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N. S. MAYO, M. S., D. V. S.,
Professor of Physiology and Veterinary Science.

TEXAS ITCH.

THERE have been reports from various parts of the state of a parasitic skin disease of cattle, commonly known among stockmen as Texas itch. I do not know why the disease is called *Texas itch*, unless it may result from the general supposition that most dreaded diseases of cattle originate in that state. Doctor Francis, of the Texas experiment station, informs me that he has never observed the disease among cattle in that state.

While Texas itch is the most common name, it is also known as *range itch*, *cattle itch*, and *cattle mange*.

This disease has been described by European authors, but comparatively little seems to be known of the disease in this country, American literature upon the subject barely mentioning the disease, and few references are made to its existence in this country.

Texas itch is not a dangerous disease, as far as the mortality or death losses resulting are concerned, yet it is quite a serious disease, considered from a pecuniary point of view. When the disease gets well started among a bunch of cattle it is difficult to eradicate, and the loss of flesh, general deterioration and annoyance to cattle which follow result in a considerable loss.

In the outbreaks of this disease in this state which I have observed,

the disease has been introduced by cattle coming from the ranges of the South and West.

Texas itch is a skin disease affecting cattle only, and is caused by a minute animal parasite, *Psoroptes communis*: var. *bovis*. This disease differs from true mange in that the parasite is of a different nature. In Texas itch the parasite lives upon the surface of the skin; in true mange the parasites (*sarcoptes*) burrow into the skin.

The Texas-itch mite is closely related to the mite which causes "scab" in sheep; both mites belong to the same genus and species, but are different varieties. The sheep-scab mite will not attack cattle, nor will the cattle mite attack sheep or other animals.

The Texas-itch mite is very small, barely visible to the unaided eye, and cannot be detected upon an animal without the aid of a lens. If some of the deeper crusts, scurf and debris be scraped from the skin in a recently infested spot, where the disease is active, as shown by the red and irritated condition of the skin, and placed in a clean, dry glass bottle and allowed to remain over night, minute white specks will be observed crawling slowly on the surface of the glass. If these are examined with a magnifying glass the details of the parasite can be clearly distinguished. Some of the white specks will be found to consist of two parasites attached mating, and other slightly larger adult females will be observed, as shown in the accompanying illustration. In some specimens, examined in profile, several quite long hairs were observed emerging from the dorsal surface and directed backwards.

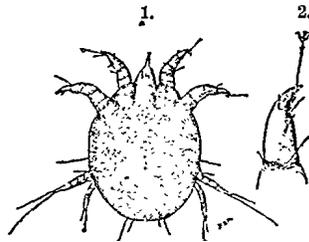


FIG. 1. Texas-itch mite, *Psoroptes communis*, var. *bovis*. Adult female, greatly magnified.*

FIG. 2. First right clam of same specimen showing disc; more highly magnified.

In young specimens these discs appear to have a perfect bell form; in other specimens it appears to have the form of a lily; while in many adult specimens it has the form of a trident, as shown in the drawing.

These itch mites are very numerous. A very small quantity of debris from an actively infested area of the skin will often reveal a score of parasites.

These mites when removed from an animal retain their activity for a considerable time. Specimens collected in small glass bottles and kept in the laboratory at ordinary temperature of the room during the winter months, which varied from 80 deg. F. during the day to 45 deg. F. during the night, would live and remain active from 8 to 11 days. Exposure to bright sunlight will kill most of the mites in a few hours.

*It should be noted that the disc on second left leg was "cut out" by the engraver.

SYMPTOMS

Texas or range itch does not appear to trouble cattle during the grazing season while the cattle are doing well on grass, nor are any symptoms of the disease observed; but when cattle are placed on dry feed in the winter, or when they are first turned on grass in the spring, especially if the cattle are thin and the pasture poor, then the disease exhibits itself in an active form and may cause serious loss. Texas itch does not usually attack adult cattle, that is, cattle over three years old, unless such animals are "out of condition," but the disease shows its preference for younger cattle—calves, yearlings, and two-year-olds. The first symptom noticed is an intense itching of the skin, usually in the region of the neck or shoulders. The animals lick themselves, dig at the skin with their teeth or horns, rub against posts and other obstacles, sometimes against barbed wire, tearing the skin until it bleeds.

The disease gradually spreads along the back, sides, and down on the outside of the legs. The disease does not seem to attack the inside of the legs, thighs, or the thin skin of the abdomen. In the early stages the coat looks rough, the hair standing on end. There is a scurfy condition of the skin; the scurf becomes mixed with a gummy exudation from the skin and forms a crust in the hair sometimes one-half inch thick. The hair then comes off or is rubbed off the badly affected area, leaving bald patches of thickened, calloused and wrinkled skin. These bald and calloused patches often show first and prominently on the top of the neck, which presents the appearance of the neck of an ox that has become calloused from wearing a yoke.

After the hair comes off, the parasites leave that part, the bald area gets well, and the hair starts to grow again. Animals suffering from this disease present a general dejected and debilitated appearance, and fall away rapidly in flesh. They eat but little, and spend a considerable amount of time and energy in licking and scratching themselves.

The disease spreads quite rapidly through a bunch of cattle, especially if the cattle are not doing well. Six or eight weeks after the introduction of an infected animal in a bunch of cattle is usually sufficient time to disseminate the disease pretty thoroughly. Thrifty, vigorous animals resist infection much longer than others, and when once attacked recover much more quickly under treatment than debilitated or unthrifty animals. The disease appears to spread by direct contact of the infected with healthy animals, by allowing the itch mites to pass directly from one animal to another. It is also spread by means of posts, feed-racks, mangers, etc., against which infected animals rub off the mites, which get onto healthy animals which may come in contact with them.

TREATMENT.

As soon as this disease is noticed among cattle, those animals which do not show any symptoms of the disease should be separated from those having the disease, and placed on ground or in yards not previously occupied by cattle having the disease. If such arrangement is not possible, all animals having the disease should be separated from the healthy, and all posts, mangers, feed-racks, etc., against which infected animals have rubbed should be thoroughly disinfected by scrubbing with a moderately strong solution of concentrated lye in water, or by using a solution of 1 part of carbolic acid dissolved in 20 parts of water.

Those animals which appear healthy should be carefully watched, and should symptoms of the disease appear the affected animals should be isolated at once.

The most successful medicinal treatment of Texas itch consists of a combination of external and internal remedies.

The value of sulphur given internally in the treatment of parasitic skin diseases is well known. Sulphur is best administered combined with common salt, placed where animals can lick it at will. One pound of flowers of sulphur mixed with four pounds of common salt is a good proportion. If cattle are not used to eating salt at will, the quantity of this mixture should be limited to a small handful at first, and gradually increased.

The external treatment consists in the application of remedies to the skin which will destroy the parasites and eggs, but will not injure the animal.

A remedy which is quite extensively used and which gives excellent results is composed of two pounds of fresh lime and one pound of flowers of sulphur in one gallon of water. The efficiency of this remedy depends somewhat upon the manner of preparation; hence the directions are given in full.

To four pounds of fresh lime add one gallon of boiling water; when the mixture gets to boiling vigorously stir in two pounds of flowers of sulphur, stirring well and adding one more gallon of water. When the mixture has cooled sufficiently it is applied with a broom or scrubbing-brush. This remedy, while it irritates the skin a little, does not take the hair off, but sticks in the hair and stays on the animal until the parasites are totally destroyed. If properly applied, one application is sufficient.

There are some objections to this remedy. It is too thick to be easily applied, and it does not seem to penetrate the matted hair, and crusts readily. As it is somewhat caustic, it is necessary to protect the hands with gloves and wear old clothing while applying it.

Experiments were made by substituting concentrated lye in place of fresh lime with fairly good results, not equal to the lime and sulphur. The same may be said of a solution of concentrated lye in water, to which kerosene oil was added to form an emulsion. Solutions of concentrated lye in a decoction of tobacco water were also tried, but were not satisfactory, as the tobacco, in less than .02 per cent. solution, proved decidedly nauseating to the animal.

Some calves were observed that had been treated with a solution of carbolic acid in water. The strength of the solution had been "guessed at," but it was strong enough to injure the skin and cause sores. This treatment, while checking the disease, did not cure it.

The most satisfactory results were obtained by using emulsions of creolin and zenoleum.* These remedies are coal-tar derivatives, rendered alkaline, so that, when added to water, they form permanent emulsions without agitation, and are very effective remedies in destroying insect parasites. As zenoleum proved just as effective as creolin, and was much cheaper, it was used in preference to creolin. One part of zenoleum in 75 parts of water was found to be very effective. Sixty head were treated, as follows: 27 head of calves, 21 head of yearlings, and 12 head of mixed calves, yearlings, and two-year-olds.

Warm water was used and the remedy applied with sponges, cloths, and scrubbing-brushes. It penetrates scabs and matted hair readily, does not irritate the skin nor the hands, and is easily and quickly applied. No further symptoms of the disease were observed, except in one case; that required a second application. The cost is from 2 to 3 cents per head. In addition to the medicinal treatment described, it is essential that animals suffering from Texas itch should have plenty of good food. It is surprising what beneficial results can be obtained from good feeding, and it is equally surprising how rapidly cattle will run down, become emaciated and die of general debility when affected with this disease and on poor feed. Stockmen who have had this disease among their cattle the previous year, and who are under the impression that they have cured it entirely, should carefully watch their cattle the next winter while on dry feed, as some of the parasites are apt to live over and escape notice until the cattle are placed on dry feed the next winter.

CONCLUSIONS.

Texas itch is a contagious skin disease of cattle, due to a parasite (*Psoroptes communis*, var. *bovis*).

It is communicated from one animal to another by contact and

*Creolin can be obtained of druggists. Zenoleum is made by Zenner-Raymond Disinfectant Company, Detroit, Mich.

through the medium of posts, fences, feed-troughs, etc. It attacks young cattle mostly, and especially those in poor condition. Texas itch is most prevalent during the winter season. Affected animals should be isolated from the healthy.

The disease can be successfully treated by giving animals good feed and by using antiseptic medicines internally and externally.

BLACKLEG.

THIS disease is also known as "black quarter" and "quarter ill," and is technically described under the name of *symptomatic anthrax*, because it was formerly supposed to be a form of this fatal disease. Later investigations have demonstrated conclusively that symptomatic anthrax or blackleg is not a form of anthrax. To avoid possible confusion by the use of the term "symptomatic anthrax," the common and well-understood term "blackleg" will be used in this article.

Blackleg is one of the most important diseases that cause losses to the cattle industry in this state, probably ranking next to cornstalk disease as regards the losses which result.

Blackleg as observed in this state seems to be confined exclusively to young cattle—calves, yearlings, and two-year-olds. In a few cases reports have been received of a three-year-old dying from this disease. In Europe it is reported that this disease attacks cattle of all ages, as well as sheep and goats. In this state, although a good many sheep are fed and pastured, I have never heard of a case of blackleg occurring among them.

Blackleg, as observed in this state, attacks young animals, and preferably those that are in good flesh. It is commonly reported by stockmen to attack the fattest calves in a bunch, and the opinion is also expressed that pure-bred or high-grade animals are more apt to contract the disease than common or native stock. This may be accounted for partially at least, by the better condition in which pure-bred calves are kept. I have been unable to notice any difference between pure-bred and common stock, except to confirm the general opinion that blackleg usually attacks those individuals in the best condition. It is difficult to form an estimate of the prevalence of blackleg in pure-bred as compared with native stock, as the number of natives is so great, and any conclusions drawn are apt to be misleading. It must not be inferred, however, that blackleg will attack only those animals in good flesh. It attacks animals in ordinary and even in poor condition.

Blackleg occurs during the fall, winter and spring seasons. Sometimes, but rarely, as late as the 1st of June. June, July, August and September are usually exempt from outbreaks of blackleg. Outbreaks of blackleg seldom occur during severe cold weather in winter. Fall and spring and moderately warm weather during the winter season appear to be favorable to outbreaks of this disease.

