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Diseases of Sheep Observed in Iowa.

W. B. NILES.

Owing to the increasing importance of the sheep industry and the frequent inquiries received concerning diseases of this animal, many of which are imperfectly understood by sheep raisers and veterinarians, it was deemed advisable to investigate and obtain as much information of diseases of sheep occurring in this state as could be done in a comparatively short period of time, with the facilities at our command.

With this end in view about one year ago, the veterinary section of the experiment station mailed a circular letter to people interested in the sheep industry, asking for information along the line indicated. Numerous responses were received containing much information of value. In addition to the information obtained in this way much has been learned through an extensive correspondence with owners of diseased flocks and from personal observation of diseased animals. The circular letter may be said to have fulfilled a double purpose for it served later in the season to put us in communication with owners of diseased flocks who would not have written us had they not received such a prior communication.

From the information obtained, we find, with the exception of some parasitical troubles, that the sheep of Iowa are usually healthy.

Many of the correspondents reported sheep "generally healthy," when well cared for, intimating that what trouble occurred was due to neglect. The affections caused by animal parasites are, however, more serious than is generally supposed, and many parties who in the spring reported sheep in their neighborhood "healthy," later in the season told of serious losses in their section of the state. With a view of
disseminating information among those interested in the sheep industry, the principal diseases causing trouble in this state will be briefly discussed in the following pages, together with the appropriate preventive and curative treatment. As this article is written for the benefit of the flock master as well as the veterinarian, technical terms will be avoided as much as is possible.

As is well know many of the common sheep affections are caused by parasites belonging to the animal kingdom. Some of these live on the exterior of the body and others in the various internal organs, constituting what may be called external or internal parasitism. Diseases due to animal parasites will first be discussed, and following these, diseases arising from other causes will be considered. External parasitism will be noticed first.

TICKS.

The sheep tick (Melophagus ovinus) is a familiar parasite to almost every sheep owner. It is very prevalent in Iowa flocks and is also found wherever sheep are kept. The name is somewhat misleading for the parasite does not very closely resemble ticks found on other animals. The insect is about one-fourth inch in length, of a reddish color when filled with blood from the host, and easily found by separating the wool when present in any numbers. They live among the hairs like lice and only attach to the skin long enough to fill with blood.

Experiments made by Dr. Cooper Curtice show that this parasite spends its whole life on the sheep, and that when removed it lives but three or four days. It is not able to live on any other animal except the sheep, where it can be found at any season of the year, but is much more numerous in the spring. At shearing time the insects migrate in large numbers to the lambs where the wool is longer, where they often cause, by the irritation produced in the tender skin, serious trouble. The extent of the injury, of course, varies according to the number present. In old sheep many ticks may be
present without giving the host much inconvenience. The lamb with a more tender skin suffers much annoyance; the growth and thriftiness of the animal is much interfered with.

Treatment is comparatively simple. Dipping at shearing time in any good dip will prove effectual. It is advisable to use at all times a preparation which will also destroy the scab mite, if present. Some of the dips appropriate for this purpose will be mentioned in discussing the treatment for scab. Both the old sheep and the lambs should be dipped at the same time. While one dipping will so rid the flock of ticks that they will not again become very numerous during the summer, a second dipping is necessary to completely eradicate them. This should take place about two weeks after the first when the young will have made their appearance and can be destroyed. In the winter when this treatment is not practical the free use of Pyrethrum powder well dusted into the wool will be quite effectual.

After the destruction of the insects on the sheep, it is best to put the flock in new pens until the ticks which may have been dropped about the yards and pens will have died. The shorn wool should also be far enough removed so that the ticks cannot crawl back to their hosts. By exercising vigilant care, a flock can be entirely rid of this pest.

THE SHEEP LOUSE.

(*Trichodectes Sphaerocphalus.*)

This louse is exceedingly small and according to reports rarely seen in this country. Prof. Osborn in his work on "Insects Affecting Domestic Animals" states he has found it quite plentiful on sheep coming from Canada. It is not mentioned as a cause of trouble by our correspondents. When present in large numbers, it causes severe itching, rendering some remedy necessary. The use of Pyrethrum powder or the regular dips will prove effectual. The foot louse, first described by Prof. Osborn of this station, has only been found on Canadian sheep, and always in limited numbers.
MANGE-SCAB.

What is commonly called scab is a contagious skin disease caused by the scab mite. Three forms of scab have been described in connection with sheep, viz: Head scab, common scab, and foot scab. Each form is due to a different species of mites which to the naked eye cannot be told apart. Owing to the fact that these different species attack different parts of the body the prevailing form of scab can usually be easily determined. The scab mites are exceedingly minute parasites, scarcely visible to the naked eye, having a small head with biting mouth parts, oval bodies and four pairs of legs. The form cannot be made out with the unaided eye. (See cut for appearance). As in the case of the tick and

THE COMMON SCAB MITE.
(Psoroptes Communis, var. ovis.)

a—Adult male, dorsal view.
b—Adult female, dorsal view. Both greatly enlarged. (After Haines.)
louse, the entire life history is completed on the sheep. Their presence may be detected by placing some of the scabby crusts and wool in a glass dish in the sun, when the mites will crawl out on the wool, where they resemble white specks.

At present we have no knowledge indicating that scab mites from other species of animals will live and multiply on sheep, nor that sheep scab can be communicated to other animals. It is readily transmitted, however, from one sheep to another by healthy sheep coming in contact with those that are diseased or by being placed in yards or other enclosures where scabby sheep have been kept. The mites left about fences, yards or other places where affected sheep have scratched and rubbed, according to Dr. Curtice, remain alive from twelve to fifteen days; consequently sheep placed in yards or pastures from which diseased sheep have been removed some little time before, may contract scab.

Common scab is much the most prevalent form and probably the only form occurring in this state. The symptoms are easily recognized. The back, neck, flanks and rump are the usual regions attacked. Dr. Curtice in Animal Parasites of Sheep describes the symptoms and changes produced as follows:

"Attention to the disease is first attracted by the infected sheep scratching, biting, and rubbing themselves. The coats of the animals look rough, taggy, and felted. The itching is always most violent when the sheep have been heated by driving or warming in a stable.

"By separating the wool and examining a recently infected spot, there can be seen some minute elevations, which differ from the surrounding skin in being slightly whiter or yellower, and which have been produced by the bites of the pests. The insects themselves can be found among the hairs at but little distance from the bites. As time passes and the insects multiply in numbers these elevations become more and more numerous, and closer and closer together, until they finally unite over a considerable extent. From the summit of each elevation or papule, a watery, serous fluid exudes and accumulates, which transforms them into vesicles and pustules, and which in drying cover them over with a thin crust. In a few days the whole surface is covered with a yellowish, greasy, scaly layer, under which the parasites are hidden. As the disease proceeds this layer gradually increases in thickness by an increase of the serous exudate, and in circumference by the extension of inflammation produced by the ever-multiplying parasites which live beneath it, forming scaly crusts. These crusts, in being torn
out, mainly by the rubbing with which the sheep endeavors to allay its intense itching, carry with them the tags of the wool, the loss of which is an early symptom of the disease. At a later period the crusts are replaced by another set of thicker, firmer, adherent scabs, which are still further enlarged by the outward migration of the parasites. As they abandon the center of the scabs these are again replaced by a peeling off of the external layers of the skin, which gradually heals, while the disease slowly progresses at the outside. The complete cure is very slow, and the skin remains thick and folded for a long time. In sheared sheep the skin becomes covered by a thick, dry crust, like parchment, while beneath, it remains much swollen.

