plants, such as alkanet (*anchusa officinalis*), field horse-tail (*equisetum arvense*), meadow saffron (*colchicum autumnale*), and knotgrass (*polygonum aviculare*) are said to impart colour to it.

Emanations will communicate their particular smell, and for this reason cow-houses should be disinfected with odourless disinfectants. It has been contended that where carbolic acid has been used the milk has produced nausea and vomiting when partaken of, whether boiled or raw (Dr. Vieth).

We have seen a case of a herd of twenty-five cows, the milk of which had a disagreeable odour. The carcase of a dead horse in a state of decomposition was discovered hidden in a wood near where they grazed. When this was removed all complaints ceased.

Micro-organisms.—It is generally stated that micro-organisms contained in the blood are not eliminated in the milk, but this is by no means proved. It is well known that under certain conditions red blood corpuscles are found, which would tend to prove the probability of micro-organisms finding their way into it also.

PHYSIOLOGICAL ANOMALIES.

Secretion of Milk independent of Gestation.—This anomaly is known as heterochronic lactation. Observations on this point have been made in human medicine by Scanzoni de Natales,[1] Guillot,[2] Gubler,[3] and De Sinety,[4] who have demonstrated that a minute quantity of milk is frequently present in the mammæ of newly-born infants. The same fact has been recognised in fillies by Lacoq, Mazure, Dayot,[5] Lemaire,[6] Hamon,[7] Grenot,[8] and Gathelier.[9] In the case recorded by Mazure the udder of the filly was the size of the two clenched fists, in that of Grenat milk appeared the day after birth and lasted for twenty-three days.

[1] Scanzoni. Verhandl. der phys. méd. Gesell. zu Wurzburg, T. ii. No. 29, page 852.
[2] Archiv gen. de méd.
[3] Mem. de la Soc. de biol. 2nd series, vol. ii.
[4] Archiv de Physiol. 1875.
[5] Dayot. Recueil, 1854, page 850.
[6] Lemaire. Recueil, 1854, page 475 ; 1861, page 1852 ; 1875, page 55.
[7] Hamon. Recueil, 1858, page 311.
Grenot. Ann. de méd. vét., 1861, page 197.
[9] Gathelier. Bull. de la Soc. des sc. Vét. 1898, page 25.

As far as is known, heterochronic lactation is not known in any of the other species.

The secretion of milk may make its appearance some time before parturition without the subject being pregnant, in which case there is either some sexual excitement or stimulus to the gland. Baudeloque notes the case of a girl of eight years of age suckling an infant for a month.

Harvey mentions that doe rabbits that have been covered but not impregnated showed signs of mammary activity at the time parturition should have been due.

Buffon, Rainard, and Delafond[1] noticed the appearance of milk in bitches, that had been to the dog, but had not held, at the time when they should have pupped had they been pregnant; but this has been questioned. Bitches are, however, frequently observed under the same conditions to have the glands swollen, retire and prepare a bed for themselves, and it is evident that this sudden flow of blood to the gland is in relation to disturbance of the generative system.[2]

In most of the domestic animals the secretion of the milk can be accelerated by manipulating the gland. This fact was well known to the ancients, Aristotle mentioning that it was the custom amongst the goat-herds of Mount Etna to cause virgin goats to milk by this method.

Cornevin, in an article dated 1876, states that he has been told by French peasants that they are often able to produce milk from she-goats by drawing and manipulating the teat just before bringing to the buck, and Gelte confirms this.

Limbourg[3] has seen a four-year-old mare in milk that was not in foal, and whose udder had never been touched. Bru[4] also reports the case of a two-year-old filly giving milk after being tied up next to a she-donkey that used to lick her.

In the *Veterinarian* of 1856 a case is reported of a mare twenty years of age, that had never been pregnant, nursing a foal whose mother had died. Broad records a case of a filly that gave about two

[1] Société Centrale, 1857, pages 460 to 469.

[2] Joly and Filhol have observed the same and examined the milk of the virgin bitch, which is identical with that secreted after parturition.

[3] Limbourg. Ann. de méd. vét. 1873, page 591.

[4] Bru. Revue Vétérinaire, 1890, page 21.

pints of milk per diem for several days;[1] the same has been seen in heifers. Luteyn Mazure[2] mentions one whose udder increased in size so much that she was thought to be in calf; it remained so for forty days, until it resumed its normal size. About the same time the following year she again gave daily about three-quarters of a bucket of milk, which came in a jet from the teat.

Lloyd[3] has seen a heifer in milk that was five months in calf.

Laho and Courton[4] have seen a five months old heifer which continued to give milk for six months. The quantity was about seven pints, and to all appearances it was good in quality and normal.

Dr. Dugès de Guanajato reports the case of a she-mule giving milk. Barbe de Bazas[5] has related a curious case of a spayed sow that was shut up with a young pig. The sow began to rapidly fall off in condition, when it was noticed that her teats were enlarged, were full of milk, and the young pig was sucking at her.

Gavard records an analogous case in a goat six months old,[6] and Colin at the Alfort School in a six months lamb.

It is not uncommon to see the gland swell and give milk in virgin bitches, who acquire a trick of licking the parts: no doubt this induces sexual excitement and is a habit difficult to stop. The best plan is to tie the animal up, give a purgative, and apply something nauseous to the teat.

Lactation in the Male.—The case of the buck goat mentioned by Aristotle is well known, and according to him this phenomenon was transmitted by the animal to certain of his male progeny. Blumenbach records that he saw at Gottingen a buck that gave eight ounces of good milk daily.

Koschate also reports a three-year-old buck that in front of the rudimentary teats had a mammary gland the size of an apple, with two well-marked teats on it. The animal gave about what is described as "a *glass*-full" of milk daily.

Geoffroy Saint Hilaire has seen one that gave about three

[1] Broad. Veterinarian, 1864.
[2] Mazure. Ann. Vétérinaires, 1854, page 96.
[3] Lloyd. Veterinarian, February 1878.
[4] Laho and Courton. Ann. Belge, 1876, page 141.
[5] Barbe. Revue Vétérinaire, 1883, p. 117.
[6] Gavard. Journal de méd. vét. et de Zootech. Dec. 1893.

quarters of a pint of milk daily, and Cornevin one with well-developed teats which he recorded in his Zootechnie.

G. Colin is of opinion that this is anything but exceptional.

In the human being castration will cause mammæ to develop ; a case of this in a bull has come under our own observation.

CONGENITAL ANOMALIES

Are not common, but cows have been noticed with absence of the mammæ.[1] Lafour mentions one in which the foal was nearly starved before it was discovered that the mare suffered from this deformity. When present there is generally more or less complete hermaphrodism.

When there are more than the normal number of glands, the deformity is termed polymastic, and is much more frequent than the former condition, but generally it is not an extra gland, but a teat : the first is uncommon, but the latter often seen.

In animals with several mammæ the numbers vary considerably ; and it is commonly said with sows that there is a teat for each pig born.

In the cow supplementary teats are often seen, generally two ; more rarely four, situated behind, and below the two normal posterior ones. These supplementary teats frequently have a canal perforating them, and it is not uncommon for them to give milk.

M. Sanson has seen a cow with seven teats, all of which gave milk, and Jansen states that supernumerary teats are connected with a supernumerary gland.

In the goat the supplementary teats are in the reversed position to those of the cow.

ACQUIRED ANOMALIES.

Atrophy and hypertrophy of the mammæ may be classed under this heading.

Atrophy in the cow may generally be traced to a previous attack of mastitis which obliterates the acini. In aged animals it may

[1] M. Sanson mentions a five-year-old Durham cow with complete absence of an udder, but there were four small rudimentary teats ; M. Goubaux a cow with but three teats.

be due to prolonged inertia of the organ or to bad food. Obstruction of the teat when neglected will cause atrophy of that particular quarter. Watterwald mentions an interesting fact that atrophy of the udder will supervene after certain diseases of the ovaries or uterus.

When a section of an atrophied udder is examined under the microscope it will be seen that it is transformed into a fibrous mass, the acini and gland tissues being choked up and shrivelled.

The appearances are different if the atrophy is due to inflammatory process, or from an obstruction arising during the course of lactation.

In the latter case the changes in the gland are such as might be expected if it had been dormant, in the former by destruction of its elements.

This former class is incurable; in the latter the diminution is only temporary, and secretion may be restored if the obstacle to the flow of milk is removed.

Hypertrophy is sometimes due to a pathological process, and is seen in cows with mammitis, accompanied with abundant vegetations on the mucous membrane of the sinus. The quarters attacked remain larger than those that are active. Hypertrophy is also seen in milking animals, and is the result of breeding and manipulation of the udder.

In cases of pathological hypertrophy the secretion is suppressed, and there is alteration in the consistency of the gland. In normal hypertrophy the functions are at their maximum.

INJURIES.

CONTUSIONS.

Contusions of the mammæ are common in animals that have largely developed and pendulous udders, and are often seen in the ewe and goat, more rarely in the cow; they are rare in the bitch, but if existing, the last pair, or last but one, are those generally involved. Old bitches that have had many litters, and whose udders are pendulous, are most exposed to injuries, and this accounts for the fact that in these animals tumours are more frequently developed in the posterior than the anterior mammæ.

In certain breeds of sheep and goats the udder hangs nearly down to the ground, and is liable to injury in rough, rocky pasture also to be bruised by the hind limbs.

In certain breeds of cows the udder is so largely developed that when they move the hind limbs are straddled apart, and in such it is liable to bruises and chaffing.

The calf, in sucking, when he butts with his head is likely to injure his mother. Kicks, blows with the horn of another animal, and contact with stakes, &c. are all causes, also the habit some cows have of trying to jump the fence of the field.

Repeated blows on a very pendulous udder are more dangerous than a single one, but the consequences are not so serious if inflicted after the calf has begun to suck as they would be before.

Contusions can be divided into two classes:—*1st.* When there is only a slight bruise that can hardly be looked upon as a contusion. *2nd.* When there is subcutaneous or interstitial hæmorrhage, which is quickly followed by ecchymosis of a greater or less extent on the seat of the injury. If the blow is violent the blood may collect and form a hæmatome, or the gland tissue may be lacerated or disintegrated. Rodet[1] reports the case of a bitch that received

[1] Rodet. Engorgement squirrheux de la glande mammaire. Recueil de Médécine vet., 1827, page 42.

an injury on the mammæ resulting in a large hæmatome. A cure was effected by the application of leeches.

Besides the local symptoms of ecchymosis and subcutaneous infiltration, there is often great pain when the animal is milked, and, if the blow is severe, lameness of one or both the hind limbs.

In the bitch repeated blows are a common source of chronic mastitis and the formation of adeno-fibroid tumours.

Frequently the injury is not noticed, but when there is pain treatment is necessary to preserve the secretion of milk and prevent the complication of mastitis and formation of abscesses. A sedative ointment of opium or poppy heads, accompanied with massage, is usually sufficient to afford relief.

WOUNDS.

Wounds of the mammæ are generally found in the cow, goat, and ewe, in which animals the gland is more exposed than any others.

Common causes are sharp substances, such as broken glass in the bedding, stabs from a pitchfork, bites of dogs, injuries from barbed wire-fencing, and, as M. Chanel states, bites of vipers.

In cases of aphtha or variola, after the pustules have broken a raw surface of greater or lesser extent remains, that may run on into rupture of the integument and tissue of the teat. Gellé relates a case of a cow in which there was rupture from the point to the base into the canal, with an escape of milk and blood.

Accidental opening of the sinus or canal is often followed by a lacteal fistula.

Before the introduction of antiseptic surgery wounds of the udder were considered to be specially dangerous, and even now they are a serious matter on account of the large number of lymphatics and blood-vessels that are in this region. They appear to be peculiarly liable to become gangrenous, which is noticed in practice when it is necessary to resect the canal for stricture or to amputate the teat. Wounds of the mammæ do not require any special treatment, but care should be taken to prevent them being contaminated by the bedding.

Lacteal Fistula.—This complication is liable to occur when a

wound is inflicted on an active gland, penetrating the sinus or canal, and if neglected it never cicatrises, an opening remaining. The fistula is often marked by a small protuberance with indurated borders, from which there is a constant trickle of milk down the teat. This protuberance is generally on the upper part of the cicatrix, and the affected teat is almost always slightly curved.

The fistula sometimes opens into the sinus, sometimes into the canal, and as long as the animal remains in milk has no tendency to heal. When the patient becomes dry, in some rare instances it may close, but usually it remains unnoticed, and when she again comes into milk it is discovered to be still patent. The lesion is a serious one, and any surgical measures must be postponed until the animal is dry.

It is seldom that the cow is seen soon enough to allow of healing by the first intention; usually granulations have sprung up round the edges of the wound. If sutures are attempted in this stage all antiseptic precautions must be taken, and the part covered with a layer of iodoform and collodion. A milk syphon must be passed three or four times a day to draw off the milk and keep the canal patent. It is usually, however, better to wait till the animal is dry, and then pare the edges of the fistula and suture it.[1]

ABRASIONS, CHAPS, AND FISSURES OF THE TEATS.

These are purely diseases of milking animals, and are generally seen in the cow, especially in those breeds with largely developed udders, pendulous teats, and fine skin. One of the most common causes is the teat being kept wet with saliva after the calf has done sucking, but it will also be produced by cold and the irritating properties of soiled bedding.

Symptoms.—An abrasion is usually the first symptom, running on into a fissure. It may pass unnoticed if slight, and merely exist as a number of small, red cracks, radiating from the orifice of the canal up the teat in either straight or serpentine irregular lines. They are very shallow, and do not cause any pain, and the first thing that attracts attention is the presence of blood in the milk

[1] P. Leblanc. Fistule Lactee absces, etc. Journ. de Lyon, 1899, p. 332, A. Lucet Apropos d'un cas de fistule lactée. Journ. de Lyon, 1900, p. 20.

after the calf has been sucking. These small abrasions run on into deep fissures, from which oozes a discharge, and which at the bottom are of an unhealthy yellow or red colour. The teat is enlarged, hot, and painful, and the lymphatics corded and swollen. The animal resists the calf sucking or the teat being handled, and there is no tendency to a spontaneous cure. In some cases the sphincter is implicated, and an obstruction of the canal takes place.

Treatment.—The teat should be carefully dried as soon after the calf has done sucking as possible, and if a fissure has formed he should be taken away and reared by hand. The cow must be milked carefully, and the udder completely drained, but if she will not stand this on account of the pain, the milk syphon must be passed.

If possible, each time the calf has finished sucking, or after the syphon has been passed, a suspensory bandage should be applied both to support the gland and to keep it from contact with the bedding. This is, however, sometimes a matter of difficulty.

The part should be carefully washed several times a day with a solution of boracic acid, dried with a piece of absorbent cotton wool, and an ointment of 1 part boracic acid or aristol to 5 of vaseline applied (Vinay).

If the pain is great, opium and vaseline ointment, 10 per cent., applied after bathing with any warm antiseptic solution will give relief. Cocaine ointment made up with vaseline, 5 per cent., may be tried, but it diminishes the secretion of milk.

Trasbot recommends equal parts of starch and glycerine, and in old cases iodine and glycerine.[1]

If the wound shows no tendency to cicatrise, it will have to be cauterised with nitrate of silver.

Note by Translator.—In cases of sore nipple in the human being bismuth and olive oil is recommended. I have used it with success in veterinary practice.—J. A. N.

[1] Trasbot, art. Mammary Glands, Dict. Bouley et Reynal; Fleming, Veterinary Obstetrics, art. Diseases of the Mammary Gland; Rainard, note on Diseases following Parturition, Journal de Lyon, 1845; Zundel, Dict. Hurtrel d'Arboval, art. Mammary Gland; Vennerhoem, Handbuch der Thierarzt. Chirurgie, art. Mammary Gland; Saint Cyr and Violet, Traite d'obst. vet., Diseases of the Mammary Gland, page 771.

ERUPTIVE DISEASES OF THE TEAT.

IN foot-and-mouth disease, variola, and gangrenous coryza, especially the two former, a pustular eruption appears on the teat. Foot-and-mouth disease cannot well be mistaken for anything else. The pustules are round, contain a clear fluid, and are found in the mouth, also sometimes on the feet. In addition to the general symptoms its highly contagious character will easily distinguish it.

The pustules of variola appear spontaneously on the teats. They are distinguished by their pale yellow colour and being pitted or *umbilicated.* The absence of general symptoms or of the characteristic lesions in the mouth or on the feet will early distinguish it from foot-and-mouth disease. Kaempffer, in an epidemic of variola amongst a herd of ninety cows, notes that thirty remained unaffected. The eruption was situated on the udder, and especially on the teats, on each of which three to six pustules could be counted, which were completely developed in four days. True pustules were seldom seen, as they were broken in milking, leaving ulcers that healed but very slowly.[1] The pustules of both variola and aphtha are likely to leave indolent ulcers after them.

Carrey hus drawn attention to the appearance on the mammæ of true pustules in cases of gangrenous coryza. They are lenticular, hard, and are more noticeable where the skin is fine and without hair. They are quite different to those of aphtha or variola.[2]

Johne has described under the name of furunculosis an inflammatory pustular eruption on the udder of the cow after feeding on potatoes. The secretion of milk was not interfered with, and the pustules remained for several months. They were situated on the base of the teat, and at first the size of a filbert nut, growing rapidly to that of a hen's egg. They were red and painful, with an infiltrated livid zone round the base. On the third or fourth day they burst and discharged a purulent fluid, mingled with shreds of necrosed tissue. All attempts at inoculation gave negative results, and a cure took place without difficulty by the use of disinfectants.[3]

[1] Kaempffer. Berlin Thierarzt. Wochens., 1896.

[2] Carrey. Pustules on the Teat of the Cow in the disease improperly termed Gangrenous Coryza. Journal de Lyon, 1888, page 238.

[3] Vennerholm. Furunculose im Euter Krankheiten in der Haut des Euters in Chirurgie. By Bayer and Fröhner, page 303.

Schik has recorded an eruption on the mammæ characterised by vesicles, which were succeeded by scabs and superficial eschars, accompanied with lymphangitis. The disease is said to be contagious, but the author does not say if he was able to reproduce it.[1]

Giovanoli, some time after Johne, described furunculosis of the mammæ. He attributes its cause to pricks from the leaves of the Spanish chestnut used as bedding, and states that the boil appeared generally at the base of the teat. "It is an inflammatory tumour of the skin, which increases in size to that of a walnut, being hard, painful, and red. It only involves the skin, being non-adherent to the deeper structures, and freely moveable. There is sometimes a depression round it of a blue or even black colour. Cows usually allow themselves to be milked without difficulty, especially if the tumour is inclined to enlarge. They burst and give exit to a purulent fluid, with blood and pieces of necrosed tissue or a core. A scale forms, which falls off, leaving a small cicatrix." Giovanoli recommends boracic acid ointment.[2]

INJURIES TO THE GALACTOPHEROUS SINUSES AND CANAL.

These may be mechanical, such as dilatation of the sinus or canal from retention of the milk or overstocking, which is done in some parts of France by fastening a ligature or indiarubber ring round the base of the teat, or it may be caused by a partial obstruction of the sinus or canal.

The quarter of the udder will increase to large dimensions, and in acute cases all four will be involved.

At the base of the teat there are rounded swellings that remain even when it is empty, and at first sight give the impression that they are tumours. Manipulation will show that there is no infiltration or thickening of the part, and that the skin is supple and elastic.

The other lesions of the sinus and canal are of inflammatory origin, viz., fibrous bands with adhesions, and granular vegetations, the former being much more commonly seen in the canal than in the sinus, in which situation they are comparatively rare.

[1] Schik. Contagioses Eutereczem, Berlin Archiv, s. 319.
[2] Giovanoli. Schweiz. Archiv, 1900, no. 4.

Jensen examined the udders of 2048 cows, and he gives statistics. The principal traumatic lesions were submucous hæmatoma, submucous œdema, and rupture of the walls of the canal. The results of inflammation were ulceration and granular growths, these last being both single isolated neoplasms, and diffused papillomata.

The results of mastitis are stated by Jensen to be—

1st. The formation of fibrous growths within the sinus.

2nd. Diffused thickening of the lining mucous membrane.

3rd. The formation of cicatrices of a variable size.

4th. The formation of adherent bands.

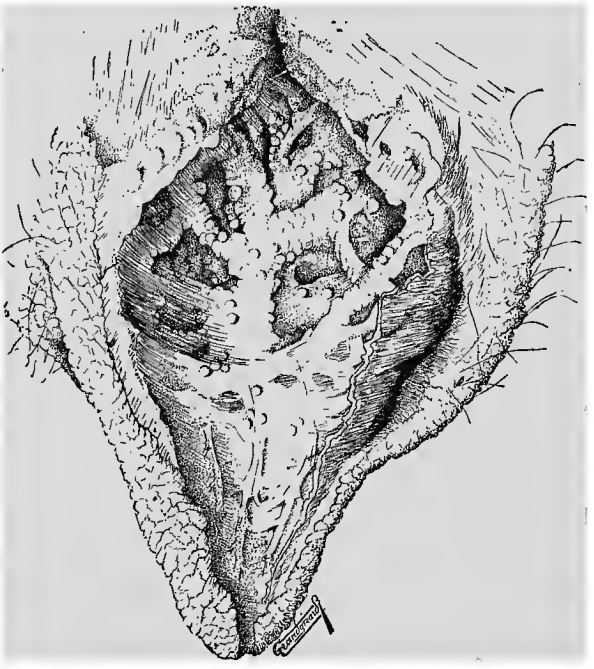

FIG. 4.—Section of galactopherous sinus showing growths on mucous membrane.

Cicatrices are the most common, viz.—221 out of the total examined, and granular growths 91.[1] There are numerous other records in veterinary literature bearing out Jensen's observations.

Bouchet records a case of obstruction of the right posterior teat

[1] Jensen. Krankheiten in der Zitze bei der Kuh, M.F.D., 1895, page 96, Bd. vii. s. 401.

of the cow. The animal died from another cause, and on post-mortem examination the author discovered submucous emphysema involving the entire sinus. There were a number of vesicles containing gas, which measured from one-quarter to five-eighths of an inch, moveable on pressure, that displaced the membrane, and blocked up the sinus.[1]

Coremans found in a four-year-old cow a dilation of the sinuses, the mucous membrane of which was covered over with spherical nodules the size of a pea, with a smooth, firm surface. They were pedunculated and easily detached. It was thought that these

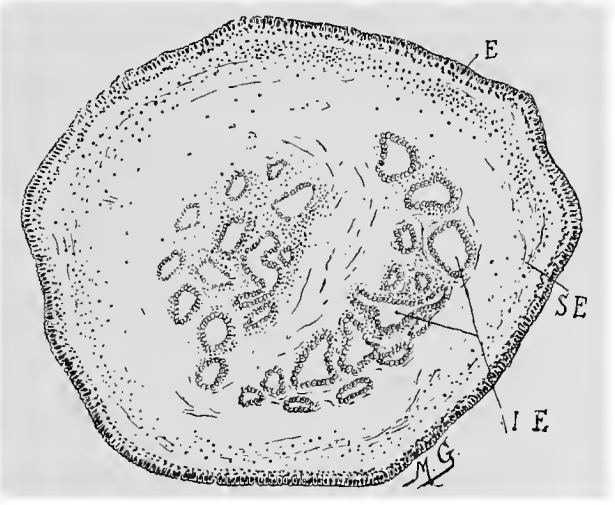

FIG. 5.—E, epithelium; SE. sub-epithelial infiltrated zone; IE, cavities lined with epithelium. (Low power.)

nodules were of a tuberculous origin, but the bacillus could not be detected, microscopic examination showing that their structure was fibrous.[2]

Barlocher met a case in which an adherent wart blocked up the entire lumen of the canal.[3]

We have noticed in many cases of foot-and-mouth disease in cows that the mucous membrane of the sinuses and canals was studded over with granulations the size of a pin's head. The

[1] Bouchet. Société Centrale, 1887, p. 478.
[2] Coremans. Ann. de méd. vét., August 1894.
[3] Barlocher. Archiv für Thierheilkunde, 1845.

surface was covered with cylindrical epithelium, the same as lined the galactopherous sinus, and in the centre were a number of irregular shaped cavities lined with the same.[1]—(Figs. 4, 5, 6.)

