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Glanders

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South Dakota Agricultural College

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AGRICULTURAL COLLEGE
AND
EXPERIMENT STATION
BROOKINGS, S. D.

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DEPARTMENT OF VETERINARY SCIENCE.

GLANDERS.

PRESS PRINT, BROOKINGS.

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Glanders.

C. A. CARY, VETERINARIAN.

Glanders is a specific, contagious disease, most frequently found in the equine species; but may be transmitted (by inoculation or by ingestion of glanderous material) to man, sheep, goats, dogs, cats and some of the rodents. The susceptibility of the hog is yet questionable, but it is certain that horned cattle and domestic fowls are proof against glanders.

Temperate or cool climates appear to be more favorable to its development and maintenance than the hot, torrid zones. So far as known temperate regions have the greatest outbreaks of this disease. Possibly this may be due to the facts that the temperate countries possess the greater number of domesticated equines, and that the highest civilization of the cooler climates recognizes and records the majority of the cases that occur.

History informs us that the primitive veterinarians of the fourth and fifth centuries recognized glanders in some of its forms. Although it is one of the oldest known diseases, many of its phenomena and conditions are yet unknown. With all the accumulated medical knowledge of the past twelve centuries, no effective remedy has been discovered.

Glanders produces its lesions or morbid processes in the lymphatic vessels and glands and connective tissue adjacent to them, of the skin and subcutaneous connective tissue; of the mucous membrane of the nasal passages and respiratory tract, and of the lungs and spleen. These places or parts are most commonly affected in the beginning of the disease but the lesions do not

confine their morbid changes to any one part or locality during the progress of the disease.

Gerlach and other authorities have divided glanders into the following classes: Nasal Glanders, Pulmonary Glanders and Farcy Glanders.

Nasal Glanders is the most common and may be recognized by the following symptoms:

1. **NASAL DISCHARGE.**—This is generally the most prominent of all the symptoms and is of the least diagnostic importance. At first the discharge is thin and watery, gradually becoming thicker, sticky and pasty; it may be greenish yellow, grayish, almost black with dust or streaked with blood—the color usually depends upon the food eaten and the dust in the air inspired by the animal. The discharge from the nose is not as copious in chronic cases as in strangles (distemper) or acute catarrh. However, it is augmented during damp, rough weather and by poor ventilation, bad food, etc. The viscid, tenacious discharge adheres around the external opening of the nose and appears to lessen the diameter of the opening. It is said to occur more frequently from the left than from the right nostril; yet it may appear from both nostrils or from either the right or the left one. The discharge may be almost entirely odorless, or it may give forth a strong stench. The rank, obnoxious smell does not appear until the ulceration attacks the bone or cartilaginous tissue of the nasal chambers. Many of the foregoing physical characteristics of the nasal discharge are similar to the nasal discharge in strangles, catarrh, caries of the teeth and neoplastic or new dental tissue growths in the sinuses or cavities connected with the nasal passages. Hence the nasal discharge can be used as a diagnostic symptom only when associated with other more prominent characteristics.

2. **ENLARGEMENT OF THE LYMPHATIC GLANDS IN THE SUBMAXILLARY REGION.**—This symptomatic condition of the glands—lying below the base of the tongue between the branches of the lower jaw, near the throat—is produced by the absorption of glanderous matter by the lymphatics in the mucous membrane of the nasal passages. This absorbed glanderous material, on its way to the general circulation, excites a kind of a chronic in-

flamatory action in the submaxillary lymphatic glands. The swollen glands are soft and loose at first, but gradually become hard, nodulated and finally become firmly fixed high up on the the inside of the jaw bone, below the base of the tongue. These hard, nodulated glands vary in size from a hazel nut to a walnut and are distinctly limited. The swollen glands usually appear on the same side upon which the nasal discharge occurs. For instance, if the nasal discharge occurs from the right nostril, the indurated, swollen, lymphatic gland will appear on the inside of the left branch of the submaxillary bone. If the discharge appear from both nostrils the glands may swell on one or both sides. Very rarely do these glands suppurate or form ulcers and are not to be confounded with the puffy, soft swelling of the subcutaneous tissue as is seen so frequently in strangles.

This nodular lymphatic swelling in the submaxillary region is not, by itself, sufficient in importance to determine the presence or absence of glanders. It should be accompanied by a more important symptom than a nasal discharge in order to "proclaim" glanders. Hence its characteristic presence is the only real symptomatic indication it possesses.