"Late Symptoms and Diagnosis.—The fleece of scabby sheep presents a characteristic rough look. In places the wool is stuck together in masses; in others it fails, while in others, which are apparently sound, it can be easily plucked off. The rubbing and scratching indulged in by the sheep not only tend to tear away the wool but increase the irritation of the skin, which may become intensely inflamed and swollen and finally end in a superficial death of the part."

The disease is more severe during winter and spring when the wool is long. The extent of the infection and the general condition of the animal has much to do with results. If poorly fed or debilitated from other causes and the parasite invades a considerable part of the body, emaciation and death may result. In many cases serious loss in the flock results from unthriftiness and loss of wool. At other times the damage aside from partial destruction of the fleece is light.

On account of the losses sustained and the difficulty in ridding the premises of scab after it has once been introduced, this disease is regarded as one of the most dreaded sheep affections.

To the best of our knowledge, the disease has never been widespread in Iowa. Occasional outbreaks have occurred from time to time, but they were confined to a few farms. Eight out of about fifty correspondents report that scab has at some time or another given trouble in their neighborhood. At the present time the subject is of considerable importance owing to the fact that there is danger of the disease being introduced into different sections of the state by the bringing in of western sheep. Most droves of range sheep are more or less affected, and unless due care is exercised, the disease is sure to be introduced in this way. One lot of such sheep
coming under my observation was dipped when brought in but the disease continued and when shipped to market, some weeks later, several showed well marked symptoms of the disease.

Treatment should be both preventive and curative. It is much easier to prevent the introduction of the disease into a flock than to eradicate it after once introduced. All additions to the flock should be dipped whether showing symptoms of scab or not. Infected herds should be quarantined and pens and yards where they have been kept, cleansed and disinfected before other sheep are put in unless considerable time has elapsed since the infected animals were removed. Dr. Curtice advises that after disinfecting yards and pens that they be left vacant for three weeks.* After dipping, the sheep should be put into new yards and kept from former ranges for at least three weeks. In order to completely rid a flock of scab, all sources of infection must be carefully guarded against.

The most successful curative treatment consists of the thorough use of some effectual dip. This is much preferable to the old way of applying ointments to the affected regions. To be effectual, the dip must contain something which will poison the mites. The patent commercial dips used by many very successfully, usually contain arsenic, nicotine, or some tar product as a basis. McDougall’s dip, which is quite extensively used, contains some of the tar products, probably one or more of the cresols, and is safer than an arsenical dip and one of the best of the patent dips. Cooper’s dip, which is an arsenical preparation, is highly recommended by some flockmasters. These dips are open to the objections made against all patent medicinal preparations, the principal being that their composition is unknown and that the purchaser must pay more for them than they are worth. The main point in their favor is that they are convenient to use, dilution with water only being necessary. The objection to the following (copied from “Animal Parasites of Sheep”) and some other formulas is, that much time and bother are necessary in their preparation:

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*Animal Parasites of Sheep.
“The Australian or Rutherford dip, which has been very successful in the hands of large flockmasters, is as follows: Take of tobacco and flowers of sulphur one pound each, to every four gallons of water to be used. The tobacco should be steeped in a portion of the water two or three successive times so as to extract all of the juice. The leaves or stems may be used; of the latter three times the weight is required as is needed of the former; a press or wringer is convenient to squeeze out all of the liquor from them. The sulphur should be mixed with some of the tobacco water and stirred until it is of creamy consistency. These ingredients should be added to the required amount of water. During the dipping this mixture should be constantly stirred and a little fresh water added from time to time to replace that lost by evaporation.

“This dip, to be more effective, should be heated to between 100 degrees and 110 degrees Fah. in summer, and 110 degrees and 120 degrees Fah. in winter, never being allowed to fall under or exceed these limits. The sheep should remain immersed in it from sixty to ninety seconds, and the head should be completely immersed at least once.

“**Australian Sulphur and Lime Dip.**—Take of flowers of sulphur 100 pounds, of quicklime 150 pounds, water 100 gallons. Mix and stir while boiling for ten minutes, until the mixture assumes a bright red color, then add three gallons of water. Hold the sheep in the mixture until the scabs are thoroughly soaked. Immerse the head at least once. Use the dip at 100 to 110 degrees Fah. Dip twice at an interval of two weeks.”

The Colorado Experiment Station used very successfully what they call “The Ft. Collins Lime and Sulphur Dip.” It contains eleven pounds of lime and thirty-three pounds of sulphur to the one hundred gallons of water. The lime and sulphur are first well mixed with a small quantity of the water and boiled for about two hours and then enough water added to make one hundred gallons. In the Colorado experiments the temperature of the dip when used was about 90 degrees and the sheep were kept in two minutes.

For numerous other dip receipts which have been recommended, the reader is referred to “Animal Parasites of Sheep.”

In Germany the cresol dip—a 2½ per cent. solution of cresol in water—is in much favor because it is effectual and leaves the wool in good condition. This last is an important factor and Prof. Curtiss, of this station states, is one of the merits of McDougall’s dip.

More depends upon the thoroughness of the work than upon the preparation used. If the scabs are first softened with an alkaline wash, fewer mites will escape destruction.
In order to destroy both mites and eggs, a second dipping should take place about eight days after the first. By this time the eggs escaping destruction at the first dipping will have hatched, and mites that may have so far escaped will rarely survive the second application. If the second dipping is delayed too long the young mites will have developed and deposited eggs which would necessitate a third dipping.

Since the above was written the Dept. of Agriculture in view of the extensive traffic in scabby infected flocks, has promulgated new regulations for the prevention of the disease and is in other ways considering the question from a practical standpoint. All public stock yards of large cities are regarded as infected with scab mites and animals for inter-state traffic going through them must be dipped.

As before stated preventive treatment should largely consist in avoiding if possible the introduction of affected sheep. In buying animals for breeding purposes it is advisable to dip them at once, unless it is known that they have come from flocks free from disease; and even then if they have been shipped in stock cars. All feeders should be dipped at least once, notwithstanding they may have passed through the process shortly before purchase. The sheep breeder who buys feeders should keep those purchased from other sources apart from his home flock.

If our people will cease to bring scabby sheep into the state this disease need give us little concern.

GRUB IN THE HEAD.