SYMPTOMS.

One of the first symptoms usually noticed is that the sick animal remains apart from the herd, usually lying down and not ruminating (chewing the cud). If the animal is able to get up, and is driven, it moves stiffly, some one of the four legs, depending upon which part of the body the disease locates or "settles" in, being very stiff and requiring an especial effort on the part of the sick animal to use it. In moving the affected leg, the action reminds a person of a wooden leg. The stiffness is more apparent when the animal first gets up. Exercise tends to "limber the animal up" considerably. Sometimes the stiffness is observed in more than one leg, as in the fore legs and shoulders, or the right or left half of the body. In some cases the animals appear stiff in all the muscles of the body.

While the disease may "settle" on either side of the body, in a majority of cases which I have observed the left side has been attacked. Whether this seeming difference can be attributed to the tendency in cattle to lie down more often on the right side, I am unable to say.

The most characteristic symptom of the disease is the formation of gas, which collects in the connective tissue beneath the skin of the affected part of the body. This gas can be detected by the distended skin over the part, and by a peculiar drum-like sound emitted when the part is tapped lightly with the finger, but more certainly by pressing the hand firmly on the skin, and slowly moving the hand along a peculiar crackling sound is produced, caused by the rupture of the cellular tissue beneath the skin which is distended with gas.

The muscular tissue of the affected leg, quarter, side or neck is swollen and tense. The circulation of the blood in the affected muscles and skin over the muscles is arrested, and the part appears colder to the touch than other portions of the body.

If an incision is made through the skin, it will be noticed that sensation in the part is lessened, if not destroyed. The imprisoned gas bubbles out through the incision a little, and the blood which escapes is dark and turbid.

In the earlier stage of the disease there is a rise of temperature, but as the disease progresses toward an unfavorable termination the temperature falls until it is below normal, and death takes place.

Death results from what may be called "blood poisoning." The

nerve centers controlling the heart, and lungs become paralyzed from toxic or poisonous substances in the blood, and death follows, usually within two days after the first symptoms are noticed; sometimes death occurs within 12 hours.

POST-MORTEM APPEARANCES.

The abnormal conditions which are usually noticed after death are, a dark appearance of the blood, which seems to have settled in the superficial veins, or those lying just beneath the skin. The muscular tissue or meat of the affected part presents a dark, bloody, bruised and swollen appearance. A microscopical examination of the blood or "juices" from the affected part shows large numbers of long bacteria or germs, technically known as bacilli.

CAUSE OF BLACKLEG.

The cause of blackleg in cattle is a germ, or bacterium. It is what is known as a facultative parasite; that is, a bacterium or germ that under ordinary circumstances lives outside of the animal body, but under favorable conditions gains entrance to the animal body, probably through the medium of the food or water, develops and multiplies in the animal body, and produces the disease known as blackleg.

The disease does not spread directly from one animal to another, but a sick animal is liable to scatter the germs in pastures, drinking places and upon food which other animals may take, and thus contract the disease. Not only is a sick animal liable to infect food and water, but the germs are liable to escape from the body after death. The practice of leaving the carcass of an animal that has died from blackleg in some ravine or out-of-the-way place, where it is likely to be dragged about by dogs, wolves, or other flesh-eating animals, or where the escaping germs will be washed by rains into water-courses or pastures, is a dangerous one, and should not be allowed. Animals dying from blackleg should be burned or buried deeply.

From the foregoing statements, the necessity of removing healthy animals from the sick and placing them in quarters where neither food nor water is infected by the germs will be recognized.

There are a number of differences noticed between blackleg as observed in Kansas and the disease as described by European and American authors.

European authors state that the disease is most prevalent during the summer season. The reverse of this is true in this state. In Europe, blackleg is said to attack cattle of all ages, as well as sheep and goats. In this state, young cattle only are attacked—calves after weaning, and before they are three years old.

Authorities generally agree that blackleg is more prevalent in low, wet, lands than in higher altitudes and drier climates. As the germ of blackleg is supposed to live, normally, outside of the animal body, it would seem as if decomposing organic matter and the presence of moisture combined with a high temperature would appear to favor the production of the disease. In this state, blackleg seems to be as prevalent and greater losses occur in the western part of the state at an altitude of about 4,000 feet, and an annual rainfall of less than 20 inches, as it does in the eastern part of the state at less than 1,000 feet elevation, an annual rainfall of nearly 40 inches, and a high temperature through the summer season. No outbreaks of blackleg occur during the summer.

The germ of blackleg does not appear to be a virulent one. This view is supported by the fact that, as observed in this state, it only attacks cattle, and then only those of certain ages, after weaning and under three years old.* Age seems to confer immunity, or fortifies the animal's system so it is enabled to resist the disease. The disease occurs also only during certain seasons, when the animal's system is apt to be weakened.

In outbreaks of blackleg among young cattle of susceptible age and under favorable conditions, comparatively few of the total number of animals exposed contract the disease. It is possible that those animals that do not contract the disease under these conditions possess immunity (the power of resisting disease). It is possible that young cattle which do not contract the disease may have acquired immunity by having the disease in so mild a form as not to be noticed. Practical observation does not seem to confirm this view. There seems to be no noticeable mild form of the disease. Susceptible young cattle either contract blackleg in a well-defined form, or they do not take it at all.

MORTALITY.

The mortality or death rate among young cattle that take blackleg is quite high. Probably more than four out of every five that contract blackleg die from this disease.

TREATMENT.

The most satisfactory treatment for blackleg, as with most other diseases, is preventive treatment. The best preventive treatment for blackleg is vaccination of susceptible animals with a weakened virus prepared after the method of Arloing, Cornevin, and Thomas. This virus is prepared as follows: The "bruised-looking flesh" from an

*It is possible that blackleg occasionally attacks a three- or four-year-old. I have never observed such a case, but a few have been reported by stockmen, but with some uncertainty as to the disease being blackleg.

animal that has died from blackleg is cut from the affected quarter, cut into small bits, dried at a temperature of about 100 deg. F., pulverized, and the coarser particles separated. This powder is divided into equal parts and attenuated or weakened by heating it. The weaker vaccine which is used first is heated for six or seven hours at a temperature of about 200 deg. F. The other half is heated the same length of time at a lower temperature, about 180 deg. F., and furnishes the stronger virus, which is used last. Three or four grains of the weaker virus are dissolved (?) in water, allowed to stand several hours and injected beneath the skin of the animal. The second injection is made in the same manner, about one week after the first injection. Virus prepared in this manner has been used quite extensively in this state and in Missouri and Nebraska, and appears to give excellent results. If a case of blackleg has occurred in a vaccinated animal it has not been reported, and no bad results have followed the vaccination in any way so far as I have been able to learn.

Blackleg virus, prepared as above described, can be purchased on the market at a cost of about 20 cents per animal inoculated. Other remedies are also used to prevent blackleg, with varying degrees of success. A remedy which has been used by Colonel Harris, and has given good results, is composed of the following ingredients:

| | |
|------------------------------------|---------|
| Sulphur | 10 lbs. |
| Saltpeter (nitrate of potash)..... | 3 " |
| Copperas (sulphate of iron) | 6 " |
| Air-slaked lime. | 3 " |

Pulverize these ingredients and mix them thoroughly, and use one pound of the above remedy mixed with one gallon of common salt, and place where cattle can lick it in the place of common salt.

Another remedy which is also used consists of a mixture as follows:

| | |
|-------------------------|---|
| Common salt, | } Equal parts of each by weight, pulverized and mixed. |
| Sulphur, | |
| Hyposulphite of soda, } | |

Cattle are "salted" with this remedy in the place of common salt. Both of these remedies are intended to be used during the season of the year when blackleg is apt to occur.

The treatment of animals already sick with blackleg is not satisfactory, as most of the animals attacked by the disease die. A very few recover, sometimes without treatment.

The treatment generally adopted is what is technically known as "depletive." A purgative of Epsom salts, from one-half to one pound dose, varying with the age and size of the animal, dissolved in water and given as a drench. Raw linseed oil is also given as a purgative, in doses of from one to two pints, given as a drench through the mouth. Enemas (injections) of warm water, to empty the bowels.

Bleeding from the jugular vein in early stages is also practiced, from one to four quarts of blood being drawn from the animal. In some cases bleeding appears to give relief, and in others hastens death. Stockmen who have had considerable experience with blackleg think that exercising an animal violently when the first symptoms are observed gives good results. A man with horse or dog runs the sick animal about as long as it can go without suffering; and after the violent exercise the animal should be kept moving gently until it is "cooled off." It seems to be the opinion of those with experience in this form of treatment that the violent exercise keeps the blood from settling in any part of the body.

CONCLUSIONS.

Blackleg is a "germ disease" of young cattle, caused by a facultative bacterium.

Young cattle acquire the disease by getting the "germs" on the food or in drinking water.

It prevails in this state during fall, winter, and spring.

Altitude and rainfall seem to have no effect upon its prevalence.

Treatment of sick animals is not satisfactory.

The best method of prevention is by vaccination.

BOVINE TUBERCULOSIS.

TUBERCULOSIS of cattle is the same disease as tuberculosis in the human family, popularly known as consumption. It is what is known as a germ disease; that is, it is caused by a definite, living, vegetable parasite, belonging to the bacteria, and known as *Bacillus tuberculosis*.

The *Bacillus tuberculosis* was discovered, and its relation to human and animal tuberculosis demonstrated, by Dr. Robert Koch about 15 years ago, and the same investigator, a few years later, discovered tuberculin and its application to tuberculosis or consumption. Bovine tuberculosis is found most extensively among pure-bred or high-grade cattle. Tuberculosis is quite rare among native western cattle.

The reason why tuberculosis is more prevalent among pure-bred cattle is probably on account of inbreeding and the highly artificial state such animals have been subjected to in producing the pure-bred and highly specialized cattle of to-day. Such conditions do not produce the disease, but when an animal becomes infected with the

germs of tuberculosis, such conditions tend to favor the development of the disease.

HOW CATTLE CONTRACT TUBERCULOSIS.

Cattle may contract tuberculosis from persons or other animals affected with the disease. The germs of tuberculosis do not float through the air under ordinary conditions. If the sputa or matter coughed up by an infected person or animal, and which usually contains large numbers of the germs, is dried, it may be stirred up and float about as dust. Animals may also acquire the germs of tuberculosis from infected food or drink.

There is a tendency for tuberculosis to run through certain families of cattle. This may be due to some inherent weakness of the animals, or to a direct transmission of the germs from parent to offspring. The danger of tuberculosis being transmitted from parent to offspring is greater in cows than in bull. There seems to be little danger of transmitting the disease from bulls unless the genital organs are affected. The disease is more liable to be transmitted from cow to calf because the calf is nourished before birth with blood from the cow, and is apt to get the germs from this source. The danger is also very great if the genital organs of the cow are affected with tuberculosis. Tuberculosis can also be transmitted through the medium of the cow's milk, and as pure-bred calves usually run with the cows more than common calves, the danger of contracting tuberculosis from this source is correspondingly increased.

SYMPTOMS.

Tuberculosis is one of the most insidious diseases known. Slowly, without symptoms or apparent cause, this deadly disease progresses, until some vital organ is seriously diseased and the victim hopelessly afflicted before any symptoms are shown.

The germs of tuberculosis may locate in or attack almost any part of the body, depending apparently upon the manner in which the germs gain entrance to the body, and the greater resistance to the germs shown by some tissues or organs of the body. The lungs, liver, spleen, diaphragm (midriff), udder, genital organs and joints are the most common portions of the body attacked, and the symptoms vary with the part of the body attacked and the progress of the disease. The respiratory, lymphatic and digestive organs are parts most commonly diseased and show the most characteristic symptoms.

