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CATTLE POISONING BY NITRATE OF POTASH.

On the 17th of August, 1894, Mr. Errickson, a farmer living near Olsburg, Kansas, drove his cattle, numbering twelve head of mixed natives, from his pasture to the barn yard, about five o'clock in the evening. The pasture was very dry and short, and as the cattle were taken up earlier than usual, Mr. Errickson fed them some corn stalks taken from the manger of a bull which was kept confined in the barn. The bull had not eaten the corn stalks clean, only picking off portions of the leaves, and the remaining portions, estimated by Mr. Errickson at four large armfuls, were taken out of the manger and fed to the cattle in the barn yard by placing the stalks in piles about the yard. The corn stalks that were fed to the cattle were grown on a small plat of ground beside the barn yard. During the earlier part of the season the stalks had made a vigorous growth, but the severe and continued drouth of July had checked the growth sufficiently to preclude the possibility of a corn crop, so the corn was cut in July and shocked for fodder. The corn stalks were not large enough for the ears to form, and though the stalks had dried up considerably, they would be considered fairly good corn fodder. The cattle coming from the dry pasture seemed to relish the stalks and ate them readily. Mr. Errickson was away from home during the evening but returning about one o'clock in the

morning and passing through the yard where the cattle were confined, noticed that some of them were lying in peculiar attitudes, and upon examination found that seven out of the twelve head were dead. The dead animals were lying in easy positions in various parts of the yard. There were no signs of struggling, the dust beneath their legs being slightly brushed away, showing that the legs had moved but slightly before death.

The next morning Mr. Errickson called a practitioner of human medicine who opened several animals and reported the following general conditions: A few of the animals were bloated but not badly. The bloating was probably the result of the formation of gases within the rumen after death. There was a small amount of the masticated food and juices from the rumen escaping from the mouth and nostrils. This was mixed with some mucus and saliva, and appeared to have been forced from the rumen by the pressure of gas. The lungs of all examined were found congested. The mucus membrane of the rumem was highly congested in spots, the lining membrane peeling off readily. The mucus membrane of the abomasum, or the fourth stomach, was also highly congested.

One animal, a yearling heifer, was brought about twenty miles to Manhattan for my examination. I was necessarily called away and only had an opportunity to open the ventral cavity and make a hasty examination. The animal was well nourished. The abdominal cavity was distended with gas. The animal had probably been dead at least sixteen hours, and the weather was very warm. The abdominal cavity contained an increased amount of serum. The rumen was distended with gas, and was well filled with corn fodder. The mucus membrane was highly congested over quite large patches, the lining membrane peeling off over the corresponding areas. The reticulum was congested. The omasum, or "many plies," was well filled and appeared normal, but the abomasum was highly congested. The liver was congested. The œsophagus contained a small quantity of regurgitated food. Both lungs were congested, the right lung more than the left. This animal was found lying upon the right side, showing that this congestion was partially hypostatic. The left half of the heart was dilated and filled with firmly clotted blood. The aorta was also filled with blood. Other organs appeared normal.

Mr. Errickson suspected poisoning, and portions of various organs and contents of the rumen were collected, preserved and chemically examined for all the common poisons, but without results. Professor G. H. Failyer, chemist to this Experiment Station, reported to me an analysis of corn stalks which were supposed to have caused the death of cattle several years before, when examination of the stalks revealed the presence of large quantities of nitrate of potash, (saltpetre). Acting upon this suggestion, I requested Mr. Errickson to send specimens of the stalks similar to those fed to the cattle, and also asked where the stalks were grown. Mr. Errickson reported that the stalks were grown upon a small lot, estimated at one-eighth of an acre, adjoining his barn

yard. This small lot upon which the stalks were grown had been used for a number of years as a bog yard, but had been plowed and planted to corn, to keep the weeds down.

A casual examination of the samples of corn stalks received, revealed the presence of large quantities of nitrate of potash, (saltpetre). Beneath the leaf sheath which surrounds the stalk just above the joints the nitrate had crystallized in fine white crystals which resembled a white mould, but was easily recognized by tasting with the tongue. Around and in the cut ends of the stalks were solid masses of almost pure potassium nitrate. If a stalk was cut in two and tapped lightly upon a table, the crystals of potassium nitrate would be jarred loose and fall as a fine powder upon the table. Upon splitting a corn stalk, the crystals in the pith of the stalk could easily be seen with the unaided eye. The bitter cooling taste, so characteristic of potassium nitrate, could be obtained by placing a small bit of the stalk in the mouth. On lighting a bit of stalk with a match, it would deflagrate, burning rapidly like the fuse of a fire cracker. A chemical examination of a quantity of stalks gave 18.8 per cent. of the dry weight of the stalk nitrate of potash.

