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## HOG CHOLERA AND THE USE OF SERUM

By H. Preston Hoskins, Assistant Veterinarian

### THE DISEASE

#### Importance

A well-known swine-breeder has characterized hog cholera as the limiting factor in the swine industry. A prominent veterinarian recently referred to hog cholera as "the most dreaded scourge in the entire list of diseases affecting domestic animals of this country today."

Hog cholera is different from some of our other animal diseases in that losses usually come suddenly and are therefore felt more keenly. As a matter of fact tuberculosis and contagious abortion are probably just as costly to the farmer, but because these diseases are slow and insidious in their course, the losses caused by them are not apparent to the average farmer. Hog cholera may cause a loss of a thousand dollars in one herd in a week's time, while the same loss resulting from tuberculosis or contagious abortion, spread over several years, might not be given more than passing notice.

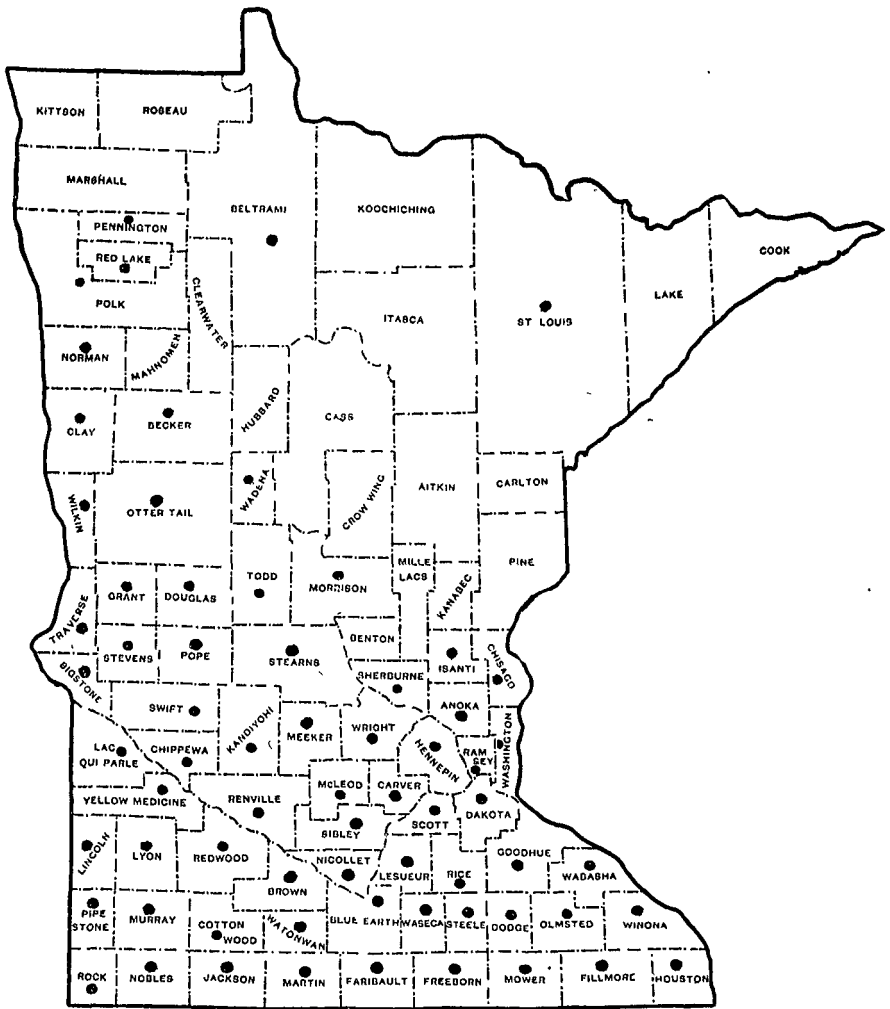
#### History

Hog cholera has been recognized as a contagious disease of swine for many years. The first authenticated outbreak in this country occurred in 1833, when a large number of hogs in Ohio died from a disease which answers the description of hog cholera as we now know it. The disease has existed in Minnesota for over twenty years, having been introduced into the southern part of the state in the early nineties.

This highly contagious disease has caused the loss of millions of dollars annually. It has been estimated that the losses during 1913 reached sixty-three million dollars. During that year the loss in one state alone is said to have reached the enormous total of thirteen million dollars.

Altho the heaviest losses from this scourge have been suffered in the corn-belt states, Minnesota has lost large numbers of hogs during the last few years, especially in the southern counties. The disease apparently reached its height in the summer of 1913. The losses in Minnesota, both direct and indirect, were estimated at about five million dollars. Minne-

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Distribution of Cholera in Minnesota

In each county in which a black spot is shown, there have been outbreaks of hog cholera. Some counties have reported only one outbreak, while in some the disease has spread practically over the entire county. Some counties in which no black spot is shown may have had cholera, but no reports of the disease have reached the State Live Stock Sanitary Board or the Experiment Station.

sota has gradually been taking her place among the pork-producing states, and cholera has increased in proportion to the growth of the industry. The importation of hogs from infected localities of other states has undoubtedly played a prominent part in the spread of the disease, not only in this state but in other localities throughout the country.

### Cause

Hog cholera was for a while attributed to several kinds of germs found in the bodies of sick or dead hogs. About ten years ago veterinary bacteriologists in the employ of the Bureau of Animal Industry of the United States Department of Agriculture, investigating this disease, came to the conclusion that hog cholera is not really due to any of the hitherto-known organisms, but is caused by a germ which had never been identified up to that time. The hog cholera germ is so small that it will pass through the pores of the finest porcelain filter made. It has never been seen, even with the most powerful microscope. All attempts to cultivate the germ artificially have failed. The cause of the disease is classified as a filterable virus and is usually spoken of as such. Measles and scarlet fever of human beings, swamp fever of horses, and foot-and-mouth disease of cattle, are caused by filterable viruses of different kinds. Even tho the hog cholera germ has never been seen or cultivated it is known that such a germ exists, from the way the disease behaves. It is also known that the hog cholera germ must be present before there can be a case of cholera. Hog cholera can no more exist without the germ of hog cholera than corn can grow without the seed. The way in which these germs gain entrance to a herd is often a mystery, but they get in somehow.

### Indirect Causes

Besides the actual cause of the disease there are factors which must be considered from a hygienic standpoint in its prevention and control. If the vitality of hogs is weakened by keeping them in poor quarters, by improper methods of feeding, or by their being infested with parasites of different kinds, there is less chance to ward off infection. It is therefore of the greatest importance that the hog pens and yards be kept reasonably clean, well ventilated, lighted, and drained; that proper attention be paid to the feed so as to insure the animals a wholesome, well-balanced ration; and that watch be kept for any evidence of parasites, such as intestinal worms, lung worms, lice, and mange mites.

### Symptoms

Altho the symptoms of hog cholera are rather characteristic, they may vary considerably in different animals, outbreaks, and localities. It is sometimes absolutely impossible to make a positive diagnosis of hog cholera from the symptoms alone, and a tentative diagnosis, based on symptoms, must frequently be verified by a post-mortem examination. Hogs that are susceptible to cholera usually show signs of the disease in from one to three weeks after they have been exposed to the infection. Sometimes no symptoms are noticed before the attention of the owner is called to one or more dead hogs. It sometimes happens that the first hogs in a herd, stricken with the disease, die rather suddenly, without warning. Then others will follow, showing some or all of the usual symptoms.

Loss of appetite is usually the first symptom noticed. The animal affected may lag behind the rest of the herd and show less inclination to eat than the others. This lack of desire to eat may be slight at first, but a day or so later the loss of appetite will be complete. The hog may be very thirsty and drink large quantities of water, if available. This is usually accounted for by the fact that the affected animal has a high fever. The animal walks with a staggering gait and is very unsteady in his movements, especially in the hind legs. When standing still, he sometimes will brace himself against a fence, a post, or another hog, and will very frequently stand with the hind legs crossed, the back humped up, and the tail hanging limp.

Diarrhea may be noticed but is not always present, as the animal may be constipated. The condition of the bowels will depend in some measure on the kind of feed the animal has been receiving. Neither

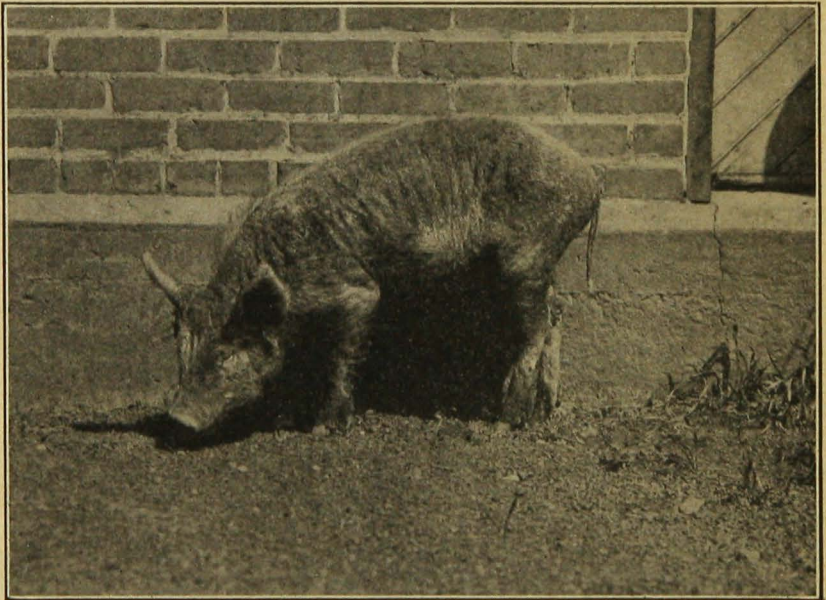


Fig. 1. Hog Sick with Cholera

constipation nor diarrhea alone is enough to indicate the presence of cholera even if a number of hogs in the same herd show either one of these conditions at the same time.