2. NODULES AND ULCERS ON THE VISABLE MUCOUS MEMBRANE OF THE NOSE.—These are found mainly on the septum nasi—the partition between the right and the left nasal passage. The tubercles are, at first, red or gray and hard, varying in size from a millet seed to a pea; in a short time they become soft and yellowish; finally break open (erupt) and discharge a brownish yellow, oily liquid which resembles raw linseed oil. This viscid yellowish brown discharge is said to be so acrid that it forms serpentine channels in the mucous membrane as it flows over the surface. On the edges and sides of the ulcers formed by the erupting of the primary nodules, secondary nodules form and erupt. The primary nodules and ulcers may be so near each other that the tissue separating them may soon become eroded by secondary nodules, and the larger ulcers thus become confluent or united. Thus the "pitlike, ragged edged ulcer," or chancres are formed and enlarged. In some instances the resistance of nature or medical agents arrest the development of the chancres, and healing takes place, leaving white scar tissue to

mark the spots of ulceration. These scar tissue spots are sometimes star-shaped, but their outlines always correspond to the previous ulcers. By no means does the presence of this scar tissue indicate the complete recovery of the case; for, upon the slightest provocation—a bad hygienic conditions or withholding the medicinal treatment—the ulcers will return or the morbid processes will appear in some other part of the body—in the lungs or subcutaneous connective tissue. The nodules, chancres and scar tissue are not confined to the visible mucous membrane of the nose, but they may be on the mucous membrane of the sinuses of the tuberculated bones, of the pharynx, larynx or trachea (wind-pipe). Nodules or tubercles may also be present in the connective tissue of the lungs. According to Pennington nasal glanders is very frequently accompanied by tubercles in the lungs and they occur on the same (?) side upon which the nasal discharge, ulceration of the septum and the indurated submaxillary glands occur. When the nodules and ulcers are numerous on the nasal mucous membrane, the irritation caused by them may induce an acute inflammation throughout the nasal mucous membrane and a catarrhal exudate will appear on its surface. Hence, the discharge from the nose, during certain stages in glanders, may be composed of the catarrhal exudate from the inflamed mucous membrane, the yellowish, oily eruption from the nodules and ulcers, particles of food from the pharynx (throat) and dust from the air. Ulcers may be found on the visible mucous membrane as a direct result of injuries to the membrane or bones surrounding the nasal chambers—as splinters penetrating the nasal tissues or bruising of the tissues by contact with hard bodies or fractures of facial bones by the falling of the animal and by barbarous use of clubs and whip stocks. In such cases the complete recovery and healing of the wounds readily occur under proper treatment. Yellowish streaks and bluish lead-colored tints are said to be premonitory symptoms of coming nodules and ulcers. These signs are, however, uncertain; and, no doubt, are present in other diseases, as catarrh, pneumonia, etc.

There are a few minor attending indications in nasal glanders that may aid the reader in detecting the disease. A slight hemorrhage (bleeding) may occur periodically from the nose. A

small amount of blood may be found on the manger, feed box or on the front legs, left or smeared in such places by the animal rubbing his nose over them. This hemorrhage will appear without any indications pointing to a cause, like heavy pulling, overwork or to bleeding from the lungs in large quantities. Again there may be a dry, soft "heavy" cough with slightly increased rapidity in breathing. The coat or hair may look rough and the animal may present considerable ematiation. One or more of the limbs may swell suddenly and the animal become suddenly lame from some unaccountable cause. Occasionally there is a manifest swelling of the skin and subcutaneous tissue around the external nares, or opening of the nostrils. This indurated swelling and the drying, sticky nasal discharge materially decrease the diameter of the opening.

These minor characteristics are not constant and generally appear when nasal glanders is complicated with one or both of the other forms.

PULMONARY GLANDERS.—The lungs are the chief organs in which the form of the disease occurs. In the acute attack there are small spots, inflamed as in lobular pneumonia; but if the case becomes chronic, small glanderous nodules are formed in the connective tissue of the lungs. These tubercles may undergo resolution or the successive changes known as fatty, cheesy and calcareous conditions, depending upon the duration of the morbid processes. In the chronic form of pulmonary glanders the symptoms are indicated by a soft, dry cough, difficult or labored breathing, and a general unthrifty condition of the animal. There are instances, however, where the horse may thrive quite well, presenting only that peculiar cough and breathing common to an animal affected with "heaves;" and yet such an animal may communicate the disease to healthy horses. No doubt this occult form of glanders is responsible for many of the so-called spontaneous outbreaks of this disease. Fortunately, occult or hidden pulmonary glanders is not common, although fewer cases are recorded than actually occur, because this form of the disease cannot be determined, in all instances, prior to the death of the animal. Even the expert veterinarian cannot detect the presence of this occult form of glanders until he holds a *post*