MAMMARY CALCULI.

Calculi form in the sinus, and are met with in the cow and goat. They are sometimes improperly termed "corns." They are formed by the milk coagulating and throwing down floculi of

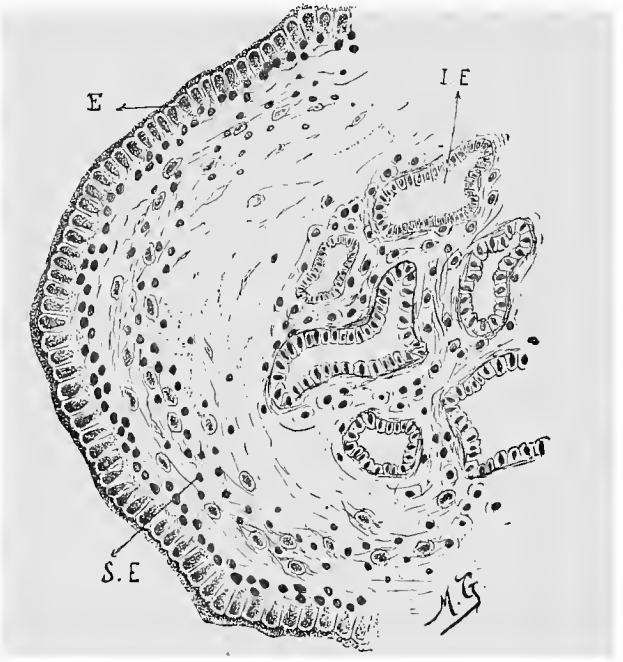

FIG. 6.—Same specimen as No. 5 (high power). E, epithelium; SE, subepithelial infiltrated zone; IE, cavities lined with epithelium.

caseine, which gradually accumulates and acquires the consistency of a stone.[2]

1. *Cow.*—Veille found twenty-two calculi in the sinus of a cow, varying in size from a hazel up to a chestnut, and weighing altogether about $2\frac{1}{2}$ ounces.[3]

[1] Leblanc. Lesions of the Galactopherous Sinuses, Journal de Lyon, 1889, page 327.
[2] Rainard. Notes on the Diseases supervening on Parturition, Journal de Lyon 1845, pp. 10, 57, 201, 297.
[3] Veille. Revue Vétérinaire, 1878, p. 540.

Duplenne had a case of a cow with mammary obstruction due to an oblong calculus of a yellow colour, the size of a hazel nut.[1]

Smith also, in a similar case of obstruction of the left posterior quarter, found at the base of the teat a hard moveable body, which by manipulation was brought almost to the orifice of the canal, where it lodged fast. An incision was made, and a calculus the size of a bean, of a pale yellow colour and a smooth polished surface, removed. It was as hard as stone, and appeared to be composed of lime salts.[2]

Goat.—The only case recorded is by Bauer. The calculus was white, ovoid, and the size of a pea, much resembling a small pearl. On section it was found to be made up of a number of concentric layers. The composition was 60 parts of organic and 40 inorganic matter, the latter consisting of biphosphate of calcium, phosphate of magnesia, and traces of iron and chlorine.[3]

Diagnosis.—This is not difficult. There are the usual symptoms of partial obstruction of the teat, and the calculus can be easily detected as a hard moveable body not adherent to the membrane of the duct. Calculi can remain in the sinus for years without causing any inconvenience.

OBSTRUCTION OF THE TEAT.

Obstruction may be *complete*, *incomplete*, *congenital*, or *acquired*. Congenital obstruction is also known as imperforation. Acquired obstruction is generally the result of inflammation, but it may be due to a calculus.

1. *Imperforation.*—Supplementary or undeveloped teats are usually imperforate, and it is in such that this condition is usually found. It is not, as a rule, noticed until the animal comes into milk for the first time. Vaes saw a case in a heifer in which the two posterior teats were imperforated, one only at the orifice, the other its entire length.[4]

In virgin heifers obstruction may be caused by a secondary

[1] Duplenne. Note on a Case of a Cow with Engorgement of the Udder and Retention of Milk. Mem. de la Soc. Vét. du Calvados et de la Manche, No. II., page 72.

[2] Smith. Calculus in the Lactiferous Canal, Veterinarian, 1850, page 927.

[3] Bauer. Calculus in the Mammary Gland of the Goat. Repertorium der Thierheilkunde, Hering, 1854.

[4] Vaes. Imperforate Lacteal Canal in a Cow. Mem. de la Société du Calvadas.

lesion, as, for instance, the sequelæ of an attack of foot-and-mouth disease.

True imperforation is not as a rule a very serious matter. The teat should be seized between the finger and thumb of the left hand and the milk drawn down with it. Where the skin protrudes at the point by the pressure of the fluid, a crucial incision is made, and relief is instantly given. The canal may remain patent, but it is likely to close up again when the animal becomes dry, and on again coming into milk the operation has to be repeated.—(Fürstenberg.)

Vaès remarks that the operation wound may become infected, and give rise to various complications.

2. *Obstruction* may be either complete or incomplete. It is caused—1*st*, by transverse fibrous bands in the canal; 2*nd*, by granular growths or warts; 3*rd*, by calculi.

Symptoms.—If the obstruction is complete no milk can be drawn, although it continues to be secreted, and accumulates in the canal and sinus. When these become full the secretion is partly suspended on account of the ducts and acini being choked up. The affected quarter swells up and is œdematous, on account of the pressure exerted on the vessels interfering with the circulation. There is considerable tension over the quarter, and pain on pressure. These symptoms much resemble those of mastitis, except that the milk is not altered in quality. If not relieved the secretion gradually diminishes, and the quarter loses its functional activity.

In partial obstruction the symptoms are much the same, but not so pronounced. A little milk may be drawn off in a thin stream, but the process is a long and difficult one. Complications are more to be feared in partial than total obstruction on account of the fact that micro-organisms can gain access to the canal and sinuses.

3. *Obstruction by Transverse Bands.*—In some rare cases this is situated at the extremity of the teat as a sequelæ to an injury of the sphincter, and in such the accumulation of milk will distend the teat to the end. If the obstruction is in the middle, the distention will only be above it, and the portion below will be hanging down; if at the base, the teat will not be swollen at all, but pendulous.

By manipulation the obstruction can be detected as a circular

swelling of a greater or less degree of hardness surrounding the canal. It can be accurately located by passing a sound.

Below the point of obstruction there is a small quantity of viscid clear fluid given off that is full of white floculi formed from the membrane, and which is loaded with various forms of epithelium (Larsen,[1] Bang, and Stockfleth state that 10 per cent. of cases of obstruction are caused by fibrous bands).

4. *Granulations and Warts.*—Obstruction by this cause is generally incomplete, and manipulation will allow of the growth, "which is immoveable," being detected.

5. *Calculus.*—The obstruction is often intermittent; manipulation will allow of the hard foreign body, which almost always is moveable, being detected.

Prognosis.—It is always a serious matter, although when only partial the quarter may remain useful for a long time.

Complete obstruction may not leave any systemic complications beyond alteration in the secretion of the milk, but there usually is loss of the quarter.[2] It must always be looked on as serious, as it is likely to recur, and surgical interference is frequently followed by gangrene.[3]

Treatment.—If due to adhesion, no matter what is adopted, half the cases are unsuccessful.[4] If the obstruction is incomplete dilation of the canal may be attempted with the sound, but antiseptic precautions must be taken. Pieces of catgut, quills, a bundle of threads impregnated with wax, knitting needles, grooved directors, and trocars, have all been recommended for this purpose, but their utility is more than doubtful, and Strebel, Larsen, and other authors who have studied this question strongly condemn such articles, and insist on a proper sound being used, of which there

[1] Larsen. Adherent bands in the interior of the Teat and their Treatment. Monatschrift f. Prakt. Thierh. iv. B. 74, 1893.

[2] Bernard mentions a case of a cow that had obstruction of the teat when her first calf was born. The obstruction was overcome, but returned, and nothing further done. The quarter enlarged greatly for three years, when the animal was killed. The sinus was found distended with a quantity of fluid of a yellow colour resembling whey. (Ann. de méd. vét. 1877, p. 298.)

[3] Fabry recommends that the sinus be punctured and a fistula established to allow of the escape of the milk. The animal to be dried off as soon as possible and fattened. (Ann. de méd. vét. 1873, p. 229).

[4] Albenga. Practical observations on certain points in cases of Mammitis. (Giorn. di méd. vét.) August 1871.

are a number of patterns. Those described by Strebel, Morier, and Luthy[1] are almost identical. Guilbert recommends an instrument that opens the canal[2] (fig. 8), and Morier's has a hollow cone at the end (fig. 7).

The sound is passed beyond the obstruction, and as the edges are sharp it is divided when it is withdrawn. It is advisable to throw the patient and turn her on her side, as the teat must be held straight. It should be carefully washed with a disinfectant, and a 1 per 1000 solution of perchloride of mercury injected into the canal and retained there previously to passing the sound, which should be sterilised. In spite of all precautions the obstruction is liable to recur, and Strebel in 200 cows noted a high rate of mortality.[3]

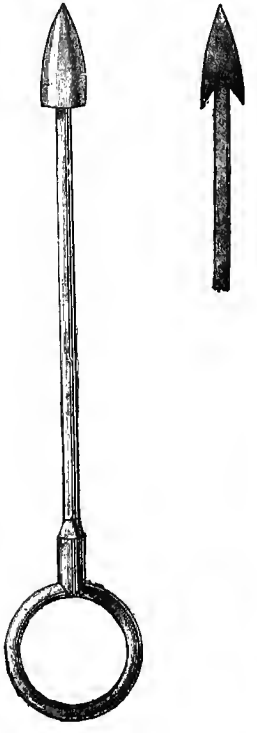

FIG. 7.

FIG. 8.

Extensive resection of the canal and amputation of the teat, which has been advocated by Stokfleth and Kühn, are not to be recommended, especially the suggestion of the last author—amputation with scissors.[4]

Bracker reports an interesting case of a cow with stricture of all four teats, in which he practised crucial resection with careful antisepsis both before and after operation. Three days after, in spite of all efforts, gangrene set in, and the patient had to be destroyed, the entire udder being involved.[5]

[1] Luthy. Magazin, III. 1867.

[2] Guilbert. Société Centrale, 1887, p. 170.

[3] Strebel. Journal de Méd. Vét. 1868, page 512. Schweizer Archiv, f. Thierheilk., 1893.

[4] Stockfleth. Amputation of the Teat. Clinische Jagtagelser, 1861. Kuhn, Chirurg. Bayer, and Fröhner. Article, Mammary Gland.

[5] Braker. Complications supervening on Resection of the Lactiferous Canal. Veterinarian, June 1900.

Walthère-Varsage has practised incision into the canal in three cases. In two mastitis supervened; in the third gangrene and death.[1]

Beck has treated ten cases of obstruction, with two failures, by pressing on the teat with the fingers and forcing the milk through the obstruction, which is thus broken down.[2]

Anderson[3] has contrived a pair of forceps with indiarubber jaws to seize the teat and exert pressure in the same manner, and which is said to be a success.

6. *Obstruction caused by Tumour or Wart.*—Certain practitioners advocate attempting to break down the growth with a sound, but the practice is not to be recommended, neither is it very successful. The other plan is to open the sinus or canal and dissect out the growth. Barlocher has operated on a cow, and removed a growth the size of a hazel nut. The wound was sutured, and cicatrised in fifteen days. Strict antisepsis was practised.[4]

Madsen has performed the same operation successfully, removing the growth with scissors.[5]

7. *Obstruction by Calculus.*—It is sometimes practicable to force the calculus out of the canal by manipulation, and if there is any chance of success no effort should be spared. If it is not too hard it can often be broken down by the fingers, and the fragments evacuated without danger of injury to the membrane, but in the event of failure the canal or sinus must be opened and the calculus extracted.

Smith[6] has recorded a successful case of this nature, the wound healing by first intention. The calculus, however, formed again four years after.

INFLAMMATORY DISEASES.

The inflammatory diseases of the udder are known as *mammitis* or *mastitis*.

[1] Walthère-Varsage. Obliteration of the Galactopherous Canal in the Cow. Ann. de méd. vét. 1855, page 505.

[2] Beck. Behandlung der Scheindeunde in der Zitzan bie der Kühe. M. F. D., 1893-94, Bd. 5, s. 154.

[3] Anderson. Moanedsk. f. Drylægar, ix. page 113, U. 340.

[4] Barlocher. Obstruction to the Teat in a Cow. Archiv f. Thierheilk. 1845.

[5] Madsen. Radical operation für verstopfen der Zitzen der Kühe, M.F.D., 1893-94, Bd. 5, 280.

[6] Smith. Calculus in the Lactiferous Canal of a Cow. Veterinarian, 1852.

Diseases of the udder are daily assuming more importance, as it becomes recognised by the public that they play a considerable part in rendering milk and meat unfit for human food. The consumption and demand for pure milk increases yearly, as not only is it the natural food for infants and children, but it has been recognised as being the only proper nutriment in certain diseases.

The diseases of the udder of milking animals, therefore, possess an interest from both an economic and hygienic point of view, but for a long time they were but little known, as the early veterinarians confined their attention to the diseases of the horse.

The first writer on the subject in France is Bardy de Brassac, in 1814. In 1816 Morier published a monograph on engorgement of the gland. Vatel mentions mastitis in his pathology, 1828, and Hurtrel d'Arboval devotes a chapter to this subject. Then follow the observations of Duplenne, 1831, Dillon, 1835, Lecoq and de Roche Lubin, 1835, and Rainard, 1845. Gelle, Lafosse, Röll, Cruzel, and especially Saint Cyr, all devote a considerable space in their works to this important subject.

Trasbot edited an article on it in Bouley and Reynal's Dictionary, and amongst foreigners we may mention Rivolta, 1875, Franck, Schlösser, and Dieckeroff, who have all contributed valuable observations on this subject.

From a bacteriological point of view it has been studied by Nocard, 1884, Bang, 1886-89, Kitt, 1885-91, Brusasco, 1885, Mathis, 1885, Hess and Bourgeaud, 1889, Hess and Guillebeau, 1891-'92-'93-'94, Lucet, 1889-91, Zschokke, 1893, Jensen, 1900,[1] and these various authors have thrown much light on what has been heretofore an obscure subject.

CLASSIFICATION OF MASTITIS.

There have been many classifications by various observers according to the views they held. Saint Cyr and Violet distinguish it as catarrhal, phlegmonous, and parenchymatous.

Möller recognises interstitial, parenchymato-catarrhal, and parenchymato-gangrenous mastitis. Harms and Fleming have adopted

[1] Jensen. Bacteriological Research in Mammitis in the Cow. Moaneds. fur Drylæger, 1900, page 237.

the classification of Saint Cyr and Violet. Franck describes œdema of the mammæ and interstitial mastitis.

Lucet bases his classification on the mode of infection, and describes lymphogenious, hæmatogenious, and galactogenious mastitis. Kitt classifies the disease, 1st, by pathological anatomy, 2nd, by clinical symptoms. The first is the same as Lucet's. From a clinical point of view he recognises—

1. A non-infectious œdema.
2. An infectious œdema.
3. Sporadic catarrhal mastitis.
4. Enzootic and infectious catarrhal mastitis.
5. Infectious purulent sclerosis of the mammæ.

M. Trasbot divides the disease into acute and chronic.

Hess has adopted a most complete classification based on the alterations in the secretion of the milk.

No alteration in the secretion, .		1. Sporadic Œdema. 2. Infectious Œdema.
Slight alteration in the secretion, . . .	No derangement of the gland.	1. Alteration in the secretion. 2. Sanguineous secretion.
	Slight glandular derangement.	1. Mammary Catarrh.
Serious glandular derangement, ...	Serious derangement.	1. Parenchymatous mastitis. 2. Tuberculous mastitis.
	Unimportant derangement.	

This classification, like all the others, lays itself open to criticism. Hess places œdema amongst the inflammatory diseases, whereas it is only a symptom. The same applies to what he terms Milchfehler (alteration of the milk), and Blutmelken (red milk). The alteration of the milk is the result of the presence in the canal and sinus of non-pathogenic bacteria, and there is a change in the secretion independent of any pathological process. This holds good in the case of Blutmelken, which is merely a symptom; on the other hand, he draws a clear line between those cows in which there is slight and well-marked alteration in the secretion Even then there is a theoretical division, as there are cases of catarrhal mastitis in which the secretion is as much altered as in parenchymatous.

Enzootic mastitis gives rise to great alteration in the milk in the

later stages, although at first it is not noticed; on the other hand, sporadic mastitis has little influence on it.

In spite of these drawbacks, however, Hess's classification appears to be more scientific than any of the others, for in such a matter it is easier to criticise than construct, and an ideal classification has yet to be made.

Classifications based solely on etiology or pathological anatomy are false, and in propounding an ideal one every clinical symptom should be taken into consideration.

At the onset all cases of mastitis are catarrhal, but in a short time almost invariably run on into parenchymatous. The line of demarcation between the two is entirely artificial, and although no doubt there are cases of purely catarrhal mastitis, they are exceedingly rare. On the other hand, there are great and well-marked differences between benign catarrh of the sinus and parenchymatous mastitis. The term parenchymatous mastitis is not a happy one, though, being in common use, we are compelled to adopt it, but consider it to mean mastitis in which the entire gland, connective tissue, lacteal ducts, and acini are all involved in a greater or lesser degree.

Mastitis is by some authorities divided into acute and chronic. The acute form may be either catarrhal or parenchymatous. In some cases only the sinuses and canals are affected, and not the gland tissue; in others the whole organ is involved in the inflammatory process, with radical changes in its elements. The following classification is therefore proposed :—

Acute mastitis	Catarrh of the sinuses and galactopherous canals. Parenchymatous, involving the whole structure of the glands.
Chronic mastitis	Catarrhal or contagious mastitis of Nocard and Mollereau. Parenchymatous, *i.e.* mastitis in the bitch, tuberculous mastitis and induration of the udder in the cow.

There is also the phlegmonous mastitis of Saint Cyr and Violet, but the abscess may be considered as an accidental complication.

All species of female domesticated animals are subject, but usually it is the cow that is attacked. This can be readily understood when the size of the mammæ and their constant state of activity are remembered. The other species are the ewe, goat, bitch, and rarest of all the mare and sow.

ETIOLOGY.

1. *Predisposing Causes.*—The state of the part at the time when the secretion has attained its maximum is most favourable for the development of the disease. At this period there is an enormous influx of blood into the gland, which is swollen, distended, and is susceptible to the effects of injuries. When this period is past, it resumes its normal size, becomes soft and supple, accommodates itself, and is then not so likely to suffer. Injuries comprise blows from the horns and heads of other animals, kicks, wounds by pitchforks, bites, butts from the head of the calf when sucking, and violence in milking. In all these cases an abscess is generally formed.

Climate, season, and temperature are all factors, also retention of the milk, or "*overstocking*," as not only is the prolonged presence of it in the sinuses and canals a predisposing cause, but the gland, being enlarged, is more liable to injury. Dirty bedding and insanitary cow-houses are also to be taken into consideration.[1]

As has been shown by M. Nocard, certain forms of mastitis are contagious, and caused by specific micro-organisms.

2. *Infection.*—Nocard, Bang, Kitt, Hess, and Lucet have demonstrated that contagious mastitis is caused—1*st*, by the organism gaining access through the lacteal canal; 2*nd*, through the current of the blood; and 3*rd*, through the lymphatic system. The causes of contagious mastitis, therefore, can be divided into vascular and galactogenous.

A. Vascular Infection includes infection both by the blood and lymphatic vessels, the organism being deposited by these channels in the gland, and this is much more likely to occur when it is at its greatest activity in full milk. The chief diseases that interest us in causing mastitis are those characterised by cutaneous infection, such as variola and foot-and-mouth disease. Tuberculous mastitis is no doubt derived from internal sources, but it is also conveyed by the blood-vessels. Metastatic mastitis, secondary to arthritis and metritis, is also conveyed to the part by the vessels. Vascular mastitis is, however, nothing like as common as galactogenous.

B. Galactogenous Infection.—M. Nocard first demonstrated the

[1] Jouquan. A probable cause of mammitis in the cow.—Recueil de médécine vétérinaire, 15th August 1892.

presence of pathogenic organisms and the possibility of their entering the canal from the exterior; which, as pointed out by Kitt, being constantly moist with milk, is an admirable soil for their growth and a direct passage to the sinus, much the same as the pharynx to the respiratory and digestive systems. Most authors state that, if the teat is disinfected, the milk will be free from organisms, but Guillebeau, out of sixteen healthy cows, from which milk was taken with all antiseptic precautions, found the canal to be infected in nine. Zschokke states that the sinus and canal are constantly contaminated with micro-organisms in the same manner as the mouth, and in six subjects out of ten we have in the cow found this to be the case.

The organisms found have been the *Staphylococcus albus, S. citreus, and S. aureus*, generally the latter, but all three may be present together.

Not much importance is attached to their presence, as they have not been proved to be pathogenic, but all the same they give food for thought, for if they are not the immediate agents inducing mammitis, their association with it may cause the disease to assume an aggravated form, and, furthermore, they may be the determining cause of an abscess.

Normally the sinus is the habitat of a large number of various sorts of micro-organisms.

The following have by actual experiment been proved to cause mammitis.

Nocard and Mollereau have isolated a streptococcus which has been also recognised by Bang, Kitt, Hess, Borgeaud, Guillebeau, Zschokke, and others, the pathogenic properties of which have been proved. MM. Hess and Guillebeau have isolated in the various inflammatory diseases of the udder those shown in the following table :—

Gelatine liquefied,		Staphylococcus mastitis.
Gelatine not liquefied,	Culture on potato—poor, white, pale yellow, or brown,	Galactococcus versicolor.
	Culture on potato—poor, white or ochre yellow,	Galactococcus fulvus.
	Culture on potato—rich, white,	Galactococcus albus.
	Potato culture—barren,	Streptococcus mastitis sporadicæ.
		Streptococcus mastitis contagiosa—Nocard & Mollereau.

Gelatine not liquefied.	Fluid media not consolidated (Gallertig).	Gelatine cultivation not in filaments,	Bacillus Guillebeau. *a.* (Frendenreich.)
		Gelatine cultivation in filaments,	Bacillus Guillebeau. *b.* (Frendenreich.)
Gas developed by the addition of sugar,		Will not grow on gelatine,	Bacillus Guillebeau. *c.* (Frendenreich.)
Gelatine liquefied and coloured a deep green after agitation,			Chlorobacterium lactis.