On account of the slow progress of the disease, no symptoms are usually noticed until some part becomes so badly diseased that the general health of the animal is affected. It is astonishing how badly an animal may be diseased and to all appearances be in good health.

Several years ago I was called to treat a pure-bred Shorthorn cow, that until the day I was called had appeared in excellent health. The disease was diagnosed as tuberculosis and she was destroyed. *Post-mortem* examination showed both lungs badly diseased, a tuberculous abscess in one lung containing a pint of pus (matter). Her heart was a mass of tuberculous tissue weighing 16½ pounds, and almost every internal organ more or less diseased. This cow had a sucking calf at her side two months old. The calf was destroyed, and was found to have a tuberculous abscess in one lung as large as a walnut and the bronchial lymphatic glands were also diseased.

When tuberculosis is far enough advanced to affect the general health of an animal its presence is noted by the animal being "out of condition." The appetite is capricious, the coat often rough and staring, the eyes sunken and dull. The animal appears listless and falls away in flesh; hence the names "wasters" or "piners," that are sometimes applied. If the lungs are badly affected the animal often has a cough, sometimes a "hacking" cough, and in other cases deep and severe, often associated with a discharge of pus (matter) and mucus from the nostrils. If the digestive system is diseased, it is often shown by a chronic diarrhea, or sometimes by obstinate constipation, and sometimes these conditions vary. When the lymphatic glands are tuberculous, they become enlarged. This is often noticed in the lymphatic glands between the lower jaws, or in the glands below the ear.

POST-MORTEM APPEARANCES.

These vary with the part of the body attacked, but the same general appearances characterize the disease in most of the internal organs. The most common and characteristic condition is small tubercles or smooth, shining nodules, ranging in size from a millet seed to large, irregular masses—a common size is that of a pea. These tubercles are usually found on the outside of the lungs, on the lining of the chest cavity (*pleura costalis*), on the diaphragm (midriff), spleen, liver, stomachs, and lining of the abdominal cavity.

There are often lumps or masses of diseased tissue in the lungs. Sometimes this diseased tissue occupies the larger portion of the lungs. If this diseased mass be cut open with a knife, a dense covering of fibrous connective tissue will be found on the outside, and on the inside will be found a yellowish, cheesy, or sometimes slightly granular mass, which often contains salts of lime or "grits," readily noticed by grating upon and turning the edge of the knife blade. In some cases the cheesy mass in tuberculous tissue softens and changes to pus or matter, which spurts out when the abscess is opened.

IMPORTANCE OF TUBERCULOSIS.

The losses to the cattle industry from tuberculosis is quite small. Comparatively few cattle die from tuberculosis, most of these occurring among cattle kept for breeding and dairy purposes. The small death losses resulting from tuberculosis may be accounted for, partially at least, by the fact that most cattle are sent to the shambles while young, before the disease has time enough to develop; and in adult animals, when an individual ceases to be profitable for dairy or breeding purposes it is sold for beef, before the true nature of its unprofitableness becomes apparent. The chief importance of bovine tuberculosis is its relation to the public health. Tuberculosis or consumption is the greatest danger that threatens the human race at present. It is scattered throughout the world, but on account of its insidious nature does not command the attention that its importance deserves. It has been estimated that one-seventh of the total population dies from tuberculosis, and that 125,000 people die annually in the United States from this disease.* As tuberculosis of cattle is identical with that of man, and the disease can be transmitted to mankind through the milk and flesh, which furnish so large a part of the food of man, the importance of this disease is apparent. Milk from suspected tuberculous animals should not be used for human food or fed to susceptible animals without first sterilizing or pasteurizing the milk to destroy injurious bacteria. In pasteurization, the milk is heated to about 160 deg. F. and rapidly cooled. In sterilizing milk, it is heated to a temperature of 185 deg. F., which is sufficiently high to destroy injurious organisms. The methods and apparatus employed in pasteurizing and sterilizing milk are described in a bulletin issued by the Bureau of Animal Industry of the United States Department of Agriculture.

DIAGNOSIS OF TUBERCULOSIS.

It is impossible to diagnose bovine tuberculosis in its early stages unless the disease is located where pieces of the diseased tissues can be procured and examined microscopically for tubercle bacilli.

In 1889, before tuberculin was introduced as a test, the writer was assistant veterinarian at the Michigan Experiment Station. An effort was made to free the Michigan Agricultural College herd from tuberculosis. Individual animals from suspicious families were subjected to all physical tests known, microscopical examination of mucus from nostrils and milk from suspicious cows, but no evidence of disease found, the animals apparently being in the best of health; yet a *post-mortem* examination would reveal tuberculosis, in some cases

* Reference Handbook of Medical Science.

extensive, and it was necessary to abandon physical tests for tuberculosis in early stages as a failure.

TUBERCULIN AND TUBERCULIN TEST.

Tuberculin is a toxin or poison excreted by the tubercle bacillus, the germ of tuberculosis, during the process of its growth. Tuberculin was isolated by Dr. Robert Koch, and introduced into human medicine as a curative remedy for tuberculosis, or consumption. It is sometimes called Koch's lymph.

Tuberculin is prepared by growing the tubercle bacilli outside of the animal body, in nutritious medium. The growing germs excrete a poison which is collected and freed from the living tubercle bacilli, so there is no possibility of transmitting the disease by using the tuberculin.

In testing animals with tuberculin, the temperature of the tested animals is taken with a clinical (fever) thermometer every two hours, beginning at 6 A.M. and continuing until 12 P.M., when a small quantity of the tuberculin is injected under the skin, and the temperature is again taken as on the preceding day. If the animal has tuberculosis, there is a rise of temperature (fever) of from two to six degrees Fahrenheit. If the animal is free from the disease, the temperature does not vary more than the normal daily variation.

The tuberculin used in all the tests which I have made was furnished by the Bureau of Animal Industry of the United States Department of Agriculture. Four different lots of tuberculin were used, and all appeared uniform and equally efficient.

No bad results followed the injection of tuberculin, except possibly in No. 29, a Jersey cow that became partially paralyzed in her hind quarters and unable to rise. In some cases a trembling of the voluntary muscles and passing of soft dung mere noticed. No abscesses, smelling or soreness at points of injection were noticed in any case, and I am led to the opinion that such results, reported by some other experimenters who used tuberculin prepared by the Bureau of Animal Industry, were due to improper sterilization of instruments or to methods of injection, and not to be attributed to the tuberculin.

A rise of 2 deg. F. above the normal following the application of tuberculin is considered sufficiently high to warrant a diagnosis of tuberculosis, unless it can be accounted for by other causes. It is essential that tuberculin tests be made by competent veterinarians, who are familiar with the temperature of cattle and the causes which influence its variation.

TABLE OF

| Number | Date. | Breed. | Age. | Sex. | TEMPERATURES. | | | | |
|----------|-----------|---|---------|-----------|-------------------|---------------|----------------|---------------|---------------|
| | | | | | Before injection. | | | | |
| | | | | | A. M. 6:00 | A. M. 8:00 | A. M. 10:00 | NOON 12:00 | P. M. 2:00 |
| M. D. Y. | Y. M. D. | | | | | | | | |
| 1 | 2-23-'94 | Pure Shorthorn..... | 5-4-0 | Female... | 101.4 | 101.4 | 101.6 | ..... | 102. |
| 2 | " | { Half Aberdeen-Angus, | 0-8-0 | " | 102.6 | 102.6 | ..... | 101.8 | 102. |
| 3 | " | { Half Shorthorn..... | 1-5-15 | " | 102.2 | 102.5 | ..... | 102. | 102.2 |
| 4 | " | Grade Holstein..... | 1-5-15 | " | 100.8 | 102.2 | ..... | 101.4 | 101.2 |
| 5 | 4-1-'94 | Pure Shorthorn..... | 2-3-0 | Female... | ..... | 102.6 | 102.4 | 101.8 | 101.8 |
| 6 | 4-14-'94 | " | " | " | ..... | 101.8 | 101.4 | 102.4 | 102. |
| 7 | 11-12-'94 | Native..... | " | Male..... | ..... | 101.8 | 101.4 | 101.6 | 102. |
| 8 | 12-30-'95 | { Half Jersey, half Short- horn..... | 6-0-0 | Female... | ..... | ..... | ..... | ..... | ..... |
| 9 | " | { Half Jersey, half Short- horn..... | 7-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 10 | " | Pure Jersey..... | 9-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 11 | " | High-grade Shorthorn .. | 10-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 12 | " | " | 10-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 13 | " | Pure Jersey..... | 3-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 14 | " | " | 3-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 15 | " | " | 3-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 16 | " | Registered Jersey | 9-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 17 | " | { One-half Jersey..... | 4-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 18 | " | { One-half Shorthorn .. | 8-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 19 | " | { Three-fourths Jersey .. | 7-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 20 | " | { One-fourth Shorthorn, } | 8-0-0 | " | ..... | ..... | ..... | ..... | ..... |
| 21 | " | Registered Jersey | 1-0-0 | Male..... | ..... | ..... | ..... | ..... | ..... |
| 22 | " | High-grade Jersey..... | 5-0-0 | Female... | ..... | ..... | ..... | ..... | ..... |
| 23 | " | Registered Jersey | 2-2-9 | " | ..... | ..... | ..... | ..... | ..... |
| 24 | 12-8-'96 | Pure Jersey..... | 2-9-3 | " | 101.2 | 101.2 | 101.9 | 101.8 | 101.7 |
| 25* | " | " | 2-8-13 | " | 102.2 | 102.5 | 103. | 103.2 | 101.9 |
| 26* | " | " | 4-0-17 | " | 102.8 | 103. | 103.4 | 103.3 | 102.6 |
| 27 | " | Pure Holstein | 10-9-0 | " | 101.8 | 102.4 | 102.8 | 103. | 102.8 |
| 28 | " | " | 3-0-24 | " | 102.2 | 102.2 | 102.4 | 102.9 | 101.5 |
| 29 | " | " | 8-7-9 | " | 101. | 103.6 | 104.8 | 104.2 | 102.4 |
| 30 | " | Pure Jersey..... | 1-9-2 | " | 102.2 | 102. | 102. | 102.4 | 101.2 |
| 31 | " | " | 0-11-9 | " | 102.2 | 102.4 | 103. | 102.5 | 103.1 |
| 32 | " | " | 0-11-20 | " | 102.2 | 102.2 | 102.5 | 102.1 | 101.9 |
| 33 | " | " | 1-0-15 | " | 102.2 | 102.4 | 102.8 | 102.4 | 102.3 |
| 34 | 12-14-'96 | Pure Holstein..... | 1-1-3 | Bull..... | 101. | 101.5 | 101.4 | 101.6 | 101.7 |
| 35 | " | " | 0-10-7 | " | 101.1 | 102.2 | 102. | 102.8 | 102.2 |
| 36 | " | Pure Shorthorn..... | 1-2-15 | " | 101.2 | 102. | 102.1 | 102.9 | 102.5 |
| 37 | " | " | 0-9-20 | " | 101.6 | 101.6 | 102. | 102.4 | 101.9 |
| 38 | " | Pure Hereford..... | 0-11-14 | " | 101.6 | 101.9 | 102.4 | 102.1 | 101.8 |
| 39 | " | Pure Shorthorn..... | 0-6-20 | " | 101.4 | 101.8 | 101.9 | 101.4 | 101.1 |
| 40 | " | " | 0-6-27 | " | 102.2 | 102.2 | 102.3 | 101.9 | 101.8 |
| 41* | " | Pure Holstein..... | 3-4-7 | " | 101.8 | 101.8 | 101.6 | 101.8 | 101.8 |
| 42 | " | Pure Hereford..... | 3-0-4 | " | 97.5 | 99.5 | 101.4 | 100.6 | 100.7 |
| 43 | " | Pure Jersey..... | 1-9-1 | " | 100.8 | 101.2 | 101.3 | 101. | 101.4 |
| 44 | " | " | 5-6-28 | " | 101.4 | 101.5 | 101.9 | 102.3 | 101.8 |
| 45* | 1-1-'97 | Pure Shorthorn..... | 3-11-12 | Female... | 101.6 | 101.3 | 101.9 | 101.5 | 101.2 |
| 46* | " | " | 9-3-1 | " | 101.6 | 102. | 102.2 | 102. | 101.8 |
| 47* | " | " | 4-3-3 | " | 102.8 | 102.6 | 103.5 | 103.1 | 103. |
| 48* | " | " | 4-3-13 | " | 101.2 | 101.8 | 101.9 | 101.6 | 101.5 |
| 49* | " | " | 4-3-5 | " | 101.4 | 101.3 | 101.4 | 101.2 | 101.1 |
| 50* | " | " | 3-10-28 | " | 102. | 102.6 | 102.3 | 102.3 | 102.6 |
| 51* | " | " | 5-11-7 | " | 101.4 | 102.2 | 102. | 101.6 | 101.7 |
| 52* | " | " | 4-11-22 | " | 101.6 | 102.2 | 102.5 | 102.6 | 102.3 |
| 53 | " | " | 8-8-4 | " | 101.3 | 102.1 | 102.2 | 101.9 | 101.8 |
| 54 | " | " | 6-2-28 | " | 101. | 101.5 | 101.9 | 101.7 | 101.5 |
| 55 | " | " | 2-4-13 | " | 101. | 102. | 102. | 101.9 | 101.7 |
| 56 | " | " | 1-2-15 | " | 101.1 | 101.5 | 102.2 | 101.5 | 101.8 |
| 57 | " | " | 1-2-13 | " | 102.1 | 102.5 | 102.5 | 102.3 | 101.9 |
| 58 | " | " | 1-8-17 | " | 101.8 | 102.3 | 102.5 | 102.8 | 102. |
| 59 | " | " | 1-10-22 | " | 101.5 | 102.1 | 102.1 | 102. | 101.6 |
| 60* | " | Hereford..... | 4-4-16 | " | 101.6 | 102.2 | 101.9 | 101.3 | 101.4 |
| 61 | " | Pure Hereford..... | 6-3-21 | " | 101. | 102.2 | 102.5 | 102.9 | 103. |
| 62* | " | " Aberdeen-Angus... | 7-3-25 | " | 101.1 | 101.9 | 101.9 | 102.5 | 101.9 |
| 63* | " | " | 8-5-19 | " | 101. | 101.1 | 101.5 | 101.5 | 101.4 |
| 64* | " | " Shorthorn..... | 3-5-11 | " | 101.2 | 101.9 | 102.5 | 102.4 | 100.8 |
| 65 | " | " | 3-1-1 | " | 102.2 | 102.1 | 102.3 | 102.4 | 101.9 |
| 66 | " | " | 0-5-18 | " | 102.2 | 102.6 | 102.8 | 103.1 | 102.6 |
| 67 | " | " | 0-5-24 | " | 101.8 | 102.2 | 102.6 | 102.2 | 102.5 |
| | | | | | 102. | 103. | 103.1 | 103.1 | 102.7 |

