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BANG'S DISEASE OF CATTLE

With a Short Account of the Disease in Other Farm Animals

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BANG'S DISEASE

CONTAGIOUS ABORTION OF CATTLE

The disease known as Bang's disease, infectious abortion, contagious abortion, slinking, or dropping of calves, is infectious in character. Abortions resulting from injuries or causes other than germs are very uncommon. "Abortion" means the birth or expulsion of an immature fetus and this is one of the most prominent symptoms of this complex disease. "Sterility" (failure to breed) very often follows infection with the germs causing abortion. Retained placenta is also usually closely associated with abortion infection and the premature expulsion of a living fetus (premature birth), which usually dies, is most often due to the abortion germ, *Brucella abortus*. Approximately 85 per cent of all abortions are due to this germ. Diseases of calves, such as white scours and calf pneumonia, while they are not due to the same germ that causes abortion are often found in a herd in which the adult animals are harboring the abortion infection. Diseases of calves may occur, however, entirely independent of abortion infection. To sum up, Bang's disease, or bovine infectious abortion, is widespread, the most pronounced symptom of which is the birth of a dead fetus before time. Sterility, or failure to breed, and mastitis or garget are commonly associated with abortion.

HISTORY OF BANG'S DISEASE

Contagious abortion has been recorded since early times. In Germany the disease seems to have existed in a severe form in the latter part of the Eighteenth Century. Among the early investigations as to the nature of the infection were those of Nocard in France in 1885, of the Highland Agricultural Society of Scotland in 1886, of Bang and Stribolt in Denmark in 1897, and the Departmental Committee of the Bureau of Agriculture and Fisheries of Great Britain in 1909. In this country, MacNeal and Kerr, in 1910, pointed out the significance of the Bang organism in relation to abortion of guinea pigs. Since then many American investigators have devoted much time and thought to the study of Bang's disease or bovine infectious abortion.

GEOGRAPHICAL DISTRIBUTION

According to available data, this disease exists with more or less constancy in all countries where cattle raising is an industry. It appears to be world-wide. In the United States the disease has spread until in many herds of either purebred or grade cattle there are animals that have been or are infected with the organism causing the disease. It has spread widely in the United States during the last 20 years, owing in large measure to the increased traffic in purebred cattle. In Minnesota approximately 12 per cent of the cattle are infected.

IMPORTANCE OF THE DISEASE TO THE CATTLE INDUSTRY

The lack of reliable statistics concerning animal diseases in the United States makes it difficult to estimate even approximately how great are the losses that must be charged against a widespread, insidious, common disease like Bang's disease. The estimates have varied from $25,000,000 annually to much larger amounts, but most of them have been based largely on tangible or actual losses in various communities. No definite, searching, universal survey has ever been made that took into account the tremendous losses that are not tangible. Consequently, all estimates that have been made may have fallen far short of the actual losses.

One must not be content to figure the probable value of a calf that was expelled dead or is weak or does not live; the shrinking of beef in the beef animal; the diminished production of milk in the dairy animal; the temporary or permanent sterility that may follow the infection, and not infrequently the loss of the cow herself through infection. Serious as these are, we must yet take into account the enormous financial loss that the breeder of select purebred cattle may suffer because of the disease in his herd. A careful study made at Storrs (Connecticut) Agricultural Experiment Station showed that the loss per cow in milk production alone was over $100 annually.

Rich, studying the economic factors of abortion of cattle, found that the total loss resulting from abortion in the University Farm herd over a period of 29 years was $12,760. This did not include losses from cows giving birth to dead calves over 260 days' calving period.

He also determined that the loss resulting from abortion in a good commercial grade herd of 16 cows was $136, and in a typical purebred herd, $486 annually.

Veterinarians and cattle breeders know that Bang's disease is a widespread, economically important evil. The trouble they are having because of it makes them more eager to discuss it than any other infectious disease of cattle, and we know from general observations and special studies that it is more widespread and more common than it was some years ago. It will continue to spread and become more common unless a real fight is made to control and check it.