The eyes are frequently much inflamed and discharge a sticky mucus which tends to glue the lids together. This is usually seen only in those hogs in which the disease runs a rather chronic course.

Redness of the skin is often noticed, especially in white hogs. The skin behind the ears, under the belly, and along the flanks is most frequently affected in this way. As the animal gets weaker and death approaches, this reddish color may change to a purplish tinge. Hogs dying from causes other than cholera may frequently show this discoloration of the skin. The coat is usually rough, the bristles standing erect.

Coughing often occurs in consequence of the lungs being affected by the disease. However, it should be remembered that lung worms, dust, and a number of other causes frequently give rise to a cough which may not be due to cholera at all. Vomiting is sometimes observed, and usually indicates an inflammation of the mucous lining of the stomach. In slowly developing cases this may go on to the stage of ulceration. Bleeding from the nose is sometimes seen just before death. In chronic cases, pieces of skin on different parts of the body may actually fall off, especially about the hoofs, jaws, and ears.



Fig. 2. Inner Lining of Large Intestine, Showing Characteristic Ulcers

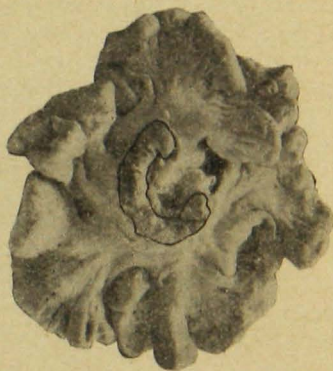


Fig. 3. Intestines Showing Hemorrhages

A line has been drawn around the lymph gland in the center, which is much swollen and very dark in color.

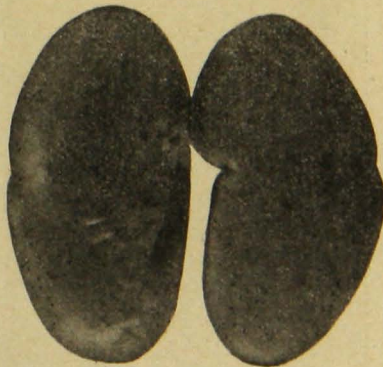


Fig. 4. Kidneys Having the So-called Turkey-Egg Appearance

Note the minute hemorrhages on the surface.

With the continued loss of appetite, high fever, and diarrhea, the hog rapidly loses flesh and the flanks become quite sunken. A very characteristic attitude for a hog affected with cholera is shown in Figure 1. If the temperature be taken the thermometer will frequently show quite a high fever. This may run as high as 110 degrees, Fahrenheit, in warm weather, although in the majority of cases the temperature will not rise much higher than 107 or 108 degrees. The normal temperature for a hog runs

from 101 to 103.5 degrees, Fahrenheit. The course of the disease varies. The first animals stricken in the herd usually die very soon. As the disease progresses, the later cases may not die so rapidly and some hogs may develop the chronic form of cholera and not die for several weeks. Some may even recover, and such hogs can be counted upon as being permanently immune against the disease.

#### Autopsy

Post-mortem examination of a hog dead from cholera may reveal certain abnormal appearances or conditions of the organs or parts of the body. The intestines may suffer extensive inflammatory changes, the

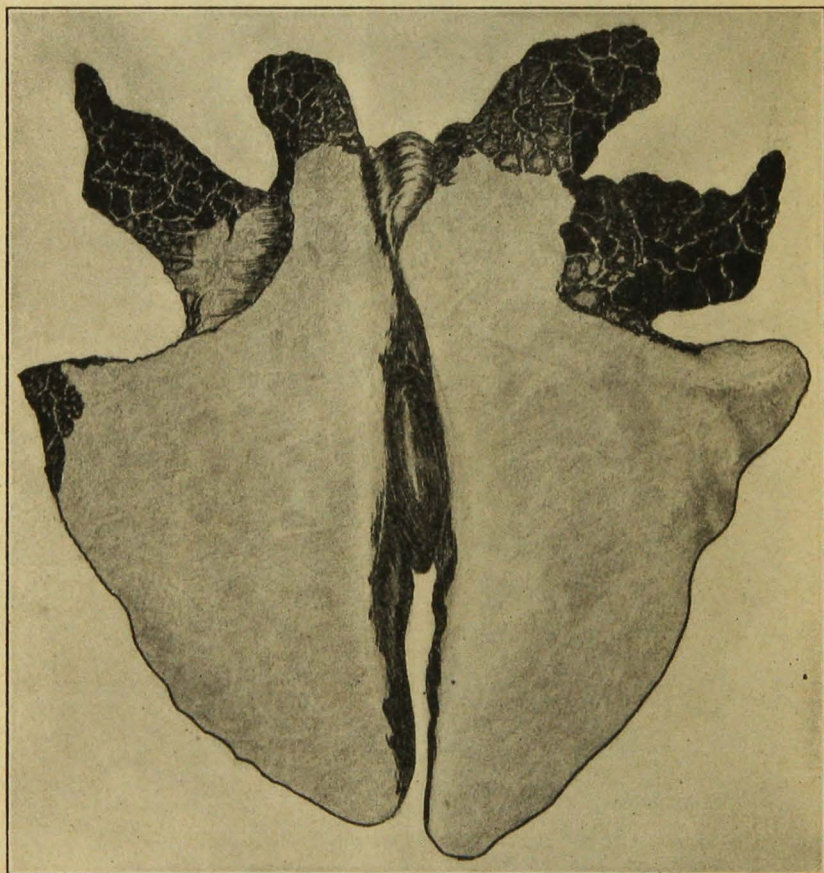


Fig. 5. Lungs Showing Areas of Pneumonia (Dark Color in Upper Tips), Seen in Hog Cholera

outer coat showing small hemorrhages (blood-stained specks that will not wash off), while the lining of the bowels may show some of these hemorrhages or the characteristic ulcerations seen in chronic cases. (See Figure 2.) The lymph-glands lying along the intestines are swollen and

dark red, sometimes almost black. (See Figure 3.) Lymph-glands in other parts of the body show the same appearance, especially those at the angle of the lower jaw, those between the lungs, those on the lower surface of the liver, and those in the groin. Normally these glands are yellowish-gray in color.

The kidneys show numerous small hemorrhages both on the surface, beneath the capsule, or surrounding membrane, and down through the substance of the organ, as shown in Figure 4. This condition is spoken of as the "turkey egg" kidney on account of the speckled appearance produced by the hemorrhages, and may be observed more distinctly after the capsule has been stripped off. The hemorrhages are quite small and appear as



Fig. 6. Splens, Normal and Diseased

The spleen on the left is studded with swollen areas, light in color. The others were taken from hogs of the same size. The one on the right is from a healthy hog.

specks, varying in size from that of a millet seed to that of a pin head. The number also varies. In some cases there may be but a very few present, while in others the organ appears to be almost entirely covered. Too much importance should not be placed on this lesion alone, as it is sometimes seen in another disease. (See Necrobacillosis.)

The lungs are frequently the seat of extensive changes. Spotted areas are noticed, especially on the anterior lobes (those parts extending up into the front of the chest cavity). To the touch these feel firm, more like

liver tissue than normal lung, which is somewhat elastic and pink in color. The lungs may also have a speckled appearance, due to the numerous small hemorrhages scattered over the surface and throughout the substance of the organ. (See Figure 5.) Other organs may be affected as follows: The heart may show a few hemorrhages on the surface similar to those on the kidneys. The bladder will very frequently show a few hemorrhages, on both its inner lining and outer covering. The spleen may show some of these hemorrhages, or may be very much enlarged and be very pulpy on cutting it. (See Figure 6.) The liver will ordinarily be mushy, so that a blunt object, such as the finger, may easily be pushed into it.

It is very unsatisfactory to hold an autopsy on a hog that has been dead for any length of time, particularly during warm weather, when decomposition changes take place very rapidly. On the other hand, if the weather is cold and the carcass frozen it is rather difficult to make a satisfactory examination. For these reasons it is usually advisable to allow the veterinarian to kill the sickest hog in the herd if there is any doubt as to the exact nature of the disease.

In neighborhoods where cholera is prevalent and a number of hogs show symptoms as outlined, it is usually not necessary for a veterinarian to hold a post-mortem examination, but in localities where cholera is not known to have made its appearance, and the nature of the disease is at all obscure, a veterinarian is hardly justified in treating a herd for cholera without first having made sure of his diagnosis by a post-mortem examination.

### **DISEASES SOMETIMES MISTAKEN FOR CHOLERA**

Certain diseases should be carefully distinguished from cholera, otherwise they may cause more alarm than is necessary and money may be expended needlessly for treatment that will do little or no good.

#### **Intestinal Worms**

Intestinal worms probably cause more losses among hogs than any disease, with the exception of cholera. Perhaps there is no disease or condition that is more likely to be confused with cholera. To complicate matters, hogs are frequently found affected with both. Serum given to such hogs is usually wasted, as they are already in a weakened condition, and serum fails to save them. We usually recommend against vaccinating a herd of hogs hadly infested with intestinal worms. For further information concerning the latter subject, see Agricultural Extension Bulletin No. 51, Some Internal Parasites of Domestic Animals, by Dr. W. L. Boyd.

#### **Garbage Poisoning**

In the vicinity of our large cities and towns, many hogs are fed on garbage and table refuse exclusively. These hogs sometimes develop intestinal disorders. In a number of cases the cause has been found to be the presence of powdered soaps which are used for cleansing sinks and utensils and find their way into the garbage. They irritate and inflame the lining of the intestinal canal and act as poisons. Loss of appetite and diarrhea are symptoms noticed, and because a number of hogs may show these symptoms at the same time, cholera may be suspected.