A visit to Mr. Errickson's farm and examination of the surroundings, corroborated the statements previously noted. Corn was grown on three sides of the barn yard—the small plot, formerly a hog yard, containing about one-eighth of an acre, and upon the other two sides large fields. A careful examination of the stalks from the fields, even those grown close to the barn yard, failed to reveal any potash that could be detected by methods previously mentioned, while in the corn stubble remaining in the hog yard, potassium nitrate was present in abundance, although there had been rain since the corn was cut.

Several years ago there was a loss of cattle from a similar cause. Upon this Professors Failyer and Willard, who investigated the subject, have reported as follows:

In November, 1888, a Mr. Williams, near Grainfield, Gove county, this state, sustained a serious loss from a herd of 120 head of cattle. The stock was in good condition and well cared for. The herd was grazing on the buffalo grass of the prairies and had not been fed other food. Mr. Williams had put up corn fodder in August. The corn had grown vigorously and was cut while in a very immature state. It was consequently of very light weight but was well cured and of a bright green color. The grass being covered with ice and sleet one morning, the herd was fed about eight or nine o'clock with the fodder previously mentioned. After eating of this the stock was turned out, but had gone only a short distance from the corral, moving slowly, when some of them were seen to be ailing. They soon began to die and many were dead by twelve or one o'clock. In all, about forty died. The case was investigated for the Department of Agriculture by Dr. Paul Paquin. He pronounced it poison but could not determine the kind of poison from such examination as he was able to make. He had some of the corn stalks examined chemically. So much potassium nitrate, (saltpetre), was found, that it was thought this had probably caused the deaths.

Later the writers made some investigations of the subject. The corn fodder of a portion of the field was so impregnated with the nitrate that many of the stalks would burn like a fuse, sometimes flashing into a blaze, On the outside of the stalks and just under the cuticle

a white deposit of the nitre was visible on many stalks. An analysis of one stalk that may have been more than commonly charged with the salt, showed that one-fourth of the total weight of the stalk was saltpetre. At this rate a ton of the fodder would contain 500 pounds of the compound. It is not at all probable that a ton of the fodder taken at random would have contained this amount, as the stalk analyzed was richer than the average, But, even making a great percentage of allowance, it must be seen that a load of this fodder must have contained a large quantity of the salt. An examination of the land was made to see why this corn should be so rich in the nitrate. The only assignable cause was the fact that the portion of the field from which most of the load fed that morning was taken, had some years before been used as a cattle corral. The undecomposed manure was still scattered over the surface and much was mixed with the soil. The conditions prevailing are certainly favorable for the accumulation of nitrates in the soil. There was a large amount of organic nitrogen on and in the soil; there was sufficient moisture much of the time to permit nitrification and seldom so much moisture as to check it; the high temperature was favorable; there was not enough rainfall to leach the soil of the nitrate formed. So there was every opportunity for nitrate to accumulate in the soil, and from the soil to pass into the corn plants. Certain it is that the corn was highly charged with potassium nitrate. An examination of the soil to see how rich it was in nitrates, was rather unsatisfactory as such examination would necessarily be; but we found a little more than twice as much nitrate in the soil upon which the fodder grew, as was found in a fertile soil here on the College farm, Furthermore, plants grown in pots of the soil made a much better growth.

An examination of the blood and of the contents of the stomach and manifolds of the animals dying from the fodder, as supposed, was made for nitrates and nitrites. Faint reactions were obtained for these; but we satisfied ourselves of the inconclusive character of these, since we have found nitrites at least in the fluids of slaughtered animals, while the absence of nitrates from such easily decomposable substances as blood, the contents of viscera, etc. would not be proof that they had not been there and had been destroyed in the processes of extraction and concentration if not by previous putrefaction.

To test the poisonous properties of potassium nitrate further than we could learn from our literature on the subject, an experiment was undertaken in connection with Dr. Burleigh, then Veterinarian of the Station. We have not the benefit of Dr. Burleigh's notes, and must give such account of this as our own meager notes will enable us to do. The chemical part of the experiment fell to us. A yearling steer was used in the trial. On April 1st he was given 200 grams (about seven ounces) of potassium nitrate. In order to induce him to eat it, the nitrate was mixed with a big feed of ground grain, viz, four quarts of a mixture in equal parts of wheat, bran and corn chop. There was no apparent injury. The next day, 400 grams (fourteen ounces), of the nitrate was mixed with four quarts of the same feed and a quantity of cut green rye, and offered him at 10:25 A. M. Before 10:50 he had eaten somewhat less than half of this and ate no more. At 12 o'clock Dr. Burleigh saw the steer and he seemed to be all right. Because of this and the previous negative result, he did not watch him so closely as he would otherwise have done. Shortly after one o'clock the steer was dead. No study of the symptoms was made for the reasons previously given, and the notes of the post mortem conducted by Dr. Burleigh have never been in our possession. Various fluids of the body were tested for nitrates and nitrites. The liquid drained from the contents of the first and of the third stomach gave no reaction for nitrates or nitrites, nor did the kidneys yield these to water in which they were soaked. Nitrates were found in the following liquids: serum surrounding the heart; serum from the abdominal cavity; serum from blood, and serum collected in the cavity of the skull. Nitrites were found in the serum of the blood, serum from abdominal cavity, serum surrounding the heart, and in the bile. The nitrites were very strong in the latter. These tests could not be made the same afternoon the animal