TEMPERATURES.

| TEMPERATURES. | | | | | | | | | | | | | | Max. temper- ature before..... | Max. temper- ature after..... |
|-------------------|---------------|---------------|----------------|------------------|---------------|----------------|---------------------|---------------|---------------|---------------|---------------|----------------|--------------|-----------------------------------|----------------------------------|
| Before injection. | | | | After injection. | | | | | | | | | | | |
| P. M. 4:00 | P. M. 6:00 | P. M. 8:00 | P. M. 10:00 | A. M. 6:00 | A. M. 8:00 | A. M. 10:00 | NOON 12:00 | P. M. 2:00 | P. M. 4:00 | P. M. 6:00 | P. M. 8:00 | P. M. 10:00 | | | |
| 101.5 | 101.8 | ..... | ..... | 101.8 | 102. | 101.6 | 102.2 | 101.8 | 101.6 | 102. | ..... | ..... | ..... | 103. | 102.2 |
| 103. | 102.4 | ..... | ..... | 104.4 | 106. | 106. | Destroyed at 11.30. | | | | | | 103. | 106. | |
| 102.8 | 102.2 | ..... | ..... | 103.6 | 103. | 102.6 | 102.2 | 101.4 | 102.4 | 102.6 | ..... | ..... | ..... | 102.8 | 103. |
| 102. | 102.4 | ..... | ..... | 101.4 | 101.6 | 101.6 | 101.6 | 101.6 | 101.4 | 102. | ..... | ..... | ..... | 102.4 | 102. |
| 101.8 | 102.6 | ..... | ..... | 102.6 | 102.4 | 103. | 102.4 | 102. | 101.6 | 102.2 | ..... | ..... | ..... | 102.6 | 103. |
| 101.6 | 101.8 | ..... | ..... | 102.4 | 102.6 | 106.4 | 106. | 106. | 105.4 | ..... | ..... | ..... | ..... | 102.4 | 106.4 |
| 103. | 102.9 | ..... | ..... | 102.5 | 102.9 | 103.2 | 104.5 | 105.5 | 105.5 | ..... | ..... | ..... | ..... | 103. | 105.5 |
| ..... | 101.6 | ..... | 102.6 | 101. | 101.6 | ..... | 102. | 101.4 | ..... | ..... | ..... | ..... | ..... | 102.6 | 102. |
| ..... | 102.4 | ..... | 102.8 | 101. | 103.2 | ..... | 102.8 | 102. | ..... | ..... | ..... | ..... | ..... | 102.8 | 102.8 |
| ..... | 103. | ..... | 100.8 | 103. | 103.6 | 103.6 | 102.4 | ..... | ..... | ..... | ..... | ..... | ..... | 103. | 103.6 |
| ..... | 101.6 | ..... | 101.8 | 101. | 102.2 | ..... | 102.2 | 101.6 | ..... | ..... | ..... | ..... | ..... | 101.8 | 102.2 |
| ..... | 101. | ..... | 101.2 | 100. | 100.6 | ..... | 100.6 | 100.4 | ..... | ..... | ..... | ..... | ..... | 101.2 | 100.6 |
| ..... | 102.5 | ..... | 103. | 101.4 | 102. | ..... | 102.6 | 101.8 | ..... | ..... | ..... | ..... | ..... | 103. | 102.6 |
| ..... | 101.6 | ..... | 102. | 100.6 | 102. | ..... | 101. | 101.2 | ..... | ..... | ..... | ..... | ..... | 102. | 101. |
| ..... | 103. | ..... | 103.2 | 102. | 103.4 | ..... | 103.2 | 102.6 | ..... | ..... | ..... | ..... | ..... | 103.2 | 103.2 |
| ..... | 101.4 | ..... | 101.6 | 100.4 | 101.6 | ..... | 102. | 102.6 | ..... | ..... | ..... | ..... | ..... | 101.6 | 102.6 |
| ..... | 102.4 | ..... | 102.6 | 100.4 | 101.2 | ..... | 101.4 | 102.4 | ..... | ..... | ..... | ..... | ..... | 102.6 | 102.4 |
| ..... | 102. | ..... | 102.6 | 101. | 101.8 | ..... | 103.2 | 103. | ..... | ..... | ..... | ..... | ..... | 102.6 | 103.2 |
| ..... | 102. | ..... | 102.8 | 100. | 102.6 | ..... | 104.2 | 105.8 | ..... | ..... | ..... | ..... | ..... | 102.8 | 105.8 |
| ..... | 102. | ..... | 102. | 101.2 | 102. | ..... | 102.4 | 101.8 | ..... | ..... | ..... | ..... | ..... | 102. | 102.4 |
| ..... | 103. | ..... | 103.8 | 103. | 105. | ..... | 107. | 107.2 | ..... | ..... | ..... | ..... | ..... | 103.8 | 107.2 |
| ..... | 102. | ..... | 102.4 | 101.6 | 101.2 | ..... | 101.4 | 102. | ..... | ..... | ..... | ..... | ..... | 102.4 | 102. |
| 101.9 | 101.6 | 101.6 | 101.2 | 101.4 | 101.6 | 101.6 | 101.8 | 101.4 | 101.8 | 101.7 | 101.4 | 102.1 | 101.9 | 101.9 | 102.1 |
| 102.4 | 102.5 | 102.9 | 103.6 | 102.3 | 102.7 | 102.8 | 101.6 | 102.1 | 102.9 | 102.8 | 103. | 103.4 | 103.6 | 103.4 | 103.4 |
| 102.6 | 103. | 103.4 | 102.9 | 105.4 | 106.6 | 105.8 | 102.5 | 104. | 105.6 | 106.2 | 105.9 | 105.9 | 103.4 | 106.6 | 103.4 |
| 102.7 | 102.5 | 102.3 | 102.6 | 102. | 102.3 | 102.2 | 103. | 102.8 | 103. | 102.6 | 103.5 | 102.6 | 102.8 | 102.8 | 103.5 |
| 101.7 | 101.8 | 101.5 | 101.8 | 101.1 | 102.4 | 103. | 102.5 | 102. | 102.4 | 102.3 | 102.1 | 102. | 102.9 | 102.9 | 103.2 |
| 102.4 | 102.9 | 103. | 103.6 | 102.4 | 103.4 | 104.5 | 102.8 | 103.1 | 102.6 | 103. | 103.2 | 104.1 | 104.8 | 104.8 | 104.8 |
| 101.4 | 101. | 101.1 | 101. | 102.6 | 105.8 | 107.6 | 103.3 | 104.5 | 103.4 | 102.6 | 101.5 | 104.1 | 102.4 | 102.4 | 102.4 |
| 102.8 | 101.7 | 101.5 | 101.3 | 101. | 102.5 | 102.8 | 103.1 | 102.7 | 102.8 | 102.6 | 102.4 | 102. | 103.1 | 103.1 | 103.1 |
| 101.9 | 102. | 101.4 | 101.8 | 101.8 | 101.8 | 102. | 102.2 | 102.4 | 101.9 | 101.9 | 102. | 101.9 | 102. | 101.9 | 102.5 |
| 102. | 101.9 | 101.6 | 101.8 | 101.9 | 102. | 102.5 | 102.2 | 101.9 | 101.5 | 102. | 102.2 | 102. | 102.8 | 102.8 | 105.5 |
| 101.4 | 101.1 | 101.7 | 101.2 | 101.3 | 101.6 | 102. | 101.8 | 101.4 | 101.3 | 101.7 | 102.2 | 101.6 | 101.8 | 101.8 | 102.2 |
| 102.2 | 102.3 | 101.8 | 102. | 101. | 101.4 | 102. | 102.8 | 102.5 | 101.7 | 101. | 102.1 | 102.6 | 102.8 | 102.8 | 102.8 |
| 102.7 | 100.6 | 101. | 101.8 | 102.2 | 102.2 | 102.6 | 102.9 | 102.8 | 102. | 102. | 103.2 | 103.7 | 102.9 | 102.9 | 103.7 |
| 102.2 | 101.4 | 101.2 | 101.5 | 101.4 | 101.4 | 101.8 | 102.3 | 101.8 | 101.5 | 102.5 | 102.4 | 102.4 | 102.4 | 102.4 | 102.4 |
| 102.1 | 101.6 | 102. | 102.4 | 101.3 | 101.9 | 102.5 | 102.4 | 101.9 | 101.4 | 102. | 102.4 | 102.6 | 102.6 | 102.6 | 102.6 |
| 101.8 | 101.5 | 101.4 | 102. | 101.8 | 101.8 | 102.2 | 102.1 | 101.6 | 101.4 | 102. | 102.3 | 102.5 | 102. | 102.5 | 102. |
| 102.1 | 101.6 | 102.2 | 102.4 | 101.7 | 102. | 101.4 | 102. | 101.6 | 101.8 | 102.4 | 103. | 102.4 | 102.4 | 102.4 | 103. |
| 102. | 101.7 | 102.2 | 102.1 | 101.1 | 101.6 | 101.5 | 101.6 | 101.6 | 101.6 | 102.3 | 102.9 | 102.7 | 102.2 | 102.2 | 102.9 |
| 101. | 101.1 | 101. | 101.1 | 101. | 101.6 | 103.6 | 105.4 | 106. | 105.1 | 105.6 | 105.1 | 105.5 | 101.4 | 106. | 101.4 |
| 101.8 | 102.4 | 102.2 | 102.3 | 101.2 | 101.8 | 100.8 | 100.6 | 101. | 101.2 | 102.3 | 102.6 | 102.8 | 102.4 | 102.8 | 102.8 |
| 101.7 | 102.4 | 102.2 | 101.5 | 101.1 | 101.4 | 101.6 | 101.1 | 101.6 | 100.9 | 101.4 | 101.4 | 101. | 102.4 | 101.6 | 101.6 |
| 101.4 | 101.2 | 100.9 | 100.6 | 100.9 | 101.5 | 101.4 | 101.1 | 100.6 | 100.4 | 101.2 | 100.9 | 100.5 | 101.9 | 101.5 | 101.5 |
| 101.9 | 102. | 102.1 | 102. | 102.1 | 103.2 | 105.6 | 105. | 106.5 | 105.8 | 105.5 | 106.1 | 106. | 102.4 | 106.5 | 102.4 |
| 103.8 | 104. | 103.9 | 103.6 | 104.6 | 103.2 | 107.6 | 105.2 | 106.3 | 107. | 106.5 | 105.5 | 105.5 | 104. | 107.6 | 107.6 |
| 102. | 102. | 101.6 | 101.4 | 101.1 | 101.6 | 101.8 | 102.1 | 103.1 | 103.5 | 103.7 | 104.2 | 103.6 | 102. | 104.2 | 104.2 |
| 101.6 | 101.8 | 101.9 | 101.6 | 101.6 | 101.9 | 106.1 | 106.6 | 105. | 104. | 103.4 | 105.4 | 105. | 101.9 | 106.6 | 106.6 |
| 102.6 | 102.2 | 102.1 | 102.2 | 101.7 | 103.4 | 106.6 | 106.1 | 105.8 | 105.2 | 106.2 | 106.3 | 104.1 | 102.6 | 106.6 | 106.6 |
| 101.9 | 102. | 101.6 | 101.6 | 101.2 | 103.9 | 105. | 107.1 | 106.7 | 105.5 | 105.7 | 104.9 | 105.6 | 102.2 | 107.1 | 107.1 |
| 102.6 | 102.6 | 103. | 102. | 102. | 104.1 | 106. | 105.9 | 105.4 | 105.4 | 105.8 | 106.6 | 106. | 103. | 106.6 | 106.6 |
| 102. | 102. | 102.1 | 101.6 | 100.7 | 102.4 | 104. | 103.9 | 105. | 105.1 | 105.5 | 105.5 | 105.4 | 102.2 | 105.5 | 105.5 |
| 101.9 | 101.8 | 101.2 | 101.3 | 101. | 102.2 | 105.5 | 106.1 | 105.9 | 104.1 | 104.8 | 105.4 | 104.9 | 101.9 | 106.1 | 106.1 |
| 102. | 102. | 101.5 | 101.7 | 101. | 103. | 102. | 102.1 | 101.7 | 102.8 | 101.6 | 101.4 | 101.2 | 102. | 102.8 | 102.8 |
| 102. | 102. | 101.7 | 101.8 | 101.1 | 101.6 | 102. | 101.4 | 102.6 | 103. | 102.6 | 102.6 | 102.4 | 102.2 | 103. | 102.2 |
| 101.9 | 102.2 | 102.3 | 102.4 | 101.6 | 101.5 | 101.8 | 101.7 | 102. | 101.4 | 101.5 | 101.3 | 101.4 | 102.5 | 102. | 102. |
| 102.3 | 103. | 103.2 | 102.8 | 101.8 | 101.8 | 102.1 | 102.2 | 102.3 | 101.6 | 101.6 | 101.8 | 102. | 103.2 | 103.2 | 103.2 |
| 102. | 102.1 | 101.5 | 101.3 | 101.1 | 102.1 | 101.9 | 102. | 101.8 | 102. | 101.3 | 101. | 101. | 102.1 | 102. | 102. |
| 101.9 | 102. | 102. | 101.9 | 101.2 | 101.8 | 101.1 | 102.2 | 101.7 | 101.3 | 101.8 | 101.4 | 101.6 | 102.2 | 102.2 | 102.2 |
| 103. | 102. | 102. | 101.7 | 102. | 103. | 107. | 106.6 | 106.1 | 105.8 | 106.1 | 106.3 | 106. | 103. | 107. | 107. |
| 102.1 | 101.6 | 101.4 | 100.7 | 100.4 | 101. | 101.6 | 101.8 | 101.9 | 101.2 | 100.4 | 100.4 | 102.5 | 101.9 | 101.9 | 101.9 |
| 101.5 | 101.4 | 101. | 101. | 100. | 101.1 | 101.2 | 102.2 | 104.8 | 105.5 | 105. | 106.2 | 106. | 101.5 | 106.2 | 106.2 |
| 101.2 | 100.5 | 101.1 | 100.8 | 101. | 102. | 104.2 | 105.5 | 105.2 | 105.5 | 105.4 | 104.9 | 104.9 | 102.5 | 105.5 | 105.5 |
| 102. | 102. | 101.8 | 101.3 | 101.4 | 103.3 | 107. | 106. | 105.6 | 105. | 105.1 | 106.2 | 105.5 | 102.4 | 107. | 107. |
| 102.4 | 101.9 | 101.6 | 102. | 101.6 | 102.2 | 102.5 | 102. | 102.5 | 102.4 | 101.3 | 101.5 | 102.8 | 102.5 | 102.5 | 102.5 |
| 102. | 102. | 10 | | | | | | | | | | | | | |