### Lung Worms

Certain worms have been found to inhabit the air passages of the lungs. Frequently a number of young pigs in the same herd will appear sick and gradually lose flesh. The most marked symptom, however, is the persistent hard coughing caused by the irritation in the air passages. The distinguishing difference between this condition and cholera is that only the young pigs will be affected, as a rule. They will not die rapidly, as with cholera, and the other symptoms of cholera will be absent. This disease frequently appears on the same farm year after year, unless precautions are taken to prevent it.

### Necrobacillosis

This is an infectious disease that has caused serious losses among hogs. During the early months of 1915 it was responsible for very heavy losses among young pigs, in this state. The disease is caused by a distinct germ which produces various symptoms and lesions in different species of animals, depending on the particular part of the body affected. Under the name of necrobacillosis may be included such conditions as "bull-nose" and "sore mouth" of young pigs. In the former condition the germs damage the mucous membrane of the respiratory tract. In the latter, sometimes also called "canker," the disease is localized in the mucous membrane of the digestive tract. In very young pigs the disease may assume such a severe form that the pigs die before extensive lesions have had time to develop. In older pigs, having more resistance, where the disease assumes a less virulent type, ulcers are found in the mouth, around the gums, tongue, and mucous membrane lining the cheeks. This disease has been mistaken for cholera in a number of instances, as the kidneys in affected animals sometimes exhibit the turkey-egg appearance which is looked upon as being so characteristic of hog cholera. It should not be difficult to distinguish between the two diseases. Necrobacillosis will very frequently appear among the young pigs in a herd without any sickness being apparent among the older hogs. The lesions characteristic of hog cholera are not found in necrobacillosis, with the exception of the kidney lesions referred to and in a few cases areas of pneumonia similar to those seen in hog cholera are found in the lungs. The swelling of the nose, characteristic of bull-nose, and the ulcers in the mouth, characteristic of sore mouth, are not found in hog cholera. Necrobacillosis may make its appearance among pigs from immune sows at a very early age, which is not true of hog cholera. Where necrobacillosis exists, serum is of no value in combating the disease. Necrobacillosis responds to local treatment in cases detected early. The application of a solution of permanganate of potash to the affected parts will be found to be of considerable value. The teats of the sows should be disinfected by an application of the same solution. Thorough disinfection of the pens is absolutely necessary in controlling this disease.

### Enteritis (Inflammation of the Bowels)

Enteritis has appeared among hogs in different parts of the state, especially in the southwestern counties. The symptoms shown by the affected animals are very suggestive of cholera, and include loss of appetite, diarrhea, fever, and extreme weakness. A post-mortem examination

shows an inflammation of the bowels, but the other lesions characteristic of cholera are absent. The inflammation of the bowels is marked by the formation of a false membrane, such as is seen in diphtheria. This is seldom seen in cholera cases. Enteritis may appear in hogs immune against cholera.

### Digestive Disturbances

Sudden changes in feed will frequently affect hogs, and the resulting symptoms may be such as to cause the owner to think that he has cholera in his herd. The most marked symptoms are dullness, diarrhea, and loss of appetite. Post mortem examination fails to show any of the characteristic lesions of the disease, few hogs, if any, actually die, and a change of feed is usually followed by recovery. Digestive disturbances may follow the feeding of spoiled feed or the addition of drugs or medicines to the feed.

### Tuberculosis

Tuberculosis is found among hogs to quite a large extent, especially those fed on skim milk from creameries, or those allowed to follow cattle affected with tuberculosis. If the milk comes from cows that are tuberculous, or if the cattle have the disease, the hogs may develop the disease from taking the germs into the digestive tract. On account of its slow course, tuberculosis need not be confused with cholera. Not all hogs in the herd will appear to be affected. Unthriftness will be the most marked symptom, in the case of tuberculosis, but the disease rarely causes sudden death, as is the case with cholera without other symptoms preceding. Cases are on record where both tuberculosis and cholera were present in the same hog at the same time. Hogs may have tuberculosis without showing any symptoms.

## SPREAD OF THE DISEASE

### How the Disease Spreads

The germs of hog cholera are undoubtedly spread in a great many ways. It is not necessary for healthy non-immune hogs to come into direct contact with sick hogs or cholera-infected premises, in order to contract the disease. Persons may carry the germs on their clothing or shoes. Dogs frequently spread the infection by carrying off the carcasses of hogs dead from cholera. Doves, pigeons, and crows undoubtedly are factors in spreading the disease. Infected food stuffs or a contaminated water supply may introduce the infection. Treated or immune hogs may carry it from infected herds or pens, although perfectly healthy themselves. This has often been known to occur, following the introduction of a pure bred boar or sow into a herd. Stock cars and chutes that have not been thoroughly disinfected may be the means of spreading the disease. A herd may be infected by improper vaccination methods.

### Disposition of Carcasses

Carcasses of all hogs which have died from cholera, lung worms, and tuberculosis should be so disposed of that none of the infection can be scattered to uninfected premises. The best way to dispose of these carcasses is to burn them. When this is not possible they should be buried.

at least three feet in the ground and covered with quick lime, else prowling animals and scavenging birds may carry parts of a carcass to healthy herds on uninfected farms. Pens in which there has been cholera should be thoroly disinfected and no hogs should be introduced into the herd immediately, unless they have been rendered immune by treatment with serum.

### Disinfection

Before we had any means of combating hog cholera with vaccination, it was the custom to clean up and disinfect the premises after cholera had carried off most of the hogs, and then start all over again. Now that we have a new means of combating the disease, in the use of a preventive serum, there is a strong tendency on the part of many hog-raisers to neglect disinfection and think it unnecessary.

The belief has become very wide spread that freezing will kill hog cholera germs. This is not true. Cold seems only to hold them in check for a while, until the appearance of warmer weather. Cholera exists during the winter months but it usually does not spread so rapidly as in warm weather. The cases are not so acute or sudden, and frequently they are complicated with lung troubles, such as pneumonia, and the use of serum is not always attended by the desired results. The following general rules are offered for disinfecting premises where hog cholera has existed:

(1) Burn all dead hogs promptly, as near the place where they died as possible, or bury them three or four feet underground, covering them with lime. Burning is better, and this method should be used wherever possible.

(2) As soon as the last victim of cholera has either died or recovered, burn all the litter that has been contaminated with the discharges from the sick animals. Burn it as near as possible to the quarters where the disease has existed.

(3) Spray the pens both inside and out, using a strong disinfectant solution and a force pump, if one is available, so as to get into all cracks, crevices, and corners. The United States Government recommends a three-per-cent compound solution of cresol (Liquor Cresolis Compositus, U. S. P.).

(4) Apply a coat of whitewash containing crude carbolic acid or chloride of lime to the walls of the hog houses, the pens, and the fences.

(5) Sprinkle the floors of pens, alleys, and yards with slaked lime.

(6) Scald frequently with boiling water all buckets, barrels, and troughs used in feeding the hogs.

For further information on disinfectants and their uses, consult Minnesota Agricultural Extension Bulletin No. 44, Barnyard Sanitation.

### Preventive Treatment

One of the greatest discoveries made by scientists within recent years is the method of immunizing hogs against cholera. Well hogs may be treated (vaccinated) with serum so that they will not take the disease if exposed later. This method of treatment has now passed the experimental stage and is on a practical working basis. There are several different methods for immunizing hogs. They have their advantages and disadvantages, and the method to be employed in each particular case will in great measure depend upon conditions in and surrounding the herd to be treated. Immunization consists in bringing about the presence

of what are called immune bodies, or protective substances, in the blood. These enable the animal to resist such cholera germs as may enter the system. They are present in the blood of hogs that have recovered from cholera, and such animals are therefore sometimes called "immunes."

**Serum-only.**—A hog that has been treated with serum without exposure to cholera at the same time, or shortly afterwards, does not form any protective substances or immune bodies of its own. It is rendered immune for a comparatively short time (from three weeks to two months) by the protective substances in the serum injected. This passive immunity conferred by the serum can not be relied upon with certainty to protect the hogs for a period greater than two or three weeks, altho in a great many cases it apparently has protected hogs for two months. This is due mainly to the great variation in the natural immunity and susceptibility of hogs, and to a lesser degree depends on the amount of serum injected. This treatment is generally spoken of as the "single" or "serum-only" treatment or method.

On the other hand, a hog that has been treated by the single method and exposed to cholera at the same time, or shortly afterwards, will usually form its own protective substances in the blood, sufficient to render it permanently immune. The function of these appears to be to neutralize or render harmless the germs of cholera when they gain entrance to the hog's body. If the hog is not immune, there is nothing to prevent the growth of cholera germs and they multiply and produce the symptoms and lesions characteristic of the disease, but if the hog is immune the germs can make no headway and they are apparently destroyed without any harm being done to the hog.

In a few cases hogs given the single treatment and at the same time exposed to infection, fail to develop a lasting immunity and after the temporary immunity given by the serum has worn off, they again become susceptible to the disease, and, if the infection is still present, develop cholera. However, if the hogs given the single treatment are given plenty of exposure and there has been no mistake in the diagnosis, and if the work of disinfecting has been thoro, there should not be any great danger of a recurrence of the disease. This has been very well demonstrated in the coöperative work carried on in Renville County during the last year. New outbreaks in previously treated herds have been the exception rather than the rule.

**Serum-virus.**—When it is desired to make a hog permanently immune and there is, as yet, no cholera in the herd, it is necessary that hog cholera germs be introduced into the system simultaneously with the serum which protects them from the germs injected. This is accomplished by the introduction into the hog's body of a small amount of virus. Virus is the germ-laden blood obtained from a hog sick with cholera. It is injected at the same time as the serum but with a separate syringe and in a different part of the body. By this method the hog is enabled to develop enough protective substances of its own to render it permanently immune. This is known as the "double" or "serum-virus" method of treatment. If no serum is injected to counteract the virus, the hog will die of cholera.