died, as the post mortem was not completed until nearly night. A test showed that nitrates rapidly change to nitrites in these fluids. Bile which showed no reaction for nitrites gave this reaction in a very few hours after nitrate had been added to it and the nitrate slowly disappeared. The nitrate and nitrite in the above instances were in greater quantity than they are probably present in normal animal fluids, although we have found nitrites in some of the fluids of slaughtered animals. It seems certain that these salts were due to the nitrate absorbed and distributed on the body. As no nitrates nor nitrites were found in the stomachs rapid absorption would be implied.

There can be no question that saltpetre in proper quantity will act as a rapid and deadly poison. There is every reason to believe that the cattle belonging to Mr. Williams, were killed by the potassium nitrate in the corn fodder. Corn fodder containing one-half as high a percentage of saltpetre as that analyzed by us would contain one pound of the salt to every eight pounds of fodder, while that analyzed would contain one pound of the nitrate for every four pounds of stalks. Such fodder ought to be highly destructive. We have previously mentioned that in a portion of the field conditions favored the production of nitrate in the soil while lack of drainage prevented its loss in this way.

It may be further pointed out that the evaporation from the corn in a dry climate or a dry season would cause more water to pass through the plant, thus serving to carry the nitrate from the soil into the plant. There is real danger in similar situation, that is, in soils enriched in nitrogenous organic matter, and such seasons a fodder crop may contain so much nitrate as to ki'l stock. In a wetter season the danger is certainly less, and usually there is no danger at all in such seasons.

On April 3rd, 1895, in the capacity of veterinarian to the State Live Stock Sanitary Commission, I was called to Winfield, Kansas, to investigate a disease which had caused the death of ten head of cattle out of a herd of thirty-four. The cattle were mixed native cattle, thin in flesh. They had been running on pasture land and had been fed some hay. They were watered from a well and windmill but the supply of water available for the cattle appeared limited. The owner of the cattle first noticed some of the cattle sick about noon, on April 1st, they having previously been fed some corn fodder scattered in the corral. In eighteen hours after the first animal was taken sick, six were dead and six more sick. Two of the sick animals recovered. The symptoms as described by the owners were as follows: The animals appeared stupid and sometimes delirious. There was trembling of the voluntary muscles with a reeling, staggering gait, the animals appearing weak in the hind quarters. The animals urinated frequently and the bowels were loose. When the animals fell down they would not attempt to rise and would die in a short time. The dead animals were lying in the corral and were badly bloated, the bloating having taken place after death. An examination was made of a steer that had died that morning, with the following result: The rumen contained considerable partially digested corn fodder. There was congestion of the rumen in patches, the mucus membrane being easily detached wherever there was congestion. The omasum, or many plies, was filled with food and abnormally hard. The fourth, or true stomach, was congested, as was also the small intestine in patches. The lungs were moderately congested, and the heart was

relaxed being filled with clotted blood. The muscles of the heart were inflamed and the pericardium distended with serum.

The corn fodder which had been scattered about the yard had been eaten very clean, only heavier portions of the stalk remaining. An examination of these revealed the presence of nitrate of potash. It could readily be detected by tasting the stalks, or upon lighting a piece of stalk with a match it would burn with the characteristic "sizzing" due to the presence of nitrate of potash. These corn stalks were grown in a field, and as far as I could learn, there had been no feed yard or other place where circumstances would be favorable to the formation of potassium nitrate. Corn fodder from this field had also been fed to other cattle previously without ill effects, and I am informed that the corn fodder was fed to the remainder of these cattle later and no further bad results followed. It seems probable however that the combination of circumstances, the cattle being thin in flesh and probably eating the first stalks fed them more greedily than after they had become used to the change, is an explanation of this. It seems probable that the large amount of coarse fodder eaten also affected them, as there was impaction of the manifolds, or omasum, but not severe, in the steer examined.