A few correspondents have reported trouble from this source, but the loss from this cause is probably slight, as but one report of a badly affected flock has been received. As is quite well understood the sheep gad fly or bot fly, (Œstrus Ovis) is the parent of the grub found in the nasal passages and sinuses of the head. The young larvae deposited at the margin of the nostril attach themselves and gradually work their way to the final resting place, the sinuses of the head. During this time and after lodging in the cavities (sinuses), they give
rise to considerable irritation, causing more or less secretion of mucus, and this leads to a discharge from the nose, which, with the sneezing is the principal indication of their presence. According to Neumann, (Treatise on Animal Parisites) three or four grubs in the sinuses may give rise to no trouble whatever, but when numerous there is often frequent sneezing and snorting, with a discharge of mucus and sometimes expulsion of larvæ. As the irritation increases, the head is held high and drawn back, but the animal does not turn in a circle as in case of "Gid" due to a tape worm cyst in the brain. In very bad cases as the disease advances, the affected sheep becomes thin and weak and may finally die. Death, however, is not common. The parasite cannot easily reach the brain as some suppose, but may in rare cases traverse the thin plate of bones separating the two cavities and lodge in that organ. The correspondent reporting serious loss describes the trouble in his flock, as follows:

"The second winter after engaging in the sheep business, I suffered a big loss, say one-fourth of the flock, principally the lambs. They kept up a sneezing for a long spell at a time, till they would bleat for help. They would stand in the sheep house with the head down, the bloody mucus streaming from the nose. In the last stages, the head would jerk as if there was pain at every pulsation; they would linger several days. I noticed a good looking ewe lose her lamb and in a short time she staid in the house. She soon looked badly, the bloody slime streaming from the nose and eyes bulging from the socket. As she got worse, I cut her throat and cut off the scalp and took out eighteen grubs on each side, between the horn and eye. I scalped several, some worse, I thought mortified, having a yellow tinge close to the brain. We tarred the noses of the old sheep during July and August, but never thought of the lambs. After that I tarred everything and have kept up the practice. Have never lost sheep since, showing these symptoms."

As already stated the loss in Iowa caused by the sheep bot fly is not heavy.

In regions where bot flies are sufficiently numerous to call for preventive measures, the smearing of tar, or tar and fish oil, over the nose with a brush will give the best results. The convenient plan of making the sheep tar their own noses by eating salt from tarred troughs is not effectual. The worst affected may sometimes be cured by a surgical operation
which consists of trephining the sinuses and removing the grubs. This can only be done by a veterinary surgeon. Some advise sawing off the horns which will expose the cavities at their base, from which the grubs may be extracted to advantage in some cases.

**INTESTINAL PARASITISM.**

While some form of intestinal parasite is usually present in sheep, it is only when the parasites become very numerous or the species is exceptionally harmful that serious trouble arises. When the parasites become very numerous they may cause trouble in various ways. Sometimes by irritating the mucous membrane, sometimes by partially or completely blocking up the intestinal tube, and at other times by consuming the nutritive material which should go to nourish the host.

In Frohner's & Friedberger's Pathology and Therapeutics of Domestic Animals, the general symptoms of the presence of intestinal worms, are enumerated as follows:

1. Emaciation and disturbance of nutrition, (Anemia and Cacexia.)
2. More or less intense gastro-intestinal catarrh, (Diarrhoea, W. B. N.)
3. Constipation and its consequences, (Colic.)
4. Nervous phenomena of very numerous forms and degrees.

When intestinal parasites are suspected present, a diagnosis can often be made by administering some worm remedy, which may cause the appearance of worms in the stools. A very satisfactory way is to carefully examine an animal that has recently died or been slaughtered for the purpose.

As will be observed by the following descriptions some intestinal parasites are easily detected, while a very careful examination must be made in order to note the presence of others.
THE STOMACH WORM.  
(Strongylus Contortus.)

Of all the parasites of sheep, this worm probably causes the greatest loss. It inhabits in immense numbers, the fourth stomach of sheep and goats. As shown in the accompanying illustration, it is an exceedingly small thread-like worm, not over one inch in length, and scarcely visible in the contents of the stomach unless carefully looked for. So small is it, that owners of diseased flocks fail to discover the cause of the trouble until advised to examine carefully for the presence of worms, when they are able to detect myriads of these short thread-like parasites, having a slightly twisted appearance, apparently making up the greater portion of the contents of the fourth stomach.

When the sheep has been killed for examination, the movements of the worms may cause the contents of the organ to appear as a squirming mass. In color they are sometimes tinged with red and at other times of a dirty white, depending upon whether or not they are filled with blood from the mucous membrane of the stomach. They are supposed to receive nourishment from the liquids of the stomach and from the mucous membrane to which they are often attached.

The life history of the parasite is quite simple and such that the disease is readily communicated from infested to healthy sheep. The adult worms, to a greater or less extent present in the stomach at all seasons of the year, produce eggs which are passed out with the droppings, and contaminating the herbage or water supply, again enter the stomach and develop into the mature form. In certain seasons of the year they are found here in all stages of development. During spring and summer the conditions being favorable, the
eggs are taken into the stomach in great numbers. In our opinion the herbage is often the contaminated vehicle, for many parties who have suffered severe loss, state that the water supply came from deep wells and that the pastures were dry and high.

Lambs are the principal sufferers; the older sheep being more vigorous are usually able to withstand the effects of the parasite. Occasionally, however, the old as well as the young, succumb.

This form of parasitism, like all others, is manifested at certain seasons. Sometimes as early as July, but usually not until August or September will the worm have become sufficiently developed and so numerous as to interfere with the health of the animal. In most flocks the lambs do not begin to die before August or September.

The symptoms do not differ much from those observed in other forms of intestinal parasitism. Often the lambs begin to die before the owner becomes aware that anything serious is the matter. More often, however, it is noticed that the lambs have ceased to thrive as they should. They lose their appetite, droop or mope about and become rapidly emaciated. Diarrhoea is often a prominent symptom. Death soon occurs.

Usually before death a flabby swelling appears beneath the jaw. It may be stated here that this enlargement under the jaw is often mentioned by sheep owners in describing sheep diseases. It is not a symptom of any particular disease, but is a dropsical effusion caused by defective circulation of the blood and always denotes debility and a bloodless condition (Anemia).

A number of correspondents have referred to what they term "black scours". This is no doubt the diarrhoea of the stomach worm trouble, or of some other form of intestinal parasitism. In the trouble under consideration the weakest lambs are the first to die, and when a large per cent. of the flock succumb the disease extends over a considerable period of time. Those which do not die become badly emaciated and continue so unthrifty as to be of little value unless carefully
treated. Consequently the entire loss cannot be gauged by the number of deaths.

For many years this parasite has been a cause of serious trouble in Mexico and Texas, and more recently has occasioned considerable loss in many other sections. In Virginia the trouble is referred to in the last report of the State Veterinarian, and in Indiana it was last year the subject of a bulletin article. Information from Canada tells of serious losses there from the same source. In this state the stomach worm has caused more or less trouble for several years, and during the past two years serious losses have occurred in many sections of the state.