We advise single treatment for herds recently infected. From experience we have learned that it is not a wise plan to use serum in herds where the disease has prevailed for a long time or where large numbers of the hogs have died or where many are sick. Some disappointing results have

been obtained by using the single method in unexposed or non-infected herds, as the disease may be contracted six weeks later or in even less time because the immunity conferred by the serum has died out. A correct diagnosis is important before the serum is administered. If the sickness suspected of being cholera is not this disease and the single treatment is used, there is no possibility of the hog being rendered permanently immune. It is also very important to know whether any other serious disease exists in the hogs at the same time that they are affected with cholera. Serum will be of value in combating cholera, but it will not check other diseases or prevent deaths from other causes. If something besides cholera ails the hogs-at the time they are treated, the serum will be wasted.

The double method has been used in herds in which cholera has just made its appearance and in such cases it is necessary to distinguish very carefully between the infected and the non-infected hogs. If the double treatment is given to hogs already infected, the result may be very disastrous. The greatest use for the double treatment has been for immunizing healthy herds in localities where cholera has made its appearance. There is some risk of introducing cholera into a healthy herd by the double treatment. While this risk is not great, there is no positive way of telling beforehand whether bad results will follow. Hog-owners must take their chances. The double treatment must therefore be administered with a full understanding of the possibility of disappointment. It must be administered with extreme care, because when used carelessly or under improper conditions, it may cause a large number of treated hogs to develop vaccination cholera and thereby infect previously uninfected premises.

Even when used with extreme care by expert veterinarians, a small percentage of vaccinated hogs (about two per cent on a large number) develop the disease as a result of the treatment. There are some losses, ranging upward from a fraction of one per cent, in about one-fifth of the healthy herds given the double treatment.

As the virus contains the living germs of cholera, it actually produces a mild attack of the disease, but the serum injected at the same time serves to hold the germs in check and prevents them from getting a foothold. Most hogs will not show any effects from the double vaccination, but a few may show a slight indisposition or refuse feed about a week after they have been vaccinated and then be all right again in a day or so.

Some hogs are much more susceptible to cholera than others, which means that they have much less natural immunity than others. Herd after herd may be vaccinated by the double method without a single case of cholera developing as a result. Then a herd may be vaccinated by the same veterinarian, using the same serum, and a number of cases of cholera develop afterward. This can be explained in several ways: (1) These hogs may have been infected before the vaccination but not long enough for symptoms of cholera to have developed. (2) A great variation in natural resistance is possessed by different hogs. And (3) the hogs which developed cholera may have been in a poorer physical condition than those which successfully withstood the treatment. Unless in good physical condition, hogs should not be given the double treatment.

The question is often asked whether premises are necessarily infected where the double treatment is used. This can not be answered positively,

to cover all cases, but our observations have been that if none of the hogs show any signs of cholera following the treatment, there need be little fear of the premises being infected. But if some of the hogs develop marked symptoms, whether they die or not, there is strong likelihood that the premises will be infected.

It has been experimentally shown that susceptible (untreated) hogs may be confined in a pen with other hogs just given the double treatment and the untreated hogs will not develop cholera as long as the treated hogs remain healthy. However, it is not customary to give part of a herd the double treatment and allow the balance to go untreated. If some of the hogs are not in condition to be given the double treatment, they should be protected with the single treatment until such time as they may be given the double treatment.

It will be seen from a comparison of the single and double methods that in the former the cholera germs present in an infected herd answer the same purpose as the virus given in the double method used in a healthy herd, namely, to prolong the immunity. The hogs take the germs into their system in a natural way when the single method is used and they are actually inoculated with the germs when the virus is injected. The results in both cases are practically the same.

**Combination or "follow-up" method.**—The follow-up method is the combination of the single and double treatments, which may be used in herds exceptionally valuable from a breeding standpoint, where it is desirable to reduce chances of loss to a minimum. The single treatment is given about ten days before the double treatment. In this way an immunity is conferred that prepares the hogs for the double treatment. The expense is the greatest objection to this method.

**Artificial pen exposure.**—As a substitute for the serum-virus method a few veterinarians in this state have used a method of vaccination to which we have applied the name "artificial pen exposure." It has been employed in neighborhoods where cholera has made its appearance but only on farms and in herds where cholera has not yet broken out. The treatment consists in the injection of the requisite amount of serum and then the introduction into the herd of one or more hogs dead from cholera, or hogs that are very sick with the disease and about to die. The number of sick or dead hogs to be introduced depends upon the size of the herd to be exposed.

This should be done immediately after the hogs have received the serum treatment. The treated hogs are then allowed to associate as closely as possible with the sick hogs and even to eat the carcasses of the dead ones. One veterinarian has gone a step further and has cut up a dead hog and fed a small portion of flesh to each hog treated, in this way being sure that each hog gets some infection. This is of the greatest importance for good results.

By taking actual infection into the system in this way, or by association, the vaccination process is intensified. Practically the same results will be obtained as when the serum-virus method is employed, or when the herd is naturally infected and treated with serum only. There are several disadvantages in using this method. First of all, it is a violation of the state live stock sanitary laws to transport along a public highway, a hog sick with cholera or the carcass of a hog dead from cholera; so that this method should be confined to closely adjoining farms where a

sick or dead hog can be obtained without taking it over or along the public highway.

The second great objection is that the premises are necessarily infected. If the double treatment had been used, there would be about four chances out of five that the premises would have remained uninfected. If the single treatment had been used, there is always the possibility that the herd would have been protected sufficiently long for the danger to pass before the immunity died out. It has been said that the artificial-pen-exposure method was practically harmless, with regard to the possibility of vaccination cholera following. Experience has shown this not to be true as we have records of a case in which vaccination cholera actually followed, but the evidence in this case would seem to indicate that the weights of the hogs had been underestimated and insufficient serum given to protect them.

**"Virulent blood vaccination" or "Minnesota" method.**—It has been observed for some time that pigs from immune sows possess a high degree of immunity lasting for some weeks after birth. It is found possible to reinforce this immunity by injecting a small dose of virus at the age of about three or four weeks. A second injection can be given later, the exact time for which is now being determined by experiments. The Minnesota Experiment Station was the first to test this method, and results up to this time are encouraging. If field trials on a large scale continue to be successful, this new method will prove of great help in the control of hog cholera. Perhaps the greatest point in its favor is the low cost of treatment, which is quite insignificant as compared with that of the serum methods.

## REMEDIES

At the present time there are many remedies on the market purporting to be either preventives or cures for hog cholera. It is extremely doubtful if any of these can be relied upon to either cure or prevent this disease. The majority of these preparations can be placed in one of two classes: (1) disinfectants; (2) tonics and condition powders. Some of them have been analyzed and found to contain a few harmless drugs, having no specific value in the treatment of hog cholera. Others have been given actual field trials with unsatisfactory results. Some of them may actually do harm when given improperly. One of the possible bad features of them all is the false sense of security that they give to the person who has purchased and used them. We do not recommend any drug or remedy to be used as a preventive or cure for hog cholera and farmers are warned against investing their money in questionable remedies, except as disinfectants.

## SERUM AND VIRUS AND THEIR USE

### Curative Value of Serum

Little or no curative value is claimed for serum, but from results already obtained we can say that it is a safe and sure preventive of the disease, if used by competent persons, at the proper time, in sufficient doses, and in as clean a way as possible. The source of the serum should always be taken into consideration. There are on the market a large

number of commercial hog cholera serums. Most of these are prepared under careful Government supervision, but only too frequently we hear of bad results following the use of some of the commercial serums.

At the present time most of the commercial serum plants are under Government inspection, such plants being licensed to engage in interstate commerce. The labels on the bottles of serum produced at such plants bear the Government license number. However, this is no guarantee of the potency or the purity of the product, but it simply means that the plant at which the serum was produced has met certain requirements of the Federal Government, and that the serum has been produced and tested under regulations prescribed by the Government officials.

It is encouraging to note that apparently better results are being obtained with serum from year to year. This is only natural, as methods of serum production are being improved constantly, and veterinarians are obtaining a better knowledge of the disease and the proper conditions for using the various methods of treatment. There is also a noticeable lessening of the tendency to hide cases of cholera or to delay treatment unnecessarily.

Ordinarily it is inadvisable to treat sick hogs. Sometimes, however, hogs that are visibly sick are treated and saved. More frequently chasing, catching, and holding the hogs for the injection of serum proves to be more than the sick hog can stand in his weakened condition, and death may follow soon after treatment.

We usually recommend against treating hogs showing a temperature of over 105 degrees, Fahrenheit. Too much dependence should not be placed in the temperature alone, but just as much importance should be attached to the physical condition of the hog at the time of treatment. In the case of valuable, pure-bred hogs it will very often be advisable to treat even those which are showing the early symptoms of the disease, if plenty of good serum is available. Large doses of serum should be given in such cases. It is doubtful whether any damage is ever done from giving too large a dose of serum. The value of the hogs saved under these conditions will very frequently be considerably more than the cost of the serum and the veterinary services.

#### What Serum Is

Hog cholera serum is the clot-free blood obtained from a hog that has been rendered very highly immune against cholera. It takes from one to two months to work a hog up to the point where the blood will contain enough protective substances that when a small amount of it is injected into another, the latter will be rendered immune.

#### What Virus Is

Virus is the clot-free blood drawn from a hog that is very sick with cholera and about to die. It is virulent or disease-producing blood and contains the actual living germs of cholera and must therefore be handled with extreme caution. A small amount of virus injected into a susceptible hog will usually produce a typical case of cholera. The Experiment Station will not furnish virus with serum unless a veterinarian holding a special permit from the State Live Stock Sanitary Board has been engaged to use it. This is on account of danger of actually causing the



disease which we are trying to prevent, if the virus gets into the hands of incompetent or inexperienced persons.