CAUSE OF BANG'S DISEASE

Bang's disease in cattle is caused by a very small, short, oval-shaped germ, so small, in fact, that thousands of them piled one on top of the other cannot be seen with the naked eye. In order to determine their size and shape they must be viewed through a microscope. This organism, now called *Brucella abortus*, was first described as the cause of a contagious abortion in cattle by Prof. Bernhard Bang of Denmark, and for this reason this type of abortion is called Bang's disease. (See Plate I, Fig. 1.)

The germ causing Bang's disease may be found in the udder, the pregnant uterus, and in the discharges from the vagina of cows a short time after aborting or giving birth to a full-term calf. The average length of time that this germ is found in the vaginal discharges is two

to three weeks after calving or aborting, and during this period a cow is especially dangerous as a spreader of disease to other cows. The abortion bacteria are found in the milk and the udders of cows that have aborted, and in certain instances in the milk of those that have not been observed to abort. Many of these cows become permanent carriers of the Bang organism in their udders, and it is shed continually in their milk. The germ may also be found in the bodies of aborted fetuses and full-term calves.

PLATE I

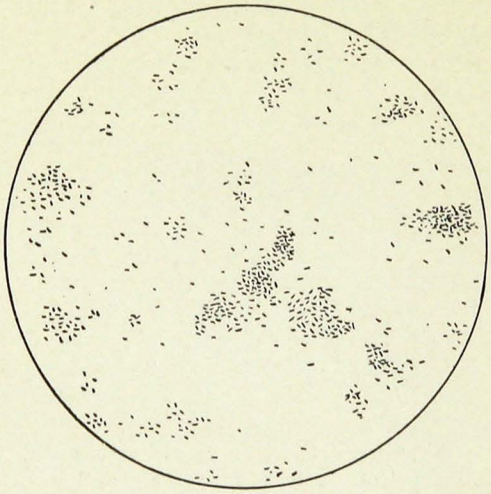


Fig. 1. *Bact. abortus*, the Germ Causing Contagious Abortion. Magnified 700 Times