mortem examination and finds the tubercle lesions in the lungs or other internal organs. But if horses have contracted glanders from contact with a horse "suspected" of this trouble, it is quite evident that the "suspect" should be isolated and watched for further manifestations: or, better still, hold a *post mortem* examination at once. Pulmonary glanders is very frequently associated with nasal glanders, and in some instances it accompanies farcy glanders. When the visible and external symptoms of farcy glanders or nasal glanders have disappeared or have been "hushed" by medical treatment, and the disease has become apparently latent, very often the tubercles in the lungs remain in such a condition as to enable the animal to transfer the virus to healthy horses.

● Obviously pulmonary glanders, although very infrequent, is the most dangerous and microbe distributing form of glanders, because of its occult or hidden nature.

FARCY GLANDERS.—The lesions of this kind of glanders are in the lymphatic vessels and glands of the skin and connective tissue lying immediately beneath the skin. The lesions or morbid changes begin by the formation of nodules under the skin; are at first hard, hot and sensitive to the touch; gradually become soft in the center, and finally erupt, discharging a brownish yellow, viscid, sticky liquid similar in appearance and consistency to raw linseed oil, except it is at times, tinged with blood. After a time the discharge becomes more and more purulent (mixed with pus) indicating that nature is trying to heal the ulcers. The tubercles, farcy "buds" or "buttons," vary in size from a pea or hazelnut to a walnut, and the ulcer formed by the eruption of the nodules, are ragged edged with gray, dirty bottoms and with the drying, sticky discharge surrounding their borders and matting the hair. The chancrous ulcers have little tendency to heal; in case they do heal, they leave hard, button-like tubercles which may break open again; or, should they disappear entirely, new nodules are certain to appear in the same region or other parts of the body—the lungs or nasal membrane. The inflammation in the lymphatic vessels and glands—caused by the absorption of glandrous material containing the specific microbe—retards or checks the return of lymph to the general cir-

enlargement, and swelling or oedema of the affected parts is the result. This accounts for the swelling of the limbs when one (most frequently a hind limb) or more of them are affected. Either before the swelling appears, or after it wholly or partially disappears, the thickening and distension of the walls of the lymphatic ducts and valves, make the vessels or ducts appear like knotted cords; they are usually hot and sensitive to the touch. [The lymphatic vessels and glands are found in all parts of the body except the brain and the bones. The lymphatic vessels are about as many in number as there are veins and arteries, and they convey a watery lymph from all parts of the body to the largest veins and to the heart. The lymphatic glands are situated along the course of the ducts or vessels and act as filters or in some way change the lymph of the vessels.] The farcy ulcers, ulcers and nodules, buds or buttons may appear on any part of the surface of the body; but they are seen most frequently on the inside and outside of the thighs, on the legs below the knee and hock, on the inside of the front limb in the axillary region, on the sides of the neck along the jugular veins, and on the sides of the lips. In nearly every case of farcy which the writer has observed in South Dakota, the location of the nodules, ulcers and swelling was in one of the hind limbs—the ulcers appearing in the region of the hock in some cases, and in others on the inside of the thigh. Generally the nodules or buds precede the swelling, but they may appear after the engorgement, or are not noticed until after the swelling is manifest. The swelling of the limb or limbs resembles the swelling in what is known as "big leg;" but in "big leg" (sometimes called "water farcy") the characteristic buds and ulcers are wanting; also there are no ulcers in the nostrils. In some rare cases the swelling entirely subsides and all that remains to indicate the presence of farcy are the knotted and corded lymphatic vessels with here and there a farcy bud or ulcer, or scars marking the spots where buds and ulcers have been. The nodules and ulcers are the important symptomatic conditions in farcy and they "pronounce" the animal to be affected with farcy glanders.

SYSTEMIC CONDITIONS AND OTHER CHARACTERISTICS.