During the past season this trouble has been reported from many counties and in many flocks the fatality has been very high. It is safe to say that during the year 1896, the stomach worm caused greater loss in Iowa than all other sheep affections combined. The following figures will give some idea of the losses sustained.

One breeder reports losing 55 lambs out of a flock of 180; another 40 out of 100; another 24 out of 45; another 105 out of 135; and another 40 out of 50. Many others reported heavy losses.

It seems evident from the increased number of diseased flocks reported from year to year, that this parasite is rapidly becoming more widely disseminated among our flocks. This matter is easily explained, for many of those engaged in breeding fine sheep have lost heavily, and animals purchased from these flocks have served to contaminate others.

Fortunately, the loss caused by the Strongylus Contortus can be almost entirely prevented. All that is necessary is for flockmasters to become familiar with the trouble and apply the proper remedies at the right time. The measures to be employed are both preventive and curative. Prevention is, of course, the more important. In starting a flock it is advisable if possible to procure breeding animals from uninfected flocks.

This precaution should always be taken in adding new animals to a head. Serious infection may, to a great extent,
be avoided by changing the pasture yearly and separating the lambs from the old sheep as early as it can be done. Drinking from stagnant pools should not be allowed. Water from deep wells is always preferable.

The frequent change of pasture and separation of the young from the old is a very essential feature in the prevention of loss from any form of intestinal parasitism. Medicinal treatment should always be begun early before any symptoms of disease appear in the flock. This treatment may be instituted in July, and if not carried out before, should be begun just as soon as any symptoms of trouble are seen. By giving the appropriate worm treatment early, the loss may be entirely avoided; by beginning as soon as the lambs begin to die, the loss can, to a considerable extent, be prevented. After becoming badly affected no medicine will in many cases prevent a fatal issue, and at this time our efforts must be directed toward sustaining the strength of the patient and improving the general conditions, as well as to destroying the worms.

Many preparations have been recommended for the destruction of the stomach worm. Dr. J. H. Detmers, in reporting on this disease in Texas, recommended the use of Tartar emetic as follows: A half pound of Tartar emetic is to be dissolved in twelve quarts of water, and from one to two ounces of the solution, containing from five to ten grains of the remedy, is to be given to each patient, depending on its size. Picrate of Potash, supposed to be less irritating to the stomach, has been recommended in from \( \frac{2}{4} \) to 5 grain doses for lambs.† It is conveniently dissolved in water.

In "Animal Parasites of Sheep" Dr. Cooper Curtice recommends an emulsion of oil of turpentine and milk—one part of the turpentine to sixteen of milk. The mixture is well shaken to emulsify the turpentine and each animal given from two to four ounces of the mixture according to age. If one dose is not enough, he advised that it be repeated in three

†Neuman's Treatise on Animal Parasites.
or four days. German writers also recommend oil of turpen-
tine very highly.*

Dr. E. P. Niles, of the Va. Expt. Station, reports good
results with the following recipe: Take of powdered Areca
nut three drams, powdered Artemesia one and one-half drams,
Sodium Bi-carbonate six drams; mix and divide into three
powders, giving one powder to each sheep ten or twelve hours
apart; the size of the dose may be increased or decreased ac-
cording to the size and age of the sheep to be treated; two
or three doses are usually sufficient. Dr. Bitting of the Ind.
Expt. Station has recommended the use of Santonin in one
to four grain doses once a day for a week.

The experience of the writer has been chiefly confined to
the use of oil of turpentine, as recommended by Curtice in
"Animal Parasites of Sheep." In a badly affected flock
treated last season under my personal direction, the disease
abated after two doses three days apart, had been given.
This treatment has been recommended to a number of flock-
masters, several of whom have reported excellent results;
some stated that no improvement followed.

Those who tried the tartar emetic on our recommenda-
tion, did not give very favorable reports. Drugs given only
after the death of a number of animals in the flock can not be
said to have had a fair trial, and so far our observations have
all been made on flocks of this kind. Even under these cir-
cumstances, however, the oil of turpentine caused an abate-
ment of the disease in several of the flocks treated, and if
given early would doubtless prevent in all cases a fatal issue.
With Santonin, picrate of potash and many other remedies,
we have had no experience.

In dealing with a flock where the stomach worm is sus-
pected, it is advisable to treat the entire flock in July and
again one month later. This may be repeated later on if occa-
sion demands. If as effective as it promises to be, the turpen-
tine has the advantage of being cheap and easily administered.

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*Freidberger and Frohner's Path. and Therapeutics of Domestic
Animals.
Two or three doses should be given at intervals of about three days.

Patent worm medicines as a rule are to be avoided. They cost too much, their formulae is unknown, and unless given for some time, are not usually effective. An entire flock can be quickly drenched with the turpentine emulsion. The most convenient method is to have a strong assistant stand the sheep upon the hind limbs when the medicine will be readily swallowed if poured slowly into the mouth from a small bottle.

The fact that the time to treat the flock for the stomach worm, is early in the season before symptoms of disease appear, cannot be too strongly emphasized.

THE NODULAR INTESTINAL DISEASE.

This affection, as the name indicates, is characterized by the appearance of small nodules in the intestinal wall. It was first described in the government publication entitled "Animal Parasites of Sheep," issued in 1890, and was referred to as being prevalent in the east and south. Since that time it has been found to exist in most sections of the country and in this State it is very rare to find a sheep over eight months of age that does not show some indications of the trouble. The disease has often been mistaken by veterinarians and others for intestinal tuberculosis, and during the past two years many specimens of intestine containing the nodules referred to have been received, the sender asking about the nature of the disease and if it was not tuberculosis. So close is the resemblance that government inspectors at the abattoies, unfamiliar with the nodular disease have mistaken it for tuberculosis. To the experienced a careful examination will show considerable difference between the nodule and the true tubercles of tuberculosis. In the nodular trouble the enlargement is usually elongated and the contents are of a decidedly greenish cast. The recent ones contain a cheesy mass, while those of some time standing are calcified. In some animals but few of the nodules are present—chiefly confined to the cæcal wall. In other cases the intestinal wall, both of the large and small
intestine, will be thickly studded with the characteristic bunches. The correspondent sending the specimen from which the accompanying illustration was made, stated that the whole wall from the stomach to the rectum was filled with the nodules.

In the report previously mentioned, the disease is stated to be due to an intestinal worm called Ḟesophagostoma Columbianum, which inhabits, during adult life, the interior of the intestine. As may be seen by the accompanying illustration, it is an exceedingly small worm, varying from one-half to one inch in length. To be detected, the worm must be carefully looked for.

The larval worm bores into the wall of the gut and by the irritation produced, causes the formation of the nodular masses referred to. By a careful examination of a recent nodule, the young worm can be detected in the cheesy contents of the enlargement, and the statements of Dr. Curtice, who first described the disease, are no doubt correct.