TOXIC, OR POISONOUS, ACTION OF POTASSIUM NITRATE.

When potassium nitrate is taken into the system, it is readily absorbed and its action is rapid. In medicinal doses it acts upon the kidneys and stimulates their action, and causes an increased action of the various glands of the body, and upon the mucus membranes, increasing their secretion. It also lowers the temperature of the body when given in proper doses, and acts beneficially in other ways, not well understood. Although extensively used in veterinary medicine, cases of poisoning are comparatively rare. The following cases are reported: "Mr. Morton gave a healthy horse two pounds dissolved in six pounds of water, and found that it acted upon both kidneys and bowels, but its effects ceased in twenty-four hours (Veterinarian, 1837). Moirod, however, reports that a half pound gived to horses and two or three drachms to dogs, inflame the alimentary canal and urinary organs causing depression and death, usually within twenty-four hours."* Authorities generally consider potassium nitrate a protoplasmic poison and the most poisonous of any of the neutral potassium salts, and more poisonous than either the nitrate of soda or ammonia. When a poisonous dose is taken, death results from the paralyzing effects upon the nervous system, or from its irritating effects upon the internal organs, or by a combination of these two.

Of the poisonous action upon the human system, Dr. Bartholow says: "In ease of toxic action of potassa and its salts, the local destruction, pain and inflammation are accompanied by the usual systemic symptoms, great depression of the powers of life, a weak, rapid pulse, shrunken countenance, cold surface

*Finlay Dun, Veterinary Medicine.

followed by coma and insensibility. In a small proportion of cases the local mischief is not great, but the effects of the poison are expended upon the nervous system and assume the form of muscular weakness, paralysis of the inferior extremities, weak action of the heart and coma, and a very large dose may cause death suddenly by paralysis of the heart before the local inflammation has time to develope."*

To test the toxic, or poisonous, properties of potassium nitrate upon cattle, 200 grams of nitrate of potash, finely pulverized and mixed with wheat chop and chopped green corn, was fed to a heifer weighing about 500 pounds. She began to eat it readily and after eating probably one-third of the amount refused to eat more. The animal had been well fed with hay and grain and was not especially hungry at the time. The animal appeared slightly sluggish afterward and passed more urine than normal, but further than this nothing unusual was noticed. A second experiment was made later upon another heifer weighing about 500 pounds. She was given 300 grams (about nine and two-thirds ounces), of nitrate of potash, dissolved in water as a drench. Her temperature before giving registered 102.5° F. The potash was given at 10:45 A. M. at 10:55 a considerable quantity of urine was passed. At 11 o'clock there was violent trembling of the voluntary muscles, causing the animal to fall to the ground. The pulse was small, rapid and almost imperceptible. The animal was urged to get up and with considerable difficulty succeeded in doing so, and remained standing. At 11:15, thirty minutes after giving the potash, her temperature registered 102° F., having fallen one-half degree. Some urine collected at this time, and examined later, revealed the presence of nitrate of potash in considerable amount. The trembling of the voluntary muscles and shaking of the knees continued. The animal would void urine about every ten minutes. In voiding urine she would stand for some minutes with back arched and the abdominal muscles contracted. She seemed slightly uneasy, but did not seem to suffer severe pain. At 12:25 P. M., a small quantity of mucus was passed *per anum*, and a small amount of mucus and tears dropped from the nose, and some mucus and saliva from the mouth. Her temperature registered 102.2° F. At 12:55, she lay down, resting her lower jaw upon the ground and seemed to doze occasionally. At 1:20 P. M., her temperature had risen to 102:9° F; her pulse was stronger but still very rapid. From this time onward she seemed to be getting much better, and at 4 o'clock in the afternoon was left, seeming likely to recover, but she died during the night of October 6th. An autopsy was held October 8th, at least thirty hours after death, which revealed the following condition: The animal was lying in the yard on the left side. No signs of struggling were visible except a slight movement of the legs. The skin was dark with congested blood. The mucus membrane of the rumen and reticulum was highly congested, the mucus membrane being very readily torn and peeled off. The abomasum; or fourth stomach, was highly inflamed;

*Materia Medica and Therapeutics.

the small intestines congested in places, of a foot or more; liver congested; gall bladder distended with normal looking bile; spleen normal. Both lungs were congested but not badly. The pericardium (heart sac) was inflamed in patches, the pericardial fluid being increased in amount. Both ventricles were contracted, the auricles being filled with blood. Both kidneys were congested, being much darker in color than normal; bladder empty. The cerebral meninges were congested with dark but not firmly clotted blood. The blood of the body appeared darker than normal and much more fluid; other organs apparently normal.