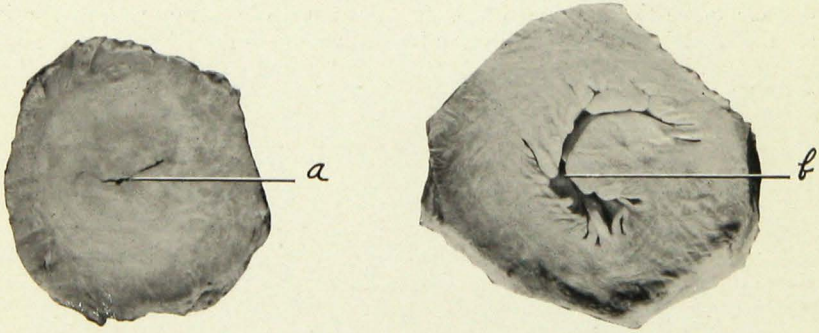


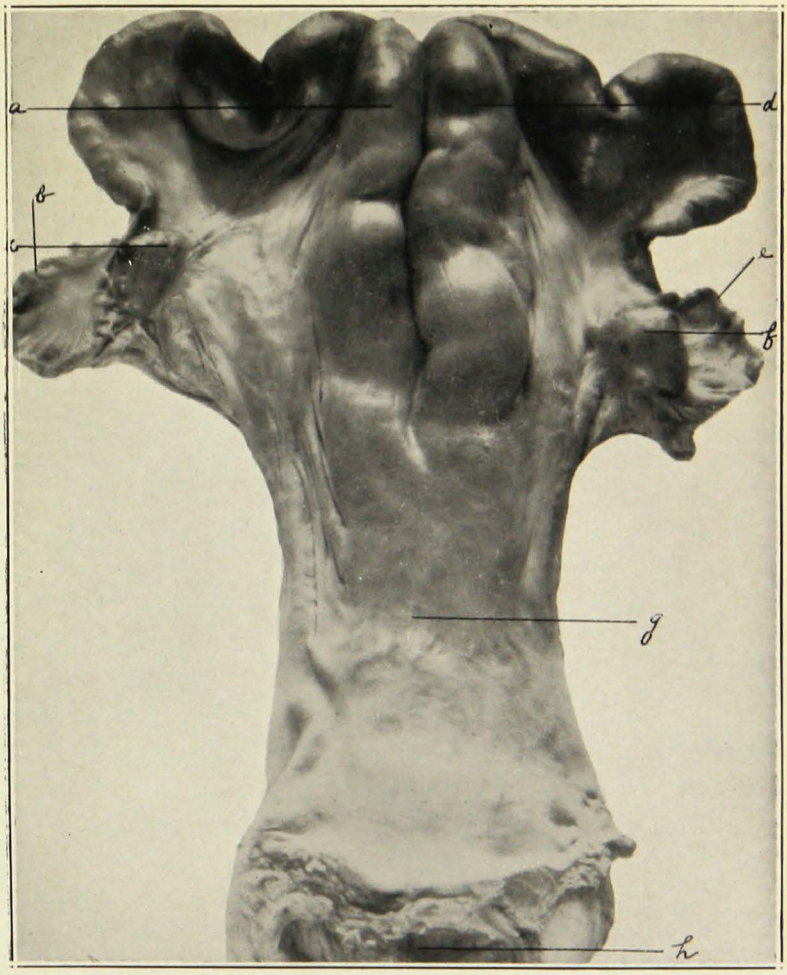
Fig. 2. a. Cross-Section of Cervix or Neck of Womb Showing Normal Small passage from Vagina to Womb

b. Same Passage Near the Vagina

This opening is completely closed only when the animal is pregnant, and contrary to popular opinion seldom requires "opening" in order for the animal to breed.

This organism does not as a rule live long in pastures or barnyards and is killed in four to five hours when exposed to direct sunlight. When protected from the air and the effects of drying and sunlight, as in manure, it will survive for many days. A 2½ per cent solution of cresol will destroy the organism in 15 minutes, and if heated to 60 degrees Centigrade or 140 degrees Fahrenheit, it will be killed in 10 minutes.

PLATE II



Normal or Healthy Bovine Uterus

a. Left horn of uterus
b. Left Fallopian tube
c. Left ovary
d. Right horn of uterus
e. Right Fallopian tube
f. Right ovary
g. Body of uterus
h. Location of opening of cervix

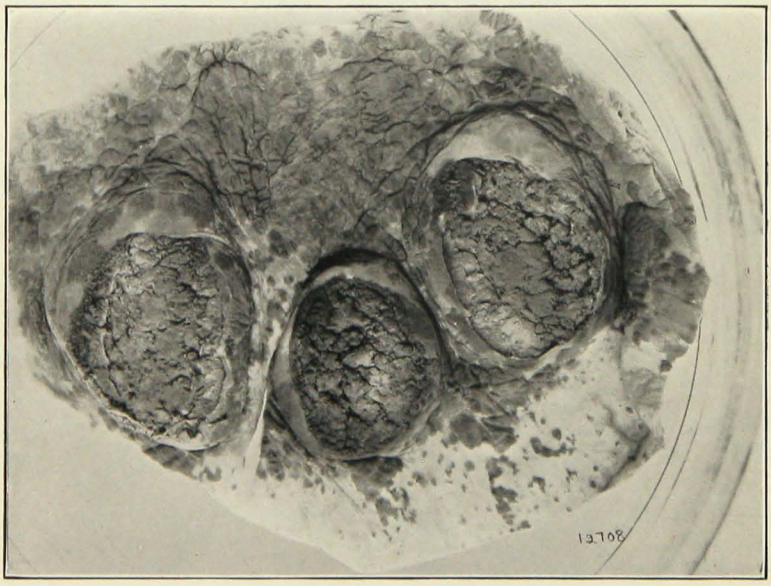
It has been estimated by various authorities that 85 per cent of the abortions in cattle are due to Bang's disease. The other 15 per cent of the abortions are due to different causes such as infections with other bacteria or protozoa, eating poisonous plants, violent physical injury to the pregnant mother, or improper nutrition. The only other type of infectious abortion resembling Bang's disease, in that a number of cows in the same herd become infected and abort, is an infection known as *Vibrio fetus*. This infection differs in many respects from the disease under consideration and has been found in only a few herds in Minnesota.