TABLE OF TEMPERA-

| Number. | Date. M. D. Y. | Breed. | Age. Y. M. D. | Sex. | TEMPERATURES. | | | | |
|---------|-------------------|-------------------------|------------------|-----------|-------------------|---------------|----------------|---------------|---------------|
| | | | | | Before injection. | | | | |
| | | | | | A. M. 6:00 | A. M. 8:00 | A. M. 10:00 | NOON 12:00 | P. M. 2:00 |
| 68* | 1- 1-'97 | Pure Aberdeen-Angus ... | 0-10-12 | Female... | 101.8 | 102.1 | 102.3 | 102.2 | 102.1 |
| 69 | " " | " Hereford..... | 0-11- 6 | " | 101.6 | 102. | 102.3 | 102.5 | 102.2 |
| 70 | " " | " Shorthorn..... | 0- 3-27 | Male..... | 102.2 | 103.3 | 103. | 103.3 | 102.4 |
| 71 | " " | " | 0- 3-23 | Female... | 102.2 | 103.3 | 102.8 | 102.5 | 102.2 |
| 72 | " " | " Aberdeen-Angus... | 0- 4- 3 | Male..... | 104. | 104.2 | 105. | 104.8 | 103.5 |
| 73 | " " | " | 7- 8-23 | " | 102. | 101. | 101.6 | 101.3 | 101.1 |
| 74 | " " | " Shorthorn..... | 0- 6- 6 | " | 102.6 | 102.6 | 103.5 | 103. | 102.7 |
| 75 | 4-26-'97 | Pure Holstein | 0- 3- 5 | " | 101.8 | 101.6 | 102. | 102. | 102.4 |
| 76 | " " | " | 0- 3-17 | " | 101.2 | 102. | 102.2 | 102. | 102.2 |
| 77 | " " | Pure Shorthorn | 0- 1-12 | " | 101.2 | 102. | 102. | 101.8 | 101.8 |
| 78 | " " | " | 0- 2-13 | " | 103.6 | 104. | 105. | 105. | 104.2 |
| 79 | " " | " | 0- 3- 2 | Female... | 106. | 107. | 106. | 106.2 | 106.3 |
| 80 | " " | " | 0- 0- 9 | Male..... | 102.4 | 101.8 | 102. | 102.2 | 102. |
| 81 | " " | Pure Jersey | 0- 3-10 | " | 102.5 | 102.5 | 102.6 | 102.2 | 102.4 |
| 82 | " " | Pure Hereford..... | 0- 2-14 | " | 102.6 | 101.8 | 101.4 | 102.4 | 102.4 |
| 6 | 3- 2-'95 | Pure Shorthorn ..... | ..... | ..... | ..... | ..... | 102. | 102. | ..... |

*All these animals reacted strongly, and were probably tuberculous, but no opportunity has been afforded to hold autopsies. The cattle are still living.

No. 29 was a pure Jersey cow that has been referred to as the only case where tuberculin may be said to have produced unfavorable results.

This cow had not been doing well for more than one year previous to the test. About six months before the test was made, I was called to treat this cow. The cow was in fair condition, but at times had considerable difficulty in getting up and moving about, being stiff and not having good control of her hind quarters. A thorough physical examination was made, and from the general condition exhibited the disease was diagnosed as tuberculosis. This cow was tested on December 7, and responded to the test, her temperature going to 107.6 deg. F. on the 8th. About 5 P.M. on December 8 she lay down, and was unable to get up, even with assistance, her hind-quarters appearing to be paralyzed. She remained in this condition, with no apparent pain, and eating a fair ration, until the afternoon of December 9, when she was destroyed. *Post-mortem* examination revealed extensive tuberculosis, the retro-pharyngeal and bronchial lymphatic glands, lungs, diaphragm and liver being diseased. The liver was so badly diseased, that it was a source of speculation as to how that organ could perform its function. The spinal meninges were also diseased, and the pressure on the cord probably accounts for the partial paralysis exhibited. Why the tuberculin should have aggravated this trouble, I am unable to state. It is possible that after the effects of the tuberculin had worn off she would have regained the use of the partially paralyzed muscles.

No. 6 was a pure Shorthorn cow, and was tested twice. On April 14, 1894, her temperature rose from 102.4 deg. to 106.4 deg., and on

TURES - CONCLUDED.