These authors have experimentally reproduced in the goat all the various forms of mastitis met with in actual practice, viz., catarrhal and parenchymatous and the various complications following on it, with Nocard's streptococcus. Thinking that other pathogenic micro-organisms also gave rise to inflammatory diseases, they continued their researches and caused catarrh in the udder of the cow with the streptococcus of erysipelas, the *S. cereus flavus*, and the bacillus of Friedlander. The organism of pneumo-enteritis of the pig caused violent parenchymatous mastitis, but the most dangerous of all appears to be the *Bacillus Guillebeau.*

Nencki has studied the action of the *Streptococcus pyogenus* and the microbe of scarlatina, and by direct inoculation into the sinus has caused an acute catarrh that quickly becomes chronic; the organisms injected into the gland retaining their virulency for several months. The other organisms studied by Kitt, viz., fowl cholera, blue milk, *Odium lactis*, and *Artrococcus lactis*, do not appear capable of causing injury.

Jensen, from some recent researches, comes to the conclusion that the various forms of mastitis are caused by three distinct groups of organisms :—

1. Streptococci, causing the contagious mastitis of Nocard.
2. Staphylococci, causing parenchymatous mastitis.
3. Various bacteria, causing spontaneous mastitis followed by necrosis and abscess.

From Jensen's numerous experiments it would appear that experimentally the number of agents capable of causing mastitis is legion, but there are grave doubts if this is the case in actual practice.

Parasites attacking the mammæ find entrance through the teat and the canal. In the human being it has been proved that *actino-*

mycosis of the breast is of thoracic origin, the parasite invading the mammæ from the pleural cavity or sub-mammary tissue. In the domestic animals the same source of origin cannot be proved, and in the absence of all lesions in other organs it is only reasonable to suppose that the point of invasion is the teat.

The same applies to *Botryomycosis*, which invades the mammæ in a similar way as it does the cut end of the spermatic cord.

Pathology.—Actual experiment has clearly shown that various microbes cause mastitis. Hock caused severe inflammation of the mammæ in seven cows by sprinkling the ground with a virulent culture ten days before they were placed on it. The inflammation ran such a violent course that in fourteen days three of the cows were dead. Active treatment saved the lives of the other four, but the udder remained indurated and did not regain its functional activity.[1]

Kitt has produced similar results by the direct application of a virulent culture to the teat.

The period of inoculation is short. Kitt inoculated the teat of a cow with a virulent culture, and in forty-eight hours three of the quarters were hard, swollen, and painful, the milk being abnormal. If the virus is introduced directly into the sinus the incubative period is shorter still. The same author injected a virulent culture in distilled water, and in four and a half hours after there was tumefaction of the gland with alteration in the milk.[2]

The most marked and earliest symptom at the commencement of an attack of mastitis is coagulation of the milk in the sinus. Chemical analysis has shown that there is a diminution in the quantity of sugar, and an increase in fats and albumen. The chlorides are increased at the expense of the phosphates.

The specific action of the micro-organisms has also been studied.

Streptococcus mastidides sporadicæ increases the miscibility of the milk in water and albumen, diminishes the quantity of fat and sugar, and gives it an acid reaction.

Bacillus Guillebeau A. changes hydrate of carbon into alcohol, and forms lactic and acetic acids and hydrogen.

[1] Hock. Wochensch. für Thierheilk. No. 34-24.

[2] Kitt. Mittheilungen ueber mastitis.—Monatsh. f. nach Thierheilk. ii. S. 21-24.

Bacillus Guillebeau C. causes sugar to ferment, forms ethylic alcohol, acetic and carbonic acid, and hydrogen.

In *sparodic parenchymatous mastitis* the milk is of a dirty yellow colour, and contains flocculi, sugar is diminished, the fat and albumen remain normal, the quantity of ash is diminished, also phosphorus, lime, and potash. The chlorides and soda are increased.

In *mucous catarrh* the milk is thickened with the discharge, and there are variations in the amount of sugar, phosphorus, potash, chlorides, and soda.[1]

The membrane is also affected, the organisms having a suitable soil to grow on; this is frequently intensified by the presence of *Staphylococcus pyogenus*, &c.

Alteration of the milk is always seen in cases of mastitis, but the course the inflammation runs depends on the nature of the infective organism, in some cases there being suppuration, and in others hyperplasia of the connective tissue, which causes hypertrophy of the gland. In process of time the exudate is absorbed, the connective tissue becomes thickened and fibrous, and the whole gland indurated. In cases in which mammary abscesses form, it is not necessary that such should at once develop, it may be a considerable time after the primary attack. Indeed, cases are known where they have not appeared till after the cow has gone dry and come into milk again; however, it is always a sequel to the first exciting cause.

If pathogenic organisms remain in the sinus or canal, although there may be no evidence of their presence, a very slight provoking cause, such as a blow, or the natural congestion of the gland on calving, is sufficient to arouse their activity.

PATHOLOGICAL ANATOMY.[2]

The pathology of mastitis has not been well studied in either human or veterinary medicine. The researches of Nocard and Mollereau with milch cows, and the former on ewes, are entirely experimental.

In 1885 Mathis published a paper on the subject, and he is the

[1] Hess, Schafer, Bondzinski, Landwirth Jahrbuch der Schweiz. 4 Bd. S. 45.

[2] Leblanc. The Pathological Anatomy of Mammitis. Bulletine de la Soc. des. sc. vet. 1900, page 165.

first to give a description of the microscopical appearances of parenchymatous mastitis.

Foreign professional literature is equally silent on the subject, and the only author who has touched on it is Kitt.[1]

This may no doubt be accounted for by the difficulty in obtaining specimens, as the disease is not usually fatal, and it is only by accident that they can be obtained, and even then the alterations are so great that they give but little clue as to what they would be in its earlier stages, and the history of the case and clinical symptoms are unknown.

For several years past we have been fortunate enough to have had a number of cases that we have been able to follow out, and

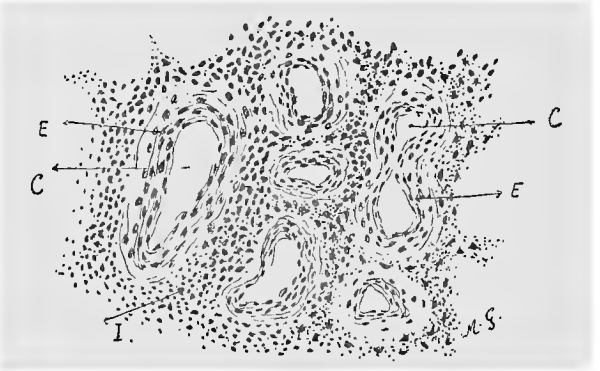

FIG. 9.—Horizontal section of a series of galactopherous canals, showing the granulations that have replaced the epithelium. (Low power.) C, galactopherous canal; E, granulations replacing epithelium; I, peripheric infiltration of leucocytes.

compare the post-mortem appearances with the symptoms observed during life in the ewe, goat, bitch, and cow.

What first strikes one in making a microscopic examination is the great development of the connective tissue. In places the glandular structure is converted into fibrous tissue, although in others there is only thickening of the walls of the acini.

Subacute forms of mastitis are usually interstitial; under the microscope it will be seen that the lacteal canals are greatly altered; in many the epithelium being stripped off, and in its place luxuriant granulations, which are arranged in concentric rings, gradually obliterating the lumen.—(Fig. 9.)

[1] Kitt. Anomalein der Milchdrüse, page 231.

The walls of the canals are considerably hypertrophied and fibrous, not only in the larger but in the minute ramifications, and even the intralobular canaliculi.

The infiltration into the canal walls extends up to their termination and into the acini, and it is shown that this is the point of commencement of the initial inflammation, as the maximum amount of such infiltration is at their periphery.

The epithelium of the acini is partly destroyed, blocking up the lumen ; peripheric infiltration completes this destruction by enlarging the walls and obliterating the channel. The choked-up acini become unrecognisable, and the lobule is transformed into a mass of connective tissue rich in cells, but in which it is impossible to

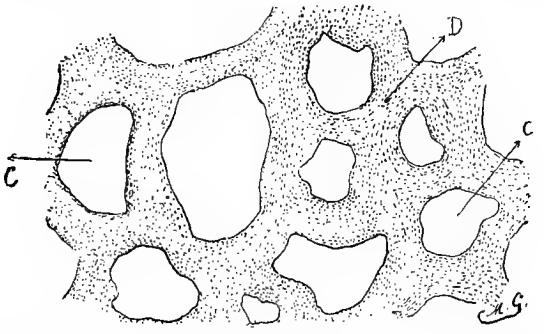

FIG. 10.—Section of interlobular septum with dilated galactopherous canals ; epithelium completely removed. C, galactopherous canals ; D, connective tissue. (Low Power.)

trace out any of the epithelium, which is either replaced by fibrous tissue, or the infiltration gradually disappears.

In some instances the acini are not altogether obliterated, but the newly formed connective tissue in the ducts causes adhesions of the walls, which block them up.—(Fig. 11.)

This obstruction causes dilatation of the acini, with which the ducts are connected.—(Fig. 12.)

From our study of the pathology of the disease, and knowing that the greatest amount of infiltration is around the periphery of the ducts, it would appear that this is the point of departure of the inflammatory process.

If we examine the mammæ of a goat or ewe that has died within three or four days from the commencement of an attack of gan-

grenous mammitis, we will find that only the epithelium lining the ducts is involved, being detached from the walls and blocking up the lumen. In fact the whole glandular structure is reduced to a framework of connective tissue, which tissue is greatly infiltrated.

FIG. 11.—Section of a large galactopherous canal. C, lumen of canal; E, granulations replacing epithelium; G, lymph cells blocking up the lumen of the canal; I, infiltration of leucocytes; P, thickened wall of canal; P^1, connective tissue band partly blocking up canal. (High power.)

There is no trace of the epithelial lining membrane, which is completely swept away, but the process is so rapid that the connective tissue has not had time to participate.

When the diseased process has reached its maximum the con-

nective tissue becomes affected and infiltrated, and this is specially

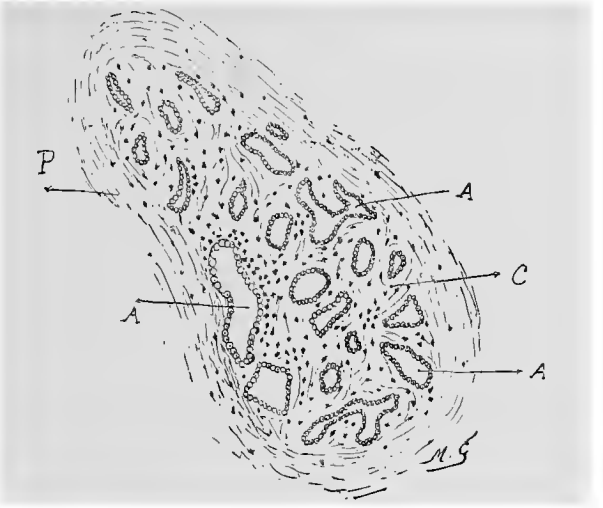

FIG. 12.—Lobule showing dilated acini. A, dilated acini; C, conjunctive tissue; F, wall of lobule. (Low power.)

well marked at those points where the destruction of epithelium is greatest.—(Figs. 13 and 14.)

In such cases, therefore, there can be no doubt but that the

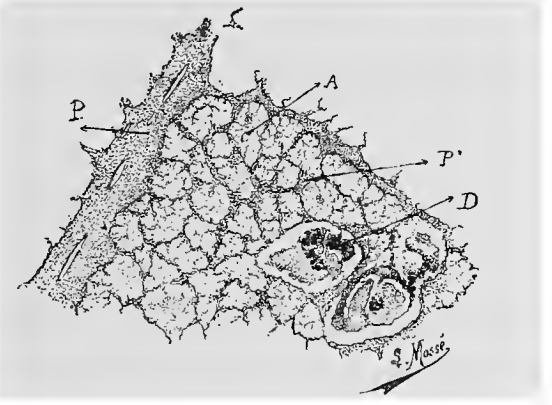

FIG. 13.—Gangrenous mastitis in the goat. A, acini; P, wall of lobule; P^1, connective tissue surrounding acini; D, small abscess. (Low power.)

lesions affecting the epithelium precede those implicating the connective tissue.

When the progress of the attack is slower, although still com-

mencing in the epithelium, the connective tissue has more time to become involved, and the changes are more marked.

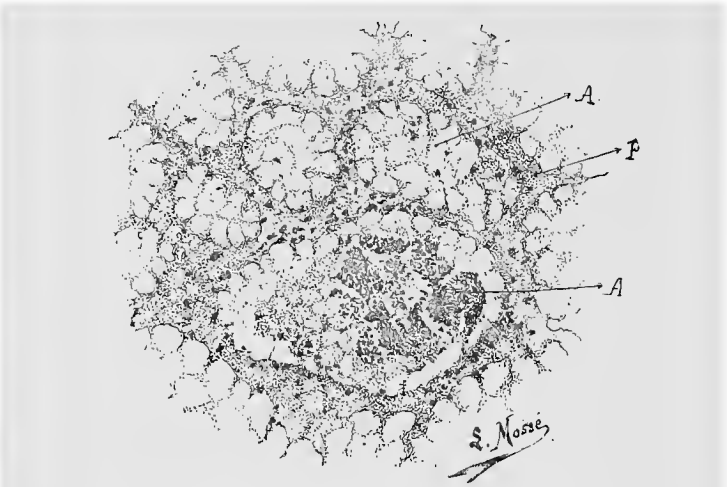

FIG. 14.—Gangrenous mastitis in the ewe. A, acini; P, wall of acini slightly infiltrated. (High power.)

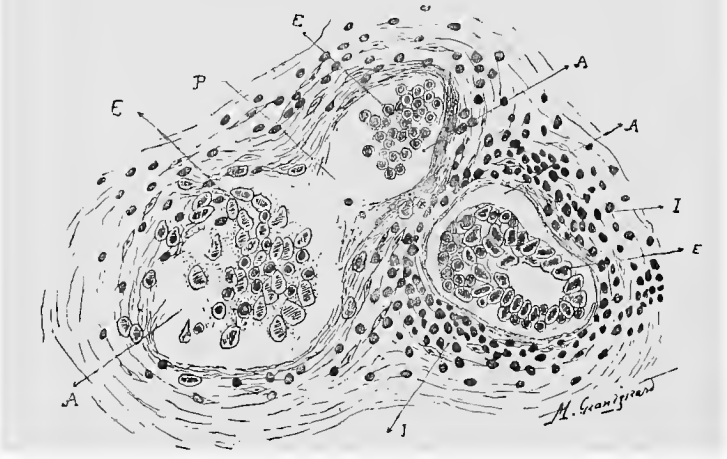

FIG. 15.—Acini with epithelium detached from walls and mixed lymph cells. Two acini have coalesced, in one of which an abscess is in process of formation. A, acini; E, desquamated epithelium and lymph cells: I, peripheric infiltration; P, point at which the division between the two acini is ruptured. (High power.)

We will now consider the formation of abscesses, and it may be laid down as a general rule that they commence in the acini, and

can be well studied in a consecutive series of sections. There is destruction of the lining epithelium of the ducts and acini, with the presence of a large number of leucocytes in the lumen, blocking it up and penetrating into the neighbouring ones, so that the lobule is gradually transformed into a small abscess, limited by the lobular membrane. This is ruptured in its turn, and an abscess of considerable size is formed.—(Fig. 15.)

It would seem that the development of an abscess never commences from the connective tissue.

A practical point that is cleared up by this knowledge of the pathology of the disease is that an abscess is always due to a previous attack of mammitis, and that it may not appear until several weeks or even months afterwards, when all inflammatory symptoms have subsided.

CONTAGIOUS AGALACTIA.

Contagious agalactia is a constitutional disease peculiar to the goat and ewe, complicated with local manifestations in the eye, udder, and articulations, and on this account it has been classed by certain observers as epizootic or rheumatoid arthritis.

The disease was first described at the beginning of the nineteenth century under the name *Stornarella*, by Metaxa, who considered it chronic and contagious, causing mammary catarrh of greater or less intensity, with ophthalmia.[1]

It has also been studied by Zangger (1854), Dinello and Provinzano, Brusasco (1871), d'Oreste, Rivolta, Marcone, Hess, Guillebeau, Kitt,[2] de Rocca Marra, Barthélemy, Schlossleitner, and Labat.

It generally is seen in mountainous regions, especially in the Alps, usually making its appearance in the spring. Brusasco, in April 1871, noticed an outbreak in which a goat communicated it to five ewes; he also was able to reproduce it by inoculating healthy animals with milk from a diseased one.

There can be but little doubt of its contagious nature. M. Labat has seen 120 goats out of 307 become infected after a

[1] Bournay. L'Agalaxie infectieuse.—Revue vétérinaire, 1896, p. 65.

[2] Kitt. Ueber infectiose Euterentzundungen bei Ziegen. Monatsh. f. Thierh. Bd. v. 28.

diseased animal had been put into the herd, and Carbonel 150 out of 960. Schlechter also reported a case in which 220 animals were affected in a very short space of time; and Brusasco considers the period of incubation to be from six to twenty days.

Oreste and Marcone have isolated four distinct organisms.

A. Rounded or oval, which liquefies gelatine, and also grows on agar and in bouillon. The colonies are of a pale yellow colour.

B. Does not liquefy gelatine; grows in milk, serum, bouillon, and on agar. The colonies have an oily appearance, easily stained with any of the aniline stains.

C. A very minute micrococcus. Liquefies gelatine. Rapidly causes milk to coagulate into a grey clot.

D. Slightly ovoid micrococcus, growing with an orange colour on agar. Easily stained by Gram's method or any aniline stain.

Separately introduced into the sinus, all these organisms cause coagulation of the milk and mastitis, especially *D.*[1]

They are not pathogenic in the rabbit when injected either subcutaneously or intravenously.

The septic nature of the synovia obtained from a diseased joint has been proved by Leclainche and Bournay, who by injecting it into a healthy articulation in the goat caused well-marked acute arthritis.

Symptoms.—Animals of all ages are attacked, and it does not spare males. There may be only arthritis or arthritis and keratitis, but unless there is mastitis in such cases a diagnosis is difficult to arrive at. The attack may be severe or mild, acute or chronic.

A. General Symptoms.—There is dulness and loss of appetite, lameness, and the animal lags behind the flock. "The fever increases, the respirations become accelerated, the pulse frequent, the animal ceases feeding and remains down, death taking place very quickly"—(Bournay). Generally, however, the progress of the disease is slow, and the symptoms disappear in about four weeks.—(Schlechter). According to Hess and Guillebean the temperature varies between 99° and 104° F., the respirations twelve

[1] Oreste and Marcone. Mal de Sito.—Clinica Veterinaria, 1893, p. 393.

to thirty-six, and the pulse 66 to 100 per minute.[1] Bournay and Barthélemy have observed the disease in a chronic form.

B. Local Symptoms.—As before said, there are local symptoms implicating the mammæ, articulation, and eyes.

1. *Mammæ.*—The gland is attacked with violent parenchymatous mastitis, and all the usual symptoms are manifest, viz.—alteration in the secretion, swelling, induration of the diseased quarter, great pain on pressure, and in such cases there are two terminations, viz. —glandular atrophy and the formation of an abscess. In mild cases there may be merely diminution in the quantity of the milk, without alteration in its quality, or catarrh with alteration, when the milk is of a yellow colour, containing flocculi floating about in it, its reaction is acid, and it is full of micro-organisms. It is deficient in fats, sugar, phosphorus, lime salts, magnesia, and potash salts, with increase of chloride of sodium, and sometimes contains hæmatine, the curd readily fermenting and decomposing (Hess and Guillebeau).

The affected quarter may be entirely lost, but in mild cases a cure may be hoped for in twenty to thirty days. In many cases, however, milk is not secreted until the animal again is pregnant.

2. *Articulations.*—The joints involved are usually the knee, hock, elbow, stifle, and hip. In some cases they are hot, swollen, and painful, with an accumulation of synovia and flakes of fibrine in the capsule, and sometimes pus, when generally the skin ulcerates and an open joint is the result. In the chronic form the symptoms are not so well marked. There is considerable lameness, but the animal can move fairly well, if there is not much accumulation of synovia, but there are intracapsular granulations and the sheaths of the tendons are frequently involved. This form of the disease has been observed at Opoul by Bournay, and out of twenty-eight diseased animals seen by Hess and Guillebeau, sixteen had arthritis.

3. *The Eye.*—The lesions in the eye are keratitis, and the contagious form described by Félizet in goats is nothing but agalexia. Out of twenty-four cows seen by Hess and Gillebeau eleven had keratitis. The alterations in the cornea are more or less well marked,

[1] Hess and Guillebeau. Ueber infectiose Agalaxie bei Ziegen, separat Abdruck aus den Landwirth.—*Jahrbuch der Schweiz*, Bd. vii. S. 324.

it becomes clouded, and the patient blind. Corneal abscess is not rare; it commences with a yellow point in the substance of the membrane, and if it points externally it will leave a cicatrix, but if internally, there is danger of purulent contamination of the whole of the globe.

Pathology.—The articular lesions do not present any very peculiar appearances beyond those usually seen in arthritis. In the acute stage there is infiltration of the articular tissues and congestion of the synovial membrane. The character of the synovia, however, varies, and from this it has been concluded that there are three types of arthritis.

1. *Serous Inflammation*, characterised by an accumulation of red or yellow coloured serum in the articular cavity.
2. *Fibrinous Inflammation*, the capsule being filled with false membrane.
3. *Purulent Inflammation*, with pus in the cavity, and erosion of the articular cartilages.

Hess and Gillebeau have noticed the formation of abscesses in the surrounding muscles, and Rocca Marra endocarditis, but such must be considered as being exceptional.

Diagnosis.—In the majority of cases this is easy if the local symptoms that we have described are coexistent, but on the other hand they may not be, and in such there may be doubts. Arthritis may alone be present, but the fact of its assuming an enzootic form will cause its true nature to be recognised.

Prognosis.—Is always bad; even in the most mild form there is loss of milk and loss of the mammæ, chronic arthritis and blindness. In the acute form the death rate has been estimated at 20 per cent.

Treatment.—The diseased should be carefully isolated from the rest of the flock, and the buildings disinfected. Local symptoms should be treated, but as a rule, on account of the trouble and expense, flockmasters prefer to slaughter those on which any profit can be made.

ACUTE MASTITIS.

ACUTE MASTITIS IN THE MARE.

If we may judge from the lack of literature on the subject, this is a rare disease.

Vennerholm has only devoted a few lines to it in the article on the subject in Bayer and Frohner's Surgery.