An adult white rabbit was given five grams (about seventy-seven grains), of nitrate of potash dissolved in water and given by the mouth. The temperature of the rabbit fell, the pulse became rapid and weak. There was trembling of the voluntary muscles; the animal refused to walk or move; the muscles of the hind quarters were especially weak. There were slight discharges from the eyes and nostrils, it urinated twice. The rabbit died without struggling, about one hour after receiving the potash. The autopsy revealed congestion of the lungs and of the cardiac portion of the stomach and a portion of the small intestines. The heart was distended and filled with blood; aorta filled with blood.

A Short-horn cow weighing about 1,200 pounds, which was to be destroyed for other reasons, was given 500 grams (seventeen and one-half ounces), of nitrate of potash as a drench in three quarts of water, at 10:30 A. M. She had not been fed during the previous eighteen hours. Her pulse and temperature were taken, the pulse beating forty-four times per minute and her temperature registering 101° F. In thirty minutes she had urinated three times and her bowels moved frequently. Her pulse had gone up to fifty-four beats per minute, but this may be accounted for by the excitement attendant upon giving her the drench. During the following four hours her pulse dropped to forty beats per minute and her temperature was increased to 101.8º F. She continued to urinate frequently and was affected with a diarrhoea. She appeared slightly uneasy at times, but in no particular pain. About 2:30 P. M. she hung her head and looked dull, but at 3:30 she had apparently recovered her normal condition, except that her temperature remained 101.5° F. She was given some hay and ate it readily and appeared as bright as usual at 4 P. M. She was left at about 6:30 P. M. She was given her usual feed which she ate and appeared normal; but she died during the night and an autopsy was held the next morning.

The cow was lying on the left side and there were indications in the soft soil that there had been some struggling, as if she had tried to get up several times without success. The body was well nourished, but the fatty tissue was darker colored than usual. The blood was dark and fluid. There was inflammation of portions of the rumen, reticulatum, and abomasum, or true stomach. The mucus membrane of the rumen was easily peeled off over the congested and inflamed portions. The small intestines were congested in places and the uterus was also congested. There was considerable inflammation of the heart

and both ventricles were filled with clotted blood. The liver and kidneys were congested, and the bladder moderately filled with urine. Other organs appeared normal.

From experiments made, it seems that under certain conditions a given amount of potassium nitrate will affect an animal much more seriously than under other conditions, and that comparatively small doses of potassium nitrate may cause death. This is shown by the death of seven of out of twelve head Mr. Errickson's cattle, besides the bull which had previously been fed the stalks without ill effects. Mr. Williams lost forty out 120, and near Winfield ten out of thirty-four died. It is also probable that some animals ate a greater quantity than did others.

It is well known that corn has the power of taking a larger per cent, of potash from the soil than other plants. In the corn obtained from Mr. Williams, the stalks contained 25 per cent, of the dry weight potassium nitrate. In the stalks from Mr. Errickson's, 18.3 per cent, of the dry weight was found to be potassium nitrate. In this last case the stalks for chemical examination were selected at random. In both of these cases the corn fodder was grown upon a piece of land that was very rich with manure, and therefore likely to be rich in potash. The stalks fed the cattle near Winfield, were grown in a field where the soil was probably not so rich. The stalks themselves did not appear to contain as much potash as those from the other two places, but it was there in sufficient quantity to be readily distinguished by the taste or by burning, and in some cases the crystals could be seen. These stalks had been out in the field during the winter and it is possible that a portion of the potash may have been washed out. In all three cases, it is to be noticed that the corn fodder was cut early, before the corn had matured. It is possible that the exceptionably dry weather may have had some influence on the formation or retention of the potash in the stalks. I have collected and examined many specimens of corn stalks that were cured under similar circumstances from various kinds of soil in the vicinity of Manhattan, and have failed to detect any potash by the ordinary methods of examination. In all cases the symptoms shown by the animals when they were observed before death, were those of potash poisoning. The stalks that the animals ate contained large quantities of potash, and the *post mortem* lesions being those produced by potassium nitrate it seems probable that the death of these animals was due to poisoning by potassium nitrate in the corn fodder.

If there are reasons to suspect the presence of potassium nitrate in corn stalks in sufficient quantity to injure stock it can readily be detected by lighting a dry stalk with a match, as previously described.

MASTITIS, INFLAMMATION OF THE MAMMARY GLAND.

This disease which is known by a variety of names, among which may be mentioned mammitis, "garget," "caked bag," etc, is one of the most common diseases which affect milch cows. Though rarely causing the death of an animal, often necessitates the fattening of a cow as a result of a loss of a portion of the gland, by which the secretion of milk is diminished to such an extent as to render the keeping of the cow for dairy purposes, unprofitable. It would be a difficult matter to estimate the loss resulting, but as the disease is quite common the losses must be considerable.