### How Serum Is Prepared

Perfectly healthy hogs, weighing preferably in the neighborhood of from 200 to 250 pounds, are selected. If possible, hogs already immune against cholera are selected. They may be immune (1) by having recovered from an attack of cholera; or (2) by having been given the double, or serum-virus treatment some time previously; or (3) by reason of natural immunity. A very desirable type of hog for this work is shown in Figure 7.

If the hogs are immune, the next step in the process is to render them hyperimmune; that is, to intensify their immunity or render them very highly immune against cholera. This is accomplished by introducing large quantities of fresh, virulent blood, in amounts proportionate to the

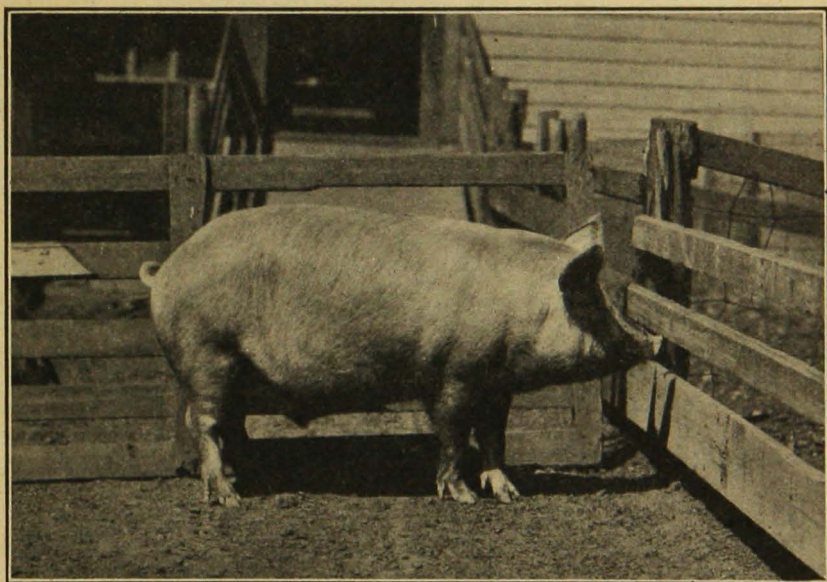


Fig. 7. A Good Type of Hog for Producing Serum

He is an immune barrow; weighs 225 pounds, but is not fat; perfectly healthy; ears not mutilated; and has a fairly long tail.

weight of the hogs, into their bodies in different ways, either into the abdominal cavity (intra-peritoneal) or into the heavy muscular tissue (intramuscular) or into the loose connective tissue just beneath the skin (subcutaneous) or directly into the circulation (intravenous). In the last method, which is the one most frequently used, the virulent blood is injected into one of the large veins in the ear. (See Figure 11.)

The virulent blood is injected either all at one time or in divided doses at weekly intervals. When the intravenous method is used, from five to seven cubic centimeters of blood for each pound of body weight are injected. This means that a hog weighing 200 pounds receives from a quart

to a quart and a half of hog cholera blood directly into the circulation. In from ten days to two weeks after the last injection, the hog's blood contains a very large amount of the protective substances desired. A hog that is simply immune has only enough of these protective substances in its blood for its own protection, but a hog that is hyperimmune has them in such large quantities that a small part of the blood, when injected into another hog will have the power of rendering that hog immune.

The hyperimmune hog is now ready to be bled for serum. Two methods are in use.

**Throat-bleeding-only method.**—The throat-bleeding-only method is used exclusively in some serum plants, and in others only when the demand for serum is very heavy and it is desired to produce large amounts as rapidly as possible, in which case the hog is bled from the throat and all of the blood taken at one operation.

**Tail-bleeding method.**—When the tail-bleeding method is employed, the blood is obtained by cutting off a small piece of the tail, under aseptic conditions, and collecting the blood in a sterilized vessel. It has been found that one thousand cubic centimeters (one quart) of blood can be taken from a two-hundred-pound hog with safety. During the process of bleeding, the blood clots, and this clot is later removed by straining the blood through sterile cheesecloth. The blood, freed from clots, is measured and a small amount of preservative added. This is the serum.

The preservative in general use is a solution of phenol (carbolic acid) in glycerin and water. The phenol is added to the blood, in the proportion of one part of phenol to two hundred parts of blood. The serum is then put in sterile bottles, hermetically sealed, and placed in a cool, dark place until it can be tested. It takes three weeks to test the serum and if the test shows that the serum is up to standard strength, it can then be used. If the serum fails to satisfy the conditions of the test, it is not used. From two to three pints of blood are removed every time the hog is bled from the tail. He may be bled two, three, or four times, and then be re-hyperimmunized; i. e., the former process is repeated, because the bleeding has resulted in decreasing the amount of protective substances in the blood. The total number of bleedings is usually determined by the length of the tail. When the tail gets so short that the hog can no longer be bled, it is killed and all the blood collected from the throat. On the average, a hog weighing from two to three hundred pounds, will yield about 15,000 cc. of serum (three and three-quarters gallons) which is sufficient to treat from three hundred to five hundred hogs, weighing one hundred pounds each, depending upon the method used.

When hogs are re-hyperimmunized, it is customary to give them a rest of about ten days between the last tail-bleeding and the re-hyperimmunization. If a plentiful supply of immune hogs is available, it is usually not customary to re-hyperimmunize, but to kill the hog after the second or third tail-bleeding. After several years of experience, it has been found that hogs do not withstand the second hyperimmunization as well as they do the first. During the bleeding period the hogs must remain in perfect health or they are not bled. Each hog is weighed each time it is bled, and if it has lost in weight, it is assumed that the hog is a little out of condition and accordingly is not bled. Hogs showing any rise in temperature above normal are not bled.

### Testing the Serum

It is customary to mix the blood from quite a number of hogs, and not to test the blood of each individually. In this way different batches of serum are more nearly uniform. About 80,000 cc. (20 gallons) of serum are tested at one time. After the serum has been thoroly mixed, a sample (about 120 cc.) is taken for testing. Eight pigs weighing from 50 to 90 pounds are selected. These pigs must be perfectly healthy; must not have been exposed to cholera; and must never have been vaccinated. If possible, pigs are obtained from non-immune sows.

Each of the eight pigs receives an injection of 2 cc. of virus. Two pigs receive 25 cc. each, of serum, two, 20 cc., and two, 15 cc., in addition to the virus. The remaining two receive no serum. The last two are called the "virus-check" pigs, having received virus and no serum. These pigs are expected to die of cholera. The pigs receiving the graduated doses of serum are expected to live. If the "serum-test" pigs live, it is assumed that the serum was of sufficient strength to protect them from the virus. If some of them die, it is assumed that the serum is not potent. If the "virus-check" pigs die in regulation time, it is assumed that the virus was virulent, and also that the pigs were not naturally immune, which is a very important point. If the "virus-check" pigs do not die, it is assumed either that the virus was not virulent or the pigs were immune and the test must be repeated.

### How Virus Is Prepared

Healthy pigs weighing not less than 50 pounds or not over 80 are most desirable for cultivating virus. It is almost needless to say that these pigs must be susceptible to cholera, not immune. Up to the present time no one has been successful in cultivating the hog cholera germs artificially, so that the only way in which it is done is to use these perfectly healthy non-immune pigs in which to grow the virus. As the carcasses are valueless except as fertilizer, after the virus has been obtained, the process of cultivating virus is one of the heaviest items of expense in serum-production.

Each pig is inoculated with cholera by a hypodermic injection of a small amount of virus. Usually in four or five days the pig will show signs of being off feed, and, ordinarily, by the seventh day will be completely off feed. Daily temperatures of the pigs are taken at this stage. The pigs are allowed to become very sick, and when the disease is at its height, they are killed by being bled at the throat, and the blood collected. This blood contains millions of hog cholera germs. This is the virus used either for the double treatment or for hyperimmunizing the serum hogs. The virus used for the double treatment is usually preserved with a small amount of carbolic acid (one-half of one per cent). This is sufficient to keep the virus from spoiling, if kept cool, but it is not strong enough to kill the hog cholera germs.

### How Serum Is Used

**Holding hogs for treatment.**—Shotes weighing 75 pounds or less can be held up by the hind legs and the serum injected into the ham, as shown in Figure 8, or they may be held up by the front legs and the serum injected into the arm pit as in Figure 9. Heavier hogs may be thrown on their backs and held in this position while the serum is injected either

into the ham or the arm pit. (See Figure 10.) Very large hogs can be snubbed up to a post and the serum injected into the ham from the rear, or behind the ear. This standing position is the safest for pregnant sows.