The disease is seen during the period of lactation, generally a day or two before foaling, and usually half the udder is affected. Bermbach saw two mares whose foals had strangles attacked with acute mastitis.[1]

Schütz and Parent have found the *Streptococcus* that goes by the former's name in the pus from the udder.[2]

Lucet has isolated from the milk of a mare suffering from mastitis an organism which he designates *Streptococcus mastitis equi*, which grows in long immobile chains. The organisms are oval or rounded, about 0μ.6 in diameter, and stain badly by Gram or Weigert's processes. They quickly lose the power of proliferation in artificial media. In cows' milk they form a firm yellow clot, do not liquefy gelatine, and are not pathogenic to the rabbit or guinea-pig. In the horse they cause abscesses when injected subcutaneously.[3]

Symptoms.—In the mare the disease is always dangerous, and is often the cause of death.

(*a.*) *General Symptoms.*—Loss of appetite, acceleration of the respirations and pulse, which is strong and full. The mucous membranes are congested and blue, and the temperature from 102° to 104° F. Diener and Zundel note that attacks of colic are frequent.

(*b.*) *Local Symptoms.*—The mammæ are increased in size, the skin covering is tense, shining, and hot. The whole region under

[1] Bermbach. Berlin Thierartz. Wochens., No. 37.

[2] Parent. Journ. de Lyon, 1862.

[3] Lucet. Microbian Mammitis in the Mare. Bull. de la Soc. Centrale, 1893, page 97.

the abdomen is tumefied, which extends to the umbilicus in front and up between the thighs. The teat corresponding to the affected quarter is hard, semi-erect, twice as large as natural, and gives exit to a dark, blood-stained fluid, greenish pus, or serum, which may be of a reddish yellow or greenish grey colour, and very fœtid. —(Diener.)

There is great pain if the gland is handled. The animal moves with difficulty, which is specially noticeable if she tries to turn. One or several abscesses form and point, which should be opened.

The disease terminates with *induration*, *formation of an abscess*, and *gangrene* of the quarter.

Induration is seen in mild cases, and succeeds on the formation of an abscess, the whole gland being transformed into a hard, fibrous, incompressible mass larger than natural, and with total loss of powers of secretion.

Formation of abscess takes place in the majority of cases three times in three cases, Jacob;[1] one case, Parent; three times in four, Diener;[2] one case, Kehm.[3]

Gangrene of the quarter occurs with about the same frequency. In Parent's case four abscesses formed in the gland, besides others in different parts of the body. Twelve days after the commencement of the attack the gland sloughed off, the sequestrum weighing about 7 lbs.

The disease in the mare almost always runs a rapid course, and, according to Parent, in spite of its gravity, with care a cure may be expected about the fifteenth day. In Diener's cases a cure was effected in No. 1, twenty-one days; No. 2, fifteen days; No. 3, twenty-one days, and No. 4, ten days; but in all cases the function of the gland was destroyed.

Diagnosis.—The œdema present, and condition of the mammæ, with the alteration in the character of the milk, are the chief diagnostic symptoms.

Prognosis is always serious, as even with the most favourable ending the gland is lost, a foster-mother having to be found for the foal, and in acute cases complications are to be feared.

[1] Jacob. Practical Considerations on Engorgement of the Mammæ. Journ. de Lyon, 1847, page 364.

[2] Diener. Mammitis in the Mare. The Veterinarian, LXVI., page 178.

[3] Kehm. Hollständige Abcesderung der Mamma Zuchstute. Rep. s. 33, 22.

Treatment.—The gland must be frequently fomented with an antiseptic, the milk drawn off, and the part lubricated with some anodyne ointment. Diener recommends camphor ointment 60, laurel oil 4, and green soap 10 parts.

If it can be applied and the patient will stand it, a linseed poultice with tincture of opium or poppy heads, kept in its place with a suspensory bandage, will have great effect in easing pain.

It is also good practice to give a purgative, for choice a saline, with laxative diet.

The abscess should be opened as soon as possible, and if necessary amputate the gland. This operation has been performed in France by Moncouet, Violet,[1] and Cadiot, and in England by Scott,[2] also frequently in Germany in cases of Botryomycosa.

CATARRHAL MASTITIS IN THE COW.

Catarrhal mastitis in the cow is also known as mammary catarrh and galactopharitis, and consists of inflammation of the lactiferous ducts and canals. In the mammæ it is analogous to bronchitis in the lungs.

Formerly it was thought to be due to abnormal retention of milk, but it is now known that although this may render the parts susceptible, it is not *per se* a cause.

Kehrer has sealed up the teat of rabbits in milk with collodium without any ill result following.

Pierre Delbet has ligatured some of the canals in the bitch. Those left patent have carried off the milk, and there has been no inflammation.

Symptoms.—The disease may assume an acute or a subacute form, for, as has been previously stated, mammary catarrh may assume many varieties, ranging from benign to parenchymatous mastitis.

Usually it is unaccompanied by any constitutional symptoms, the patient preserving her appetite, ruminating, and appearing in good health, the temperature, pulse, and respiration remaining normal.[3]

[1] Violet. Communication to Professor Mathis.

[2] Scott. Amputation of the Mammary Gland in a Mare. Veterinarian, 1895, page 462.

[3] Kroon describes a form of purulent catarrh attacking cows turned out to graze before they are dry, and he recommends resection or amputation of the teat, so as to allow of drainage of the pus from the sinus.

The milk is always more or less altered, and consists of a white or pale yellow serum containing clots and sometimes tinged with blood. One or more quarters may be attacked, either simultaneously or successively.

The affected parts are hot, swollen, and painful, the teat pendulous. Sometimes the œdema is so great that the teats are partly hidden by it.

The inflammatory lesions are well marked in the tissues surrounding the sinus, but those parts of the gland that are not involved remain supple and normal, and continue to give milk in much the ordinary quantity.

Progress, Duration, and Termination.—The disease manifests itself rapidly, and if not severe may disappear in six to eight days, but if it is, may last for a couple of weeks; and if it persists longer it is usually complicated with parenchymatous mastitis. Its terminations are various. If very benign it may disappear altogether without leaving any after-effects, but the quarter may to all appearances resume its normal condition without secreting milk until the next calving, when mastitis may again supervene. In severe cases the part may become atrophied or indurated.

Complications.—If neglected the case may run on into parenchymatous mastitis or abscess, but the thermometer will give valuable indications if it is not going on right. M. Mathis records one case in which acute pleuro-pneumonia supervened on catarrhal mastitis nineteen days after the commencement of the attack, with adhesion of the right lung to the diaphragm.[1]

Paraplegia has been mentioned by certain writers,[2] but this complication is open to doubt. Some animals, if the udder is swollen and heavy, will not get up, others are unable to do so on account of injuries to the articulation.

Tobiassen[3] relates a case of paraplegia the fourth day after the commencement of an attack that lasted for three days. On the fourth the animal was able to get up. Ten days afterwards the

[1] Mathis. Catarrhal Mammitis in the Cow with fatal Pleuro-Pneumonia. Journ. de Lyon, 1897, page 454.

[2] Lucet. Recueil de méd. vét. 1889, page 423.

[3] Tobiassen. Ueber eine ligenthümliche Form der Euterentzundung der Kühe. Maanedsk. f. Drylœger, viii. 94, 51.

milk was normal, and in a month all trace of induration of the gland had disappeared.

Villumsen records a similar case.[1] Perrussel also mentions a case of catarrhal mastitis which ended in forty-eight hours, when paraplegia supervened. In such cases the prognosis is variable, young robust animals recovering of their own accord, while aged and weak ones succumb.[1]

Arthritis and Synovitis are often present. Anderson mentions this fact.[2] In all probability they are of streptococcic origin.

Pathology.—The lesions are confined to the sinus and canals. There is swelling and degeneration of the mucous membrane, and degeneration of the epithelium, the loss of which is accompanied by submucous infiltration, dilation of the vessels, and exudation. There are granulations from the denuded membranes which fill up and block the lumen of the tubes, as before described, and the catarrh may become purulent.

Diagnosis.—The diagnosis is easy, there being tumefaction tension, pain in the affected quarter, and alteration in the quality of the milk. In parenchymatous mastitis there are other systemic symptoms and fever. The whole organ is involved, the quarter being hard and wooden to the touch. The supra-mammary glands are also generally affected. None of these symptoms are present in simple mammary catarrh.

Prognosis.—If there are no complications the prognosis is generally good, but it should be remembered that there is always a possibility of a partial falling off or total loss of milk until the next calving.

Treatment.—It is prudent to look on every case of mastitis as being contagious, and the patient should be isolated from the rest of the herd in a separate cowhouse if possible. The stall should be disinfected and scraped, afterwards washed down with some disinfectant and left empty. If possible the diseased animals should not be attended to by the same persons who look after the healthy, but if this cannot be avoided, they should carefully wash their hands in some disinfectant. The udder should be emptied several times

[1] Villumsen. Ein besondere Form der Euterentzundung. Maanedsk. f. Dryloeger, viii. page 243.

[2] Anderson. Enzoot. Mastitis. Schwed. Tidsk. f. Vet. Méd. 1893, vol. xii. page 110.

daily, if possible every two hours, and the milk received into a pail of boiling water or some disinfectant.

In simple catarrh antiseptic injections may be used, but in practice they are exceedingly troublesome to carry out, the same applying to astringents. In parts of France curdled milk used to the part with friction is looked on as a specific. Fomentations as hot as can be tolerated, with a small quantity of dilute mineral acid, appear in simple cases to act better than poultices, especially if combined with gentle massage.[1]

Lecoq recommends at the onset of the disease slightly astringent fomentations or an embrocation of sulphate of iron, alum, and white of eggs, which last, according to him, has been of signal service.[2]

If the case is not seen in its earlier stages, or if the inflammation is not abated, the astringent should give place to an emollient, with poultices, steaming, or fomentation. Friction with an ointment containing opium, iodide of potassium, belladonna, and camphor are especially useful when there is difficulty in carrying out any other treatment. The patient is better kept in the house out of draughts, clothed up to prevent a chill, and provided with a good bed. The bowels must be regulated, and a small quantity of nitrate of potash may be given in gruel or the drinking water.

PARENCHYMATOUS MASTITIS IN THE COW.

In parenchymatous mastitis the minute lactic canals, the acini, and the connective tissue are all involved, and to a greater or lesser degree the whole gland in the inflammatory process. The disease is usually accompanied with dangerous complications, and there may be grave after-effects that endanger the life of the animal.

The organisms that cause parenchymatous mastitis are—

A. *Staphylococcus mastitis*, described by Guillebeau and Lucet. It liquefies gelatine, and on potato the culture is dry, of a dirty white or brown colour. It coagulates milk, and renders serum acid. It takes Gram's stain, is pathogenic with the cow and goat when injected into the mammæ, but when injected subcutaneously it produced no result in the dog, guinea-pig, rabbit, or mouse.

[1] Schaak. Journal de Lyon 1865, page 30.
[2] Lecoq. Paper on Mammitis. Mem. de la Soc. Vét. der Calvados.

B. *Galactococcus versicolor*, takes Gram's stain. Coagulates milk, in which it forms chains.

C. *Galactococcus fulvus*, takes Gram's stain; grows on gelatine in white or yellow coloured colonies. If injected into the mammæ it only causes temporary trouble.

D. *Galactococcus albus*, grows in white coloured colonies on gelatine, which it does not liquefy. In milk it forms chains.

The bacillus of Guillebeau has been exhaustively described by Frendenreich. It is slightly mobile, does not take Gram's stain, and on gelatine grows in colonies of a yellow colour, which when a few days old become an opaque white. In bouillon the organism grows rapidly, and with the addition of sugar of milk there is a large amount of gas disengaged. On agar the culture is a greyish white. Milk coagulates in twenty-four hours, and the clot is perforated by bubbles of gas given off. If injected into the mammæ of the cow it produces violent inflammation, but is not pathogenic in the dog, rabbit, or cat.

According to Jensen it belongs to the group of coli, and Godœlst states that most of them give rise to mastitis.[1]

Symptoms—A. *General.*—Frequently these first attract notice, as they may precede the local ones. The animal refuses to feed, stops ruminating, and there is slight tympanitis. The rumen is distended, and the peristaltic action is in abeyance. The pulse is small and feeble, from 86 to 120 per minute, the temperature from 102° to 105° F. The conjunctiva is injected, the mouth hot, and the extremities alternately hot and cold, with the coat standing on end. The bowels are constipated, and the fæces hard, dry, and caked, or there may be profuse diarrhœa, but whichever there is, the evacuation is painful.

D. *Local.*—The mammæ is enormously enlarged, and the diseased quarters appear to overlap the healthy ones. There is great œdema, which extends forwards to the umbilicus and backwards up the thighs. The gland is hot, painful, and tense, and where there is no œdema hard and woody, the supra-mammary ganglia being swollen and infiltrated. The milk in the diseased quarters is altered to a yellow colour, much resembling beer, and has clots floating about in it.

[1] Godœlst. Traité de Microbiologie, pages 233-236. Lierre, 1899.

That from the healthy quarters is not at first changed, but after a few days it becomes yellow, thick, and sticky, adhering to the fingers, and much resembles colostrum.

Course and Progress.—This form of mastitis develops but slowly. After its first appearance the œdema decreases, and the hard feeling is more apparent. The general state of the patient improves, but the digestive complications give way more slowly, remaining for from fifteen days to three weeks, but even in the most favourable cases the induration of the gland remains for three weeks, and in complicated ones for as many months, with the possibility of an abscess or gangrene of the part supervening.

Complications.—The most frequent complications that set in are abscess and gangrene of the involved quarter. This generally takes place when the patient appears to be recovering from the attack, there being a sudden relapse, the temperature rising up to 105° F. Of course this may be due to other complications, but if after careful examination all the organs are normal, it may be looked on as pretty certain that an abscess is forming in the mammæ.

1. The abscess forms primarily in the glandular *culs de sac*, the walls of which are broken down, gradually the neighbouring structures become involved until one of the large canals is reached, the pus gaining entrance to the sinus. When the abscess has reached a certain size it behaves in the usual manner and can be easily recognised, but if it is deep and in process of formation it may provoke secondary symptoms that are difficult to account for. Its evolution may be slow.

Lecoq mentions a case in which it did not appear till two months after the primary attack, and we have seen one in which twelve weeks had elapsed. Lecoq reports that abscesses formed in three out of eight cases, and Bitard in all he treated.[1]

When incised exit is given to a quantity of yellowish pus, having an odour of milk, and nearly always containing *sequestræ*. From this fact it has been designated by certain German observers *anæmic necrosis*.

2. *Gangrene.*—This is also preceded by a relapse. The systemic symptoms are generally severe and may even cause

[1] Bitard. Mammitis in the Cow. Progrès Vétérinaire, 1899, page 505.

death. Lecoq has seen it take place three days after the appearance of the first symptoms, and Ellerman has noted a similar case.[1] The diseased quarter becomes a dark red or violet, there is hæmorrhagic œdema under the skin, the milk becomes purulent and full of shreds of necrosed tissue.

The gangrene gradually spreads to other parts of the gland, and a number of fistulæ form, from which a purulent discharge flows, mingled with portions of necrosed tissue

This form of mastitis has frequently been observed by Adam, Guillebeau, Schlosser, Dixon,[2] Schultz,[3] Deupser,[4] and Kohl.[5] The skin has been sometimes known to have ulcerated through and ruptured, allowing the whole diseased quarter to be cast off in a large slough.[6]

Pathological Anatomy.—There are extravasations under the endocardium, the mediastinal ganglia are tumefied and infiltrated, and the liver hypertophied. The spleen is enlarged, there are extravasations under its capsule, the lymphatic glands of the flank, pelvis, chest, and mesentery are enlarged and hæmorrhagic.

In the *mammæ* the appearances vary according to the length of time the attack has lasted. If it has been acute, the glandular lobules will be more or less infiltrated and injected, and on section a number of patches of extravasated blood and gangrenous tissue will be noticed.

The connective tissue is infiltrated with a gelatinous yellow material. When the progress of the disease has been slower, the interlobular tissue becomes fibrous, hard, more or less thickened, and it is not uncommon to find small circumscribed abscesses in its substance. The subcutaneous cellular tissue is always infiltrated, the supra-mammary glands tumefied and injected, or full of pus.

The abscesses are sometimes very large, involving the greater portion of the diseased quarter, and in one case we have seen as

[1] Ellermann. Gangrenous Mastitis in the Cow. Tijdschrift *v.* Veartsenijk, 1900, page 256.

[2] Dixon. Gangrene of the Udder. Journal of Comparative Pathology and Therapeutics, June 1900.

[3] Schultz. Berlin. Thierarzt. Wochensch. 1896.

[4] Deupser. Gangrenous Mammitis in the Cow. Berlin. Thierarzt. Wochensch. 1891, No. 14.

[5] Kohl. Case of Septic Mammitis. Berlin. Thierarzt. Wochensch. 1893.

[6] Robert. Subacute Mammitis. Journal de Lyon, 1857, page 97.

much as five pints of pus evacuated, the cavity communicated below with the sinus, and above with the abdominal muscles. In such cases the pus is thick and white, with a faint milky or sickly smell, full of broken-down epithelial and connective tissue cells and leucocytes. The walls of these abscesses are very thick; the trabeculæ of the gland, giving way but slowly, form partitions across the cavity, so that when the abscess is opened care should be taken to break these down. There is usually a portion of necrosed gland tissue contained in the cavity, which sequestræ are sometimes very large, and comprise the whole of the quarter: they resemble a large white sponge, and easily break down on pressure.

(*a*) *Microscopic Appearances.*—These have been closely studied by M. Mathis, and his description will be adhered to, viz., the *mucous membrane of the sinuses*, sections of the *large galactopherous canals*, and the *glandular parenchyma.*

1. *Mucous Membrane.*—This is normally composed of cylindrical epithelium—"but in places it is stratified"—and basement membrane, which separates it from the sub-mucous connective tissue.

In parenchymatous mastitis both the epithelium and basement membrane are destroyed, and the internal surface of the sinus is covered with thick luxuriant granulations, rich in cells, that are deposited in layers. At first sight these granulations might be mistaken for epithelium, as they are intimately connected with the connective tissue. However, there is a distinct line of demarcation between them. The latter, with hematoxylic eosin, stain a dark violet, while the former take on a much lighter rose colour.

Galactopherous Canals.—The canals are uniformly dilated, the walls are considerably thickened, and the periphery filled with lymphatic cells. The lumen is blocked up with epithelium and leucocytes.

The mucous membrane is always absent, both the epithelium and basement membrane being destroyed, and replaced by fibrous granulations arranged in layers, which give to a section of the canal much the appearance of an artery. The internal aspect, in one word, is the same as that of the sinus.—(Fig. 9.) All these tissue changes extend to the most minute ramifications, even to those that enter the lobules.

It is not uncommon to find in the interstitial tissue groups of canals altogether denuded of epithelium, with the lumen greatly dilated and quite empty. They have the appearance of having been bored out of the matrix.—(Fig. 10.)

The obstruction to the canals may also be well seen. In certain ones the lumen is absolutely obliterated by the granulations that take the place of the epithelium ; in others, one can easily trace out a band connecting the walls and dividing it into two ducts.—(Fig. 11.)

3. *Glandular Parenchymatous Lesions.*—The most striking alteration is the large increase of the connective and the total disappearance of the true glandular tissue. The connective interlobular tissue consists of strong trabeculæ, well supplied with blood-vessels, and in which are the *débris* of the lacteal canals. These trabeculæ surround the lobules, penetrate between the clusters of acini, and finally end by obliterating them altogether. The large septæ contain but few lymph cells, but they are numerous round the periphery of the acini and in the vicinity of the intralobular canals.

The epithelial tissue is altogether transformed in the acini, being present in two forms. In one it is attenuated and compressed by the peripheric connective tissue; in the other it is much dilated in consequence of the obstruction to the canals.—(Fig. 12.)

Epithelial cells are found blocking up the lumen of the acini disconnected from the wall. They are more or less altered and intermingled with the lymphatic cells, from which it is difficult to differentiate them—each individual acini resembling a yellow-coloured granulation.

At the same time that the desquamation of the epithelium takes place the walls become infiltrated with leucocytes, and in places broken down by them. The lobules lose their characteristic appearance, and are transformed into a large *cul de sac*, surrounded by a thick belt of fibrous tissue.

In many places minute abscesses form, always commencing in the glandular lobules ; never, so far as we have observed, in the connective tissue.—(Fig. 15.) They can be recognised by the loss of the epithelium lining the acini and the blocking up of the

cavity with a large accumulation of lymphatic cells, which can be easily distinguished from epithelial by their shape and the way they stain. They distend the acini and perforate its wall at one particular point, the process being repeated and the primary abscess extending to a second and third acini, so that in time the entire lobule is transformed into a purulent collection contained in a sac of connective tissue, which in its turn is also perforated, and a large abscess formed.

Diagnosis.—In this there should be no difficulty. The general symptoms—appearances of the mammæ and changes in the secretion of the milk—are so marked that a mistake should be impossible; furthermore, the whole gland is involved, which is not the case in catarrhal mastitis.

Prognosis.—This is always bad. When the disease runs its course without complications induration is the usual result, with total loss of power of secretion in the quarter, and even if the others do not participate the quantity of milk is diminished for a long time. Abscess and gangrene of the udder are also common sequelæ.

Treatment.—The general comfort should be attended to. The patient should be placed in a comfortable warm corner of the stable, and rubbed down to excite the action of the skin. The disarrangements of the digestive system are combated with ipecacuanha, coffee, and tartar emetic. When the movements of the rumen are re-established, a saline purgative and enemas will assist their action and the elimination of their contents, but in many cases purgatives are objected to, as they diminish the quantity of milk, and in this event an emollient diet must be relied upon.

The administration of repeated small doses of nitrate of potash is indicated, as it has a quasi-local action in causing the pathological products absorbed from the mammæ to be eliminated in the urine. The gland must be emptied several times daily, as in the case of catarrhal mammitis.

There are many lines of local treatment advocated, over which there is much dispute, and there is scarcely any other disease in which more widely different lines have each in their turn been lauded by those practising them, viz., *astringent*, *emollient*, *irritant*,

revulsive, and *sedative*. With all due deference to many eminent practitioners who have advocated them, we are of opinion that *vesicants*, *revulsives*, and *irritants* should be rejected, as they only tend to increase the inflammatory process and accompanying pain without in any way modifying the resulting lesions.

In the earlier stages astringents are indicated, such as vinegar and chalk, or a fomentation with warm vinegar, a solution of sulphate of iron, white of egg, sulphate of alumina and potash (Lecoq); collodion (Guillibert and Zundel); benzoic acid 1 part, tannin 5, and collodion 50 (Burri).

After this stage emollients should be employed, as they prevent the formation of abscesses, allay pain, assist absorption of exudation, and lower the temperature of the part. Linseed meal poultices are most useful; they no doubt are somewhat difficult to keep in position, but their good effects compensate for the trouble. If the pain is very great the addition of opium to the poultice will be useful. Williams, of Edinburgh, recommends a poultice of hops. He says, "These poultices are light, retain a large amount of water, and when necessary are easily changed. They are very soothing, and even when dry are not irritating." The older writers set great value on a suspensory bandage, and there is the advantage that it is easy to introduce any application between it and the mammæ.

Steaming either with hot water or medicated steam has been advocated, but is not to be recommended, and when it is impossible to apply a poultice an emollient ointment is to be preferred, such as camphor ointment (Hertwig), green soap, and extract of belladonna (Rychner); extract of hyoscyamus or iodide of potassium are all used in different forms, but whichever is selected it must be applied with continued massage, and be carried out systematically and regularly. The following are some of the best emollient formulæ :—

Nitrate of potash,		1 part.
Water,		2 parts.
Olive oil,	-	5 „

Make into an emulsion, and add 4 parts water.