Brucella abortus has some very close relatives in similar bacteria causing abortion in sheep, goats, and swine, and is sometimes found in fistula and poll evil of horses. Humans also have contracted a disease called "undulant fever" from drinking infected cows' milk or handling infected swine carcasses. This entire group of diseases is sometimes referred to as "Brucellosis."

METHOD OF DEVELOPMENT

The act of abortion, which is the most prominent symptom of Bang's disease (contagious abortion of cattle), is produced by an inflammation of the cotyledons or so-called "buttons" which unite the inner lining of the uterus (womb) of the mother and the coverings or membranes which cover or envelop the fetus (calf). The severity and extent of the inflammation of the cotyledons and other portions of the membranes determine largely whether or not a pregnancy will terminate in a full-

Plate III



Part of the Fetal Membranes Showing Cotyledons or "Buttons" Extensively Diseased as a Result of Infection with the Abortion Organism

time or a premature birth, or in abortion. If the involvement of the attachment between the maternal and fetal membranes has been severe and has occurred during early pregnancy, it often results in the expulsion of a dead fetus, while a lesser involvement may result in the birth of a live, tho much weakened, calf. Such calves frequently die shortly after birth. If they continue to live, they offer little resistance to the germs that cause white scours and pneumonia, the common diseases of the newborn and young calves. Infected or diseased cows may produce strong and vigorous calves and promptly expel the fetal membranes (afterbirth), but still be a grave source of danger by spreading the germs through the fetal fluids during the act of birth, and later through discharges from the genital tract.

CHANNELS OF INFECTION

The germ usually gains entrance to the body of the cow through the digestive tract. The vagina does not seem to be an important way by which the germ gets into the body. Infection by way of the digestive tract usually occurs by the animal consuming food that has become contaminated by the genital discharges of an infected animal. Also, animals are accustomed to lick themselves or other cattle and in this manner virulent abortion germs may gain entrance to the body. In recent years it has been shown that cattle can readily be infected by placing the germs in the eye. The importance of the eye as an avenue of natural infection is not known, but it may be of some importance. It has also been shown that the germs will enter the body of laboratory animals and cattle through the unbroken skin. The importance of this method has not been determined, but it suggests another probable channel through which animals may contract the disease. The part played by the bull in the transmission of the disease has long been a matter of much dispute. Experimental evidence shows a possiblity that the bull may transmit the disease by being actively infected and eliminating the germ in the semen. There is also experimental evidence indicating that there is a possibility of the germs entering the udder of a cow through the teat canal.

Calves do not usually harbor infection from birth nor do they usually become permanently infected with the germ through nursing mothers harboring abortion bacilli in their udders, providing this practice is discontinued early in the life of the calf. Experimental evidence has shown that calves fed on milk containing abortion organisms may eliminate living abortion bacilli in the feces. This elimination must be considered as a factor in the spread of the disease. Heifers that have begun to come in heat, however, should be carefully kept from all material contaminated with abortion germs.