There are systemic or general conditions which are considered as signs accompanying the foregoing. These may be present in all classes of glanders. In acute glanders the temperature rises to 103°—108° F.; the breathing or respirations are increased; the pulse is quickened, diminished in volume and becomes weak and feeble; the appetite is impaired, and marked debility and emaciation soon appear unless the acute attack is cut short by death or it merges into the chronic form. The acute form may resemble, at first, the first stage of acute pneumonia; but in a few days the nodules, ulcers, etc., appear on the nasal membranes or the characteristic indications of farcy glanders are manifested. Acute glanders is generally found in mules and is rarely found among horses. Chronic cases are by far the most common in the horses of this country. In fact, every authority and every official veterinarian claim that chronic glanders, in all its various manifestations, differs from acute glanders in degree of intensity and duration. An acute case may last from a few days to a few weeks and terminate in death or chronic glanders; but a chronic case, like some tuberculous persons, may live for months or years, passing a sort of a life-in-death existence. And during their prolonged, decaying existence, they may do regular work and communicate the disease to a large number of horses. The intensity of all the morbid conditions in chronic glanders is low; consequently the morbid changes are not rapid. The temperature is variable or periodic; at times, it is normal; but when there are sudden changes in the atmospheric temperature, or rough damp weather, or the food is poor from partial decay or fermentation, or when bad hygiene conditions exist, the temperature rises a few degrees and other conditions will be present, which generally attend a slight fever. Or, the unhealthy surroundings, poor food, etc., may produce an acute attack in an animal affected with chronic glanders. However, the nodules, ulcers, swellings and corded lymphatic vessels are generally well marked in the chronic form; because they retain their characteristics longer than in the acute cases. Heavy

doses of aloes or hypodermic injections of turpentine, in many instances, will intensify the effects of chronic glanders. Nasal glanders and farcy glanders may be present in the same animal. Virus from a farcy case may produce nasal glanders when inoculated into a healthy animal. In truth, the specific microbes may produce any of the various forms and conditions of glanders irrespective of origin. This interchangeableness of the partially distinct forms of glanders is due the fact that the same exciting cause produces all forms of the disease.

CAUSES AND TRANSMISSION.

Under this heading we find two classes of causes—predisposing and exciting.

The predisposing causes are variable and are simply preparing conditions that get the system ready for the exciting cause and thus enable the exciting or disease-producing microbes to gain admission to the system and intensify their destructive work. Anything which lowers the vitality and resisting power of the system acts as a predisposing cause. Sudden changes in the weather with respect to moisture, temperature and light—as hot, sultry, damp, cloudy weather—lower the vitality and resistance of the body tissue and liquids. Bad drainage, ill ventilation, coarse, rough and partially decayed hay, damaged food, impure water, strangles, catarrh, carious teeth, bronchitis, pneumonia and many other debilitating diseases, are predisposing causes. Hereditary causes are likewise predisposing in their influence. It is still a question as to whether the offspring may receive the microbes of glanders during fetal life; but it does inherit a predisposed tendency—a prepared condition of cell, of organic structure which admits the germ into the body more readily and feeds the microbe upon more of its favorite food than the system otherwise not predisposed by an inherited tendency. The writer has heard veterinarians and stock raisers claim that farcy glanders was not transmitted from dam to offspring. That may be true in regard to the microbe or its spores; but the strong predisposing tendency is inherited and the constant contact after birth of the colt with its dam affords ample opportunity for the transmission of

the germs. In all the cases (though a few in number) which the writer has observed, the offspring has developed glanders (sufficient for a distinct manifestation) before maturity and in one case before the weaning of the foal.

In giving a definition of glanders the writer stated that it was a *specific contagious* disease. By specific I mean that the exciting cause is a definite micro-organism, a parasitic microbe. The definite germ that causes glanders is *bacillus mallei* and was discovered in 1882 by Löffler and Schutz. This germ is found in the tissues of the nodules and ulcers and in the yellowish, viscid discharge from them. Pure cultures are obtained from unbroken farcy buds and from tubercles in the lungs and spleen. The nasal discharge contains this microbe, but the discharge is also thronged with numerous air germs which makes the cultures from that source impure and of no value unless the various germs can be isolated and cultivated separately. The glanders microbe in the nasal discharge may be isolated by inoculating a guinea pig with a small amount of the discharge. The glanders microbe is the only germ that will develop in the body of the guinea pig, showing peculiar enlargement of the lymphatic glands from which pure cultures of the *bacillus mallei* may be obtained. Thus the guinea pig acts as a perfect natural culture media for the specific microbe, and at the same time resists the development or growth of the air germs. The microbe of glanders is also found in the lymph of the lymphatic vessels in the neighborhood of glanderous ulcers and nodules, but before the lymph reaches the general circulation the lymphatic glands have separated the germs from the lymph by filtration. However, when the tissues have become greatly ulcerated it is quite probable, that the capillaries and smaller blood vessels absorb some of the glanderous material and the microbes are then found in the blood. In acute cases some authorities claim that the germ is found in the blood during the stage of excessively high temperature or early fever. This microbe will also grow on some of the artificial culture media—a sterilized potato, blood serum, etc.