| TEMPERATURES. | | | | | | | | | | | | | | Max. temper- ature before..... | Max. temper- ature after..... |
|-------------------|---------------|---------------|----------------|------------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|----------------|-------|-----------------------------------|----------------------------------|
| Before injection. | | | | After injection. | | | | | | | | | | | |
| P. M. 4:00 | P. M. 6:00 | P. M. 8:00 | P. M. 10:00 | A. M. 6:00 | A. M. 8:00 | A. M. 10:00 | NOON 12:00 | P. M. 2:00 | P. M. 4:00 | P. M. 6:00 | P. M. 8:00 | P. M. 10:00 | | | |
| 102. | 102. | 101.6 | 101.5 | 101.7 | 102.2 | 104.2 | 105. | 105. | 104.8 | 104.4 | 104. | 103.4 | 102.3 | 105. | |
| 102.2 | 101.8 | 101.6 | 101.3 | 101.5 | 102. | 102.2 | 102. | 101.9 | 102. | 101.6 | 101.6 | 101.7 | 102.5 | 102.2 | |
| 102.2 | 102. | 102.2 | 102.2 | 102.6 | 102.6 | 102.6 | 102.8 | 103. | 102.4 | 103. | 102.9 | 102.1 | 103.3 | 103. | |
| 102.6 | 102.4 | 102.8 | 102.2 | 102.1 | 102.2 | 102.4 | 101.4 | 102. | 102.6 | 102.4 | 102.6 | 102.4 | 102.6 | 102.6 | |
| 103. | 104. | 104.2 | 103.5 | 104. | 103.5 | 103.2 | 103.2 | 103.4 | 103.5 | 103.1 | 103.3 | 103.3 | 103.2 | 105. | |
| 101.5 | 101.2 | 101. | 100.8 | 101. | 101.1 | 101. | 101. | 101. | 101.1 | 103. | 103.4 | 105.2 | 102. | 105.2 | |
| 102.5 | 103. | 103. | 103.1 | 102. | 103.5 | 103.6 | 102.6 | 103.1 | 103. | 103.5 | 103.5 | 103.2 | 103.5 | 103.6 | |
| 102.6 | 102.6 | 102.2 | 102.2 | 102. | 102. | 101.8 | 101.2 | 101.6 | 102.2 | 102.4 | ..... | ..... | 102.6 | 102.8 | |
| 103. | 102.6 | 102.4 | 102.6 | 102. | 102.2 | 102.6 | 102. | 102. | 102. | 102.2 | ..... | ..... | 102.8 | 102.8 | |
| 102.4 | 102.4 | 102.8 | 102.4 | 101.8 | 102.6 | 102.8 | 102.2 | 102. | 102.2 | 102.6 | ..... | ..... | 102.8 | 103.8 | |
| 103. | 103.2 | 103. | 103. | 103.2 | 103.2 | 102.6 | 102.8 | 103. | 103.6 | 103.8 | ..... | ..... | 105. | 103.8 | |
| 101.8 | 101. | 103.2 | 107. | 105. | 105. | 105. | 105. | 104.8 | 105. | 105.4 | ..... | ..... | 107.8 | 106. | |
| 102.2 | 102.6 | 102.4 | 102.8 | 102.2 | 102.5 | 102.8 | 102.2 | 102.6 | 102. | 102.2 | ..... | ..... | 102.6 | 102.6 | |
| 102.8 | 102.8 | 102.6 | 102.6 | 102.2 | 102.8 | 102.6 | 102.2 | 102. | 103. | 102.4 | ..... | ..... | 102.6 | 103. | |
| 101.6 | ..... | ..... | 101.6 | 101.5 | 102.2 | 102.8 | 105. | 105.8 | 105.2 | ..... | ..... | ..... | 102.8 | 102.6 | |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 102. | 105.8 | |

ORGANS AFFECTED.

- No. 2.-Lungs and lymphatic glands.
- No. 7.-Lungs, lymphatic glands, and cerebral meninges.
- No. 19.-Lymphatic glands, rumen, and lungs.
- No. 21.-Lungs and lymphatic glands.
- No. 29.-Liver, lymphatic glands, diaphragm, rumen, and *Pleura costalis*.
- No. 53.-Uterus badly diseased.

March 2, 1895, her temperature rose from 102 deg. to 105.8 deg. This cow was destroyed, and no other evidence of tuberculosis found.

The high temperature of No. 71 can be accounted for by his extremely nervous condition, which rendered it necessary to hold the animal or throw him every time his temperature was taken. It was a small Aberdeen-Angus bull calf, and a fighter from start to finish.

After a herd has been tested, the healthy animals should be separated from those that react and placed in uninfected quarters. Stables can be disinfected by cleaning out and burning all litter, manure and trash, and disinfecting the woodwork, floors, mangers, stalls, etc., with a five per cent. solution of carbolic acid, thoroughly applied. A coat of whitewash should then be applied to the woodwork. Healthy cattle should not be allowed to come in contact with or drink from the same trough with infected animals, nor should other cattle be added to the healthy herd until they have been tested and found free from tuberculosis. In order to detect a possible error, it is an excellent plan to test the healthy herd a second time, at least six months after the first test.

RELIABILITY OF TUBERCULIN TESTS.

Errors in diagnosing tuberculosis by tuberculin may occur in two ways: Animals may react to the tuberculin test and fail to show other evidence of tuberculosis, or animals may not react to the tuberculin test and a *post-mortem* examination reveal tuberculosis. From experiment station, live-stock commission, and other official sources,

I have been able to collect reports of 11,313 cattle tested with tuberculin in the United States. Of this number 5,737 reacted to the test, and *post-mortem* examination revealed tuberculosis in 5,746. Two reacted that did not show tuberculosis, and nine did not react to the test but were tuberculous.

Adding to this number 81 cattle tested here, gives a total of 11,394. Total reacting, 5,759; number of errors, 12, or about one error in 950.

When the large number of operators and the varying conditions and circumstances under which the cattle are tested are considered, the results are gratifying, and show that, *as a means of diagnosing bovine tuberculosis, tuberculin is a very reliable test.*

But few of the reports above referred to give the different breeds of cattle tested. The following shows the distribution of tuberculosis among the breeds reported:

| <i>No. tested.</i> | <i>Breed.</i> | <i>No. reacting.</i> |
|------------------------|-------------------------------------|--------------------------|
| 111 | Jersey, pure and grades..... | 77 |
| 293 | Shorthorn, pure and grades..... | 91 |
| 283 | Holstein, pure and grades..... | 127 |
| 18 | Ayrshire, pure and grades..... | 12 |
| 13 | Guernsey, pure and grades..... | 7 |
| 20 | Devon, pure and grades..... | 11 |
| 7 | Red Polled, pure and grades..... | 3 |
| 13 | Aberdeen-Angus, pure and grades.... | 8 |

The flesh of animals affected with tuberculosis should not be used as food. While it is true that tuberculosis is seldom found in muscular tissue, which furnishes most of the food material from cattle, and that thorough cooking will destroy the tubercle bacilli, yet such conditions are not always fulfilled, and it is better to be on the safe side and destroy the flesh of animals affected with tuberculosis.

PRACTICAL APPLICATION.

From the foregoing, it will be noticed that tuberculin is a very reliable means of diagnosing bovine tuberculosis, and by using this agent it is a comparatively easy matter to recognize bovine tuberculosis and take measures for its extermination. This may be accomplished in two ways: First, by testing the cattle and destroying those that react, disinfecting the premises, and not allowing any cattle to come in contact with the healthy animals until they have been tested with tuberculin and found healthy. This plan has been tried by the state of Massachusetts. In that state an effort was made to test all cattle with tuberculin, destroy all tuberculous animals, and allow no cattle to be brought into the state until they had been subjected to the tuberculin test. After two years' effort along these lines, this plan of eradicating bovine tuberculosis has been abandoned owing to the opposition developed.

The second plan is the one followed in Denmark. It consists in

testing all animals with tuberculin, separating the tuberculous from the healthy, and keeping the healthy animals in quarters free from infection. It has been demonstrated that tuberculous cows can produce calves free from tuberculosis. As soon as the tuberculous cows drop their calves, the latter are taken from the cows at once and fed sterilized milk, to prevent the calves from contracting tuberculosis through the milk. The young calves are tested with tuberculin, and all that are affected with hereditary tuberculosis are destroyed. Later the calves are again tested with tuberculin, and any others responding to the test are destroyed. In this manner only healthy animals are raised for breeding and dairy purposes, and bovine tuberculosis is being eradicated from the Danish dairies without the serious loss that would follow the immediate destruction of all tuberculous animals.

The milk from tuberculous cows should be sterilized before being used for food for man or fed to susceptible animals, and care should be exercised that cattle do not contract the disease from attendants afflicted with consumption.

As people become more familiar with this disease, its importance becomes more apparent, and it seems probable that the time is not far distant when laws will be enacted for the eradication of bovine tuberculosis. There is a growing demand for animals for breeding and dairy purposes that will stand the tuberculin test. No person should start a dairy herd or a herd of pure-bred cattle for breeding purposes unless the animals upon which their future success depends have been tested and found free from this insidious disease. Progressive breeders of pure-bred cattle should endeavor to free their herds from this disease. A reliable test is now within the reach of all and the former element of uncertainty eliminated. The following quotation is from Prof. Dr. R. Bang, of Copenhagen, Denmark, the foremost European authority on bovine tuberculosis:

The struggle against bovine tuberculosis must of course be of several years' duration, but it can and must be crowned with victory. In this struggle tuberculin has yielded us invaluable service. Only with this agent can we determine the actual extent of the disease. On the basis of the tuberculin investigations, we are already in position to establish a rational plan of operation, and by this means alone can we retain the advantages gradually won; but the contest is well worth the pains. The conquest of bovine tuberculosis promises not only large economic profit, but also the annihilation of an important source of human tuberculosis.

CONCLUSIONS.

Bovine tuberculosis is the same disease as consumption in the human family. It is an hereditary disease, and can also be transmitted through the milk of tuberculous cows.

Bovine tuberculosis cannot be recognized in its early stages by a physical examination.

Tuberculin is a very reliable test for tuberculosis, and no bad results follow its use if properly administered.

By using tuberculin bovine tuberculosis can be detected and eradicated.

TEXAS FEVER.

THIS disease of cattle is known by a variety of names, among which "southern cattle fever," "Spanish fever" and "splenetic fever" are the most common. In Australia the disease is known as "tick fever" or "red water."

There are objections to the use of the name Texas fever for this disease, but in this state the disease is so commonly known and well understood by this name that a change would lead to confusion; hence the name "Texas fever" will be used in this article. It will be understood that Texas fever is not communicated by Texas cattle exclusively, but by cattle from all states south of the quarantine line. As a matter of fact, cattle coming from northwestern Texas do not convey the disease, but when exposed to southern cattle are as susceptible to Texas fever as other northern cattle.

Texas fever is a specific infectious disease of cattle, having its origin in cattle coming from south and east of a line beginning at Chesapeake bay, on the eastern coast of the United States, and running diagonally, following county lines, in a southwesterly direction through the states of Virginia and North Carolina to the northwestern boundary of South Carolina; then west along the northern boundaries of Georgia and Alabama; thence north about two tiers of counties in Tennessee; then westward, following county lines, across the state of Arkansas, south of the two northern tiers of counties, to the eastern line of Indian territory; thence north to the southern line of Kansas; then west along the southern boundary of Kansas to the Arkansas river; then running diagonally, following county lines, southwest across Oklahoma territory and Texas to the Rio Grande at the southwest corner of Pecos county; thence following the Mexican boundary line to the southeastern corner of California; thence along the eastern and northern boundaries of California to the Pacific ocean. This line, as briefly located, is the quarantine line established by the United States department of agriculture for 1897.

Cattle coming from south of the quarantine line during the summer season are capable of infecting ground and communicating Texas fever to cattle north of the quarantine line. To prevent the serious loss that would follow the shipping or driving of southern cattle north, the United States government, in connection with the various states,

maintains a strict quarantine against southern cattle from February 15 to November 15. No southern cattle can be brought north across the quarantine line except for immediate slaughter, and then only in cars properly labeled; and these cattle can only be unloaded in yards set apart for southern cattle only.

By the term "southern cattle" is meant cattle coming from south of the quarantine line and capable of communicating Texas fever. By "northern cattle" is meant cattle north of the quarantine line capable of contracting Texas fever. Southern cattle that infect ground or carry the disease to northern cattle are to all appearances in perfect health; and they do not contract Texas fever, although northern cattle may be dying by scores in the same inclosure from Texas fever. If northern cattle are taken south of the quarantine line into the permanently infected area, they contract Texas fever (also called "acclimation fever"), usually in a fatal form.

There are several remarkable features about Texas fever that need to be clearly understood:

1. Texas fever is communicated to northern cattle by apparently healthy cattle coming from south of the quarantine line.
2. Northern cattle do not contract Texas fever directly from the southern cattle, but from passing over ground which southern cattle have infected with southern cattle-ticks.
3. Southern cattle do not infect ground nor do northern cattle contract Texas fever after sharp freezing weather sets in.
4. Northern cattle taken south of the quarantine line into permanently infected territory contract Texas fever.
5. Young northern calves seldom contract Texas fever in a serious form.

HOW TEXAS FEVER IS TRANSMITTED.