Berdez recommends—

Blue mercurial ointmeal,	5 parts.
Soft soap, Lard, aa.	100 „
Wood tar,	q.s.

Apply two or three times per diem.[1]

De Bruin recommends oxide of zinc and camphor ointment.[2]

Detcehevers[3] had good results with subcutaneous injections of veratrine in bad cases of mastitis, with a temperature of 104° F. His formulæ is—

Veratrine,	40 cc.
Alcohol,	q.s. several minims.
Distilled water,	10 grammes.

But in all cases of parenchymatous mastitis antiseptic injections into the teat are not only useless but harmful.

If formation of an abscess is suspected, nothing can supersede a linseed meal poultice, which should be changed frequently.

Resolvents such as camphorated ammonia, liniment, or a mixture of blistering and mercurial ointment, have been recommended by Saint Cyr and Violet. Baumeister and Rueff use the following :—

Hyoscyamus succus,	8 parts.
Liquor ammonia,	2 „
Camphor,	1 part.

But, notwithstanding this high authority, the formulæ does not seem so efficacious as a poultice.

When pus has formed it must be evacuated, or else the healthy parts of the gland will be lost, but care must be taken, as cases of fatal hæmorrhage are not unknown when the operation is performed carelessly.

The cavity should be explored with the finger, the fibrous bands and pockets broken down, and as a rule a mass of seques-

[1] Hess. Monatschrift f. prakt. Thierheil. xi. page 211, 1900.

[2] De Bruin. Tydschr. voni veartser, 1889-1900, page 167.

[3] Detcehevers. Hypodermic injection of veratrine in the treatment of mastitis. Progrès Vétérinaire, 1895.

trum will be found retained in its place by the vessels. This must be broken down and extracted, the cavity being well douched with an antiseptic solution for the next few days, when, if the case goes on right, it will be found to close up rapidly. It is necessary to guard against the re-formation of the abscess, and not to forget that there may be secondary ones, which must be carefully looked for.

If gangrene has set in, the sloughing portion should be removed as quickly as possible, and in those severe cases where the whole gland is involved amputation should be at once performed. This has been successfully done by Flandrin, Hahm, Munch, Kohl, 1893;[1] Enke, 1893;[2] Deupser, 1891;[3] Schultz, 1890;[4] Hendrickx, 1890.[5] Schultz and Enke's operations have only been performed on one quarter, but in the others the whole gland has been removed.

The operation, although it sounds very alarming, is not, in the hands of an expert, so very difficult to perform, if the arrangement of the vascular system of the mammæ is remembered. In front of it, seeming to arise from the two anterior quarters, are the *subcutaneous abdominal* or milk veins. They run anteriorly along the abdomen on each side of the linea alba, and enter the chest through two openings, accompanied by an artery and nerve.

The two *perineal veins* arise from the posterior quarters running up each side of the perineum just under the skin; they are easily dissected out and ligatured.

The true nutrient artery is the *external pudic*, with the accompanying vein, nerve, and a large lymphatic, which enter at the postero-external portion of the posterior quarters: the artery is a large one, even in health, but it increases in size if the gland is diseased. The mammæ is attached to the abdomen by means of these vessels and two fibro-elastic ligaments, which arise from the centre of its base and are inserted into the abdominal wall. The attachment is completed by a large amount of loose connective tissue.

The patient should be thrown and turned on her back, the hind limbs being firmly secured, and the thighs slightly separated.

[1] Kohl. Berlin. Thierarzt. Wochensch. 1893.
[2] Encke. Necrose eines Euterviertels. Berlin. Archiv, xix. 319.
[3] Deupser. Berlin. Thierarzt. Wochensch. 1891, No. 14.
[4] Schultz. Berlin. Thierarzt. Wochensch. 1896.
[5] Hendrickx. Ann. de médecine vét., 1899, page 587.

After the region has been carefully washed and disinfected two incisions are made on each side of the teats, which join before and behind, so as to include them in an elliptical flap, "en cote de melon." The line of the incision should be carried up close to the base of the teat, so as to preserve as much skin as possible.

The skin should be dissected away from each side of the gland and the subcutaneous abdominal and perineal arteries and veins tied. The connective tissue can be broken down with the finger, assisted by a few strokes with a probe-pointed bistoury. The pudic artery when exposed is ligatured in two places, and divided between them, so as to avoid reflex hæmorrhage from the gland. The anterior part now being free is raised up, drawn backwards between the hind legs, and the suspensory ligaments divided as near as possible to it when the operation is complete. With proper precaution and skill on the part of the surgeon it should be done quickly and with comparatively little loss of blood.

The resulting wound is large, but it need not cause alarm. When the gland is removed the thighs should be brought together to remove tension on the flank and the skin-flaps brought into apposition and sutured, remembering to allow for drainage. According to Deupser resolution should take place in two months, and to Hendrickx in six weeks. This latter author remarks that the expense and trouble will be recouped by the fact that an animal that was valueless will fatten and make a good carcase for the butcher.[1]

CONTAGIOUS MASTITIS IN THE COW, DIFFERING FROM STREPTOCOCCIC MASTITIS.

In this section it is proposed to discuss certain observations on various forms of parenchymatous or catarrhal mastitis which appear to be contagious, but which it is impossible to classify with the streptococcic form either on account of there having been no bacteriological examinations made, or that it has been proved to be due to a different organism.

Dieckeroff in 1877 described a form of mastitis, characterised by rapidly forming tumefaction of one or more of the teats, with

[1] Hendrickx. Total ablation of the Mammæ in a Cow. Ann. de méd. vét., 1899, page 587.

alteration in the milk. Heifers, milch cows, and those in calf were all attacked; there were in many cases premonitory symptoms, such as rigors, loss of appetite, and slight fever. A case was seen in a nine months' old calf.

In most cases the lesions did not extend beyond the sinus, but in others the whole gland was involved, and the attack lasted several months. Death very rarely took place, but the formation of an abscess was the rule.

On post-mortem examination the canals were found to be full of caseous masses, the walls of the sinuses thickened, and sometimes covered with small tumours, the glandular structure being atrophied and replaced by fibrous tissue. Dieckeroff was at this time of opinion that the disease was due to local infection, and that it disappeared in the summer when the animals were turned out to grass. He thought that it was due to a specific ferment which caused the milk to coagulate in the sinuses and undergo decomposition, giving rise to irritation and its results; he also considered that inoculation took place either through the hand of the milker or by lying down. From the farm where the outbreak had commenced it was conveyed to a neighbouring one, where five out of nine cows were attacked, and from that to two others by a person who had been called in to value the stock.

The treatment adopted consisted in the injection into the teats of a solution of carbolic or salicylic acid or permanganate of potash, together with the usual sanitary precautions.

Outbreaks took place annually. When first noticed in 1873 nine animals were attacked, from March to September 1874 eight, in 1875 there were only a few isolated cases, but in 1876 it appeared in the winter and continued till the following autumn, during which time 140 animals suffered, some of them two and three times, and during the winter of 1876-77 there were several fresh cases. The history of this outbreak is important as it is proof of the extension of the disease.[1]

The epidemic which raged in the Duchy of Oldenbourg spread to the surrounding country, especially in the principality of Eutin.

Zurn relates the history of an outbreak in which 140 out of 180

[1] Dieckeroff. Infectious Mammitis. Deutsche Zeitsch. f. Thiermed., 1877, page 381.

cows were affected. The disease manifested itself without any premonitory symptoms beyond slight local heat of the part; there was no pain, but the milk had turned into a grumous purulent fluid, and of a yellow or white colour. In some rare cases it was followed by general malaise, loss of appetite, and stiffness of the joints.

In the milk the author found micrococci, filaments of mycotrix, spores of muco-mucedo, and cells resembling those of beer yeast. The disease could be propagated to the ewe and sow.[1]

Some years afterwards Dieckeroff witnessed another epidemic of mastitis in a large dairy. The disease was highly contagious, and was concurrent with lesions of the generative system. Various lines of treatment were adopted and failed; only complete isolation had any effect in stopping it. Reimers reported an infectious inflammation of the udder of cows at grass that is very prevalent in Schleswig-Holstein. There are both systematic and local complications, but as a rule recovery takes place.[2]

Faletti has observed among cows in the Valley of Aoste in Northern Italy, in addition to tuberculous mastitis and the streptococcic of Nocard and Mollereau, a third form, which is but little known. It attacks cows at any period they are in milk, the udder becoming hard, hot, and painful. The milk drawn off is serous, of a pink colour, alkaline reaction, and contains clots of caseine.

Microscopic examination shows a small micrococcus either isolated or in pairs, which readily stains with methyl blue. The case generally terminates in induration of the gland, and treatment as a rule is not successful, although in some cases, when taken in the very earliest stages, injection of a solution of boracic acid has had favourable results[3].

Thiele relates an epidemic of mastitis attacking 48 cows out of 93. Seven died, and the others, having lost the udder, were sold to the butcher. The disease appeared suddenly with considerable swelling of the gland, fever, and systemic disturbance. The secretion of milk was almost altogether suspended, the small

[1] Zurn. Contagious Diseases of the Udder of the Cow. Deutsche Zeitsch. von Bollinger und Franck, Bd. III.

[2] Reimers. Berlin. Thierarzt. Wochensch., S. 18, 5.

[3] Faletti. Giornale della R. Soc. Vet. Ital., No. du 15th Jan. 1898.

quantity given being caseous, bloody, purulent, and fœtid. No treatment was of any avail, but strict isolation saved half of the stock.[1]

Anderson relates as a curious fact that out of 14 cows in one shed 13 were attacked in one day, the disease commencing with rigors, which were succeeded by partial paralysis.

The temperature varied between 102° and 105° F., and the pulse from 96 to 112. In 10 of the patients the anterior quarters of the udder were attacked. The whole gland was hot, painful, and somewhat swollen, and the secretion diminished, consisting of serum, with flocculi floating about in it. After three or four days the animals began to recover and the appetite to return. In four cases there were articular complications, but eventually all recovered.[2]

This last case in all probability was one of streptococcic mastitis.

GANGRENOUS MASTITIS IN THE EWE.

Gangrenous mastitis in the ewe is a toxic infectious disease due to development in the galactopherous sinuses of a micrococcus, studied and isolated for the first time by Nocard in 1887. The disease is known in France by shepherds and others as *mal de pis*, *araignee*, and *cru*,[3] and is well-known in those localities in which milking ewes are kept. In Larzac it destroys numbers every year, and is the curse of those flockmasters who use the milk for cheese. The disease was first described by d'Arboval in 1823, again by Lafosse in 1856,[4] and in 1886 by M. Nocard at Joinville and Larzac. It is common in flocks around Paris, and M. Cagny calculates that annually 2 to 10 per cent of the ewes are attacked after lambing.

In other countries the disease was observed in 1889 by Esser, in the neighbourhood of Göttingen. The attention of the shepherd would be attracted by the ewes not allowing the lambs to suck, moving as if in pain, and dragging their hind limbs. Half the

[1] Thiele. Deutsche Zeitsch. Presse, 1898, No. 47.

[2] Anderson. Enzootic Mastitis. Schwed. Tidschv. f. Vet. Med., 1893, Bd. XII., page 110.

[3] Cagny. Société Centrale, 1887, page 213.

[4] Lafosse. La Mammite. Journal des Vét. du Medi, 1856, page 486.

ewes would be attacked in from twelve to fourteen hours, and they died in three to four days.[1]

Etiology.—It is due to a very small micrococcus in the galactopherous sinus, which has been isolated and studied by Nocard. These may be single or in colonies, and colour with any aniline stain especially Weigert and Gram. In broth it develops rapidly, so much so that in twenty-four hours the medium is almost milky. After forty-eight to seventy-two hours the growth is deposited at the bottom of the tube in a powdery mass with a strong smell.

On gelatine it grows in a yellowish-white film, and liquefies at the edges. On potatoes it grows very rapidly, coagulates milk, and turns it acid.

Injected into the sinus of the ewe a pure culture causes exactly the same manifestations as the spontaneously acquired disease, but is inert with the goat. This animal, however, is subject to a form of gangrenous mastitis that runs exactly the same course and with the same symptoms as the ewe, and in which is found an identical organism. It appears certain that the one found by the author and Mathis in the goat is identical with that of Nocard.

It is inert in most domestic animals, but injected subcutaneously in the rabbit gives rise to a local swelling, which rapidly runs on into an abscess in which the organism is found, which appears not to be limited to local reaction only, but gives rise to toxins that act on the system generally.[2]

Symptoms.—The disease commences with local and general symptoms, which are developed simultaneously.

The mammæ is swollen, hot, and painful, and in the earlier stages the milk becomes yellow, "the colour of beer," shortly afterwards changing to red.

These symptoms are in a few hours followed by the appearance on the skin of the gland of irregularly shaped red patches of different sizes, that change to a violet-purple and black colour. Over these patches the skin mortifies, becoming cold and insensible

[1] Esser. Seuchenartiges Auftreten der Brandigen Euterentzundung bei Schafen. Berlin. Archiv, S. 133, 3.

[2] Quite recently Roger and Garnier have isolated from the human female an organism that closely resembles Nocard's. It gives rise to subcutaneous suppuration like it in the rabbit and guinea-pig. It stains in the same manner and there is but little difference in its growth.—J. A. N.

with subcutaneous crepitation. In the same degree as the gangrene extends so does the mammæ shrink up and the local symptoms increase.

At the commencement of the attack the temperature is above normal, but it falls to 97° F. and the symptoms of poisoning increase. The patient remains constantly down, grinding the teeth, and rigors set in, death rapidly taking place in from two to four days. In those infrequent cases in which recovery takes place, there are open suppurating sores on the mammæ that appear to be very indolent, and take a long time healing up. The milk is lost, and it is difficult to fatten the animal for the butcher.

Pathology.—The skin is infiltrated and the connective tissue œdematous, containing gas and fœtid serum. The sinus is empty, but usually contains several dry red clots in which micrococci abound. The mucous membranes are red, the gland necrosed, and when incised resembles cooked meat or a piece of hard white cheese riddled with collections of pus.

Gangrenous mastitis from a histological point of view is of the same nature as epithelial. In certain localities there is complete destruction of the cells, only the basement membrane remaining intact, and this may be infiltrated or even destroyed.—(Fig. 14.)

The supramammary ganglia are infiltrated and contain the pathogenic organism. There is muscular atrophy and patches of ecchymoses under the endocardium.

Diagnosis.—The diagnosis is easy. The gravity of the general symptoms and the local gangrene should not leave any doubt in the mind of the practitioner, together with the fact that there is no other disease amongst sheep that at all resembles it.

Prognosis.—If not attended to in its very earliest stages it is almost always fatal, and when once cutaneous gangrene has set in no treatment is of any use.

Treatment.—Is chiefly prophylactic, consisting of isolation of the diseased and disinfection of the place they have been in. When taken at the outbreak the skin over the udder should be freely incised and the wounds dressed with powdered sulphate of copper, iodoform, tar, cresyl, or some like agent. M. Nocard has used as an injection into the sinus various antiseptics, such as boracic acid, 4 per cent.; corrosive sublimate, 1 to $2\frac{1}{2}$ per cent.;

iodine, 1 to 2 per eent.; sulphate of copper, 2 to 4 per cent.; and carbolic acid, 2 to 3 per cent, without result.

After gangrene has set in the udder may be amputated, and this has been performed several times by Esser. He removed half the gland, and after bleeding had ceased powdered the wound with iodoform and a dressing of wood tar; the results were good—out of five cases one death.

After disinfecting the contaminated flock, Esser dipped them on a hot afternoon, and then drove them with the lambs to a warm, well-sheltered pasture, where they were under the care of another shepherd; the disease disappeared.

Huth reports the existence of a gangrenous mastitis of a different type to Nocard's, with septic metritis. The disease was most virulent, and the patients died in a very short time. The remainder of the flock were only saved by removing them from the infected building.[1]

MASTITIS IN THE GOAT.

Mastitis in the goat is seen in two forms, purulent and gangrenous.

A. Purulent Mastitis.—This form has been observed by Gillibert, Bossi-Virginio, and the author. In Tuscany it is known as mal de Rospo, and is seen a short time after kidding. The attack develops slowly, with painful swelling of the gland, the skin tense, shining, and red, with pain on pressure.

The patients constantly remain down, with loss of appetite and rumination, the temperature is 104° F. The milk at first is clotted, but afterwards purulent and fœtid.

Abscesses form in the glandular parenchyma and open externally, giving exit to a large quantity of white pus that has a milky smell, and contains the *débris* of mortified gland tissue. According to Bossi-Virginio the disease is due to a specific diplococcus that is very small, mobile, and forms chains. It colours with any aniline stain, liquefies gelatine, and coagulates milk, which smells like new cheese.

If the pus is injected into a healthy udder it will reproduce the

[1] Huth. Gangrenous mastitis and septic metritis in the ewe. Berlin. Archiv, xix. s. 103.

disease; also a pure culture will do the same four days after inoculation. On section a number of small abscesses are seen, and microscopic examination reveals neo-formation in the connective tissue with atrophy of the glandular acini; the mucous membrane of the sinuses and large canals is obliterated.

This disease must not be confounded with agalaxia, from which it altogether differs.[1]

The most successful treatment consists in opening the abscess and disinfecting the cavity with warm astringent and antiseptic solutions. Bossi used carbolic acid 3 to 4 per cent., and corrosive sublimate 2 per 1000.

B. Gangrenous Mastitis.—In the goat it is due to Nocard's micrococcus, but the author has seen a case having all the characteristics of the form due to this micrococcus caused by a short bacillus that took Gram's stain. It grew well on various media, coagulated milk, and on gelatine formed yellowish-white colonies that gave off the characteristic smell of gangrene.

When inoculated into the sinus of the cow, a small inflammatory area was formed the size of a nut. The guinea-pig and rabbit remained immune.[2]

In one case M. Mathis found an organism resembling that of Nocard, and the author has the same experience. It is either a coccus or diplococcus, rarely in chains; readily takes the various aniline stains, but especially methyl blue, and also colours by Gram and Weigert's methods. It is present in the large canals and glandular tissue, also occasionally in the supra-mammary ganglia. Injected subcutaneously in the sheep, rabbit, and goat, it gave rise to the formation of abscesses (Mathis).[3]

Symptoms.—Usually the development of the attack is rapid, The animal remains standing up, with the hind legs apart, the head down, and panting. The gland is swollen, hard, hot, and painful, the teat elongated, and giving exit to a pink-coloured foul-smelling fluid. Cold patches of a red or violet colour quickly develop on the skin, and the gangrene invades the neighbouring regions.

[1] Bossi Virginio. A form of purulent parenchymatous mastitis in the goat. Giornale. di Anato., 1888, p. 135.

[2] P. Leblanc. Gangrenous mammitis in the goat. Journal de Lyon, 1899, page 459.

[3] Mathis. Gangrenous mastitis in the goat. Journal de Lyon, 1895, page 82.

The patients then go down, are very dull, and high fever sets in (104° F.); death takes place in from three to five days.

Post-mortem.—On section of the udder soon after death the sinuses and neighbouring tissues are gangrenous, of a deep red colour, with red clots that are rich in bacteria, and the whole organ cuts under the knife like cheese. The subcutaneous connective tissue is abundantly infiltrated with a yellow serum, and the inguinal glands are hypertrophied, congested, and softened.

On microscopic examination the gland tissue is destroyed, only the connective bands remaining, and in parts even these have disappeared.—(Fig. 13.)

In those portions not yet invaded by necrosis there is a total loss of the epithelium of the acini, which blocks them and the lumen of the canals up; the colonies of micro-organisms can be readily detected in their midst. There is a large amount of infiltration of lymph cells into the connective tissue. In those cases in which the progress of the disease is slower, there are a number of small abscesses in the substance of the gland, surrounded by black or green tissue.[1]

Diagnosis.—This is always easy, the virulence of the symptoms and the appearance of the necrotic patches are characteristic.

Prognosis.—Always bad, and generally fatal.

Treatment.—Isolation of the sick and disinfection of the place they have been in is of the first importance. The injection of disinfectants into the sinus is of no use. Scarification of the gland, with the application of cresyl or wood tar, has in some cases had good results, but as a rule amputation is necessary.

MASTITIS IN THE SOW.

Mastitis in the sow is rare, if we may judge by the want of literature on the subject, the only writers being Sequens and Tatray. In Sequens' case his attention was called to it by 95 young pigs, out of a herd of 500, nearly succumbing from starvation, and he discovered that a great number of the sows were suffering from mastitis, two or three of the teats being involved, the epidermis having desquamated, and the orifice being obstructed.

[1] P. Leblanc. Gangrenous mammitis in the goat. Journal de Lyon, 1899, page 272.

In other cases there were ulcers that nearly severed the lower part. The author attributed it to frost-bites, the pigs having been taken to drink in the snow on a very cold day.[1]

Tatray has seen it in sucking pigs appearing to be contagious, and attacking animals from three to four months old. In one year two-thirds of the pigs lost from two to eight of their teats, and were useless for breeding purposes. The symptoms were swelling, pain, and redness of the mammæ, the skin tense, shining, and obstruction of the orifices. After three or four days a fissure formed round the base of the teat, so that the skin could be everted. There was intraglandular suppuration, and in certain cases the lesions existed for four months without interfering with the general state of the health.

Sequens considered the disease due to infection from a specific organism in the pus.

The herd consisted of 1200, and the teats were washed with carbolic solution 3 per cent., or corrosive sublimate 1 per 1000. He also painted the part over once a week with a mixture of creoline and gum, and by these means stamped it out.

MASTITIS IN THE BITCH.

Acute suppurative mammitis in the bitch is by no means uncommon shortly after parturition, and one or more glands may be involved. They become swollen, hard, tense, and painful, and the milk is changed into a purulent fluid, with great pain and high fever, the appetite being completely lost. The animal lies down constantly on her side, and takes no notice of surrounding objects. After the lapse of a very few days multiple abscesses form in the tissue of the gland, and point externally, leaving indolent ulcers and fistulæ that heal up but slowly. Death from pyæmia may take place.—(Lucet, Leblanc.)

In one case observed by the author the first and second mammæ on the left side were affected with abscesses, and in one reported by Lucet the second. He states that he found a white staphylococcus in the pus.[2]

[1] Sequens. Absterben der Euterzitzen bei Mutterschweinen. Veterinarius, No. 11.

[2] Lucet. Fatal case of mammitis in a bitch. Recueil de Médecine Vétérinaire, 25th June 1896.

After death lesions were discovered in the liver, spleen, and kidneys, from the fluid of which, on gelatine cultures, the same organism was isolated.

Lucet's observations are interesting, as it is probable that in what he terms adeno-fibromata, the *Staphylococcus albus* will be found, as it has been in the same neoplasm in the human being, and this is another argument in favour of the inflammatory nature of this condition in the domesticated animals. Gaucher and Surmont injected into the sinus of the bitch pure culture of the *Staphylococcus albus* from a case of chronic mammitis in the human being, causing subacute inflammation of the gland.

The author has studied the histological lesions of acute mammitis in the bitch, which are those of all acute inflammations. The epithelium is chiefly involved, the connective tissue being but very slightly infiltrated, and in the substance of the gland there are minute abscesses.