By the most recent use of the word contagious it embraces that class of specific diseases which are caused by a germ that lives, grows, survives best in the tissues and fluids of an ani-

mal body, and exists naturally in a latent form (spore stage) outside of the animal body. This characteristic is not well defined in a majority of the so-called contagious diseases, because so rarely do we know the complete life history of the specific contagious germs in their extra animal body life. The germs or microbes may be grown in artificial culture media; but where and how long do they live outside of the animal body under the various conditions of dryness, moisture, light, heat, etc., is still but partially determined. Another characteristic of a contagious disease is said to be the degree of ease or readiness with which the disease-producing germ is transmitted from the diseased to the healthy by direct contact. This latter characteristic is less constant and not so well defined as the former, yet it may be considered a degree characteristic without well defined limits. An infectious disease is a specific disease in which the microbe has its native or chief natural habitat outside of the animal body, in water, decaying organic matter or living plants. The microbe is communicated or transmitted to the susceptible animals from its native or natural home by the food, water, etc., and not, as a rule, by contact of the sick with the healthy as in specific, contagious diseases. Furthermore, the germs of an infectious disease are weakened by successive artificial cultures or by limited heating, to such a degree as to modify their virulent or malignant action when introduced into the animal body. Hence, we may sum up the difference between contagious and infectious diseases by saying: That the specific microbe of a contagious disease is, in the main, an animal parasite, while the microbe of an infectious disease is chiefly a plant parasite, or a saprophyte, living on dead animal or vegetable materials; and that the contagion (microbes) are readily transferred from the diseased animal to the healthy by direct contact, while the germs of an infectious disease enter the animal body with food, etc., from their native home outside of the animal body. However, all these differences are greater in degree than in kind.

The contagion or germs of glanders are transferred chiefly by the nasal discharge. It is scattered about promiscuously—in feed boxes, over mangers, stalls and floors, on buckets, bridles, and harness, in watering troughs, etc. The discharge from the

farcy ulcers is likewise a source of contagion; however, it is small in quantity and does not become so profusely and generally distributed as the nasal discharge. The germs may gain entrance to the system by way of the digestive tract when the discharge is present in the drinking water or in the food. It thus encounters the action of the fluids of digestion and must be absorbed by the blood vessels or lymphatics. It is quite certain that the spores of the bacilli could thus enter the system by way of the alimentary canal. This is, no doubt, the source of many cases of glanders where the mesenteric-lymphatic and the lungs are the chief or beginning seats of the nodules or tubercles. The discharge may become dry, float about in the air of the stable and enter the nasal or respiratory passages; along with the dust the particles of dry discharge settle upon the mucous membrane and the bacilli penetrate the tissues or gain entrance into the tissues by uncommon abrasions. In the time of Percival glanders was transmitted by spreading the nasal discharge from a glandered horse over the septum of healthy horses and mules. This method acted with perfect or absolute certainty. Therefore, it is not improbable that glanders may be communicated by dried discharge as above described. The certainty of the transmission of glanders by inoculation is too evident to be questioned. In such cases the glandered material is introduced into an ulcer, a wound, or injected beneath the skin, into veins or arteries. The disease is, however, not transmitted by a healthy animal breathing the exhaled air from a glandered horse. This has also been demonstrated by actual experiment. The germs do not come from the living animal in a volatile form.

A few examples as observed in this State by the writer may aid the readers in distinguishing the more prominent cases.

1. A gray pony, about twelve years of age, was brought to me for examination. He was poor, unthrifty and rough in appearance; presented slight discharge from the left nostril; the discharge adhered to the borders of the nasal opening, the greater portion of which was dry and quite dark in color, while the new deposits of the discharge were greenish yellow, thick and very sticky. The submaxillary glands on the same (left) side were small, nodulated, hard and firmly attached to the deep tissues,

high up on the inside of the jaw bone. The visible mucous membrane on the nasal septum presented several ulcerated patches with ragged edges and dirty, gray bottoms. There was no obnoxious stench exhaled from the nose. The history of the case was broken by many transfers.