**Administering the serum.**—One of the most important steps in injecting serum, and one that is absolutely necessary for good results, is the cleansing of the skin at the point where the serum is to be injected. The following method has been followed at the state serum plant with extremely good results, and with only a very small percentage of abscesses:

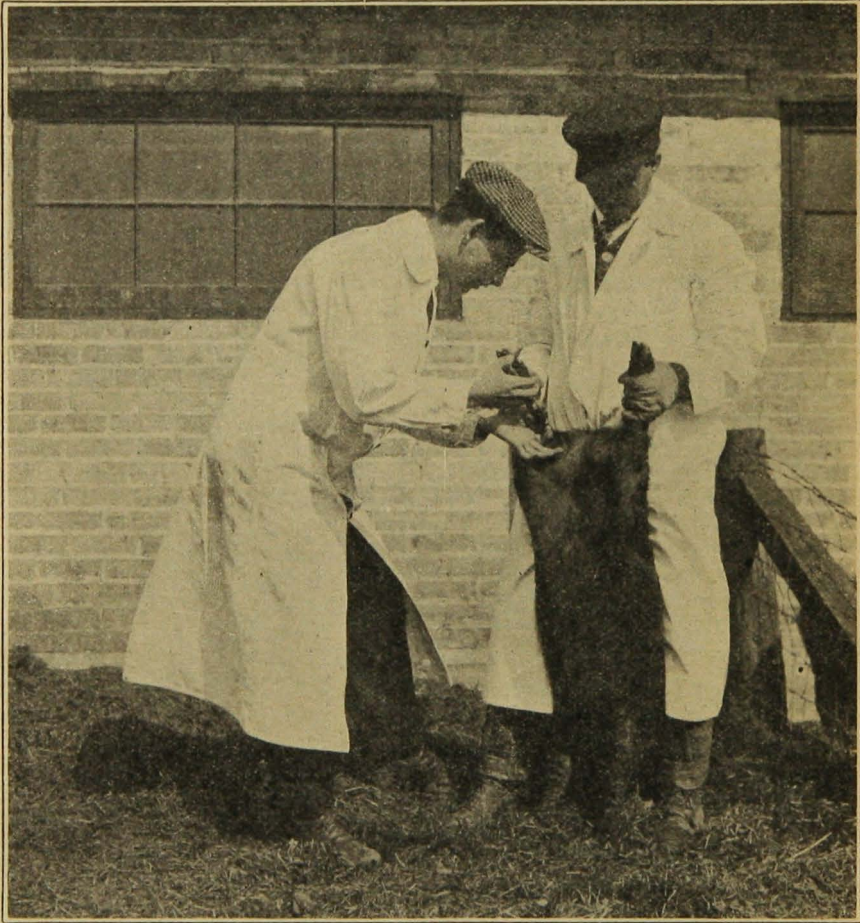


Fig. 8. Treating a 75-pound Hog

(1) With a vegetable brush, the skin is scrubbed with water and soap to remove the dirt and natural secretions. Soap that contains some strong disinfectant is desirable, or a disinfectant may be added to the water.

(2) After the skin has been cleansed, at the point where the needle

is to be inserted, it should be wiped with a wad of cotton saturated with denatured or 70-per-cent alcohol.

(3) The serum is injected, keeping the point of the needle away from the bones. If the serum is injected into the muscle, not over 20 cubic centimeters should be injected in one place.

(4) The skin is again wiped with cotton and alcohol at the points where the serum was injected. Traces of the serum should not be left on the skin to attract flies.

Instead of wiping the skin with alcohol, it may be painted with tincture of iodine. The latter is unsatisfactory, if the skin has previously been moistened, as iodine does not mix well with water.

#### Care of Hogs Before and After Vaccination

Bad results sometimes follow vaccination, due to improper or careless methods of handling and feeding hogs, both prior to and immediately after vaccination, in spite of the fact that clean, potent serum, and fresh, uncontaminated virus were used. Among the things that contribute to good results are the following:

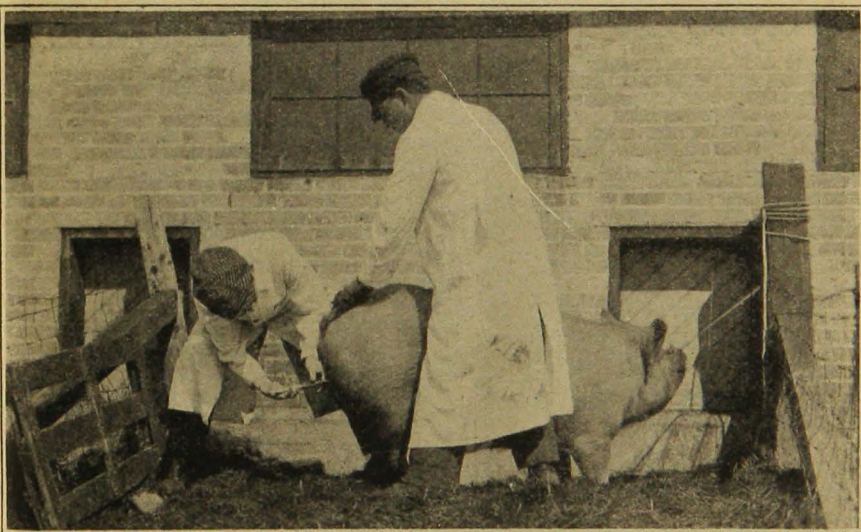


Fig. 9. Method of Securing and Treating a Heavy Brood Sow

Feed the hogs moderately for twenty-four hours before vaccinating. Do not starve them, as this will cause them to be wild and hard to handle.

During hot weather, vaccinate early in the morning or toward evening, rather than in the middle of the day.

The hogs should be kept in a clean, dry place, free from dust. This is better for both the hogs and the persons who are to handle them.

If possible, group the hogs according to size. This will lessen the chances for error in estimating the doses of serum to be injected.

Provide a box on which to place the bottles of serum and virus, trays for the disinfectants, syringes, etc., where they will be convenient, but not likely to be upset.

It is even more important that the hogs be kept clean and dry after vaccination so as to reduce to a minimum the chances for infecting the needle wounds.

Put the hogs into pens or other enclosures where they can be caught without much chasing. This should be done before the arrival of the veterinarian so as to economize his time.

Special attention should be paid to the feeding of hogs after vaccination. Give reduced rations or slightly laxative feeds. Cut down the amount of corn in the diet for at least a week. Do not make any radical changes in the method of feeding, immediately.

Watch the hogs carefully for at least three weeks after vaccination, especially after the double treatment has been used. If the hogs are well for three weeks, there is little to be feared later on.

If any hogs show signs of sickness following the double treatment, they should be isolated from the rest of the herd for observation. Sometimes when vaccination cholera develops, another dose of serum will save them.

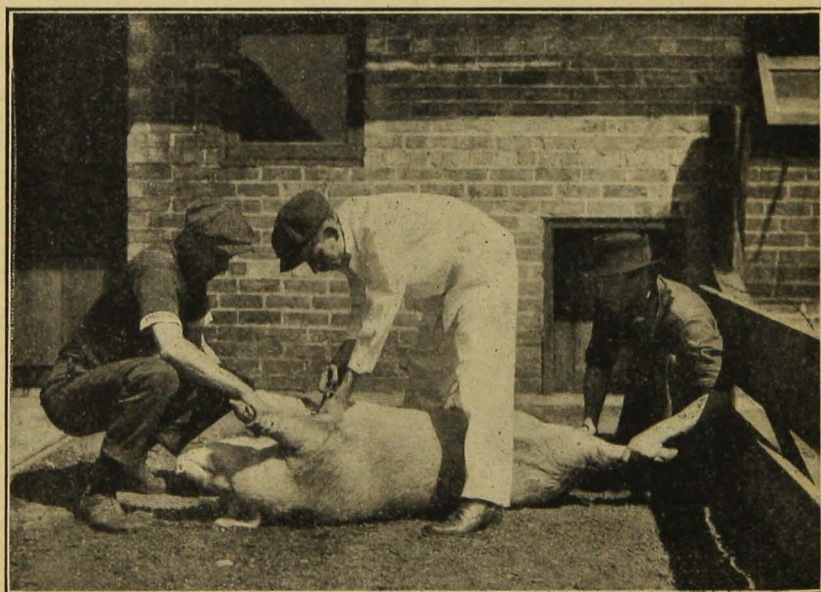


Fig. 10. Vaccinating a Large Hog in the Arm-Pit

If an abscess forms at the point where the serum was injected, it should be opened promptly and given a chance to drain very freely. Very few abscesses should occur, however, if the foregoing rules are followed. By all means, do not allow hogs to wallow in the mud just after they have been vaccinated.

We are frequently asked concerning the advisability of vaccinating brood sows, especially those which have been bred. Those seeking information wish advice on two main points; namely, the effect of the vaccination on the sow and also on her offspring. As far as our knowledge goes, there is little danger in vaccinating brood sows during the early part

of the gestation period, but there is considerable risk if the vaccination is delayed until the sows are well advanced in pregnancy, especially if the double treatment is to be used.

Bad results have been reported from time to time. Sows have been known to abort after vaccination. This was not necessarily due to any harmful properties of the serum or virus used, but is just as likely to have been caused by rough or careless handling. Hogs sometimes pass through a mild reaction following the double treatment. In the case of brood sows this may be severe enough to cause the loss of the pigs, or they may be carried to full time but not be well developed.

Unless it is necessary to vaccinate pregnant sows, either because of cholera in the herd or exposure to infection, we advise the postponement

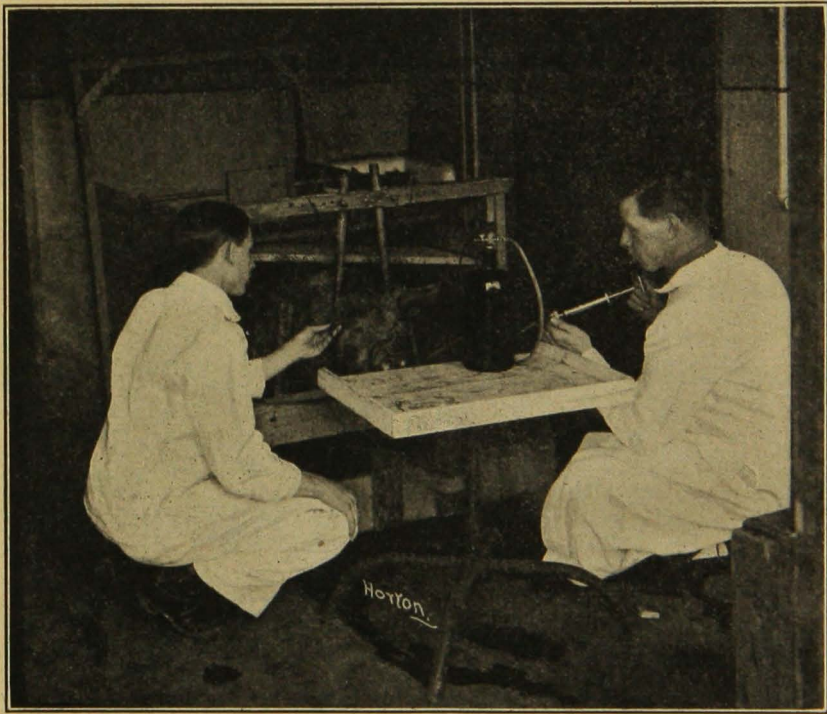


Fig. 11. Hyperimmunizing an Immune Hog, for Serum Production

The hog cholera blood is being forced into a blood vessel in the ear by air pressure.

of vaccination until after farrowing. If conditions compel earlier vaccination, and the sows are well advanced in pregnancy, the single treatment should be used exclusively. If the sows have recently been bred, and the owner is willing to take the small risk of possible bad results, the double treatment may be used. When brood sows are to be given the double treatment, they should be treated at least a month before they are bred.