CHRONIC MASTITIS.

CHRONIC CATARRHAL MASTITIS IN THE COW.

STREPTOCOCCIC MASTITIS.

Streptococcic mastitis assumes many forms; it may be acute or chronic, sporadic or enzootic, and is known in France under the names of "mastitis of milking cows," "contagious mammitis," and "streptococcic mammitis." In Germany as "contagious catarrhal agalaxia" (Kitt), and in Switzerland as "galt" or "gelber galt."

It is impossible to classify the observations on contagious mastitis published before those of Nocard and Mollereau, under the heading of streptococcic mastitis,[1] but nevertheless these authors demonstrated that it was due to specific organisms, and opened the way for future bacteriological investigation.

In the same year Kitt in Germany published some experiments he had made, and in other countries various authors—viz. in Germany and Denmark, Bang,[2] Switzerland (Hess and Borgeaud),[3] Italy (Faletti),[4] England (Clements),[5] and Holland, Lameris and Van Harrevelt,[6] all observed the disease, and have published articles on it. In 1893 Zschokke undertook some important bacteriological and experimental researches into the matter, which cleared up a certain number of points that till then had been obscure.

Bang maintained the identity for several years between Nocard's microbe and that causing "gelber galt," and the researches of Kitt and Adametz[7] have demonstrated that the active agent of "gelber

[1] Nocard and Mollereau. Contagious mammitis in milking cows. Bulletin de la Société cent. de méd. vet., 1884, page 308; 1885, page 296.

[2] Bang. Aarsagerne til Yverbetänd, &c. Tridssk. f. Veart, 1888, page 19.

[3] Hess and Borgeaud. Euter. contagiose, &c. Schweiz. Archiv. f. Thier. t. xxx. 1888, page 97.

[4] Faletti. Mastite parenchymateuse contagieuse, &c. Il med. vet. 1887, p. 484.

[5] Clements. Journ. of Compar. Med. and Vet. Archiv., 1897, page 135.

[6] Lameris and Van Harrevelt. Bakterienbefund. in Kuhmilch. nach abgeheilter Mastitis. Zeitsch. für Fleisch und Milchhyg, January 1901, page 114.

[7] Adametz. Betrag zur Kentniss des Streptokokken des Gelben Galt. Journ. für Land., XLII. 1894.

galt" was the same as that causing the mastitis of milch cows of French veterinarians, and to which he has given the name of "streptococcus agalactiæ contagiose," the organism being about 1 μ in diameter, staining readily by Weigert's method, but not so well by Gram's. In bouillon an abundant culture appears in six hours, clouding the material, and causing a white deposit to form at the bottom of the tube, the media becoming rapidly acid when the growth is checked.

On gelatine it grows in translucid white colonies, puncture cultures are white, granular, and opaque, but the medium is not liquefied. Milk is coagulated in less than twenty-four hours and is turned acid.

Injected into the mammæ of the cow and goat it is pathogenic, but subcutaneously has no result in the dog, cat, rabbit, or guinea-pig.—(Nocard and Mollereau.)

The disease is well known in many parts of France, Switzerland, Bavaria, Saxony, Holstein, Denmark, and Italy.

Symptoms.—As observed in France by Nocard and Mollereau, it developed slowly, without giving rise to any general constitutional disturbance. The milk fell off in quantity, but with the exception of quickly turning sour, it remained normal in appearance for some length of time.

On examining the mamma a nodule is noticed at the base of the teat, which gradually increases in size, varying from that of a pigeon's egg to a man's fist, and surrounded by a badly defined belt of œdematous tissue. The milk in this stage is at first watery, blue, and rich in leucocytes, but afterwards turns viscid, of a yellow or pink colour, and contains numerous clots.

In Switzerland "Zschokke" observed that there was suppression of the secretion and atrophy of the mamma, and that while it lasted the milk clotted, so much so that he looks on this as diagnostic of the disease.

Bang has reported certain cases of the disease in an acute form, with considerable constitutional disturbance, fever and loss of appetite. One or two quarters were affected, and there was a certain amount of inflammatory œdema, with heat and pain, the milk becoming purulent and the gland atrophied. Anderson reports an enzootic, in which there was serious systemic and local disturbance, the temperature rising to 105° F.

Christensen saw the disease in three cows that had calved, and in two others that had been put into the same stalls. In all five cases the development was acute and the symptoms severe. In two animals all four quarters were affected, in one three, and in one two. One of these cows died. Two others brought into the same stable were affected in all four quarters, and in all of them Bang detected the streptococcus in the milk.[1]

Complications.—In milking cows it is often complicated with arthritis and synovitis. The animal stands and moves with difficulty, and is very lame. The synovial sheaths are tense, hot, and painful, and the surrounding region swollen and deformed. As the primary lesions disappear, so do these secondary ones, and with them the lameness.

Lesions.—The diseased quarter atrophies, and is transformed into a fibrous mass. On section it is firm, dense, compact, and of a dirty white colour. There is an excessive amount of interstitial connective tissue, but most of the lobules are atrophied and obliterated. Microscopic examination clearly shows the lesions to be sclerosis, the epithelium being desquamated from the walls of the canals, blocking up their lumen as well as the acini, which are in many instances greatly dilated, the interstitial connective tissue being also much infiltrated. In sections stained with methyl blue, the streptococcus is seen amongst the cellular *débris.*—(Nocard and Leclainche.)

Diagnosis.—The contagious nature of the disease and the form it assumes, "so often catarrhal," are valuable indications. The clot formed by the milk, the absence of abscesses which so frequently are complications in parenchymatous mastitis, and the metastatic tendinous or articular synovitis should all be considered.

Prognosis.—Is always bad. As to its contagious nature, Cléments has seen 100 cows attacked within three weeks, and its termination is generally induration and loss of the quarter, from which but few recover. All other factors being equal, the attack is more severe the nearer the cow is to calving, and according to Zschokke the larger the number of streptococci found in the milk so is the danger the greater, which he maintains depends on the state

[1] Christensen. Austeckende Euterenzundungen bei Kühen. M.F.D. 1895-96, Bd. vii. s. 121.

of health of the patient. He advances the theory that if only short chains are present the disease is curable, but if long ones are it is not.

Treatment.—Preventive measures are of primary importance, the animals being isolated, the stalls cleaned, the flooring dug up and renewed, and the whole carefully disinfected.

The attendants on the diseased cattle should not be allowed to come in contact with the healthy, the cows must be milked into separate pails, and the greatest care taken it does not get mixed. If not altered it may be boiled and fed to pigs, but usually it is advisable after first boiling it to throw it away.

Nocard and Mollereau advocate the injection of a warm 4 per cent. solution of boracic acid into the gland, "about 100 to 150 grammes," two or three times at intervals of five to six days, when the milk will assume its normal state. Galtier uses a solution of iodine in the same manner.[1]

With the same object Eggeling advises an injection of corrosive sublimate to be retained ten to fifteen minutes, Weigenthaler salicylic acid, and Eber carbolic acid, with local applications, such as a solution of acetate of lead, or an ointment 1 to 4 of camphor and green soap to be applied with massage.—(Reimers.)

We do not place much faith in the plan of irrigation of the sinuses, as, besides being one that requires skilled application, they are irregular and full of pockets, so that it is almost impossible to properly disinfect the whole, especially the large canals, which are always implicated. We have repeatedly tried this plan but without success.

CHRONIC PARENCHYMATOUS MASTITIS.

Chronic mastitis is of much less importance than the acute form, and is not so often seen, which is not surprising when it is remembered that if affected cows are fattened for the butcher, ewes and goats die; at any time it is not common in the sow or mare, and the only animal it is likely to be noticed in is the bitch. Unfortunately but little mention is made of it in veterinary literature, as most of the cases of hypertrophy of the gland in this animal are described as tumours, whereas in reality it is the sequel of previous inflammation.

[1] V. Galtier. Treatment of streptococcic mammitis in the cow with injections of solution of iodine. Bull. de la Soc. des sc. Vét. de Lyon, 1901, No. 2.

CHRONIC PARENCHYMATOUS MASTITIS IN THE COW.—INDURATION OF THE GLAND.—CHRONIC ABSCESS.

Chronic mastitis in the cow is always the result of a previous acute attack, the usual lesions being "chronic abscess" and "partial or diffused chronic mastitis," which latter is sometimes termed "induration."

1. *Chronic Abscess.*—Is always due to a former attack of mastitis. The inflammatory symptoms disappear, and the cow again comes in milk, to all appearances recovering perfect health, whereas points of infection exist that only require some exciting cause to be aroused into activity. Anything will do this, such as a kick or blow, or even the physiological congestion accompanying the next calving. The case may remain latent for weeks or even months without attracting attention, and even when the abscess forms does not give rise to much inconvenience.

The cow continues in milk, and until there is a considerable collection of pus the gland is not deformed. When this takes place there is a certain amount of œdema, which fluctuates if the pus is near the surface.

The only treatment is to open the abscess and evacuate the pus, which generally is abundant, white, and with a milky smell. There is almost always a sequestrum, which must be broken down and removed in fragments, care being taken not to injure any of the large blood-vessels that cross the cavity, which must be frequently douched with a warm antiseptic solution.

2. *Circumscribed Chronic Mastitis.*—In all probability this is the result of intensified inflammatory action in certain localities during the primary attack of acute mastitis. These portions, being more profoundly altered than others, do not recover their normal condition with the rest of the gland, but always remain prone to further attacks.

Such lesions are often seen in old cows whose udders are rarely of a uniform suppleness, but have in them hard, firm patches that are painless but incompressible. On microscopic examination a large preponderance of fibrous tissue over the true gland structure is seen, with atrophy of the acini, which are sometimes obliterated by pressure, or, on the contrary, may be dilated by obstruction of the canal.

Sometimes, however, these hard masses are cysts formed from the mucous membrane, which may or may not contain milk.

3. *Diffused Chronic Mastitis or Induration.*—Induration is one of the terminations of acute mastitis, and consists of atrophy with fibrous degeneration of the diseased quarter. On manipulation the part is felt to be hard, firm, and smaller than the other quarters, with the secretion of milk almost entirely stopped, the teat being contracted and wrinkled up, but the animal otherwise in perfect health.

Microscopic examination shows an abundance of connective tissue round the acini, with the formation of cysts in them. There is no pain, and the general state of health and functions of the body are not interfered with, neither are the remaining quarters, and the animal readily fattens. Treatment is useless.

CHRONIC MASTITIS IN THE BITCH.

This is exceedingly common, in fact it is rare to find an old bitch that has had many litters whose mammæ are perfectly normal, but no doubt many of the cases described as adeno-fibromata, fibromata, and tumours are nothing but the results of a previous acute attack of mastitis. The enlargement is noticeable by contrast with the other glands, if the animal is not suckling, and should be considered as chronic lesions, not tumours.

As in the cow, the lesions may be localised or they may involve the whole gland, converting it into a hard, fibrous mass, irregularly nodulated, which is painless.

In certain cases there are cysts of undoubted inflammatory origin in the stroma of the fibrous mass, which may develop until they invade the whole gland; these may be single or multiple. The walls are studded with sessile hemispherical granulations, and the fluid contents vary, being sometimes a clear yellow serum, at others thick and viscid.

The only treatment is extirpation, which if properly performed is successful, there being no danger of recurrence. (See article *Tumours.*)

BOTRYOMYCOSTIC MASTITIS.

A. Mare.—Botryomycostic mastitis is not uncommon in the mare, the first instance being reported in 1890 by Nielsen and Sand, who saw five cases. The gland is swollen, "looking as if the mare was in milk," hard, and irregularly nodulated; the skin being tense, shining, and adherent to the structure; it is slightly painful, and usually both quarters are involved. When she moves the animal carries her hind legs apart with a straddling gait.

There are always one or more fistulæ penetrating deeply into its substance, from which is discharged a small quantity of thick yellow pus, in which are a number of yellow granular bodies resembling those of actinomycosis, but much smaller. The parasite can be discovered on microscopical examination. Fröhner also records several cases.[1]

The only treatment that is of any use is extirpation of the gland, which has been done under an anæsthetic by Sand with success.[2]

B. Cow.—The disease has been observed by Csokor, causing fibromatous changes in the organ with fistula. Microscopic examination confirmed the diagnosis.[3]

Immelmann also reports a case.[4]

C. Sow.—Hakanson saw one case in which the symptoms were the same as the mare. The gland was extirpated, and a cure effected in two months.

ACTINOMYCOSTIC MASTITIS.

A. Cow. — Like botryomycosis, actinomycosis attacks the mammæ, gaining access by the teat, causing neoplasms of varying size in the parenchyma, or glandular sclerosis, analogous to that of tuberculosis, which suppurate, forming ulcers and fistula, in which the parasite can be found. Four cases have been seen by

[1] Fröhner. Botryomycose des Euters bei einer Stute. Monats. f. Thierheil., Bd. vii. s. 55.

[2] Sand. Ueber Botryomy. im Euter bei der Stute. Arch. f. Thierheil., tome xix., 1893, page 98.

[3] Csokor. Ueber mastitis botryomycotica. Tagelb. d. Notarforse, 15.

[4] Immelmann. Botryomyces im Euter einer Kuhe. Arch. f. Thierheil., tome xix., 1893, page 103.

Rasmussen and Bang, Harms, Jensen, Johne, Erhardt,[1] Williamson,[2] and Korewaar;[3] Maxwell found eight separate centres in the udder of a cow.

B. Sow.—Bang in three months saw fifty-two cases, and Hertwig mentions one in which not only were all the glands attacked, but several of the lumbar vertebræ also.

The tumours in the earlier stages may be mistaken for adeno-fibromata or sarcomata, and are recurrent. Usually the middle teats are involved, commencing with induration of the base, but as a rule the inguinal glands are not implicated.

On section the lesions of the gland consist of a white fibrous tissue, studded with cellular patches of a yellowish grey colour, irregularly rounded and well delimited, standing out above the cut surface, varying in size from a hemp seed to a hazel nut. Sometimes they are softened and broken down, the pus containing a large number of sulphur yellow, seed-like particles, that are characteristic of actinomycosis.—(Hamoir.)[4]

In such cases surgical interference is called for, the operation being the same as in the bitch, but it is advisable also to remove the two neighbouring glands as well, to prevent recurrence. A tampon of cotton wool, with tincture of iodine, should be placed in the wound, and the lips sutured over it, which can be removed in forty-eight hours.

C. Mare.—Only one case is reported by Schöneck; the symptoms were the same as in botryomycosis. On microscopic examination the parts least affected show all the appearances of chronic interstitial mastitis. In the neighbourhood of the parasite the glandular structure is displaced by fatty degeneration.—(Müller.)[5]

MAMMARY TUBERCULOSIS.

The first good description of mammary tuberculosis was given by Fünfstuck in 1870, but since then this phase of the disease has been well recognised. Amongst the most interesting observations

[1] Erhardt. Schweizer Archiv, April 1896.
[2] Williamson. Veterinary Journal, 1899.
[3] Korewaar. Tijdsch. voor veartsenig, 3 aflescurig, 1896.
[4] Hamoir. Ann. de méd. vét., May 1898, page 251.
[5] Müller. Münchener medicin. Wochensch., 1894, page 1027.

are those of Franck and Bang, who in a very short time saw twenty-one cases. Hesse and Ernst,[1] Johne, Carsten Harms, May, Stüys, Fiorentini,[2] Nocard,[3] Smith, Ostertag,[4] and Knuth,[5] who has published an interesting case illustrated with photographs.

Nocard records three cases of tuberculous mastitis in fifty-four in which it was general. Kunhau saw 119 cases in the abattoir at Lunguts out of 17,202 cows. In Saxony mammary tuberculosis was common in the proportion of about 3 per cent. of tuberculous animals slaughtered from 1888 to 1896, and in the whole of Germany 6 per cent.[6]

Bang gives it as his opinion that many cases are not noticed.

Symptoms. — Fünfstuck gives the following description of tuberculous mastitis :—" The milk goes off, and the mammæ gradually get harder, without any inflammatory symptoms, until they resemble a stone. The animals, at first healthy, get thinner and thinner, but with the local lesion I have always noticed generalised tuberculosis.[7]

This description is the same as was given by Franck in 1875 and by Bang, who is of opinion that at the commencement of the attack there is little alteration in the general state of the health. The tumefaction, however, gets gradually harder, and in the earlier stages there is no alteration in the character of the milk. After a time it gets thick and yellow, but never purulent, which seems to differentiate it from streptococcic mastitis. Storch has analysed tubercular milk, and found it deficient in sugar, fat, phosphorus, and lime salts, but rich in soda and albumen.

If the hind quarters are affected the corresponding supra-mammary glands are hypertrophied. The lesion may be local or associated with systemic tuberculosis, and terminates in extreme emaciation, the animal dying in two to four months.

We have seen two cases in the clinic of the Lyons Veterinary College presenting all the appearance of parenchymatous mastitis

[1] Ernst. New York Medical, 1889, page 756.
[2] Fiorentini. L'allevatore, November 1894.
[3] Nocard. Mamm. tuber. Soc. cent., 30th December 1896.
[4] Ostertag. Zeitsch. f. Fleisch und Milch., 1899, page 53.
[5] Knuth. Zeitsch. f. Fleisch und Milch., 1900, page 168.
[6] Martel. La tuberculose et l'hygiène alimentaire. Presse Médicale, 22nd September 1900.
[7] Fünfstück. Bericht ub. Veterin. in Sachsen, f. 1870.

with suppression of milk, general hypertrophy of the quarter, which was hard and swollen, the supramammary glands being involved.

In one case the animal had been treated for fifteen days without any result, the nature of the disease not being recognised; she was then slaughtered as she had become greatly emaciated. On post-mortem examination she was found to be affected with general tuberculosis, and that almost the whole of the structure of the gland was involved.

The milk from the affected quarters is dangerous. Bang reports two cases of infection by ingestion, one in a calf and the other a woman. In connection with the latter case a child who was fed on the same milk from a cow with a tuberculous udder died in about six months. There are also numerous other cases reported.

Etiology.—In the majority of cases the gland is primarily affected through the current of blood,[1] and it either coincides or is secondary to tuberculosis of other organs.

In one case we came across mammary tuberculosis in a sow, although it could not be detected elsewhere. One gland alone was involved, being turned into a fibrous mass studded over with tubercles, which reproduced the disease in a guinea-pig.

M. Nocard has reproduced the disease experimentally. He says: "If a small quantity of virulent tubercle culture is injected into the udder of a milking cow or goat tubercular mastitis is induced, which progresses so rapidly as to cause death in a few weeks. In such experiments mastitis appeared in from six to thirteen days with a persistent temperature of 104° to 105° F. up to a short time before death. Post-mortem examination showed that the mammæ and mammary ganglia were affected.[2]

Pathological Anatomy.—The whole udder is enlarged, hard, and resistant to the knife, whereas if healthy it is elastic on section. The cut section has a peculiar appearance, the lobules being very distinct and separated from each other by thick infiltrated and injected bands of connective tissue, the red colour of which is most marked. The lobules themselves vary in colour, from a yellowish

[1] In 119 tuberculous animals Lungwitz states that in all the cases in which he saw tuberculous mastitis there are other organs affected.

[2] Nocard. Experimental tubercular mammitis in milking cows and goats. Recueil de méd. vét. 1900, page 721.

grey to red, and the large vessels are embedded in the connective tissue. This gives a section of the gland a mottled appearance. The membrane lining the sinus is dull and rough, and has a number of small tubercles growing from it.

In the sow the gland is fibrous, hard, and smaller than in health. It is surrounded by a thick fibrous capsule that sends septa into its substance, dividing the lobules.[1]

Fiorentini saw four cases of miliary tuberculosis in the mammæ of cows. Möbius recalls one of primary infection, all the other organs being healthy.[2]

Fiorentini remarks that the lesions commence in the insterstitial tissue at the periphery of the gland and advance to the centre.

The acini and minute canals remain visible, but there is an infiltration of leucocytes into the lobule. In cases of old standing the lobules, although retaining their form, become uniformly granular, the acini disappear, the canals can no longer be distinguished, and in certain cases contain giant cells.

Dubor, Orthmann, and Piscascek consider that these cells form in the acini at the expense of the epithelium. Sabrazes and Brissaud do not agree; they are of opinion that they are not true giant cells, but that their origin is mesodermic.

In the galactopherous canals the earlier lesions are peripheric infiltration, that at certain points are so abundant as to form small nodules that gradually protrude into the lumen of the canal, destroying its lining membrane. Tuberculous follicles form in the connective tissue, also vegetations in the arteries, which may completely obstruct the vessel.—(Delbet.)

Kolesnikow noticed catarrhal inflammation in the lactiferous canals as well as chronic interstitial lesions. Sections show hyperplasia of the interstitial tissue with well-marked chronic interstitial mastitis, and scattered through the interlobular connective tissue giant cells.—(M'Fadyean.)[3]

In some of the lobules the excretory canals are obliterated, in others they are dilated and filled with round cells.

[1] Primary mammary tuberculosis in the sow has been recorded by Van Harrevelt. Tidsch. voor. Veartse, 1899.

[2] Möbius. Primary mammary tuberculosis in the cow. Jahresb. Schütz und Ellenberger, 1897, page 52.

[3] M'Fadyean. Tubercular mastitis in the cow. The Journal of Comp. Pathol. and Therapeutics, vol ii., 1889, page 119.

Some of the acini are atrophied, others dilated and choked up with cells in process of undergoing fatty degeneration, so that under the microscope the nodules look like adipose tissue. In many places both blood and lymphatic vessels are obliterated.[1]

Diagnosis.—For a long time the true nature of tubercular mastitis remained unrecognised. The persistence of subacute inflammation, the gradual increase in the size of the gland, its peculiar hardness, and progressive loss of condition, are all manifestations. The lymphatic glands that are accessible should be always examined, also the respiratory organs, by auscultation and small pieces of the gland, for which purpose M. Nocard advises the harpoon trocar of Duchenne, of Boulogne. This instrument is one-sixteenth of an inch in diameter and is plunged into the hard part of the udder, bringing a small portion of tissue back with it.[2]

This plan has been largely used in Germany by Ostertag and Knuth, of Berlin.[3]

Prognosis.—The prognosis is bad. Primarily it acts as a point of departure for organic intoxication. Secondly, it is accompanied by generalised lesions, which of themselves will cause death by cachexia.—(Nocard.)

Prophylaxis.—The matter of sanitary police is not within the scope of this work, and we will not enter into a discussion as to whether the milk of a tubercular cow that shows no local lesion is dangerous or not; all we will say is that in most civilised countries precautions are taken, particularly in France and Denmark.

It is prudent to boil milk from unknown sources, as the bacillus resists a temperature below 203° F.

PARASITES IN THE MAMMARY GLAND.

The only case reported that we can find is one of an echinococcus by Rehmet.

[1] Kolesnikow. Archiv de Virchow, vol. 674, page 531.

[2] Nocard. Tuberculous mastitis. Société centrale, 30th Dec. 1896.

[3] Knuth. Ein Beitrag zur Fertstellung der Eutertuberculose und der Frage der Virulenz der-Milch eutertuberculöser. Zeitsch. f. Fleisch und Milch, 1900, page 168.

MAMMARY TUMOURS.