2. A large black horse, eight years old, was presented at the college free clinic to be examined for lameness. The left hind limb was enlarged, swollen from the fetlock to above the hock; over the surface of the enlargement, on the inside and outside of the leg were discharging ulcers and farcy buds or buttons, some of which had broken and become healed leaving prominent hard nodules. The owner said that the leg had been swollen for a year and that repeated "crops" of ulcers had appeared and disappeared; and that some of the nodules were never entirely absent during the year. The discharge of the ulcers clung to the hair and skin making a very dirty aspect of the ragged borders. Breaking open one of the nodules which was about ready to erupt, a small amount of yellowish, sticky, viscid liquid tinged with blood, ran out. The owner also informed the writer that about one and a half years previous to this time, the health officer had condemned several horses on his farm and that this black horse was on the farm then and had been retained there since that time. It was nearly one month before the health officers ordered the destruction of the horse, and the writer had an opportunity to examine him just prior to his destruction. He had been isolated from all other horses and kept in an old shed where poor care and rough weather could obtain free access to him. Nasal glanders had developed with a nasal discharge, an ulcerated nasal septum and enlarged submaxillary glands. Farcy buds and ulcers were not only on the left hind limb below the hock, but also on the inside of the thigh and on the inside of the left front limb in the axillary region. The limb, first affected, was swollen larger than it was when examined before, and the other limbs were more or less swollen. His general appearance was that of a wreck with a mangy rough coat and an emaciated form.

3. In March, 1891, a two year old colt was brought to me for examination and treatment. One hind limb was swollen

and numerous well marked farcy buds and ulcers were found in different parts of the limb from the thigh to below the fetlock. From reliable authority I learned that the dam of this colt was similarly affected and that the swelling and buds first appeared on the colt's limb when it was eighteen months old.

4. Under the direction of the board of health the writer was instructed to examine a bay mare which had been "suspected" by some of the farmers of the community. She was affected with a typical case of farcy glanders. One hind leg was swollen and nodules, purulent ulcers were quite prominent below the hock. Hard, nodular scars gave evidence of previous ulcers and primary nodules on the inside of the thigh. In fact, the owner said that the leg had been swollen from the pastern to the body, and that there never had been a time during the past five years when the leg was not swollen or ulcers and nodules were not manifest. The lesions seemed to get better or worse according to the care and weather conditions.

5. A large iron gray gelding was examined on free clinic day at the college, and found to be affected with farcy glanders. The affected hind limb was not swollen but there were well defined nodules, about the size of a hazel-nut, on the leg below the hock and on the inside of the thigh extending to the inguinal region. The lymphatic vessel, along the large vein on the inside of the thigh, was corded and quite warm and sensitive to the touch. The buds or nodules had been observed by the owner three or four weeks previous to this time. The owner was also of the opinion that two of his neighbors owned two horses, or each owned one horse, similarly afflicted. It is possible that this gray horse may have contracted the disease from one of the neighbor's horses; but in reality there are far more cases than those of which the public are aware and opportunities are not wanting for contracting this disease at public feed stables, hitching places, etc.

TREATMENT.

It is useless, dangerous and expensive to attempt to treat a case of glanders. I know that medicine venders and empirics will attempt treatment of anything, but the very best and most

reliable authorities are unanimous in declaring that glanders is incurable. The danger of contracting the disease is far greater than one would suppose when one sees men so reckless and knowingly careless in handling glandered horses. Recently a farmer gave an idea of the expense in handling or retaining a glandered horse in the following words: "Had I destroyed the first case of farcy that appeared on my farm I would have saved hundreds of dollars."

The State has laws which provides for the destruction of glandered animals after they are examined by the State Veterinarian. But as no funds for the support of a State Veterinarian were appropriated by the last legislature that office became vacant. However, some of the counties of this State are destroying glandered horses under the provisions of the State law. The county boards of health employ graduate veterinarians to examine the "suspected" cases, and the county sheriff executes the orders of the board of health by destroying the glandered animals.

APPENDIX.

SCAB-DIPS AND BLACK-LEG.

Early in the fall of 1890, sheep that were shipped into this State from Canada were in some instances affected with common scab. This will not occur again, since Dr. Salmon, chief of the Bureau of Animal Industry, has stationed inspectors at all the places where stock is permitted to enter the United States. Sheep inspection was not required prior to November, 1890, which may account for the entrance of the infected cases last fall.

COMMON SCAB.