Inflammation of the mammary gland or udder, usually occurs in new milch cows although it may occur at any time during the period of lactation, and sometimes in animals that have never given milk or in cows that have ceased giving milk. The disease occurs in other animals, but is of relatively small importance; hence this discussion will be confined to the disease as it occurs in cows, though it may be applied in a general way to all domestic mammals.

Mastitis IS not confined to any particular breed of cattle nor to any particular surroundings, though it is more liable to occur in cows that are heavy milkers and especially when the animals are well fed with nutritious foods, as these stimulate the secretion of milk and increase the activity of the glands. The surroundings seem to have no influence except in cases where the animal would be predisposed to injury or to influences which might affect her general health.

In the consideration of this disease it must be remembered that in the cow there are usually four mammary glands, the duct from each teat leading to each "quarter of the bag", a separate and distinct gland. The inflammation may be confined to one gland, or a portion of a gland, or it may be extended to all four glands.

CAUSES.

The cause of inflammation of the mammary glands is irritation. The irritation may be either external or internal. If external it results from blows, kicks, bruises of any kind, and probably in some cases from pressure when the animal lies down. If the irritation is internal it may be caused by foreign bodies passed up the duct of the teat, the retention of milk, or the presence of micro-organisms or germs, which have gained entrance to the interior of the gland and by their growth and multiplication irritate the gland sufficiently to

produce inflammation more or less acute. A majority of cases of inflammation of the mammary glands occur within three weeks following parturition or calving, the prevalence of the disease at this time may be accounted for by the highly congested and active condition of the glands at this period, together with the general systemic disturbance serving as a predisposing cause. The retention of milk, which is liable to occur at this period, or the presence of bacteria within the ducts of the gland or external injuries of any kind may serve as the exciting cause of the disease.

It was formerly considered that most cases of mastitis were the result of external injuries but recent investigations seem to show that a much greater number of cases, than was formerly supposed, to be caused by germs, or bacteria gaining entrance to the gland either through the ducts leading from the outside to the interior of the gland, or by other sources.

Among the forms of mastitis known to becaused by bacteria, or germs, and the most important because of its relation to other animals, including man, is

TUBERCULAR MASTITIS.

In this form of the disease the inflammation is due to the presence in the gland of *bacillus tuberculosis,* the germ which causes tuberculosis or consumption in both cattle and human subjects.

Tubercular mastitis is usually found in pure bred or high grade cows and is usually of a chronic nature. The inflammation in most cases is circumscribed and confined to a comparatively small area, though in bad cases the whole gland or glands may be involved. Tubercular mastitis is not often accompanied by marked inflammation. A hard lump may be noticed in some part of the gland which gradually increases in size without any apparent inconvenience to the animal. After months, or even years, it may gather and break the pus or matter escaping with the milk in case the abcess breaks within the gland. If there is reason to suspect tubercular mastitis great care should be exercised with reference to the use of the milk as the germs in the milk are very liable to cause tuberculosis or consumption in any other animals, including human subjects, that may consume the milk, unless the milk has been previously sterilized by subjecting it to sufficient heat to kill the tubercle bacilli which may be in the milk.

CHRONIC MASTITIS.

A majority of cases of chronic mastitis are not caused by the presence of tuberculous bacilli, but may be caused by the presence of other bacteria. Two recent cases which have been under my observation will illustrate:

Case I. A pure bred Holstein cow had suffered from chronic mastitis for some time, the gland and secretion having been altered by the disease; and so rendered useless as a dairy cow, she was fattened for the shambles. Just before being slaughtered some of the secretion from the affected gland

was collected to examine microscopically for the presence of tuberculous bacilli. Upon staining and mounting no tuberculous bacilli were found, but large numbers of streptococci. Streptococci are spherical bacteria which reproduce by division in one direction only, consequently forming chains of spherical bacteria, which resemble strings of beads. As the animal was disposed of soon, no opportunity was offered for a further study of the disease.

Case II. Was a pure bred Jersey cow that had been suffering from chronic mastitis for several years and fearing tubercular mastitis, a microscopic examination was made of milk which had been collected in sterile flasks from the diseased gland. No tuberculous bacilli were found, but a most luxurient growth of streptococcci, resembling in appearance those obtained from the milk of the Holstein cow. Cultures were made by the Petri plate method and a well defined streptococcus isolated which was new to me, and of which I could find no satisfactory discription in the literature at my command. A culture was sent to the Bureau of Animal Industry at Washington, for identification, and the opinion was expressed that it was an undiscribed variety.