While the life history of the worm is not entirely understood, it seems very probable that no host except the sheep is necessary to its existence. Like other parasitic troubles, the affection is not
observed throughout the year, but is only seen at a certain season. Sheep become infected in the summer and the nodules begin to appear in autumn, reaching the greatest size in the winter. It is at this season that the loss occurs. While slightly affected sheep seem to suffer no trouble and the disease is not discovered until the animal is slaughtered for food, it is not to be doubted but what the nodules may be so numerous, that is, the sheep so badly affected, as to cause death. The actual loss from this source is not easily determined. The

CESOPHAGOSTOMA COLUMBIANUM.

\[ a. \text{ Male and female, natural size.} \quad b. \text{ Male and female, enlarged.} \quad (\text{After Haines.}) \]

fact that many of nodules may be present in an apparently healthy animal, tends to give the impression that the trouble may not be fatal in any case. In a number of instances, however, where serious loss has occurred in flocks in different parts of the State, no other cause of death could be discovered.

The deaths from this source usually occur in late winter and early spring. Several correspondents reported serious trouble in yearlings last spring, presumably from this source. Before dying, the sheep, although having a good appetite, ran down in flesh, slipped their wool and showed a general unthrifty condition.

In one flock coming under the observation of a competent veterinarian, the nodules were frequently found in the liver, and occasionally in the lungs. I have also observed them in the liver of animals from other flocks. As yet we are not able to explain just how this affection proves fatal, but I believe that in winter and spring, serious loss often occurs from this source.
When the affection does not produce a fatal termination the loss from unthriftiness, partial failure of the wool crop, and the rendering of the intestines unfit for sausage casings, is by no means trivial.

After becoming badly affected, that is, after the appearance of the disease late in the summer, no treatment will prove satisfactory. Prevention is the proper remedy. The mature worms should be destroyed early in the summer, before the deposition of the eggs has taken place.

As the parasite is small, and thus partly protected by the mucus secretion, and also situated well back in the intestinal canal, it is not easily destroyed. The treatment recommended for the stomach worm, together with change of pasture, etc., may be tried. While medicinal treatment is uncertain, much can be accomplished by providing a pure water supply and changing pastures frequently.

Now that diseases of this nature are being more carefully observed, no doubt our fund of knowledge concerning this and other similar troubles will be increased.

TAPE WORM DISEASES.

Several species of tape-worm infest sheep, some being found in the cystic stage in the different organs—brain, liver and mesentery, and others in the mature stage in the intestinal canal.

Tape-worms belong to the order of flat worms and much resemble a small white tape. They differ much in size, some being only a few inches, and others several yards in length. Most species require two hosts in order to complete their life history (development), existing in one animal in a cystic stage and in an animal of another species in the adult stage. The adult tape-worm, when carefully looked at, will be observed to be made up of a number of short pieces or segments. These segments contain the embryo, and as the worm matures one or more segments from time to time become detached and pass out with the droppings. It is in this way that pastures become contaminated.
Four species infest sheep in the cystic stage; only two of these have been found in sheep in this country, both of which exist to a certain extent in Iowa sheep, but do not cause serious loss. These immature tape-worms are usually referred to as "bladder worms," from the fact that they are enclosed in a small bladder-like sack filled with liquid.

In one form—*Taenia Marginata*—the cysts or bladders are found principally between the layers of the serous membrane forming the caul, or mesentery; sometimes they are present in the liver. In these cysts the worm only reaches a certain stage of development, but when devoured by an animal of the right species—in case of the marginata the dog—the worm completes its development, becoming in the intestine of the dog a mature worm, capable of producing young, which pass out with the ejecta. By dropping on the grass or getting into the drinking water, they find their way into the stomach of the sheep, and again become, after migrating to the proper region, encysted.

Young sheep are the ones usually involved. The result depends upon the degree of infection. When many of the worms are present the lamb may die of peritonitis or hemorrhage from the liver. Such serious results however, seldom follow, and while the parasite is harmful, death does not often occur.

Prevention is the only treatment. Sheep should be prevented from acquiring the young worms by treating all dogs about the premises for the removal of the adult tape-worms. Perhaps it might be better to say, keep no dogs about the premises where sheep are kept, but in case it is deemed necessary to associate canines with sheep, it is advisable to dose the former for tape-worm. For this purpose the use of Areca nut, two grains of powdered nut to each pound of the dog's weight has been recommended. This should be given stirred up in milk after the animal has fasted over night. Follow this in two hours with a physic of castor oil. When sheep harboring tape-worm cysts are slaughtered, care should be taken that dogs are not allowed to devour the cysts.
GID OR TURNSICK.

The other cystic tape-worm infesting sheep, (the *Taenia Coenurus*) produces what is commonly called "Gid or Staggers," and sometimes referred to as turn-sick. In these cases the cysts are found in connection with the brain and seriously interfere with function of that organ. As in the case of the *Taenia Marginata*, the mature worm is found in the intestine of the dog. The embryo taken into the stomach of the sheep eventually reaches the cranial cavity where the cysts develop on the surface of the brain. At three months after invading the brain these cysts are said to resemble a hazel nut in size. They continue to grow, and when sufficiently developed to produce the characteristic symptoms of the trouble, vary in size from a pigeon's egg to a hen's egg. One large cyst or a few small ones may exist. The pressure caused by them may be sufficient to soften, and even perforate, the cranial wall.

The worst infected sheep may show the first symptoms of trouble during the period of invasion, that is when the parasites are migrating to the brain cavity; this usually happens in the latter part of summer or fall. The head is held to one side, drawn back or kept in some other abnormal position. The patient is dull and later may exhibit convulsions or paralysis. Death may occur in about one week after the first indication of trouble is noticed. Usually, however, the first symptoms are seen during the period of the development of the cysts. These later symptoms occur in winter or spring, and are the ones characterizing the disease. In "Friedbergers and Frohner's Pathology and Therapeutics of Domestic Animals," the symptoms are well described as follows: "The period of turn-sickness, properly speaking, begins with dullness and stupefaction. Mastication is frequently interrupted; the patient stops suddenly; at times they are weak and stumble continuously; the eye is cold and haggard and the pupil dilated. There are often characteristic modifications of locomotion. Among these complications we may mention: 1. Riding-ring movements; the animals turn to one or the other
side while describing larger or smaller circles. 2. Whirling; the fore or hind quarters execute the movements of a circle,

one of the fore or hind quarters serving as a pivot, during which the head is held and neck are kept in a downward position. 3. A rotation upon the longitudinal axis of the body. They let themselves fall and roll like a barrel from one side to the other. 4. The side fall: Taken by vertigo they stagger and fall on their side. 5. The movement of trotting: They start trotting, going directly forward, keeping the head low and lifting their legs high. 6. Lastly, a few subjects keep the head high or thrown back during the trot. They stumble frequently, and drop or fall backwards."