BY Y. BALL AND P. LEBLANC.

The tumours of the mammary gland are divided into three classes :—

1. Benign. Those that are clearly defined, localised in the gland, and not connected with neighbouring tissues or glands, and which do not recur.
2. Malignant. Those that are not clearly defined, that encroach on the neighbouring tissues and glands, and are likely to recur after operation.
3. Sarcomata. Those that are intermediary between benign and malignant; at the commencement, resembling the former but terminating in the latter.

The origin of benign mammary tumours in the human being is disputed. Cruveilhier, Reinhart, Virchow, Cornil, and Ranvier consider that they arise from the connective tissue; Lebert, Broca, and Verneuil that they have a glandular origin. The reason of this difference of opinion is that such tumours are seldom formed of one tissue only.

The connective tissue theory is unsatisfactory, as it does not explain the almost constant presence of *culs de sac*, the number of glandular elements in the interior of the tumour, or the formation of cysts.

Delbet considers that the majority of benign mammary tumours are of glandular origin and should be classed as adenoma. He considers, "and we think with reason," that they are not strictly neoplasms but inflammatory products.

Malignant tumours or cancer are not uncommon, especially in the bitch, in which animal, as well as the mare, carcinoma and epithelioma are known. The former can be considered as a variety of the latter, as they are really only infiltrated epithelioma.

Most pathologists consider that the latter is of glandular origin,

which view, however, is disputed by Virchow, but it has been pretty well acknowledged that the carcinomata are epithelial.

The theory of inflammation as regards benign tumours has been held by Virchow and Kœnig, the former of whom has said regarding fibromata of the mammæ,—"In the commencement there is interstitial mastitis, which involves the lobules of the gland and extends to the canals." The opponents of this theory put forward that such tumours in the human being are encapsuled and moveable, whereas in the bitch, with those known as adeno-fibromata, this is not the case, although no doubt they are the result of an attack of mastitis that has become chronic.

Such growths are usually seen in the posterior glands of old bitches that are subject to injuries, and while in milk are liable to be overlooked. They vary in size up to that of a man's fist, and do not invade the surrounding tissues, remaining for a long time of their original size, which is not the case with a true neoplasm.

When divided in certain parts there is an excess of connective tissue, in others numerous cysts due to destruction of the conjunctival walls separating the acini.

When the adeno-fibromata of the bitch is compared with chronic mastitis of the cow the numerous points of resemblance are very striking. In both there is hyperplasia of the connective tissue, dilatation of certain groups of acini, and the presence of cysts.

In studying the adeno-fibromata one can come to the conclusion that although in some essentials they resemble the adenomata, that they in reality differ greatly, and that what would be classed as such from a classical point of view would, to a pathologist, be a neoplasm, chiefly composed of connective tissue, which has obliterated the acini.

We have given a number of drawings of these growths, which may be of interest, but it should be remembered that the greater the amount of inflammation the greater the extent to which the mammæ is disfigured.

Diagnosis.[1]—In the earlier stages mammary tumours are seldom noticed. They frequently grow to a considerable size, but it is not usually easy to determine their precise nature. From a clinical point of view we have classified them into benign and malignant.

[1] The deductions arrived at are entirely based on observations made on the bitch.

The first are seldom very large and have no tendency to spread. They are confined to the gland itself and are moveable under the skin; furthermore, the neighbouring glands are not affected. The adeno-fibromata, fibromata, lipomata, chondromata, and myxomata are all classified in this group; the epitheliomata, carcinomata, and sarcomata, which are the three varieties clinically termed cancer, constitute the latter.

These are, as a rule, readily recognised, having a large base with diffused edges, a tendency to spread, sometimes involving the whole gland, and the neighbouring lymphatics are almost invariably involved.

Prognosis.—The prognosis of a tumour depends on its nature and development, cancer being exceedingly grave from its tendency to spread, whereas the others are nothing like so dangerous.

The gravity of a tumour depends on the degree to which it is capable of developing.

This is dangerous, as they may become so large as to impede locomotion, cause deformity, emaciation, and septicæmia, and by injuries, such as bruises against the ground, ulcers may form which are very difficult to heal.

Treatment.—It is not always advisable to remove a benign tumour of small volume. If they are large they are liable to injury and become ulcerated, or subject to interstitial hæmorrhage and hæmatoma, which may altogether alter them, and in any event cause them to become an excellent culture medium for pathogenic organisms.

I. *Benign Tumours.*—The animal is placed on her back, the hair shaved off the part, the skin disinfected, and an incision made either from without inwards or within outwards of the median line according to the case, which is frequently sufficient to allow the growth to be enucleated without any hæmorrhage. A suture or two in the skin wound and a pledget of cotton wool with any antiseptic will complete the operation.

The skin should be preserved as much as possible where it is healthy, so that there is no gaping of the lips of the wound, and, if necessary, the vessels in front and behind the gland should be ligatured.

II. *Malignant Tumours.*—The operation is the same as for

benign, but is usually more difficult on account of the line of demarcation between the neoplasm and the normal tissue being ill defined, thus rendering it necessary to remove a considerable portion of other structures with the diseased gland. This precaution should never be neglected, especially if there is reason to believe any of the neighbouring glands are involved.

Even if this is done, it is not unusual to see the tumour spread and cause death. This usually happens when the structure is not entirely removed, and the other mammæ are centres for the growth, or when the neighbouring lymphatics are involved.

Classification.

From a clinical point of view mammary tumours may be classified as follows :—

I. Cutaneous vegetations,	Papillomata of the cow.
II. Benign tumours—connective tissue,	Adeno-fibromata and the various varieties.
	Fibromata.
	Lipomata.
	Myxomata.
	Chondromata.
III. Malignant tumours (cancer)—epithelial,	Epitheliomata.
	Carcinomata.
conjunctival,	Sarcomata.

THE COW—MAMMARY CUTANEOUS VEGETATIONS.

These lesions are commonly known as warts or papillomata, and are not tumours in the true sense of the word, but inflammatory lesions of the skin, not of the mammæ alone, but may be seen over the whole body. The elements of these neo-formations show that they are caused by hypertrophy and multiplication of the papillæ of the dermis. Papillomata are seen on the mucous membranes, and, as a rule, such originate from irritation ; also from microbian infection, but when mammary they are always the result of inflammation. They often disappear spontaneously and do not usually recur after surgical interference.

There is a popular belief that papillomata are contagious and

that one will give rise to others. Certain facts in both human and comparative pathology give colour to this belief.

Dr. Aubert mentions a remarkable case in *Lyon Medical*.[1]

Bedel, in the *Bulletin de la Société des Sciences Vétérinaires de Lyon*, mentions a case somewhat the same as Dr. Aubert. Having operated on a heifer whose udder was covered with warts he accidentally wounded the left index finger, and two weeks after three small warts the size of a grain of wheat formed on the cicatrices.[2]

These and other cases appear to show that papillomata can be transmitted from the cow to man.

The observations of Majocchi on the microbian nature of these growths permits of an argument in favour of their contagious nature, and in an article published by him in the *Clinica Veterinaria*, August and September 1881, he states that he considers warts in men and animals are contagious from one species to another, and *vice versa*, and, basing their theory on this fact, several observers have endeavoured to detect a specific organism.

We have found in warts from a cow a bacillus resembling that described by Majocchi with others, but we have not been able to prove that it is specific, and although we have frequently tried various methods of inoculation we have failed to get any results. Nevertheless, we quite allow that transmission is possible, in fact cases have come under our observation that admit of but little doubt.

These growths are sometimes so numerous as to cover the whole gland, which is hidden in them, causing it to be impossible to milk the cow. Kunze[3] has reported a case of a four-year-old cow, in which the whole gland was covered with warts, causing it to resemble a cauliflower, in which the teats were hardly visible.

In almost all cases it is young subjects that are attacked, and when they reach adult age a spontaneous cure takes place, as at this period the nutritive vessels undergo a condition of thrombosis with endarterial granulations which plugs them up, while at the same time the new-formed material presses on them from without. This cuts off the supply of blood, and the wart dries up and falls off.

[1] Lyon médical, 16th Dec. 1900.—Dr. P. Aubert. Warts on the teats of the cow with multiple contagion amongst human beings.

[2] Bedel. Transmission of warts from a heifer to man.—Soc. des sc. vét., 3rd February 1901, page 56.

[3] Kunze. Werzen am Euter einer Kuh. Sachs. Berl., S. 99.

The growths are known as horny papillomata, and we have not observed them on the mammæ of any other animals except the cow. Some are globular and large, others elongated or cylindrical and much smaller; both forms may exist together.

I. The first mentioned are seen in small, round, or oval masses, or in flat discs connected to the skin by a short, slender stalk, and

FIG. 16.—Globular papilloma (cow).

are generally separate from each other. They are usually white in colour or of a yellow tinge, the surface being shiny, and covered with epidermic scales that overlap each other.

If they are large the epithelial covering is not continuous with the skin, and in such cases the lower part is grey, softer, and more pliable than the upper. The growth has a firm feeling, and on section an outer yellow layer is seen, the inner border of which is

denticulated. The centre of the tumour appears made of a mass of greyish-white fibrous tissue.—(Fig. 16.)

Microscopic Appearances.—The basement is formed of fibrous tissue, that in its earlier stages has somewhat a resemblance to sarcomata. The blood-vessels all run towards the epithelial layer. The largest part of the growth is formed of connective tissue, in the centre of which there is sometimes the *débris* of atrophied glandular structure. The outer border is denticulated, much resembling a section of the Malpighian layer of the skin.

The epithelial layer is analogous to the epidermis, the cells

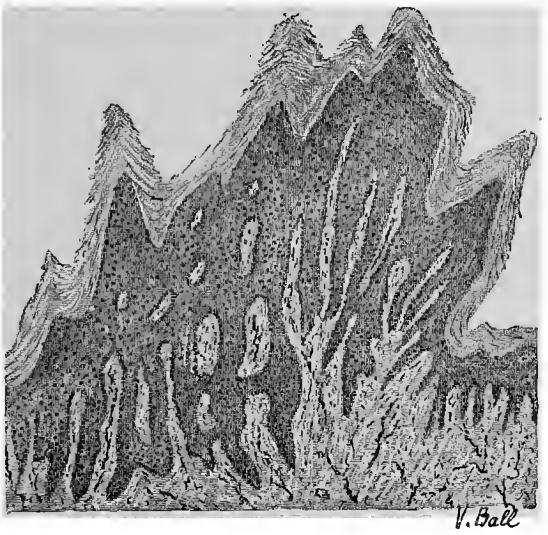

FIG. 17.—Filiform papilloma (cow).

being stratified and remarkably thick; on its inner surface it is irregular and denticulated, which is well shown in Fig. 16.

In some cases two processes come in contact, and anastomose at one or more points, showing on section spaces occupied by connective tissue.

At the inner surface the cells are large, polyhedral, and united together by intercellular prolongations, which give their edges a crenelated appearance, but as they approach the surface they become flattened, and at the outside they form a horny layer.

II. *Cylindrical Papillomata.*—These are usually seen on the teats, scattered over them more or less abundantly in patches, the

upper part in some cases having a velvety look, in others it is rounded and swollen. They are white and hard, but frequently covered with a black crust of dust and dirt. They are seldom over $\frac{3}{8}$-inch long by $\frac{1}{16}$ to $\frac{1}{8}$ inch wide, and often fifteen to twenty can be found on one teat.—(Fig. 17.)

Microscopic Appearances.—The minute structure much resembles the former. The lower surface of the layer of dermis is much denticulated, the Malpighian papillæ dividing it up, and being split into numerous branches, much more so than in the previous form. The outer border on section is in one plane, but is broken up into angles that are covered with the horny layer that is particularly thick at the summit. These angles or projections are visible to the naked eye, and give the surface of the wart a rough appearance. There are usually new growths taking place in the neighbourhood of the primary one.

Treatment.—The patients should be isolated, and more especially kept away from any young animals. The warts should be removed. This can often be done by the hand, and the bleeding is insignificant; if they are large they can be cut off by scissors, or a string or elastic band put round the base to strangulate them, when they will drop off.

Internal medication is useless.

OTHER TUMOURS.

With the exception of those mentioned, other neoplasms on the udder of the cow are rare, in fact a case reported by Resow is the only one that we are aware of. On post-mortem examination, in addition to a number of sublumbar growths of variable size, five tumours from the size of a chestnut to a man's clenched fist were found in the posterior quarter on the left side, separated from each other by healthy tissue. The largest was surrounded by a thick capsule adherent to the sinus, the wall of which was partly destroyed. The left lymphatic glands were increased in size, and the greater part of the tumour was composed of round or polygonal cells with one or more nuclei, united together by homogeneus tissue.[1]

Reindl and Kitt mention osseous tumours in the mammæ of a cow.

[1] Resow. Zeitschrift. f. Fleisch und Milchlhy., April 1900, pages 132 and 133.

MARE.

In the mare as in the cow mammary tumours are not common. Adeno-fibromata are recorded, but, as in the bitch, in all probability they are the result of inflammation. Kitt saw one in a mare that weighed 12 kilogrammes. The skin was intact, but the subcutaneous tissue thick and infiltrated.

Vennerholm mentions a case of sarcoma that developed cysts and had undergone ossification. The cysts were variable in size, and contained a chocolate-coloured fluid, with crystals of cholesterine and epithelial *débris*.

Cadiot gives a case in a mare of a mammary tumour invading the neighbouring tissues, on which he operated for fistula. Microscopic examination showed it to be a carcinoma. The account published, however, much resembles one of botryomycosis.[1]

In nineteen cases of mammary tumours that came under his notice Cadiot found one in a mare that resembled epithelioma.[2]

BITCH.—BENIGN CONNECTIVE TISSUE TUMOURS.

I.—ADENOMATA.

Under the name "Adenomata" we class tumours formed of gland structure, without it, however, being exactly reproduced.—(Delbet.)

They are rare amongst the domestic animals. We only know of one case, reported by Stockmann, in a goat with metastasis in the lungs.[3]

In the human being they are found in the breast, and are surrounded by a fibrous capsule. The gland is enlarged, but there are no indurated centres or cysts.—(Fig. 18.)

II.—ADENO-FIBROMATA.

These tumours are common in the bitch, but rare in other animals. They are mentioned in most works on pathology, but the first good account is by Professor Peuch in 1869.[4]

[1] Cadiot. Bull. de la Societe cent., Nov. 1893.
[2] Cadiot. Eléments de pathologie et de clinique. Paris, 1899, page 588.
[3] Stockmann. Journal of Comparative Pathology and Therapeutics, 1895, page 254.
[4] Peuch. Tumours of the Mammæ in the Bitch. Journal de Lyon, 1869, page 2.

The same author has edited the article on "Mammary Tumours" in St. Cyr and Violet's Veterinary Obstetrics.

Kitt and Vennerholm also mention them, the former one on the left side of a mare that weighed 12 kilogrammes. Usually only one quarter is affected, but others possibly may be. The tumour varies in size from a hen's egg to that of the clenched fist, or even larger, and this usually is the case where two glands are attacked. The line of demarcation is very distinct, and they are encapsuled. From their weight and position they become pedunculated and moveable, swinging about under the abdomen when the animal

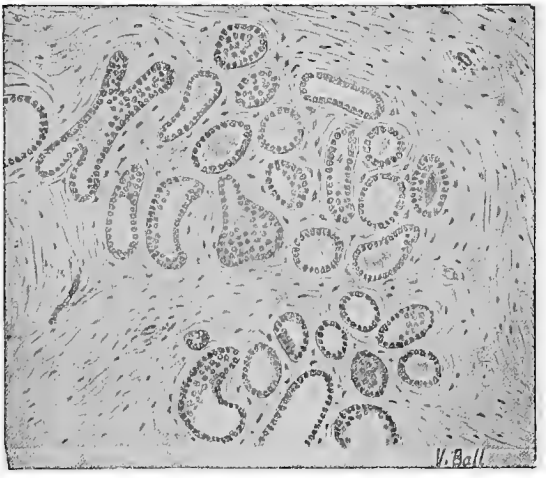

FIG. 18.—Adenoma of the breast.

moves; on this account they are exposed to contusions giving rise to ulceration and suppuration.

Adeno-fibromata have always a firm feeling, although there is a variety in which the basement membrane is not, strictly speaking, fibrous, but composed of connective tissue; such, without being actually soft, are less resisting.—(Fig. 19.)

In some cases the surface is lobulated from the formation of cysts in the structure. On section it is greyish or yellow, fibrous in places where the trabeculæ are divided across, with yellow or brown points of pigment scattered about. If there are cysts the cavities are round, the walls pliable, and containing a transparent

viscid fluid of a dark yellow or brown colour secreted by the lining epithelial cells.

Histologically they show large fibrous trabeculæ passing between the cavities which contain blood-vessels. The glandular cavities are lined with epithelium and are of various shapes, some being bifurcated or even multiple at their blind extremities; but they may be stellate, with a variable number of arms.—(Figs. 19 and 20.)

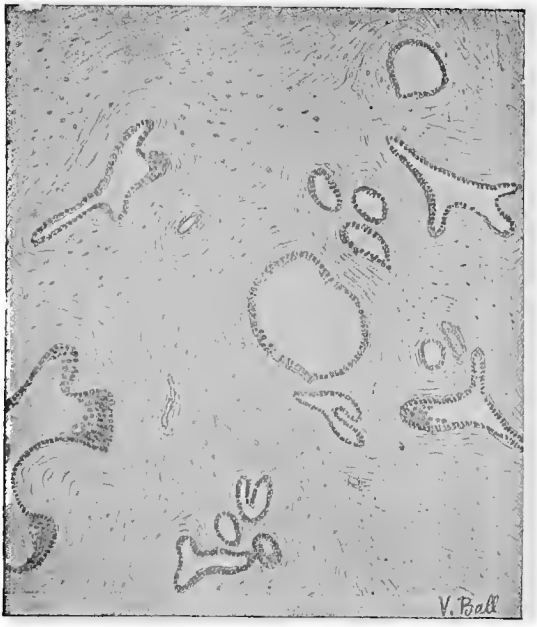

FIG. 19.—Fibro-adenoma of the mammæ.

(A.)—*Fungoid Adeno-Fibromata.*

Microscopically these tumours have all the general characteristics of adeno-fibromata, of which they are a variety. Cysts are formed at numerous points, and in the tissue surrounding them more or less voluminous vegetations, which cover the walls with granulations that may be oval or round, ramified, or arborescent, but these are only seen in the larger, the lining of the smaller ones being smooth. They contain a yellow or brown fluid, and the primary granulations frequently have secondary ones growing from them.

The size of the cyst affords an indication as to the age of the lesion.

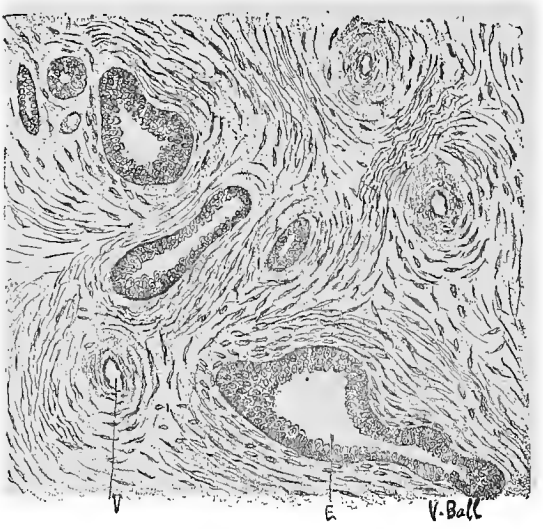

FIG. 20.—Fibro-adenoma. (High power.)

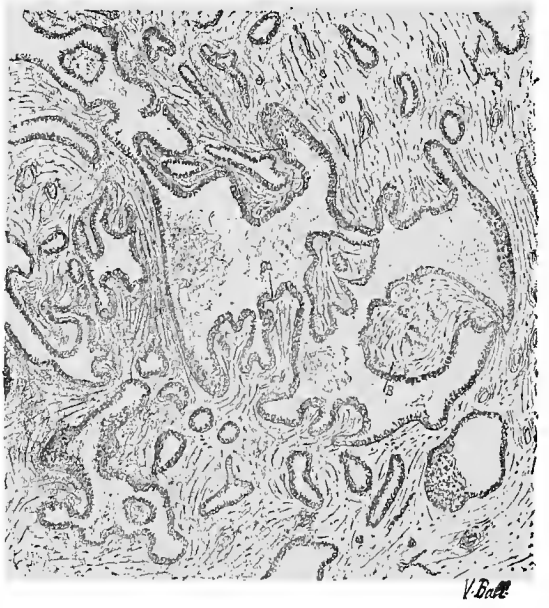

FIG. 21.—Granulating fibro-adenoma. (Low power.)

Microscopic examination shows an abundant fibrous stroma

with blood-vessels, and the existence of glandular cavities of variable dimensions, the walls of which are covered with epithelium that throws out prolongations. These intercystic granulations are pedunculated, and there are usually several in the same cyst filling it up. The cavity also contains epithelial cells—red blood corpuscles and leucocytes, and sometimes small hemorrhagic patches on the walls.—(Fig. 21.)

(B.)—*Myxo-Adenomata.*

This form of adeno fibromata is softer than any of the foregoing on account of the slight difference in the stroma. The gland is

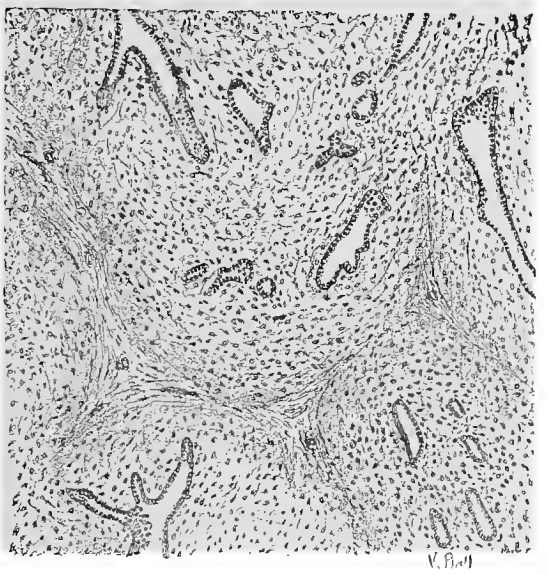

FIG. 22.—Myxo-adenoma. (Low power.)

hypertrophied, cuts easily, and the incised surface is less opaque than the adeno-fibromata. Cysts do not form, they are encapsuled, and are not so common as the former.—(Fig. 22.)

They are formed of mucous tissue in which are a small number of glandular neoformations, the stroma containing stellate cells that anastomose with each other, as well as a number of round or elongated ones.—(Fig. 23.)

The glandular cavities vary in size, some being lined with stratified epithelium, in others this is wanting.

III.—FIBROMATA.