This form of scab is found on those parts of the body where the long wool grows—chiefly on the back and sides, extending from the neck to the back part of the rump. It is caused by the scabmite (*Psoroptes Communis*). This itch-insect bites the skin and produces little whitish or yellowish elevations; and as the mites multiply (which they do very rapidly) the inflammatory condition of the skin increases and finally thick, scaly crusts or scabs are formed. These crusts are torn off by the rubbing and scratching of the sheep and tufts of wool are also lost or torn loose at the same time. New and thicker scales or crusts are formed on the spots where the first scales were torn off, and and eventually large, bare, crusty places are made prominent on the back, the neck, the flanks or the rump. The mites may be found in the early stages of the disease, in the hair near the white or yellowish spots. Later they may be found in swarms near the edges of the scabs. They may be seen with the naked eye, but it is better to look at them with a pocket lens. Pick them up with a sharp pointed stick or the point of a knife and you may see them move, appearing as white points or dots with

a dark end. Early in the disease, before attention is called to the extensive, bare and crusty places, the affected sheep will scratch, bite and rub themselves intensely and finally the fleece will present that characteristic condition known as a "cotted" fleece. This disease generally appears in its worst form during cold weather when the wool is long and when it is impossible to shear the infected sheep or dip them as thoroughly as required to destroy all the parasites. During such conditions it is a good plan to part the wool from the crest of the head to the tail, above the spinal column, and pour a good dip into the channel thus formed, using sufficient quantity to run down over the sides of the sheep, immersing thoroughly the skin and roots of the hair. In case there are scabby spaces, they should be washed and the crusts removed before the dip is applied. It may be necessary to repeat this partial dipping every two or three weeks until shearing time. The badly affected ones should be sheared early but not too early, since a majority of those sheared in March and sometimes early in April, die for want of protection.

Sheep are brought into such close and constant contact during the winter, in sheds, pens, etc., that unless the affected ones are removed from the healthy, the entire flock will be infected in a short time. If the disease continues to spread after removing those first affected, the healthy ones should be at once removed to non-infected sheds and pens.

HEAD SCAB.

Another form of scab, which has also appeared in this State during the past winter, is known as HEAD SCAB. It is also caused by a mite. But this itch-mite begins its work in the upper lip, around the nostrils, or about the eye-lids; and it confines its operations to the short-hair regions. It produces scabs over the face and ears, and may effect the eye-lids to such an extent as to cause severe inflammation in the eyes, making the sheep appear blind for a time. In severe cases it may be found on the limbs around the hocks or knees or under the belly. This mite (*Sarcoptes scabiei*) is very small and cannot be seen with the unaided eye. The head scab, however, can be readily distinguished from the common scab by its location and by the absence of visible

mites. Head scab readily succumbs to the proper treatment; but since this mite penetrates the tissue, it becomes necessary to soften and remove the crusts by the use of soap and water; after which the parts may be bathed with any effective dip. The following dip is very safe and effective: For every gallon of water take six ounces of tobacco and one-half ounce of tar-oil; steep the mixture and apply the liquid while warm, after removing the crusts by washing.

DIPS.

There are numerous patent dips, various state dips and many other kinds used by sheep owners. The patent commercial dips are objectionable, because they may be too weak, or may contain materials injurious to the wool, or may be too expensive. Some of the best, most effectual and cheapest dips will be here noted with the formula and directions for using:

1. Tobacco.....30 lbs.
- Sulphur.....15 lbs.
- Oil of Tar.....3 quarts.
- Soap.....6 lbs.
- Water.....100 gallons.

Steep the tobacco in water sufficient to cover it; decant or pour off the liquid. Repeat the steeping of the tobacco three or four times, decanting the liquid into the dipping tank or another large vessel; then stir in the sulphur. Dissolve the soap in two gallons of hot water; add the tar oil to the hot dissolved soap and stir the mixture thoroughly and rapidly; then add it to the sulphur and tobacco-infusion mixture. Finally add water sufficient to make 100 gallons of water in the entire mixture. Use at 120° F. Add a little water occasionally while using the dip to offset that which evaporates. This tobacco dip may be a little expensive, but it is one of the best and safest.

2. Sulphur.....25 lbs.
- Lime.....15 lbs.
- Water.....100 gallons.

This is a very cheap dip; but the lime is said to injure the wool. However, the sulphur-lime dip is used quite extensively in scab infested regions, which indicates that it is considered effect-

ual by those who have the disease to contend with the most frequently and extensively. Use this dip at 100 to 110° F.