A careful examination of the skull may reveal a somewhat soft fluctuating spot. Pressure here will cause pain and sometimes convulsions.
Death occurs within a few weeks from debility and exhaustion or from brain trouble. Lambs are the principal sufferers. Treatment is surgical, and in the main, unsatisfactory. It consists of puncturing and removing the cyst. This may be done with a trephine or a trochar and should be carried out by the veterinarian. In locating the cyst when fluctuation cannot be detected, strict attention must be paid to the movements of the animal. A German authority says that when the head is held sideways, that the lowest cerebral hemisphere contains the cyst. When the animal walks in a circle, the hemisphere next the center of the circle contains the parasite; when whirling to the right, the parasite is usually located in the right hemisphere and vice versa. When the animal goes straight forward, with the head up, it is located between the cerebrum and cerebelum. Not being satisfactorily treated, prevention is of much importance.

Heads of affected sheep should never be fed to dogs, and all dogs kept in connection with the sheep should be treated for adult tape-worms. The same treatment recommended for the removal of the adult Tænia Marginata is appropriate.

ADULT TAPE-WORMS.

Two species of adult tape-worms infest sheep in this country, viz.: the Tænia Fimbriata and the Tænia Expansa. The first is a very common parasite of sheep in Colorado and other western regions and is now supposed to largely have been the cause of the trouble formerly attributed to the loco plant. As far as our observation goes, it is not a common parasite in native Iowa sheep, but the importation of western sheep is likely to introduce it to a greater or less extent. This worm is found in the duodenum and gall duct, sometimes being present in great numbers. The duct may become so tightly plugged as to interfere with the flow of bile from the liver. It is stated that the duodenum may contain as high as 100 worms.

The Tænia Fimbrita, named from the fringed appearance of the segments, is very small compared with the other adult
tape-worm of sheep found here. The adult worm is from five to ten inches long and about three-tenths of an inch wide at the point of greatest width. When contracted it is lanceolate in shape. The life history is not entirely understood. Present in the older sheep all the year, the embryos pass out with the faeces, and probably find some other host before again infecting sheep.

According to "Animal Parasites of Sheep," the young Taenia begin to appear in lambs at about two months of age. The parasites develop slowly, and do not become sufficiently numerous to cause appreciable trouble until early fall, when general unthriftiness may be noticed. Later in the season, when more numerous and better developed, catarrh of the intestine and gall duct results, and in addition the duct may become so completely plugged as to cause serious disturbance of the liver functions.

Weakly, poorly kept lambs often die in great numbers after presenting a great variety of symptoms, directly or indirectly due to the presence of the worms. In large flocks the aggregate loss from unthriftiness, even in case there are no deaths, is very large.

Treatment has proven unsatisfactory. In the experiments of Dr. Curtice for the Bureau of Animal Industry, conducted in the west, the usual tape-worm remedies proved of no avail. Situated in the gall duct, the parasites are out of the reach of medicine, and again the large amount of food usually present in the paunch, tends to render the medicine inoperative. The loss by death, may, to a certain extent, be prevented by a careful system of feeding and handling. The liberal use of nutritious food, along with suitable tonics, will do much toward preventing a fatal issue.

Preventive treatment must, at the present state of our knowledge, consist of providing a supply of water uncontaminated with embryos, and in a frequent change of pasture.

The pasturing of ewes with young lambs in separate pastures may have a tendency to lessen the infection, but if, as some parasitologists think probable, the lamb may be infected
by the mother without the aid of an intermediate host, this precaution would not entirely prevent infection. The author of "Animal Parasites of Sheep" suggests that when the life history of this worm is completely understood, we may be able to devise a successful method of prevention.

**THE BROAD TAPE-WORM.**

* (Taenia Expansa.)*

This tape-worm, said to have been brought to this country from Europe by infested flocks, is now one of the most common parasites of sheep. It occurs wherever sheep are kept in this country, and is very prevalent in Iowa sheep. Within the last few years several enzootics of tape-worm diseases have occurred in this state, leading to the loss of many lambs in badly infested flocks. As several species of worms are frequently found in the same subject, it is not easy to determine the amount of damage done by each, but it is safe to say, that the broad tape-worm has been a frequent cause of more or less loss in several sections of the state, and that as the number of flocks increase and pastures become more crowded, the loss from this source will also increase.

The broad tape-worm, on account of its breadth and great length, is easily recognized. The length may exceed five yards and at the broadest part it is from one-half to three-fourths of an inch wide. At the head the width is not so great, as may be observed in the accompanying illustration. This parasite is found in the intestine at all seasons of the year, but become numerous in the fall and early winter. The life history of the worm is not clearly understood, but is thought to be quite simple. On reaching maturity a number of segments are shed at one time and the embryos contained in the segments, after reaching the herbage or water, undergo certain changes, and entering the body of another sheep, reach complete development, and again produce embryo, which are shed as before. As the conditions in spring and summer are very favorable for the existence of the embryo outside of the body, sheep may become badly infected at this time, and show
symptoms of tape-worm disease in late summer or fall. Low, wet pastures are supposed to be most favorable for producing tape-worm disease, but probably an overcrowded pasture, even if high and dry, is as much to be avoided.

The best evidence of the presence of tape-worm is the finding of the segments in the droppings. Unless a number of the parasites are present, no indication of disease will be observed, but when present in considerable numbers in young lambs, serious trouble often arises. Dr. Curtice mentions finding fourteen adult worms in a lamb four months old, and that the number of individuals present may be from two or three to a hundred. It is seldom, however, that more than five or six are observed. Symptoms of disease do not appear until the parasites reach considerable size, when they partially

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TÆNIA EXPansa.

a. Head much enlarged.
b c d e. Sections of an adult worn natural size, b being the head.
f. Young Tænia. (After Marx.)
block up the intestinal tube and probably cause considerable irritation. The affected lamb ceases to thrive, becomes weak and emaciated, and may finally die from exhaustion. In late stages, diarrhoea is a prominent symptom. The mucous membranes are pale, the wool becomes deprived of oil and is easily pulled out, and the appetite, at first good, in later stages, becomes impaired. Other diseases may supervene and carry off the already debilitated animal. The appetite of affected animals may for some time continue good; more food and drink being taken than when free from parasites.

A number of correspondents have reported serious loss of lambs from tape-worm diseases, and this, like some of the other parasitical troubles, is, no doubt, becoming more widely dissiminated over the state.

After the parasites reach the adult stage, the segments are usually soon shed, and the lamb, if not too badly emaciated, may improve and entirely recover.

Prophylaxis, or prevention, consists of providing, if possible, new pastures and a pure water supply. Over-stocking and the use of low, wet pastures should be avoided if possible.

Medicinal treatment is quite effectual if the flock is taken in hand early. No treatment will avail in the late stages of disease, when the animal has become badly debilitated. The treatment should be commenced as soon as tape-worm disease can be detected, and if possible, before actual symptoms of disease appears. For the destruction of this parasite, several preparations are recommended. Before administering the medicine, food and water should be withheld for about twelve hours, and it is advisable to follow the tape-worm remedy in three or four hours with a cathartic. Unless the head of the worm is expelled, the segments will be reproduced and the most successful remedy is one that leads to the expulsion of the entire worm.