For many years it was a perplexing problem as to the manner in which healthy southern cattle could infect ground so that northern cattle in passing over it weeks afterward, would contract Texas fever and die. It was observed that southern cattle which carried the infection were invariably infested with southern cattle-ticks (*Boophilus bovis*), and close observation of northern cattle affected with Texas fever showed that they were also infested, usually with small young southern cattle-ticks. These facts suggested the southern cattle-ticks as a possible carrier of the "germs" of Texas fever.

In 1889 the Bureau of Animal Industry produced Texas fever in northern cattle, by infecting northern cattle artificially with ticks from southern cattle.

In 1893, in connection with Doctor Francis, of the Texas Experi-

ment Station, some experiments were made along the same line. Doctor Francis's portion of the experiment is reported as follows:

July 3, 1893, ten adult females (*Amblyomma unipuncta*), commonly called the "Lone Star" tick, were collected from cattle of the station (College Station, Brazos county, Texas, in permanently infected territory, M.) Their average weight was 44 grams. They were confined in the laboratory under ordinary conditions, and began depositing eggs July 7. This continued about 10 days, having deposited about 48 per cent. of their original weight as eggs. Alive July 25 — that is six or seven days after having ceased laying eggs—though apparently dry and lifeless. August 8, larvae appeared. These were sent to Doctor Mayo, Kansas Experiment Station, and reached him August 17.

July 14 several cattle-ticks (*Boophilus bovis*) were caught and one sent to Doctor Mayo with the above. This is the lot reported as having died before being tested. A second lot was collected for me by Mr. Watts, and the eggs sent to Doctor Mayo, who received them September 8. These eggs hatched September 15. The young ticks were put on a four-year-old Jersey heifer September 28. This animal is designated in Doctor Mayo's report as No. 3.

The following report of my part of the experiment was sent to Doctor Francis on November 1, 1893 : On August 17, 1893, there was received by express from Dr. M. Francis, of College Station, Texas, two specimens of southern cattle-ticks. The ticks were very young, possibly two weeks from the egg. One bottle, labeled "A," contained young ticks of the "Lone Star" variety (*Amblyomma unipuncta*). These ticks are about the same size as the southern cattle-tick, but are easily recognized by a bright silvery spot in the center of the back. In adult females, distended with blood, this spot appears to have changed its position to "the back of the ticks neck.

Bottle labeled "B" contained young southern cattle-ticks (*Boophilus bovis*). These ticks were kept in the laboratory until August 26. The ticks in bottle "B" were not doing well on their arrival, and on August 28 all were dead.

On August 26 the young Lone Star ticks in bottle "A" were put upon two calves, half on one calf and half on the other. About 150 young ticks were placed on each calf. Calf No. 1 was about two months old and evidently a grade Jersey—a small white star in forehead and Jersey color. Calf No. 2 was about 10 weeks old, native bull calf, large white spot on flank and a white brisket running back on belly; also large white spot on face. The temperatures of Nos. 1 and 2 throughout the experiment are shown in table on opposite page.

On August 31 but few ticks could be found on either calf. These had increased in size and showed signs of moulting. On September 7 no ticks could be found on either calf. On September 5 one tick in larval stage was found, after careful search, but on September 7 this tick was missing. No more ticks were discovered until September 22 when three were found, two between the thighs and one on the brisket. All three had eight legs. One tick was empty and two



TEMPERATURE RECORD, CALVES Nos. 1 AND 2.

| DATE. | No. 1. | | No. 2. | | DATE. | No. 1. | | No. 2. | |
|--------------|--------|-------|--------|-------|--------------|--------|-------|--------|-------|
| | a. m. | p. m. | a. m. | p. m. | | a. m. | p. m. | a. m. | p. m. |
| Aug. 29..... | | 103. | | 102.4 | Oct. 14..... | 102.6 | 102.6 | 102.2 | 103. |
| " 30..... | 101.6 | 104. | 101.4 | 103.4 | " 15..... | 102. | 102.4 | 102.6 | 103. |
| " 31..... | 102. | 104. | 102. | 103.2 | " 16..... | 102. | 102.8 | 103.4 | 103. |
| Sept. 1..... | 102.6 | 103. | 102.4 | 103. | " 17..... | 101.6 | | 103.2 | |
| " 2..... | 102.8 | | 102.8 | | " 18..... | 102.6 | 102.5 | 103. | 104. |
| " 3..... | 102. | | 102. | | " 19..... | 101.8 | 103. | 103. | 104. |
| " 4..... | 102.6 | | 104. | | " 20..... | 101.8 | 102.6 | 103. | 104. |
| " 5..... | 103.2 | | 103.2 | | " 21..... | 102. | 103.2 | 102.4 | 103. |
| " 6..... | 103. | | 103.4 | | " 22..... | 101.8 | 103. | 102.6 | 103. |
| " 7..... | 103. | | 103. | | " 23..... | 102. | 103.6 | 102.6 | 103. |
| " 8..... | 102.2 | | 102.2 | | " 24..... | 102.4 | 103.6 | 102.4 | 103. |
| " 9..... | 102.6 | | 102.8 | | " 25..... | 101.8 | 102. | 103. | 103. |
| " 11..... | 102.2 | | 103.4 | | " 26..... | 103.6 | 103. | 103.6 | 103. |
| " 13..... | 103. | | 103.4 | | " 27..... | 102.4 | 102. | 103. | 103. |
| " 15..... | 102.6 | | 102.6 | | " 28..... | 102. | 102.4 | 103.2 | 102. |
| " 17..... | 102.2 | | 102.4 | | " 29..... | 102.4 | 102.8 | 102.6 | 102. |
| " 19..... | 102. | | 102.2 | | " 30..... | 102.4 | 101.8 | 103.2 | 103. |
| Oct. 12..... | 101.8 | 102.2 | 103.2 | 103. | " 31..... | 102.4 | | 102.6 | |
| " 13..... | 103.2 | 103. | 104. | 103. | | | | | |

were filled with blood. On account of the small number of ticks this experiment was abandoned.

On September 8, received by mail from Doctor Francis eggs of the southern cattle-tick (*B. bovis*). On September 15 these eggs began hatching, a few being found in the bottle. On September 22 300 or 400 of these young ticks were placed on each of calves Nos. 1 and 2, and given plenty of time to crawl well into the hair. On this date three ticks of former lot (*A. unipuncta*) were found, the largest being one-eighth inch in diameter.

On September 23 a pure-bred Jersey heifer was placed in the pen with the calves. It was intended to keep her in a separate pen, but she was put in with the calves by an assistant during my absence from home. On September 28 about 200 young ticks (*B. bovis*) that had been received on September 8, were placed upon the heifer.

On October 6 ticks were numerous on all three of the animals, and on October 10 seemed nearly full grown. On October 10 the temperature of Jersey heifer, No. 3, was reported to be very high. I saw her at noon. Her temperature was 106, pulse rapid and full, ears drooping, eyes bright, a slight discharge from nostrils and eyes. The symptoms were those of a typical case of Texas fever. The temperature of the cow during the experiment was as follows:

TEMPERATURE RECORD, No. 3, JERSEY HEIFER.

| Date. | 8 a. m. | 2 p. m. | 5 p. m. | Date. | 8 a. m. | 2 p. m. | 5 p. m. |
|-------------|---------|---------|---------|--------------|---------|---------|---------|
| Oct. 4..... | 102.4 | | 102.8 | Oct. 11..... | 104.4 | *106. | 105.4 |
| " 5..... | 102. | | 103.2 | " 12..... | 104.4 | | 106.2 |
| " 6..... | 102.4 | | 102.4 | " 13..... | 101.6 | | 106.2 |
| " 7..... | 103.4 | | 103. | " 14..... | 105.2 | | 106.8 |
| " 8..... | 102.2 | | 103.2 | " 15..... | 107. | | 107.4 |
| " 9..... | 102.2 | | 103.8 | " 16..... | 106.8 | | 107.8 |
| " 10..... | 105.4 | 106. | 105.6 | " 17..... | 104.6 | | 110.* |

*Thermometer only registered 110°; ran clear to top.

On October 15 I was called away from the state. As the symptoms pointed to a fatal termination, arrangements were made with Dr. L. R. Brady, V. S., to hold a *post-mortem* examination. The heifer died the night of October 17. The autopsy was held on October 18, about 2 P.M., and the following notes were reported by Doctor Brady:

Subject.—Jersey heifer, about 4 years old, in good condition; Experiment Station, Kansas.

Patient having died the previous night had been hauled out from barn; lying on right side, legs extended, no *rigor mortis*; southern cattle-ticks noticed on abdomen; skin, normal; discharge of bloody urine from vulva, and bloody froth from nostrils; visible mucous membranes congested and dark; incision through skin and tissues showed connective tissue yellowish in color.

Rumen half full of food * and distended with gas; reticulum partially filled; omasum filled with food the consistency of soft putty.

Abomasum filled with digested food; small intestines show hæmorrhagic spots, and beginning to show signs of decomposition; rectum filled with clay-colored feces ; lungs normal.

Heart: Left auricle of a bluish color, darker than usual, and empty; small fibrous clot at *a.v.* opening; right ventricle filled with clotted blood; aorta filled with clotted blood; post aorta empty; post vena-cava contains a bloody froth.

Spleen about three times normal size—26 inches long, 7 inches wide, and 3 inches thick—weight estimated at 7 pounds. Spleen was of a bluish mottled appearance, with a few hæmorrhagic spots; capsule distended; incision revealed contents to be a homogeneous mass of blood and broken-down tissue, the consistency of thick blood.

Liver: Enlarged, and of a peculiar mottled appearance—large blotches of clay color and deep blue. On section the liver appears bloodless, and after exposure to the atmosphere cut surface shows a peculiar clay color, with a ring of true liver-colored tissue; parenchymatous tissue easily broken down; gall cyst greatly distended, and filled with about one quart of bile of the consistency of honey, and of a peculiar granular appearance; stains the hands a bright yellow.

Kidneys: Left kidney in half shows its superior portion a blackish green color, while the inferior portion is a deep red color; capsule peels off easily; some extravasation of blood in pelvis of right kidney.

Bladder contains two quarts of bloody urine; mucous membrane shows hæmorrhagic spots.

Sub-lumbar glands badly decomposed, and easily broken down.

A peculiar odor is noticed on section through muscular tissue.

Fat surrounding kidneys yellow in color.

Uterus contains a foetus of about three months' development, which appears normal.

Other organs and tissues appear normal.

L. R. BRADY, V. S.

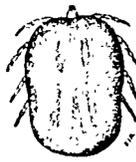
Similar experiments of producing Texas fever by infesting northern cattle with ticks from southern cattle have been made by Dr. R. R. Dinwiddie, of the Arkansas experiment station, and by Doctor Connaway, of the Missouri experiment station, in coöperation with Doctor Francis, of Texas. Experiments made by the Bureau of Animal Industry and by Doctors Connaway and Francis also show that, when ticks have been removed or destroyed, southern cattle do not in-

*In Doctor Francis's published report a typographical error makes *food* read "blood."

fect ground, and northern cattle do not contract Texas fever by running with southern cattle from which ticks have been removed.

These experiments prove conclusively that the southern cattle-ticks are the carriers of infection from southern cattle to northern cattle. The "tick theory" is no longer a theory; it is a fact, demonstrated beyond a doubt.

The following technical description of the southern cattle-tick is by Prof. C. V. Riley, who first described this parasite:



Southern Cattle-Tick
 (*Boophilus bovis*).

Adult female distended with blood: t: t t
 ural size.

A reddish coriaceous flattened species, with the body oblong oval, contracted just behind the middle, and with two longitudinal impressions above this contraction and three below it, more especially visible in the dried specimen. Head short and broad, not spined behind, with two deep round pits. Palpi and beak together unusually short, the palpi being slender. Labium short and broad, densely spined beneath. Mandibles smooth above, with terminal hooks. Thoracic shield distinct, one-third longer than wide, smooth and polished; convex, with the lyrate medial convexity very distinct. Legs long and slender, pale testaceous red; coxae not spined. Length of body, .15 of an inch; width, .09 of an inch.