The organism is a well defined streptococcus about one mu in diameter, and forming long chains. Grown upon solid nutrient agar or gelatine it forms a canary yellow growth, with a raised center and even outline. In bouillon the organism forms a yellow growth at the bottom of the flask, indicating that it will grow either with or without air. Another organism obtained on the first plate cultures, but which later cultures made from the milk failed to show, and which was probably accidental, was a not well defined streptococcus growing in short chains. The cocci themselves were not perfect spheres and under some conditions would assume a decidedly oval outline, and show a bi-polar stain. Grown on solid nutrient media it formed a pinkish gray growth, which deepened into a dark red as the culture got older and the growth deeper. The coloring of both organisms depended somewhat on the amount of coloring matter in the culture medium upon which they were growing.

Broth cultures of both of these organisms when injected into the lactiferous ducts of a healthy cow produced mild inflammation of the gland associated with the thick stringy milk, which contained the organisms or bacteria in large numbers. Treating the cases by removing all milk possible from the gland and injecting into the lacteal ducts a solution of corrosive sublimate, one part to 1,000 parts of water, brought about recovery in a short time.

*M. Nocard and Mollereau have described an infectious mastitis occuring among milch cows caused by an avoid micrococcus which formed straight or sinuous chains and collectively forming silky flakes. Other infectious forms of mastitis in cows etc. are described by Fleming.† Regarding the frequent cause of mastitis in the human subject Bilroth‡ thinks that stasis (retention) of

* Manual of Veterinary Micro-biology—p. 326.

†Veterinary Obstetrics—p. 707.

‡Cycopædia of Obsterics and Gynecology Vol. IX.

milk is the result, not the cause of mastitis, and the disease is regarded as being "in direct relationship with disease of the nipple," the "irritant being transmitted through the nipple to the interior of the gland" or "it may be distributed with the lymph through the gland."

SYMPTOMS.

Mastitis is usually preceded by a highly congested condition of the gland except in those cases where the inflammation is limited and circumscribed. The gland is swollen, tense and hard to the touch. The temperature of the affected portion being higher than the other portions. Manipulation may cause the animal considerable pain. The inflamed portion often "pits" on pressure. The secretion of milk is usually lessened and altered in appearance, being more watery than usual, with particles of stringy or curdled milk, often tinged with blood. In other cases the milk may be unusually thick.

If much of the gland is affected, the animal usually stands with the hind legs spread to avoid pressure on the gland. The inflammation may be so extensive as to cause serious systemic disturbance. There may be considerable fever, indicated by a rise in temperature, staring coat, rapid breathing and strong rapid pulse. The animal may shift her position frequently as a result of the pain in the gland. The nose may be dry, and the appetite lost.

If the disease is not severe and is properly treated, the inflammation gradually subsides, the normal secretion of milk is resumed and all the attending symptoms of the disease disappear. In many cases the progress of the disease is not so favorable. An abcess may form within the gland and break, discharging pus, or matter. In other cases the inflammation is so extensive that the circulation of the blood in the gland is seriously interfered with, gangrene results, and the part sloughs off. In bad cases blood poisoning may follow, and death of the animal result.

In some cases where the inflammation is severe, though no abcess or gangrene may follow, the secretion of milk is so seriously interrupted that the gland remains practically useless, although the inflammation may subside.

TREATMENT.

The treatment of inflammation of the mammary gland will depend considerably upon the cause. As inflammation is the result of an irritant, the first object to be attained is the removal of the irritant, and the second consideration is to reduce the inflammation.

If the inflammation is a result of retention or stopping of the flow of milk, the obvious treatment is to withdraw the milk. This is often accomplished by allowing a vigorous and hungry calf to suck the cow. As far as the removal of the milk is affected this is an excellent method, but the injury to the gland that may be inflicted by a vigorous calf knocking or bunting the gland is often considerable. If the milk is removed by hand it should be done frequently and

thoroughly, by "stripping" the animal dry. Not only in cases where inflammation is due to the retention of milk but in all other cases of mastitis where there is milk secreted, the frequent and thorough removal hastens recovery. A firm but gentle rubbing of the gland from above toward the teat gives excellent results. As this disease occurs most commonly in heavy milkers and when the flow of milk is greatest, all rich sloppy foods that stimulate the flow of milk should be withheld until the gland has regained its normal condition. In all cases where the gland is seriously congested or inflamed, bathing the affected gland with warm water gives relief, and should be as warm as can comfortably be borne by the hand. The water should be applied for twenty minutes at a time, three times daily. A kettle full of hot water should be kept at hand to keep up the temperature of the water which is being applied, but it should not be applied hot enough to cause the animal pain, as the gland is very tender. During the application of the water the gland should be gently but firmly rubbed, as described for the removal of milk. After the gland has been thoroughly bathed it should be wiped dry and a softening and soothing ointment applied. A good one is composed of a teaspoon-full of gum camphor rubbed fine and dissolved in two tablespoon-fulls of fresh lard. The camphor can be dissolved by heating the lard and stirring in the camphor. This should be well rubbed in.