### Keeping Qualities of Serum

Letters are frequently received asking how long hog cholera serum may be kept. This question can not be answered by giving a certain number of days, weeks, or months, as the conditions under which the serum was produced must be taken into consideration, as well as the conditions under which the serum has been kept after leaving the laboratory. With our present methods, serum can not be produced so that it will be absolutely free from germs. Serum producers should aim to keep it as free from contamination as possible, during the time it is in their hands. The addition of the preservative, as already described, will kill the majority of germs and will keep the rest from multiplying, provided the serum is kept cool.

Serum has been known to remain good for two years, but this could hardly be expected of all serum. At the state serum plant, it is stored at a temperature ranging between 40 and 50 degrees, Fahrenheit, and can be kept several months at this temperature. A large share of the poor results obtained with serum could probably be attributed to the fact that the serum had not been kept under proper conditions. Serum may leave the laboratory pure and potent, but its purity and strength can be very seriously impaired by improper methods of shipping and storing. Indeed, serum is very much like milk, it may be drawn carefully, but spoiled by subsequent handling. Serum is sent by express in most cases and it should be taken from the express office immediately upon its arrival, and kept in a cool place until the veterinarian comes to administer it. It should not be allowed to freeze.

### Distribution of Serum

The state serum plant at University Farm produces serum for administration by licensed veterinarians and other competent persons authorized by the State Live Stock Sanitary Board. Under the new law, which went into effect April 8, 1915, any citizen may administer serum obtained from the state serum plant, to his own hogs, but not to the hogs of any other persons unless authorized to do so by the State Live Stock Sanitary Board. When virus is ordered for the double treatment, it will be supplied only for administration by veterinarians in state employ. Serum will be sent either to the veterinarian or to the hog-owner direct, with the understanding that it is to be administered according to the above conditions. All permits to administer serum are granted by the State Live Stock Sanitary Board and not by the Experiment Station.

Serum is sent by express C. O. D. It can not be sent by parcel post. Orders should be sent by telegraph, telephone, or special delivery mail, addressed to the Veterinary Division, University Farm, St. Paul, Minn. Orders sent by ordinary mail may be delayed. When ordering serum, state just how much is wanted and not the number of doses or the number of hogs, unless the number and approximate weight of hogs are given. The order should also specify what arrangements have been made for the administration of the serum. The condition of the herd should be stated; i. e., whether the herd is healthy or infected. If infected, the number of hogs that have died should be given; also the number sick and the number in shape for treatment. Failure in giving this information may cause delay in sending the serum.



**Price of Serum**

The present price of serum is one cent per cubic centimeter. The law under which the state serum plant is now operating provides for the distribution of serum at approximate cost of production. As the cost of producing serum decreases or increases, the selling price will be changed accordingly. However, it is not likely that the distributing price will be changed frequently, as it is believed that the price of one cent per cc. is fairly stationary. A charge of one cent per cc. is made for virus. Except in extraordinary cases, serum can not be returned for credit and an order usually constitutes a sale. Serum should be ordered in advance, if a hog-owner intends to vaccinate later in the season.

**Doses of Serum**

The amount of serum necessary for a hog of any weight under any and all conditions, can be calculated from the following table:

Weight of Hog	Serum-Only Method Non-Infected Hogs in Sick Herd	Serum-Only Method Infected Herds for Hogs in First Stages*	Serum-Virus Method Non-Infected Herds Healthy Hogs
Up to 25 lbs.....	10 to 15 cc.	15 to 25 cc.	.....
25 to 50 lbs.....	15 to 25 cc.	25 to 40 cc.	30 cc.
50 to 75 lbs.....	25 to 35 cc.	40 to 50 cc.	30 to 35 cc.
75 to 100 lbs.....	35 to 40 cc.	50 to 60 cc.	35 to 40 cc.
100 to 125 lbs.....	40 to 45 cc.	60 to 65 cc.	40 to 45 cc.
125 to 150 lbs.....	45 to 50 cc.	65 to 75 cc.	45 to 50 cc.
150 to 200 lbs.....	50 to 60 cc.	75 to 90 cc.	50 to 60 cc.
200 to 300 lbs.....	60 to 80 cc.	90 to 120 cc.	60 to 80 cc.
300 to 400 lbs.....	80 to 100 cc.	120 to 150 cc.	80 to 100 cc.
Over 400 lbs.....	120 cc.	180 cc.	100 to 120 cc.

\*Temperature not above 105° F. and hogs not showing marked symptoms.

**Butchering Serum-Treated Hogs**

“How soon after a hog is vaccinated, can it be butchered for food?” is a question we are frequently asked. If the single treatment has been used, at least ten days should be allowed to elapse between vaccination and butchering. If the double treatment has been used, it would be much better to wait at least three weeks. If at the expiration of this time, the hog appears to be healthy in every way, it is fit for food. If the hog shows any signs of sickness, no matter how slight, it should not be butchered until fully recovered, and then the carcass should not be used if it shows any extensive changes as the result of previous ailment.

**WHAT TO DO**

(1) **When hogs are well and no cholera is in the vicinity.**—We do not advise vaccination when hogs are well and no cholera is in the vicinity, provided precaution is taken to prevent infection from entering the herd. Susceptible hogs should not be sent to an exhibition without being protected with serum. Hogs brought back from shows or exhibitions, or newly purchased hogs introduced into healthy herds in uninfected neighbor-

hoods, should be isolated upon arrival, for 30 days. At the expiration of this time, if the hogs have shown no signs of sickness, they can be regarded as free from infection.

(2) **When hogs are well and cholera is in the vicinity.**—The double vaccination is usually recommended when hogs are well and cholera is in the vicinity, although it is not absolutely necessary, unless there is reason to believe that the hogs have actually been exposed. If the owner has his herd almost ready for market, it would be well to market the hogs without delay. If the hogs can be finished within a month, the single treatment will protect them that long. This should be done, if the cost of vaccination will not exceed the value of the gain in weight that the hogs will make. If they are to be kept longer than one month, the single treatment can not be relied upon to protect them until they are ready for market.

(3) **When hogs are sick.**—If sickness that may possibly be cholera, has made its appearance in the herd, it would be well in all cases to have the sick hogs examined by a veterinarian. Of course it is necessary to know whether the disease is cholera or not before ordering serum, especially if there is any doubt as to the nature of the trouble. It is also important to know whether cholera is complicated with any other disease or condition. If so, the serum administered would be wasted in the majority of cases. If the trouble proves to be cholera, with no other disease or condition present, the single treatment is advised for all hogs immediately exposed to the infection.

If there are several groups of hogs on the farm where the disease has appeared, those groups in which there is no sickness might well be given the double treatment. Hogs which are extremely sick or in an advanced stage of the disease should not be treated. It is not advisable to use serum in a herd where the disease has assumed the chronic form. Delayed treatment will usually bring disappointing results. Sows nursing pigs should not be given the double treatment. The single treatment is advised both for the sows and the pigs.

Pigs should not be given the double treatment before they are weaned, if it is desired to give them a permanent immunity. On badly infected premises, a plan that has worked out very satisfactorily is to give young pigs a small dose of serum, from 15 to 20 cubic centimeters, according to size, a couple of weeks before they are weaned. Then two or three weeks after they have been weaned, provided they weigh in the neighborhood of forty or fifty pounds, the double treatment may be given with reasonable certainty that it will confer permanent immunity.

## RESULTS OF TREATMENT

The following figures show five years' results following the use of serum produced and furnished by the state serum plant, as far as reports are available. The Veterinary Division has had difficulty in getting complete reports and those from which these figures have been taken represent only a small part of the serum that has been sent out. It may safely be said that if reports were available on all serum used, the percentage of losses would be much smaller, as we have found by experience that farmers will more readily report unsatisfactory results than good results following the use of the serum. The following plan has been adopted for securing information as to the results of serum treatment:

An accurate record is kept of all serum sent out; i. e., to whom sent, when, how much, laboratory number of serum, and other items. Report blanks are sent with all shipments of serum to be filled out by the veterinarian at the time the serum is administered, and mailed in a return envelope, furnished for that purpose. Such a report includes the name of the owner, post-office address, the number of hogs treated, their condition, weights, amount of serum used, history of outbreak, number of hogs that have died, and the number too sick to be treated. One month after treatment the Veterinary Division sends out a letter asking for a report of the results, especially the number of hogs that died of cholera within four weeks after the treatment.

We take this opportunity to impress upon all the importance of reporting these results. We like to know whether our serum is producing good results in the field. If it is not, we attempt to determine the cause. In reporting deaths following treatment, only deaths from cholera should be included. We have known of instances in which hogs were reported as having died from cholera subsequent to the administration of the serum, when investigation showed that they had died of some other disease.