3. Arsenious Acid (White Arsenic) 1 lb.
- Carbonate of Potash (commercial) 1 lb.
- Water 20 gallons.

The arsenic and carbonate of potash may be boiled a few minutes in eight or ten gallons of water to hasten the dissolving; then add water sufficient to make twenty gallons. Use at 100° F. Add a little water as the dip becomes low in the tank or tub. This dip is very cheap and effective, but must be used with great precaution. The udders of the ewes suckling their young must be covered with lard or some bland oil to prevent the arsenic from effecting the udder, checking the secretion of milk. The sheep, after being dipped, must be placed in a dripping and drying pen where there are no articles of food that sheep will eat upon which the arsenical solution may fall; keep the sheep in such a pen over night. Do not let the lambs suck the ewes for several hours after dipping. It is not a good plan to submerge the head; you may cover the head with the solution by using the hand, a sponge or a cloth. Oil your hands and arms occasionally as you are dipping. You may lose a few sheep by using this dip unless you are very careful.

The amount of dip required for each sheep depends upon the time of dipping—the length of the wool. The estimated amount varies between one quart and one gallon. In all instances where the flock is affected with scab it is best to dip the sheep twice—the second dipping may be done ten to twelve days after the first. Infected pens, lots pastures or sheds should not be used for thirty to fifty days after dipping.

PREVENTATIVE TREATMENT FOR BLACK LEG.

Very frequently the writer receives inquiries regarding the prevention of BLACK LEG. In fact there is no other line of treatment for this disease.

This infectious disease may occur in sheep, and in the sheep you will find the characteristic swelling (which "crackles" when you rub your hand over it) on the front limb about the region of

the shoulder, on the side or on the thigh—most frequently on the inside of the thigh.

The writer has observed this disease in this State during the past two years and has found that it occurs chiefly on the low lands where there are small runs or brooks, ponds or hollow places which become dry and in which or along the edges of which, rank grass or other vegetation grows. In the spring or summer, immediately after a warm rain, cattle or sheep may drink from such runs, ponds or hollow places or eat the rank vegetation about them and thus convey the infectious germ into the system. Hence, it is best during such times and at the beginning of an outbreak of the disease, to remove all cattle and sheep to the high lands and water them at wells. A number of farmers of the State use the plan of putting a seton in the dew-lap of all young cattle under two years of age. This establishes a local inflammation and may inoculate the animal by giving the germs from the air a chance to enter the open wound, which may produce a mild form of the disease. In fact, putting a seton in dew-lap is a cheap preventative and is very effective. The Paquin Vaecine Laboratory at Columbia, Mo., prepares a preventative vaccine virus which has proven very reliable. The only objection to it is that the expense is too great to justify its use from an economy standpoint.

There are a number of medicinal remedies for the prevention of Black Leg, but they are in a degree uncertain. Glauber's salts in doses of four ounces to one pound, and salicylic acid, or sulphate of quinine, in doses of one to three drams, are the most active and reliable medicinal preventatives. There is no reliable curative treatment for those animals affected with Black Leg. Keep the sick animals by themselves and bury the carcasses deeply to prevent the spreading of the infectious germs.

Vast numbers of sheep are being shipped into South Dakota from Canada and the Eastern and Central States, and the writer must warn the purchasers of the risks they take in buying from unreliable parties. It is true that inspectors cannot detect many of the parasite diseases without sacrificing one or more of the

sheep in question; but the vender or former owner may know much that the inspector cannot learn by a brief examination. Already we have received many letters and specimens of parasites, indicating that some of the parasitic sheep diseases have found their way into this State. The sheep of this State have been very healthy and free from diseases, and the State is extremely well adapted to the sheep raising industry; but we must import healthy sheep if we wish to keep our prairies free from infection. The writer would advise every sheep owner in South Dakota to apply by letter to the Bureau of Animal Industry, Washington, D. C., for the book—"The Animal Parasites of the Sheep." Also buy Steele's book, "The Diseases of the Sheep" and Stewart's "Shepherd's Manual." The last two may be purchased of a medical book dealer, or ordered by your local dealer.

This Bulletin is not issued on the grounds of originality but to answer numerous queries which are constantly coming to us from all parts of the State.

In writing this department regarding diseases, state the conditions briefly as follows.

1. History of affected animals.
2. Condition before becoming sick.
3. Number of animals affected.
4. How fed; source of water; kind of pasture, etc.
5. Give age, sex, etc.
6. Are all affected at once?
7. Give symptoms.
8. Give result of your examination after death.
9. Send specimens of abnormal tissues or organs by express (prepay express.)