In some cases the duct of the teat from a certain gland may be stopped by coagulated milk or a cheesey secretion which may collect in them, and it may be necessary to pass a sound such as a knitting needle or small teat siphon through the duct before milk can be obtained.

The use of teat siphons in drawing milk from the gland, except in special cases of injury or stoppage of the teat, is not satisfactory because there is little milk already secreted in the gland to draw off. Most of the milk is secreted during milking. Poultices are recommended by various authorities in the place of, or in conjunction with, the use of hot water, but in ordinary hands they do not give good satisfaction. It is extremely difficult to apply a poultice to a cow's bag and keep it in position, because with ordinary poultices of flax seed meal or others of equal weight usually sag so much that after a very short time they do not touch the gland at all. The only poultices that give reasonable results are of very light substances such as hops or moss, and it requires frequent changing to keep them moist and warm.

In all cases where the inflammation of the mammary gland is extensive the animal should be placed in dry comfortable quarters. If the weather is cool a light woolen blanket will afford excellent protection, if there are evidences of systemic affection, such as chills or fever. In addition, if there is fever, a tablespoon-ful of powdered nitrate of potash dissolved in water and given as a drench, twice daily, will have a cooling effect upon the system.

If the inflammation is the result of germs gaining entrance to the gland

as formerly described, the milk should be thoroughly removed and some medicine injected into the lactiferous ducts through the teat. Corrosive sublimate, one part to water 1,000 parts, has given excellent results in those cases of this kind which have come under my observation. A four *per cent.* solution of boracic acid in water is recommended by Nocard and Mollereau. The medicine can be injected by placing the point of a small syringe against the opening of the teat, not inserted into the teat, and gently forcing the solution into the lactiferous ducts until the animal shows evidence of irritation. In bad cases the medicine can be injected once daily after the milk is thoroughly removed. Later, every other day will suffice. In all cases it should be remembered that corrosive sublimate is poisonous and the milk should not be used, nor a calf allowed to run with the cow until recovery has taken place, or the medicine withheld. Milk which contains germs should not be used.

In tubercular mastitis, the disease does not necessarily follow calving, but may appear at any time. It usually starts with rather hard nodules or bunches, gradually forming in some part of the gland. These are usually filled with a yellow cheesey mass. This mass may soften and form pus or matter and an abcess of the gland result. The milk from a cow affected with tubercular mastitis should not be used, nor should the cow be used for breeding purposes.

In speaking of nodules forming in a cow's mammary gland, it is not intended to include little fibrous bunches which often form in the milk ducts at the base, or in a cow's teat, as these are not tuberculous.

In case the inflammation is not checked or is very severe an abcess may form in the affected gland. It is preceded by a hard, tender and inflamed lump in the gland. This softens in the interior, and pus, or matter forms, sometimes discharging through the lactiferous or milk ducts of the interior of the gland, and sometimes breaking on the outside. As soon as pus, or matter, has formed the abcess should be opened and unless the abcess is close to the outside, the services of a qualified veterinary surgeon are required to avoid injuring the milk ducts, as running sores difficult to heal often follow injury to the ducts. After the abcess is opened, it usually contains a thin and very bad smelling pus, it should be thorouhgly washed out and kept clean, and some good healing lotion such as a five *per cent.* solution of carbolic acid in water, or corrosive sublimate, one part to 1,000 parts of water, until the part heals.

In severe cases where the circulation of the gland is interfered with, gangrene sets in and a whole or part of a gland sloughs off. The sloughing of the gland is preceded by a coldness of the part, as no blood circulates through it. The affected part becomes damp with a disagreeable smelling fluid which seems to ooze out through the skin. The diseased portion begins to separate from the healthy, and finally drops off. This is a serious condition and requires expert treatment. If this cannot be had after the diseased portion has dropped off or

been removed, the raw surface should be kept clean, and frequently and thoroughly irrigated with either of the healing lotions recommended for the abcess.

Sometimes after recovery from mammitis one gland, or quarter, may have been so seriously affected that the secretion of milk may be lessened or entirely wanting during the period of lactation, and yet may be regained and the gland practically recover its normal condition the next time the cow is fresh, or comes into milk; but in a majority of cases, if a gland is thus seriously affected, it does not recover its normal condition again.