The southern cattle-ticks are usually found on cattle on the inside of thighs and flanks, along on the belly and brisket and on the inside of fore legs close to the body, and sometimes on the neck. The adult females when distended with blood are readily seen, but the males and young ticks are much smaller and often require a close examination to detect them. This is especially true of young ticks on northern cattle. When ticks get on an animal they soon burrow their mouth parts into the skin and become quite firmly attached. They remain in this condition until they become adults and drop off. Adult cattle-ticks after dropping off do not get on another animal.

The life-history of the southern cattle-tick is about as follows: The adult female becomes distended with blood and when mature drops from the cow to which she has been attached. The female ticks are nearly helpless but are able to crawl short distances to some protected spot where they deposit a large number of eggs, estimated * at 2,100 eggs for each adult female tick. The eggs hatch in from two to six weeks, depending apparently upon the temperature, hatching more quickly in high temperature than low. The young ticks are quite active and crawl rapidly, showing a tendency to crawl up on objects, grass, etc., and not going far to one side. This probably accounts for the popular belief among stockmen that a "wire fence will stop Texas fever"; meaning that the disease will not usually spread or the ground become infested through a wire fence. While such is usually the case it is not safe to depend upon such a condition. It

*Bureau of Animal Industry Report on Texas Fever, page 87.

is possible for the young ticks to pass the fence, and if the drainage is favorable the eggs may be washed long distances by rains. The young ticks crawl up on the grass, and on being brushed off by cattle passing crawl up the animals' legs and attach themselves. Doctor Dinwiddie reports * keeping young ticks alive in the laboratory without nourishment for four months.

The period of incubation for Texas fever, that is, the time that elapses from the time northern cattle are exposed on fields infected by southern cattle, ranges from 10 to 90 days.† If the young ticks are already hatched out and ready to crawl upon the northern cattle, they may show Texas fever in 10 days. Ordinarily 30 to 40 days elapse after southern cattle infect ground before northern cattle begin to show symptoms of Texas fever.

THE "GERM" OF TEXAS FEVER.

The micro-organism which is the cause of Texas fever was discovered and described by Doctor Smith, of the Bureau of Animal Industry, in 1889, and named by him *Pyrosoma bigeminum*, because of its peculiar form. This organism is found in the blood of apparently healthy southern cattle, and also found in the blood of northern cattle affected with Texas fever. It is found free floating in the blood, but usually it is found in the interior of red blood corpuscles. This organism belongs to the protozoa, the lowest organisms in the animal kingdom, while most organisms that cause disease belong to the bacteria, or lowest organisms in the vegetable kingdom.

SYMPTOMS OF TEXAS FEVER.

Texas fever may occur in a mild or acute form. The symptoms described are those commonly observed in an outbreak of Texas fever in this state. In the mild form the symptoms are not so pronounced and the disease runs a longer course.

The first symptoms usually noticed are a loss of appetite and suspended rumination, although these symptoms are usually preceded by a rise of temperature (fever). As the disease progresses the animal hangs its head, the ears lop, the flanks are "tucked up." and the bowels usually constipated. Sometimes there is a diarrhea. This is considered to be a good symptom, as more of such cases recover. In milch cows the secretion of milk is greatly lessened, or totally suspended. The urine is dark colored, usually red, ranging from amber to cherry red. The animal is very weak, often lying down and rising with difficulty. Sometimes there is trembling of the voluntary muscles and occasionally animals are delirious.

There is usually a very high fever, the temperature ranging from

*Bulletin No. 20, Arkansas Experiment Station.

† Bureau of Animal Industry Report on Texas Fever.

105 deg.F. to 110 deg. F. I have several times taken the latter temperature, especially if the sick animals were exposed to a hot sun. Young southern cattle-ticks will be found upon the sick animals, usually on the inside of the thighs or along on abdomen or brisket. These ticks are often very small, and a careful examination is necessary in order to find them.

POST MORTEM APPEARANCES

The most prominent abnormal conditions noticed on *post-mortem* examination are a yellowish tint of the lighter colored tissues of the body, especially the fat. The spleen is greatly enlarged, usually two or three times its natural size, and very soft and easily broken down, the contents of the spleen being of a dark color and of the consistency of tar. The liver is enlarged, and the bile cyst (gall bladder) is distended with bile. The bile is usually dark colored and thick, sometimes granular. The bladder usually contains a quantity of dark red urine. This dark colored or red urine probably results from the breaking down of the red blood corpuscles by the micro-organisms of Texas fever. One attack of Texas fever usually gives immunity (power to resist) against a second attack, at least for some time. When northern animals are taken south, if they survive the first attack, they are not subject to a second attack.

The reason why southern cattle do not have Texas fever is probably due to the fact that the young calves are vaccinated, so to speak, against the disease either before birth, as the blood of southern cattle contains the micro-organisms of Texas fever all the time, or, as soon as the calves are born, the southern cattle-ticks get on the calf and inoculate it with the germs of Texas fever. It is well established that young calves do not contract Texas fever in a serious form.

Texas fever seems most virulent during the hot months of summer. As the weather gets cooler in the fall the disease seems to assume a milder form. The number of ticks which get upon a northern animal seem to influence the severity of the disease—the greater the number of ticks the more severe the form of fever.

In taking northern cattle south into the infected region, they should be taken in the fall and not turned out at once; but a very few young ticks placed on them and the number gradually increased. This treatment is said to reduce the severity of the fever and corresponding loss. Coöperative experiments are being carried on between Texas and Missouri Experiment Stations, and it was hoped this Station could assist in vaccinating northern cattle which mere to be taken south, by using serum collected from southern cattle. The same stations are also carrying on coöperative experiments with reference to dipping

southern cattle to kill the ticks, and thus render the cattle harmless when taken north during the summer season.

The following account of outbreaks of Texas fever which I have made observations upon will illustrate many points mentioned in the preceding pages:

About May 1, 1892, a herd of about 800 cattle were shipped from Pecos, Texas, to Kansas, and were admitted by a special permit from the State Live-Stock Sanitary Commission. These cattle were shipped from north of the quarantine line, but it was proven later that the cattle were from south of the line and were badly infested with ticks.

These cattle were unloaded at Hartford and driven 35 miles westward across the country. The southern cattle were thin in flesh and were driven slowly, and were allowed to pasture upon open land. A number of "stragglers," too thin and weak to travel, were left along the trail. These soon recuperated and adjoining stockmen report that these steers "seemed to enjoy running through fences to get in with other stock." The cars in which these cattle were shipped were taken to Emporia, and cleaned out on some commons south of the town. Several town cows having access to these commons contracted Texas fever and died. About July 15, 45 days after the southern cattle were driven along, native cattle began dying with Texas fever, and during the summer over 1,000 native cattle died along this trail from Texas fever. I visited this outbreak twice, holding autopsies and collecting material for examination. An attempt was made to find bacteria in the various diseased tissues, but without success. Culture tubes of agar-agar and gelatine were inoculated with material from blood, spleen, and liver, but no disease-producing organism was found. Southern cattle-ticks were found on every animal and the micro-organism of Texas fever found in mounts made from blood.

Stockmen along this trail brought suit for damages for stock lost, and succeeded in getting a judgment in the district court against the railroad company for bringing in the southern cattle. This decision was appealed to the state supreme court and affirmed. It has since been appealed to the United States supreme court, but no decision has been reached.

On August 24, 1894, I visited the Pitney ranch, in Pottawatomie county, and found an outbreak of Texas fever. About the 1st of June Mr. Pitney had purchased 170 head of California cattle, which were unloaded at Council Grove and driven to his ranch. These California cattle were put in a large pasture with 350 head of natives. About one month later his native cattle began dying, and at the time of my visit he had lost 20 head from Texas fever. A few more died later, bringing the total loss up to about 30 head. The weather was

very hot and dry. The small loss of natives I attributed to the small number of ticks on the California cattle, most of the ticks having dropped off in transit. But few southern cattle-ticks were found on the sick cattle. Microscopic examination of blood from the sick cattle revealed the presence of the protozoa.

On August 3, 1895, I visited Mr. John Welch's farm, near Ottawa. Mr. Welch had purchased 30 head of yearlings at the Kansas City yards. Among these cattle were four branded southern steers. Mr. Welch got the cattle on May 23, and on July 20 his native cattle began dying, and at the time of my visit he had lost five head of cattle with Texas fever. His cattle continued to die until he lost nearly all of the native cattle. An examination of the cattle revealed a large number of southern cattle-ticks, and microscopical examination of blood mounts from sick cattle showed the characteristic protozoa.

QUARANTINE.

It would be hard to estimate the losses that would result from Texas fever if it was not for the rigid quarantine maintained against southern cattle during the summer season.

The quarantine line as described in the preceding pages of this bulletin is based upon the presence or absence of southern cattle-ticks upon cattle. The line is usually far enough north of the infected ground to be safe, yet in some localities the line of safety is difficult to determine. A careful examination of the cattle along the quarantine line on the southern boundary of Kansas shows the cattle to be free from ticks west of Baxter Springs. In the vicinity of the Spring river, at Baxter Springs, and from there east to the eastern boundary of the state, a few cattle-ticks are to be found on cattle, in the townships of Garden and Lowell. This area is not permanently infested, but is "on the border." A number of cattle in this locality are affected every year with Texas fever without the introduction of southern cattle.

An examination of the quarantine line will show that the tick-infested area seems to be determined by the altitude, a low altitude and a brushy country being favorable for their production.

Southern cattle do not convey Texas fever during the winter season when brought north because the freezing weather kills the adult ticks as soon as they fall off.

The ticks do not live over the winter in this state, except in the southeastern corner previously described, the winters being severe enough to destroy the ticks, and thus disinfect ground where the disease may have existed during the previous summer.

It is possible that in protected places and during mild winters

ticks may live over, but I have never known an outbreak of Texas fever to occur from such a source.

People living in the vicinity where southern cattle cars are cleaned out should exercise caution to keep their cattle away from the manure and litter thrown from cars. Quite a number of cases of town cows contracting Texas fever from this source are reported.

Stockmen, in purchasing southern cattle or cattle from near the quarantine line, during the season from February 15 to November 15, should examine them carefully for southern cattle-ticks. Owners of southern cattle in this state are held responsible for losses resulting from the importation of such cattle.

It is gratifying to note that stockmen, shippers of stock and railway companies recognize the value of the quarantine, and assist in its maintenance.

TREATMENT.

Medicinal treatment of Texas fever is not satisfactory. A great many remedies have been tried, with no beneficial results apparent. The most satisfactory treatment is good care and surroundings and nourishment to sustain the animal until the fever subsides. The following plan of treatment has given the best results: As soon as an outbreak of Texas fever occurs, remove all susceptible animals to fresh, uninfested ground. Remove all cattle-ticks from susceptible animals by greasing with lard, or similar oil, and scraping the ticks off with a dull knife blade. As Texas fever usually occurs during the summer season, the cattle can be fed green corn-fodder. This furnishes a palatable and nutritious food, and has a laxative effect upon the bowels.

Sick cattle should be removed to comfortable, shady quarters, and given access to fresh water. Remove ticks as previously described, and feed green corn-fodder.

In cases where it is practicable, drenching sick cattle with sweet milk gives good results.

Texas fever is a contagious fever of cattle caused by a micro-organism (protozoa). It is carried from southern cattle to northern cattle by southern cattle-ticks.

Adult southern cattle-ticks drop off from southern cattle, lay eggs, and thus infest the ground with young ticks that carry the germs of Texas fever. Northern cattle passing over this ground get the young southern cattle-ticks and contract Texas fever.

Southern cattle do not contract Texas fever. They are vaccinated against it.

Quarantining against southern cattle during the summer season is the most effective method of preventing Texas fever.