The characteristics of the fibromata are that they are composed of fibrous tissue—that is to say, that the connective tissue has attained its highest degree of development. Fibromata of the mammæ are either circumscribed or diffused. The latter are not rare, but for the most part should be classed as adeno-fibromata, as with the proliferation of the connective tissue an epithelial

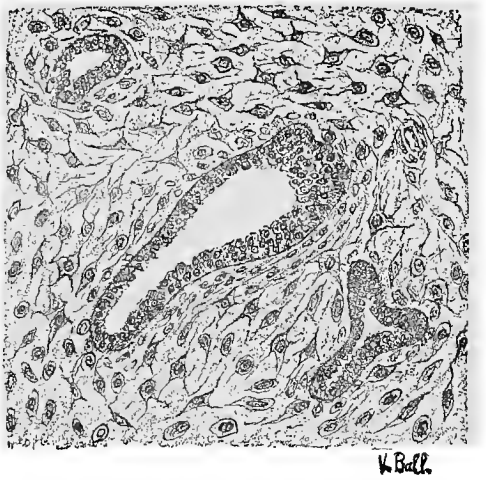

FIG. 23.—Myxo-adenoma. (High power.)

neoformation is also in existence. In some degree they have a traumatic or irritative origin, as we know that chronic irritation of the generative track in females will give rise to condyloma. These tumours in the mammæ are encapsuled and clearly circumscribed. They are hard and elastic, and their surface is generally smooth. On section the surface is greyish or yellowish-white with concentric fibrous bundles, sometimes parallel and sometimes irregularly matted together.

The cut surface is sometimes slightly lobulated, at others perfectly flat and smooth and dry.

Histological Characteristics.—The fibromata are formed of un-

dulating bundles of connective tissue arranged in a more or less irregular manner, with a few flat cells between them, but with few blood-vessels. Sometimes the fibres are arranged in a concentric circular fashion.

In some cases the centre of the tumour undergoes mucoid degeneration, being infiltrated with mucine, and becomes softened, when it is known as a "Mucoid Fibromata," in others the fibrous tissue is associated with mucus. They may be the subject of fatty or calcareous degeneration, and it is not uncommon to see them ulcerated from blows and injuries when situated on the mammæ. Fibromata do not greatly increase in size, but their excision is called for if they ulcerate.

IV.—MYXOMATA.

Myxomata are not common on the mammæ. Lucet has seen a case in a six-year-old bitch that had a large pyriform tumour on the third mammæ, 14 inches in length and 18 inches in circumference, weighing over three pounds, its surface being excoriated and irregular. It was easily removed, and was found to be a myxomata. Cultures revealed the presence of *micrococcus pyogenes albus*.[1]

The myxomata are composed of mucous tissue, and are soft and flabby, white or yellowish-white in colour, and in the mammæ are rare. They are either circumscribed or diffused, and in the latter case there is epithelial proliferation of the same nature as characterises the myxo-adenomata. They are rounded, mobile, and pedunculated, the surface being smooth and slightly lobulated. There is usually a capsule of connective tissue surrounding them. On section they are of a white semi-translucent colour, and in some cases irregularly lobulated.

The cut surface is bathed in a colourless slightly viscid liquid, and they are likely to undergo fatty degeneration.

Histological Appearances.—In pure myxomata, in the substance of a transparent amorphous basement structure are a number of round or branched cells, the latter being the most characteristic. They contain oval or rounded nuclei, with prolongations that often anastomose with the neighbouring ones, and the nutrient vessels

[1] Lucet. Recueil, 15th May 1896, page 290.

ramify in the septa. — Fig. 23, if the glandular spaces are eliminated, gives a good idea of the myxomata.

They are usually benign, but if diffused may be recurrent.

V.—LIPOMATA.

Lipomata of the mammæ are not common. Stockfleith has described them in the bitch, and according to him they are small, lobulated, and somewhat fluctuating. They are generally situated

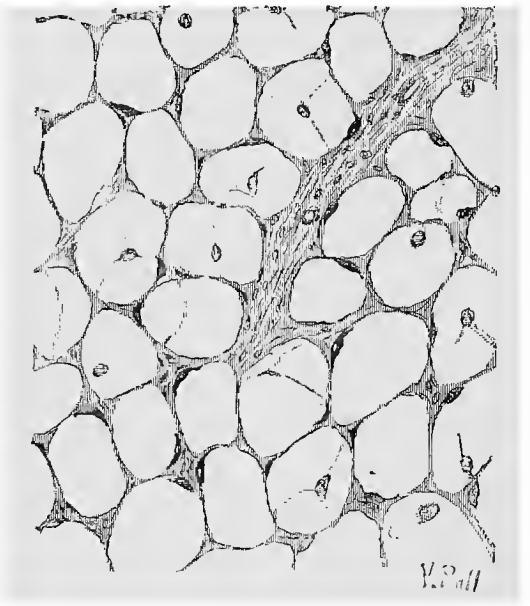

FIG. 24.—Lipoma of the mammæ (bitch).

in the subcutaneous cellular tissue between the skin and mammæ, rarely between the muscles and the gland ; being benign, they cause but little inconvenience.

They usually are of traumatic origin ; small injuries constantly repeated being a frequent cause, as we know the mammæ of the domestic animals are very subject to such. In the human being this is a common cause, as on the back of the neck with porters, in the subclavicular regions with millers who carry flour sacks on their shoulders, and the lumbo-sacral with people who wear trusses.

They are generally round or oval, clearly delimitated, easy to enucleate, and the surface is smooth. They are of a white colour, and vary in size. They are soft in consistence, particularly when *in situ*, and the cut surface is flat, white, and shining, with an oily feeling to the finger. Scattered through the mass are a number of bands of connective tissue that divide it into lobules.

The microscopic characteristics of the lipomata are those of adipose tissue, with septa of connective tissue dividing the mass of fat cells into lobules. In certain cases there is a membrane dividing the individual cells, but generally they are in contact with each other, each appearing like a clear rounded mass, limited by a membrane with a nucleus in the wall.—(Fig. 24.)

VI.—CHONDROMATA.

Chondromata of the mammæ have been specially studied in the bitch. M. Peuch recorded a case in 1870 where the third and fourth glands on the right side were involved, the tumour being 5 cm. by 1⅛ cm., hard, lobulated, painless, of the consistency of cartilage, with a large adherent base, and engorgement of the adjacent lymphatics. On examination it was found to be undergoing ossification, and, in places, fatty degeneration.[1]

Generali[2] records a case that developed in a month.

The lungs and kidneys contained numerous tumours of various sizes, some undergoing calcification. In the pons varolia one was found as large as a hazel nut, which had caused absorption of a large portion of the brain tissue. For a fortnight the animal had been subject to epileptic seizures, which gradually became more frequent. During the attack there were convulsive movements of the jaws, with salivation, extension of the head on the neck, and rolling of the eyes. The patient fell on the ground "always on the left side."

Chondromata are of slow growth, seldom generalised, and are composed of recently formed cartilage disposed in lobules of variable size. In the cases under consideration the presence of

[1] Peuch. Note on Mammary Sarcoma, and a case of Chondroma in the Dog. Journal de Lyon, 1870, page 107.

[2] Generali. Metastatic Enchondroma of the Pons Varolia in the Dog. L'Ercolani, April 1892.

embryonic cartilage may be put on one side, as it is difficult to see how it could affect the mammæ.

The whole of the gland can become affected, the surface being smooth and slightly lobulated, and on pressure it feels firm and slightly elastic. On section the surface is of a bluish-white colour, and the bulk is made up of hyaline cartilage with a small quantity of fibrous tissue arranged in more or less regular lobules, that are joined together by trabeculæ of greyish-coloured connective tissue.

FIG. 25.—Chondroma of the mammæ (bitch).

The cut surface is flat, smooth, and slightly moist. In places there may be seen a cartilaginous network permeated by fibrous tissue in which are located very small cystic cavities containing a brown or red-brown fluid. True cysts are also sometimes seen with a number of either simple or lobulated cartilaginous growths on the lining membrane projecting into the cavity.

Histological Appearances.—Isolated masses of cartilage are found scattered irregularly through the tumour of variable size,

round, oval, or sometimes very irregular in shape, with the remains of fibrous tissue running through them that disappears in the process of chondrification. The cartilaginous cells are scattered irregularly except on the edges of the isolated masses, where they are arranged concentrically ; they are of considerable size, round or oval. At the edges of the cartilaginous zones blood-vessels, sometimes of a considerable size, are seen.

In some cases there are cartilaginous prolongations in the fibrous tissue, and in the septa that divide the larger lobes the gland tissue has disappeared, it being exceptional to find a few small collections of atrophied epithelial cells, which are completely surrounded by the cartilaginous formation.—(Fig. 25.)

In places where there are true epithelial proliferations the blood-vessels are large. The alveoli are either simple or compound, filled with proliferating epithelium, and resemblance to the adeno-mata is most marked, so much so that these tumours have been designated adeno-chondromata.

A curious feature is the tendency to ossification seen in the epithelial islets and interglandular fibrous tissue ; but this is not complete or a true bony deposit. The same is observed in the cartilaginous lobes.

MALIGNANT TUMOURS.

I.—EPITHELIOMATA.

Epithelioma are common in the dog, Cadiot having seen eleven out of nineteen cases, and Fröhner states that *cancer* is the most common of all the mammary tumours. They vary from the size of a hazel nut to a child's head, are regular in shape, sometimes hard and lobulated, sometimes fluctuating at one spot, usually the centre. The skin frequently is intact, or only distended, but there may be ulcers formed, the result of injuries from which fœtid pus is discharged.

The base is deeply adherent, and the neighbouring lymphatics are almost always involved. The general state of health is not affected in the earlier stages until metastatic complications arise. Fröhner has, however, several times observed septic endocarditis.

General Characteristics. — Epitheliomata have certain special characteristics. Cornil and Ranvier designate certain tumours of glandular origin under this designation, and we have noticed that portions of them may present some of the appearances of carcinomata or adenomata. The surface is irregular, lobulated, and adherent to the skin; it is soft and of a yellowish white colour on section, the surface being covered with a certain quantity of fluid containing epithelial cells.

The tumour appears to develop by proliferation of the epithelium of the mammary acini, which send out offshoots that invade the connective tissue, and forms round them, dividing them off into isolated islets.

Microscopic Appearances.—Under a low power a tolerably regular division of the cellular masses is seen, which is independent of the connective tissue surrounding the alveoli (Fig. 26), but generally this connective tissue is not very greatly developed. The epithelial cells have a tendency to arrange themselves in circles, or more or less rounded, but not in any very large masses.

Under the high power the mass of cells will appear contracted into the cavity of the alveoli, which is usually due to the action of the alcohol in which the specimens have been preserved, but in the fresh state they are in contact with the walls.—(Fig. 27.)

These masses of epithelium are formed of large polygonal cells that are in contact with each other, those on the outside being

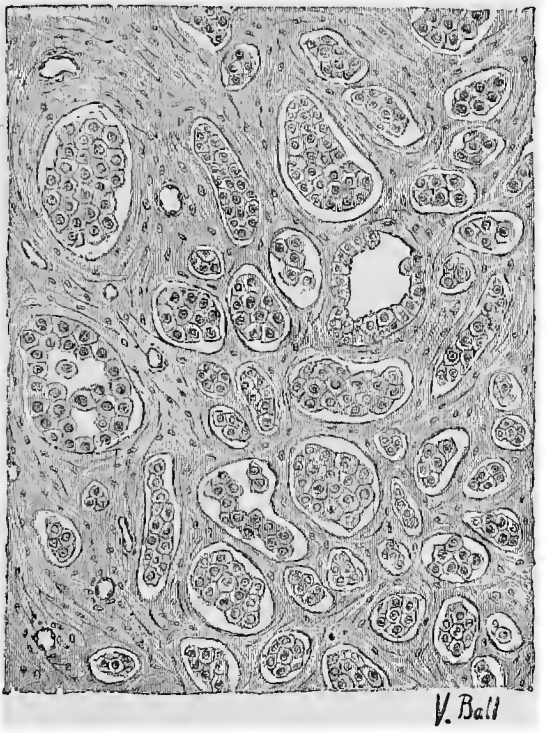

FIG. 26.—Epithelioma of the mammæ (bitch).

somewhat flattened. This formation is characteristic of the epitheliomata; in the carcinomata, on the contrary, they are apart. Scattered here and there through the tumour are portions where the acini can be recognised, the epithelium being only slightly hypertrophied. The basement connective tissue contains a number of blood-vessels.

Cadiot,[1] Gilbert, and Roger mention the existence of a clear

[1] Cadiot. Elements of Surgical Pathology. Paris, 1899, page 588.

exudate in the centre of the epithelial masses containing degenerate cells, without any nuclei.—(Fig. 28.)

II.—CARCINOMATA.

Carcinomata are much less frequent in the bitch than epitheliomata. Peuchen has described three varieties, and Vennerholm states that the most common are the encephaloid and scirrhous carcinomata.

Pflug relates a case in a bitch. The patient was fifteen years old, and the tumour, the size of a child's head, involved the posterior gland on the left side and the three on the right. It was operated

FIG. 27.—Epithelioma of the mammæ, showing hyaline substance in the alveoli (bitch). (After Cadiot.)

FIG. 28.—Epithelioma of the mammæ, showing necrobiosis of the cells in the alveoli (bitch). (After Cadiot.)

on without trouble, the wound readily healing. The animal died fifty-four days afterwards, and post-mortem examination disclosed secondary growths on the liver, spleen, lungs, brain, mesentery, bladder, and kidneys.[1]

Morey and Carougeau report a case in a bitch eight years old, in which the first mammæ on the left side was involved, and rapidly increased in size, the neighbouring lymphatic glands also being infected. The base of the tumour was diffused, the surrounding tissues being invaded; on section exit was given to a large quantity of bloody serum.

[1] Pflug. Cancer of the Mammæ and Metastasis of various organs in the bitch. Zeitsch. für Vet. Viss. de Pütz.

Sections were cut from paraffine mountings stained with hematoxyline and picro-carmine. The sections had the characteristic cavernous appearance. The septa were very thin, straight, or slightly undulating, and formed of a few fibres supporting blood-vessels. The cavities enclosed by these septa were of various dimensions, the smallest being at the outer part of the neoplasm,

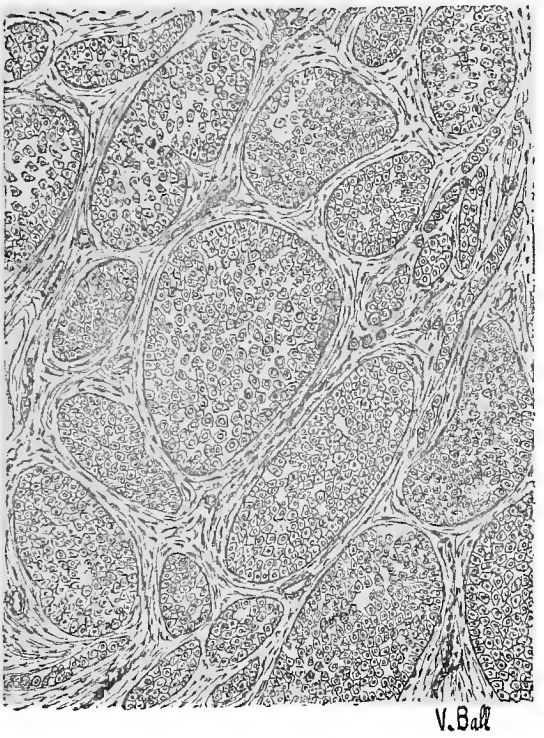

FIG. 29.—Carcinoma of the mammæ (bitch).

and getting larger towards the interior, where the field resembled a large mosaic of cells, with the *débris* of fibres from the broken down septa. The perfect alveoli contained round or polyhedral cells, separated from each other, and which did not entirely block up the space. The tumour was in active growth, the neighbouring tissues being infiltrated.[1]

Secondary tumours were found in the lungs.

[1] Morey and Carougeau. Encephaloid Carcinoma in the bitch. Journal de Lyon, April 1898, page 210.

Both carcinomata and epitheliomata come under the classification of cancers, which is a clinical definition applied to malignant tumours generally, but strictly speaking carcinomata should come under the heading of epitheliomata, as their structure is partly epithelial. Carcinomata of the mammæ are hard, and may be of a considerable size, not encapsuled, but adherent to the skin, which it may even invade, and from which it is not possible to remove it. The skin is often deeply corrugated, and covered with round or oval ulcers that granulate at the bottom. On section a certain quantity of fluid exudes, containing various forms of epithelial cells. The section shows a number of grey or yellow masses, separated from each other by septa of connective tissue of a greyish-white colour; rarely there are cysts.

Histological Appearances.—The growth consists of a number of alveoli, containing epithelial cells, bounded by stroma formed of fibrous or connective tissue. The consistency of the tumour depends on the quantity of connective tissue present, and is in reality the difference between encephaloid and fibrous carcinomata. The latter are also known as scirrhous cancer, and the amount of fibrous tissue is relatively greater than the epithelial cells, but an encephaloid carcinoma may become fibrous. In carcinomata that have a tendency to spread, there are a few connective tissue stroma, through which blood-vessels run delimitating the alveoli; these frequently communicate with one another.—(Fig. 29.)

In certain cases the alveoli contain no cells or are only partly filled, also the septa may be infiltrated with them; particularly is this the case when the tumour is growing. It should also be noticed that the alveoli communicate with the lymphatics, which facilitates the generalisation of the growth.

III.—CONNECTIVE TISSUE TUMOURS.—SARCOMATA.

Sarcoma of the mammæ is not so common as epithelioma, Cadiot having encountered it in six out of nineteen cases. Vennerholm mentions the possibility of ossification or the formation of cysts.

In 1870 Peuch published the following excellent description of them in St. Cyr and Violet's Obstetrics :—" They are larger than

the adenomata, and vary in consistency, being in places soft and fluctuating, with cysts that contain a yellow, red, or dark-brown fluid, rich in mucine and albuminoids.[1]

From a clinical point of view sarcomata are large, round, and adherent at the base, throwing out rounded projections into the neighbouring tissues. They are often ulcerated, the bottoms of the ulcers being covered with dark granulations bathed in sanious pus, and which readily give access to putrefactive organisms that cause septicæmia. Usually the neighbouring lymphatics are implicated.

Peuch describes fasciculated, mucoid, and encephaloid sarcomata.[2]

Cadiot twice reports fusiform, three times round-celled, and

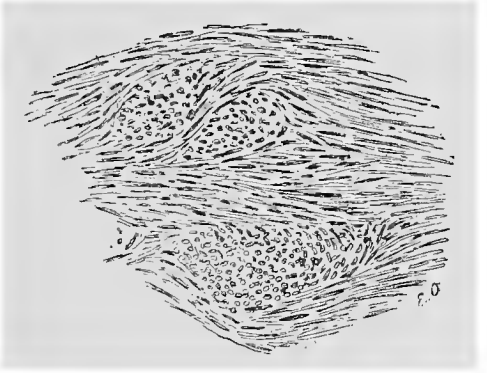

FIG. 30.—Fusiform sarcoma of the mammæ (bitch). (After Cadiot.)

once osteoid sarcoma. "In the latter the tumour was formed by the glandular *culs de sac*, with hyaline cartilage and osteoids, canaliculi were seen, but were much fewer than in normal bone.[3]

Cadéac reports a case in a bitch. The posterior gland was involved, and rapidly increased till the tumour weighed seven pounds. It dragged along the ground and became ulcerated. The animal was operated on, but died a few hours afterwards, post-mortem examination disclosing granulations on the mitral valves. The tumour proved to be a fungoid sarcoma.[4]

[1] Peuch. Notes on Mammary Sarcoma in the Bitch. Journal de Lyon, 1870, page 107.

[2] Peuch. Mammary Tumours. Traité d'obst. vét., 2nd edition, St. Cyr and Violet, p. 1150.

[3] Cadiot. Eléments de pathologie et de Clinique. Paris, 1899, page 591.

[4] Cadéac. Fungoid Sarcoma of the Mammæ. Journal de Lyon, 1900, page 399.

They are nodulated, freely moveable under the skin, to which they do not adhere, and usually the line of demarcation is very clear, but at the base other tissues may be invaded. They are generally round-celled or fusiform, but both varieties may exist in the one tumour. Pressure may cause the skin to ulcerate, and these are filled with soft red granulations, which may mortify and turn yellowish-green, giving off a putrid smell. Round cell sarcomata are soft, and osteoid hard to the touch, the fusiform being between the two in consistency, and at the periphery, especially in

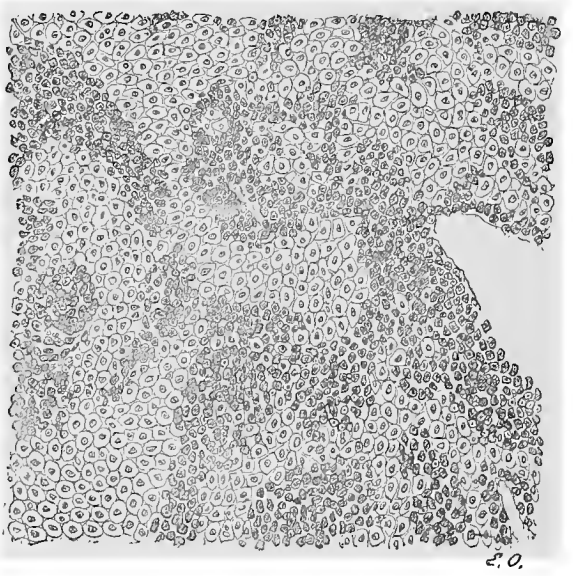

FIG. 31.—Chondroid sarcoma of the mammæ (bitch). (After Cadiot.)

the round-celled variety, it is not uncommon to find small cysts containing a yellow or reddish-brown viscid fluid.

Microscopic Appearances.—1. *Round-Celled Sarcomata.*—This is somewhat a misnomer, as the cells are not always perfectly circular; they more resemble epithelium, only the angles are not so sharp and acute. They vary in size, a few giant ones being present. There is a nucleus and nucleolei usually in the centre.

The cells form masses lodged in the alveoli, and in some cases infiltrating the stroma. The blood-vessels are numerous. In places the growth may take on the characters of an adenoma, but if it recurs after operation this change is not again seen.—(Fig. 31.)

2. *Fusiform Sarcoma.*—In this variety, although the majority of the cells are fusiform or spindle-shaped, round ones are scattered through the mass.—(Fig. 30.)

The fusiform cells are in apposition to each other, and arranged in bundles, sometimes looking like involuntary muscular fibres.

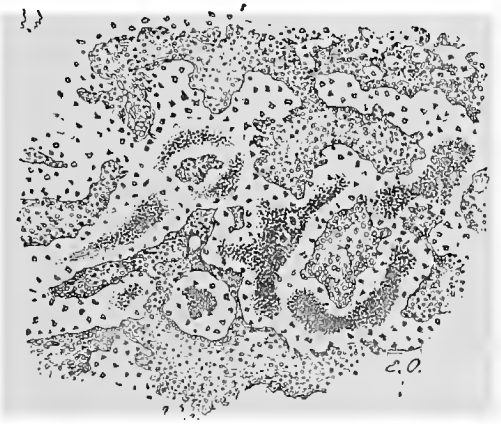

FIG. 32.—Osteoid sarcoma of the mammae (bitch). (After Cadiot.)

The cells vary but little in size, and the stroma are largely developed.

3. *Osteoid Sarcoma*, also known as osteo-sarcoma. The process of ossification is not complete, as it is only found at certain points, and there are neither Haversian canals nor canaliculi.—(Fig. 32.)

The fusiform sarcomata generally undergo this change, the bony structure being scattered about in isolated patches.

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