Areca nut, powdered, in one to three dram doses, male shield fern in two ounce doses, kousso in one and one-half to two dram doses, and picrate of potash in from six to twenty grain doses, are the preparations most highly recommended.
The picrate of potash is said to be very efficient, but if properly administered, no doubt any of the above will give good results. Oil of turpentine is also much used. After using this remedy for the destruction of the stomach worm, I have observed sheep to pass large numbers of tape-worms.

In the treatment of badly affected flocks, the animals should receive the best of care, and in addition to being supplied with nutritious food in liberal quantities, should for a time receive tonic treatment.

LARGE ROUND WORM.

(Ascaris Lumbricoides.)

This parasite is very common in swine, but is seldom met with in sheep. It is thought that the latter may become infested with the parasite by being pastured with swine. As will be observed by glancing at the cut, the worm is several inches in length and would be easily recognized when present, if looked for. It is found in the small intestine and is most abundant in summer and fall. Any good worm medicine will destroy them.

THE CAECUM WORM.

(Trichocephalus Affinis.)

This parasite is found in the large intestine of sheep, goats and cattle. It is common in Iowa sheep, where it is often found in great numbers. As seen by the accompanying cut, it is a small, whip-like shaped worm. The slim part rep-
resents the head extremity which is attached to the mucus membrane. The thick portion or caudal extremity floats freely in the intestinal contents.

The life history is simple. The eggs, after passing to the ground and developing to a certain extent, pass with food or water into the intestine again, where they complete their development.

The caecum worm is not thought to be especially harmful, but when present in large numbers, I believe that alone or in conjunction with other parasites, it may cause serious trouble.

The usual worm remedies can be used with a considerable degree of success. After the administration of oil of turpentine, I have seen these worms passed in considerable numbers.

From the foregoing remarks it will be observed that partly owing to the fact that the complete life history of several of the common internal parasites is not known, we are not able to effectually prevent sheep in all cases from becoming infested with intestinal parasites, but that much can be done by providing a pure water supply, and by frequently changing pastures, and avoiding overcrowding. While low, wet pastures are always objectionable for sheep, it is also a mistake to pasture sheep year after year on the same piece of land, even if high and dry.
In case a flock has become badly affected it is advisable to sell the entire lot and if possible purchase breeding animals free from infection.

It will also be noted that the best time to administer worm remedies is before actual symptoms of disease appears. By treating early not only will death be prevented but the lamb can be kept in a thrifty condition. When treatment is delayed, those that do not succumb remain unthrifty and are of little value. In all instances, where animals have become weak and anemic, tonic preparations, as well as medicine for destroying the parasites is necessary. For toning up the weakened system, iron, along with ginger, gentian or nux vomica, will be found useful. In the absence of a veterinarian (who could most satisfactorily prescribe after examining the flock) the following may be tried:

Iron sulphate 1 part, ginger and gentian each 4 parts. After pulverizing thoroughly, mix and give each lamb two teaspoonfulls of the mixture twice daily. The powder may be given in ground feed.

In treating for the destruction of intestinal parasites it should be remembered that much depends upon a thorough application of the remedy. The presence of numbers of the parasites in the droppings is proof that the remedy is effectual. In case of the stomach worm, they are seldom seen in the ejecta even after successful treatment as they are digested by the fluids of the stomach.

FLUKE DISEASE.

In England and on the continent of Europe, the liver-fluke has been the cause of heavy losses to sheep raisers, and as certain sections of our state contain considerable low wet land, it has been supposed that the parasite might be a cause of loss in Iowa sheep. Some writers in the agricultural press have referred to what they supposed might be "fluke disease." In view of these facts it seems desirable to determine if possible, the presence or absence of the fluke in Iowa. After looking over the literature on the subject, noting the results of
several years personal observations, and gathering as much information as possible from other observers, it can be said that the liver fluke (*Distoma Hepaticum*) has not been recognized in Iowa. In fact it may be said to be a rare affection in the United States. Outside of a small strip of territory along the gulf in Texas, and a possibly portion of Long Island and California, the parasite does not exist in this country. Now that our lands are comparatively well drained it is not likely that if infested sheep were introduced into the state the disease would gain a foothold.

As it is not a disease of Iowa sheep the affection is not described in these pages.

**THE LUNG WORMS OF SHEEP.**

Two species of lung worms infest sheep, viz., the hair lung worm (*strongylus ovis pulmonalis*) and the thread lung worm (*strongylus filaria*). The last is best known, and probably the one most often present in Iowa sheep.

The hair lung worm is a very small, hair-like parasite, from one-half to an inch in length, found in adult life in the small bronchical tubes. The life history of the worm is very similar to that of some other sheep parasites. The young embryo or eggs escape from the lungs during the act of coughing and become in this way scattered over the yards and pastures. Along with food and drink, they enter the bodies of other sheep and eventually find their way to the lungs. After reaching the extremity of the small air tubes, they become encysted in the lung tissue, where they mature. After completing development, they again enter the bronchial tubes and produce eggs containing live embryo.

The presence of verminous pneumonia, as the disease, due to this parasite, is called, is not easily detected in the living sheep, and not until the disease becomes far advanced, do the symptoms become very pronounced. Those animals most seriously affected, have a deep cough, become debilitated and the wool appears dry and harsh.
An after death examination is necessary in order to positively diagnosis this form of lung trouble. Small nodules of a slightly greenish cast, surrounded by thickened lung tissue, will be observed. The finding of the young worm in these tubercles reveals the true nature of the trouble. In some cases a considerable amount of lung tissue will present indications of pneumonia. The affection cannot be successfully treated, and consequently preventive measures are of the most importance. Lambs must be kept from drinking stagnant water, and as early as possible in the season, separated from the flock and put into new pastures. Breeding ewes should be purchased from uninfected flocks.

The thread lung worm, (strongylus filaria) has received more attention, as it has frequently caused serious trouble in different countries. Several of our correspondents have mentioned the presence of lung worms in their flocks, (probably the filaria) and judging by reports and personal observations this worm is quite widely disseminated over the state, and a frequent cause of more or less loss.

The thread lung worm is much larger than the hair worm,
being from one to three inches in length. It is easily seen when the bronchial tubes are cut open, where they may be found in considerable numbers. The life history is similar to that of the ovis pulmonalis. The eggs containing the young embryo are expelled by coughing, and thus deposited about yards and pastures. The young worms by being inhaled in the form of dust or taken in with food or water, eventually reach the lungs of another sheep, complete their development and again produce eggs. It is still undetermined whether the young worm must partially develop in connection with a second host or whether the worm may pass from one animal to another without an intermediary bearer. Until the life history of the lung parasite has become positively known, it is better to assume, in dealing with the subject of prevention, that one sheep may directly infect another. It is well known that the embryo possess great resisting powers to destructive agents. According to one observer, they may remain alive in water for more than two months, and another found that drying for thirty days did not destroy them.

As moisture and heat are favorable to their preservation, it can be readily understood that a warm wet summer is favorable to the production of the disease. Infection occurs in spring and summer and the disease appears in early fall and winter. Young animals, as in all parasitic affections, are the principal sufferers.