CONDITION OF HERD	TREATMENT	HOGS TREATED	LOSS FROM CHOLERA	
			Number	Per Cent
Infected at time of treatment.	Serum-only . . .	7,896	1,214	15.4
	Serum-virus . . .	700	90	12.8
Healthy at time of treatment.	Serum-only . . .	4,349	4	0.01
	Serum-virus . . .	10,265	155	1.5
	Pen exposure..	690	10	1.4
Total.....	All methods..	23,900	1,473	5.1

It will be seen from the above figures that most of the losses following treatment were in those herds in which cholera had made its appearance before treatment was applied. In sick herds where care is taken to treat only those hogs which are apparently uninfected, good serum, properly administered, should save from 85 to 95 per cent of those treated. If all hogs in the herd, both sick and well, are treated, the loss will depend upon the extent of the infection. Five years' experience has shown that there should be few losses following the proper use of the double treatment in uninfected herds. It has been found that on the average no losses will occur in 75 per cent of such herds; but there will be some losses in about 25 per cent of healthy herds. These losses may not be great but even one case of cholera following vaccination means a new center of infection, and here lies the greatest objection to the continued widespread use of the double treatment. Altho the double treatment looks like a safe investment for the individual hog-owner, experience has shown that its unrestricted use on a large scale is not helping to control hog cholera.

It is practically impossible to introduce cholera into a perfectly well herd by the use of the single treatment, and if any hogs die within a

month after having had the single treatment, there is strong reason to believe that they were infected before treatment. If cholera makes its appearance in a healthy herd that has been given the double treatment, this usually takes place about the second week after treatment. If hogs given the double treatment show symptoms of cholera earlier than the seventh or eighth day and die earlier than the tenth day, it can safely be assumed that they were infected before treatment.

### DISTRIBUTING POINTS FOR STATE SERUM

The new law contains a provision for the establishment, by the Veterinary Division of the College of Agriculture, of one or more distributing centers in each county in the state, where state serum may be obtained without undue delay. The law does not specify that any certain persons or organizations shall have charge of these distributing points. It is believed that there would be little demand for double treatment if hog-owners knew that there was a supply of good serum easily accessible for use in sick herds when the emergency arises. It is to meet this condition that these distributing points will be established as rapidly as possible. Farmers' clubs, shipping associations, creamery associations, seed associations, swine breeders' associations, and others, have already taken up the matter with a view to taking advantage of the provisions of the new law. Usually each member of such a club contributes a small sum for the purchase of a stock of serum, this stock to be replenished as used. The amount of serum to be kept on hand will vary in different localities, with different organizations, and at different times of the year. Small quantities will suffice during the months when cholera is not prevalent. During July, August, September, and October larger amounts will necessarily have to be kept on hand. Ten thousand cubic centimeters would probably be the limit under all conditions. Some person or persons will have to be responsible for the serum; i. e., they will have to look after the financial management, ordering the serum, dispensing it, and seeing that it is properly kept at all times.

### RENVILLE COUNTY DEMONSTRATION WORK

In 1914 Congress appropriated about \$500,000 for experimental work in the control of hog cholera. This money was divided among some twenty different states, making the amount to be expended in each state from \$20,000 to \$25,000.

In Minnesota, Renville County was selected as the field of operation. Work was started on April 8, 1914, when headquarters were established at Olivia. The first herd was treated May 8. There had been 135 outbreaks of cholera in the county between January 1 and May 8, so that the disease had a fairly good headway when the work was started. At the time the first herd was treated it was known that cholera actually existed on 13 farms in different parts of the county. During this period 1,960 hogs were reported as having died. From the day on which the first herd was treated until January 1, 1915, there were 481 outbreaks and 3,109 deaths from cholera.

One of the first things done was the taking of a hog census. This revealed that about 9,000 hogs had died from cholera in the county during

the year 1912. During 1913 over 43,000 hogs died, a little over half of the number raised. It is estimated that over 100,000 hogs were raised in Ren-ville County in 1914.

The Federal Government furnished four veterinarians and a clerk. The State Live Stock Sanitary Board was represented by one veterinarian whose principal work was to see that quarantines were placed on infected premises and that these were not violated. He also supervised the disinfection of infected premises and stock yards and stock cars. No charge was made for the serum used or for the services of the veterinarians.

Reliance was placed solely in the single treatment, not a drop of virus having been used by the veterinarians, although they treated 13,524 hogs in 456 infected herds, and 165 hogs in 13 exposed but not infected herds.

Of the hogs treated, 1,094 died. This included 873 hogs that showed temperatures above 104 degrees and other symptoms at the time they were treated. In only 20 cases did hog cholera reappear later in infected herds treated with serum only. Of 2,419 hogs left untreated because they showed advanced symptoms of cholera, 1,956, over 80 per cent, died.

Nineteen outbreaks between January 1, 1915, and April 16, were reported, as compared with 135 during the corresponding period of 1914.

The work is being continued during the present year, 1915, and the men will undoubtedly be kept on the ground as long as funds are available. The work done so far shows that efficient hog cholera control depends upon four factors, namely,

(1) Organization, (2) Education, (3) Sanitation, (4) Vaccination.

Successful work is impossible without the proper organization of forces. Education of all interested persons by spreading knowledge of the disease and methods whereby it may be controlled is an absolute necessity. Sanitation means anything that will promote more healthy conditions and thereby lessen disease. Recourse to vaccination should be had only when made necessary by the actual existence of the disease or when the hogs have been exposed.

### DO NOT FORGET

That a great deal of cholera is spread needlessly and unnecessarily. Bear in mind the many ways of spreading the disease.

That good results in using the single treatment in infected herds depend mainly upon the promptness with which treatment is applied. Every day treatment is delayed, the heavier will be the losses.

To do the right thing by your neighbors. If you have cholera on your place, do not conceal it. Warn your neighbors that the disease exists on your premises and ask them to keep away until danger of spreading the infection is over.

That serum is perishable, and should be protected against exposure to extremes of heat and cold, direct sunlight, and air contaminations, such as dust.

That if there is any sort of an association or club in your community organized to fight cholera, you should join it immediately, so that you may secure the benefits of the organization if you should be so unfortunate as to get cholera in your herd. United effort will win in the fight against cholera.

That nine persons out of ten will underestimate the weight of a hog. If there is any doubt as to the approximate weights of the hogs to be vaccinated, several should be carefully weighed before starting to treat them. Select one of the smallest and one of the largest, so as to get the extreme limits of the weights. By doing this, big errors in dosage can be avoided.

That the person who does the actual work of injecting the serum should do nothing else. Plenty of other help should be available to catch and hold the hogs, and to cleanse the place of injection. Avoid breaking the cork in drawing it from the serum bottle. Particles of the cork falling into the serum may subsequently plug up the needles and cause considerable delay and inconvenience.

That hog cholera is a highly infectious and contagious disease, that may be carried from farm to farm in a great variety of ways unless extreme care is exercised. If every farmer will do his share, the work of controlling the disease will be much easier.



Fig. 12. Instruments and Materials Used in Vaccinating

Bottle of serum	Bottle of virus
Jar for serum	Small, wide-mouthed bottle for virus
Serum syringe	Virus syringe
Corkscrew	Tray for antiseptic solution
Cotton	Thermometer
Towel	Brush
Disinfectant	Soap

To promptly burn the carcasses of all dead hogs. Failure to do this may be followed by the prosecution of the owner of the hogs, for violating one of the laws of the state. Twenty-four hours should be ample time under almost any conditions.

That considerable loss can frequently be avoided by promptly separating and isolating all hogs showing signs of sickness. If the trouble proves to be something besides cholera, no harm has been done. If it is cholera, much spread of infection has been avoided.

That lime is a valuable disinfectant, at the same time being one of the cheapest. Freshly slaked lime should be scattered freely over the floor of the hog pens, alleys, and yards, and every few days raked up with the

manure and hauled to the fields. The lime still has considerable value as a fertilizer.

That hog cholera may be spread through the drinking water. If you have a choice, by all means give your herd access to water from a well, in preference to a running stream.

That a properly constructed, well lighted, drained, and ventilated hog house will pay in the end. It will not only be easier to keep in a sanitary condition, but in case disease should make its appearance, it can be more easily and thoroly cleaned and disinfected.

That money spent for hog cholera cures and preventives is usually wasted. Several of these remedies have been examined and tested by the different experiment stations. If you wish information about any of these that have been offered to you for sale, write the Experiment Station for information before you purchase.

### STATE LIVE STOCK SANITARY BOARD

The Minnesota State Live Stock Sanitary Board is composed of stockmen and veterinarians, appointed by the Governor. The purpose of this board is to protect the health of the domestic animals of the state. Local boards of health assist the sanitary board in the prevention, suppression, control and eradication of contagious and infectious diseases of domestic animals whenever possible. The board is given the power to quarantine or kill any animal infected with or exposed to any infectious disease, and in certain cases to remunerate the owner for part value of the animal. The board has the power to exclude from the state any animals which may injure the health of live stock in the state.

The law requires every person who knows or has reason to suspect that a contagious or infectious disease exists on his premises to notify the local board of health to that effect. It is unlawful for any transportation company to bring into Minnesota any domestic animals, except for immediate slaughter, unless they are accompanied by a certificate of health executed in regular form. Many other states require similar certificates. It is unlawful for any person to sell pure-bred cattle in Minnesota unless accompanied by a certificate of health.

The sanitary board maintains a staff of field veterinarians for carrying out the provisions of the several sanitary laws of the state, such as the investigation of outbreaks of infectious or contagious diseases, testing pure-bred cattle for tuberculosis, testing horses for glanders, administering hog cholera serum where the services of a competent veterinarian cannot be procured, and advising owners of the proper method of procedure in dealing with these diseases.

The board does not send out a field veterinarian unless the circumstances appear to warrant it, but encourages the employment of local veterinarians whenever possible. By so doing it is possible to save delays, which are sometimes unavoidable. In most cases the local veterinarian will be able to establish a diagnosis without awaiting the arrival of a field veterinarian from the sanitary board.

For a copy of a pamphlet containing the laws of the State of Minnesota relating to the State Live Stock Sanitary Board and local boards of health, and their duties and powers in dealing with animals and animal diseases, write to Dr. S. H. Ward, Old Capitol, St. Paul, Minn. Dr. Ward is secretary and executive officer of the State Live Stock Sanitary Board.