The symptoms are similar to those caused by the strongylus ovis pulmonalis. In late stages the badly affected animal becomes very anemic and has a very distressing paroxysmal wheezy cough. The skin becomes dry and pale and the wool easily pulled out. This peculiar appearance of the skin has given rise to the term "paper skin."

Poorly fed lambs, or those debilitated from other causes, are the first to succumb. The duration of the disease largely depends on the extent of the infection, the care received by the sheep, etc. After lingering for several weeks the lamb may die from exhaustion or suffocation. Both species of lung
worms may be found in the same subject, leading to a more aggravated form of lung trouble.

The after death appearances differ very much in different cases. In aggravated cases the lungs present on the surface several large reddened patches, which when cut into show solidification (hepatization) of the lung tissue. The bronchial tube supplying the reddened part will be found largely plugged with worms and mucus. The finding of the worm is conclusive.

Prevention, as in the case of the hair lung worm and the intestinal parasites, consists of avoiding if possible, infected pastures. Pastures containing stagnant water are especially to be avoided. Water from deep wells and new pasture for the lambs as soon as they can be separated from the ewes are advisable. Curative treatment is more successful than in disease due to the hair worm, but in many cases is far from satisfactory. We may attempt to destroy and get rid of the parasites by the use of the vapors of tar, carbolic acid, oil of turpentine, sulphur and other volatile preparations. This treatment is carried out by placing the animals to be treated in a closed building filled with the vapor of the agent used. The fumigant if not actually destructive to the worms, causes irritation and coughing which expels them. A close watch must be kept during the application, or an attendant remain in the building with the sheep lest the inhalation be too long continued and the sheep die of suffocation.

The use of oil of turpentine administered by the month has been recommended with the idea that as it is to a certain extent excreted through the lungs it may thus come in contact with the worms and destroy them. The injection of medicine into the trachea (windpipe,) the treatment recommended for calves, is hardly practicable with sheep, and its efficacy in any case has not been definitely determined.

Nutritious food with tonic treatment will do much toward preventing a fatal issue.
FOOT ROT.

A number of correspondents report having had at some time to contend with foot rot. Within recent years there has been little trouble from this source.

Two forms of the disease exist; the contagious and sporadic, or non-contagious. The last is more common in this state. It is largely due to neglect and is usually seen in wet seasons when sheep are kept in low wet pastures. The horn grows unusually long, becomes softened and the feet become sore, causing marked lameness. The front feet are generally attacked first and may become so badly involved that the affected animal will graze on its knees. In severe cases the hoof drops off.

In the contagious form the disease is communicated from one animal to another, and is usually introduced into the flock by buying diseased sheep. The symptoms are much the same as in the other form. The first symptom noticed is slight lameness. An examination will reveal tenderness between the claws and in some instances slight swelling around the top of the hoof. Ulcers finally appear in these regions and eventually the hoof may drop off. This result is rare in this form however.

The treatment for both forms is practically the same. The affected animals should by all means be placed in a dry pasture, and in case of contagious foot rot the healthy sheep should be removed to other quarters. The affected feet should be carefully examined, thoroughly cleaned and all diseased horn removed. The ulcerating patches (proud flesh) should then be touched with some good caustic. For this purpose full strength carbolic acid may be used, care being taken to touch only the diseased parts. Butter of antimony has been highly recommended. Both of these preparations are conveniently applied with a small swab. Copper sulphate, (blue vitrol) and sulphate of iron are common remedies. One part of either drug is dissolved in fifteen or twenty parts of water and the diseased parts touched with the solution. When the feet are not badly diseased the animals may be
driven through a trough containing one of the above solutions with good results; but as a rule the handling and careful treatment of every animal is advisable. By going over the flock a few times in this way the disease can easily be cured. By avoiding wet pastures and muddy yards, with early treatment in case the disease appears, the loss from the source will be trivial.

ACTINOMYCOSIS.

This disease, commonly known as lumpy jaw in cattle, is very rare in sheep, two or three cases only, to our knowledge having been put on record. But one case has been observed by the writer. Here the lung was the seat of the disease. A portion of sheep lung sent from north-western Iowa revealed several cavities filled with actinomycotic material which showed under the microscope numerous very characteristic actinomyces tufts.

ACTINOMYCSES TUFTS.
From lung of sheep, much enlarged. (Original.)

Should the disease be recognized before death, treatment with potassium iodide would probably prove as effectual for the disease in sheep as when administered to cattle.

INFECTIOUS ABORTION.

This trouble is rarely observed in sheep and but two outbreaks have come to my notice. One party reported that it
began in his flock by two or three ewes aborting every week. The number increased until from one to five ewes aborted daily. When all were due to lamb, but fifty live lambs had been obtained from one hundred and thirty ewes. This flock was not worried by dogs and was in every way to the best knowledge of the owner, well cared for. He thought possibly the feeding of corn might have had something to do with the trouble, which, I think, is not probable.

In the other instance, the loss reported was small and was thought to be due to the feeding of turnips. In this flock the lambs were dropped a little before the proper time and came dead.

Infectious abortion in the mare or cow is now generally conceded to be caused by some form of micro-organism which in some way gains entrance to the uterine cavity causing degenerative changes in the membranes and leading to the expulsion of the fetus. When occurring in sheep, the trouble is probably due to a similar cause. Carbolic acid, given internally or injected beneath the skin, has proven a valuable remedy in cattle, and would be worthy of a trial in combating the disease in sheep.

LOUPING ILL.

The affection described under the above head in English works, and causing considerable loss in that country, has by some been supposed to prevail to a slight extent in this state. Whether or not this is true, has not been definitely determined. No cases very closely resembling this disease as it occurs in England having come to our notice. This fact, together with the information contained in the late reports regarding the cause of the trouble, leads me to doubt its existence in Iowa. It is now supposed that the disease is conveyed by ticks something like Texas fever in our own country, and so far we have no evidence that ticks found on sheep in this state are the bearers of infection. It is true that cases of paralysis of the posterior extremeties of ewes in late stages of pregnancy are sometimes reported. These have some resem-
blance to louping ill, but are probably due to other causes and not identical.

It may be stated here that much remains to be learned—regarding sheep diseases, and that the veterinary section of the Station will be pleased at any time to hear from parties interested in diseases of this animal.

In concluding this paper I desire to mention the valuable assistance of my colleague, Dr. Stalker, whose long term of service for the state has given him unusual opportunities for observing diseases of sheep occurring in this western section of the country. For suggestions, reading of proof sheets, etc., I am much indebted to him. In addition, I desire to acknowledge my indebtedness to those veterinarians and flock-masters who have so kindly given me the results of their observations, and in other ways encouraged the prosecution of the work. To the printed works of Curtice, Stiles, Neumann, Law, Frohner and Friedberger and the annual reports of the Bureau of Animal Industry, I have made frequent reference.

The accompanying illustrations are in part original and in part copied from "Animal Parasites of Sheep." Those marked original were drawn from nature by Miss Charlotte M. King, under the direction of the writer. The others are from the source mentioned above.