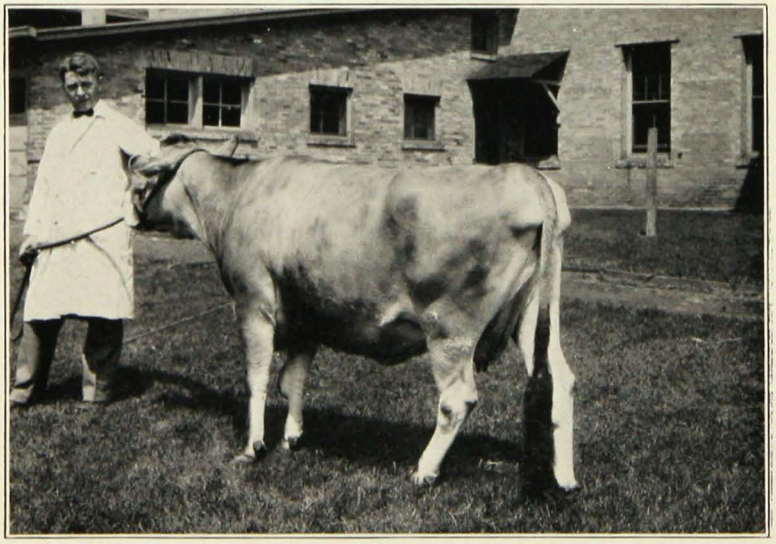
IMMUNITY AND SUSCEPTIBILITY

Calves under six months of age are especially resistant and might be said to be immune to Bang's disease. Sometimes they will give a positive blood test, but as a rule they do not become permanently infected. Young heifers in their first and second pregnancies are particularly susceptible to this disease and if exposed to infection usually

contract it and abort. Older cows also contract this disease tho not as readily. Bulls are less susceptible but at times will give a positive blood test. Occasionally there will be a sudden inflammation in one or both testicles of the male due to the abortion bacillus and there may be a temporary, reduced fertility. Not infrequently the animals will become permanent nonbreeders. No one breed or type of cattle is any more resistant to this infection than another, and the disease is no more prevalent in one breed than in another.

Not all animals when exposed to Bang's disease react alike. There are varying degrees of susceptibility. If infection is introduced into a clean herd, the females of breeding age may be grouped into distinct classes depending upon their natural resistance to Bang's disease. Some animals appear to have resistance or immunity against the disease. These animals, however, are relatively few in number. One group will become infected, some of them will abort, and most of them will be spreaders of the disease through their milk and vaginal discharges. These cows may recover in a year or more, occasionally in a few months, and cease reacting to the agglutination test and spreading bacteria. This group is also small because most cows that acquire Bang's disease after they reach the breeding age do not recover and may be spreaders of infection as long as they live. Two degrees of resistance are found among cattle that remain infected. Some of them will become normal breeders and to all appearances will be normal cows. These animals are, however, still spreaders of Bang's disease. A high percentage of cattle belong in this group. However, a large number of infected animals become unproductive breeders and abort repeatedly (see Plate IV) or

PLATE IV



This cow has aborted six times and had one living calf at full term, as a termination of seven pregnancies.

fail to conceive when rebred and are a total loss as far as reproduction is concerned.

There is evidence of resistance or immunity to this disease by some animals under special conditions. This tendency toward immunity has acted as a stimulus to investigation in the attempt to produce a satisfactory artificial immunity. The hope of controlling Bang's disease by vaccination has not yet been realized. The only method that has shown much promise of success consists in vaccination with living abortion germs of reduced virulence. Experimental evidence and experience have shown that vaccination frequently reduces the percentage of abortions in a herd. However, the resistance resulting from vaccination is not consistent, and the results have not been sufficiently satisfactory to justify recommending this method of combating Bang's disease. Further experimentation may evolve a method of vaccination which is satisfactory for its control.

SYMPTOMS

The period of incubation (the time elapsing between the exposure of an animal to infection and the development of the signs of the disease) varies. According to Bang it is about 10 weeks. In producing the disease experimentally, the period of incubation has been determined as approximately 130 days. The symptoms preceding the expulsion of the fetus are a dough-like swelling of the udder ("making bag") together with swelling of the vulva, followed by a yellowish brown, odorless discharge from the vagina. Restlessness and stamping of the hind feet may also be noticed. These symptoms usually appear two or three days before the fetus is expelled. Occasionally heifers have been observed to make bag and even give milk at the sixth month of gestation, the abortion not taking place until about the seventh month. Swelling of the udder in advanced pregnancy does not always indicate abortion, as heifers usually make bag a few weeks before parturition.

Cows will often abort without manifesting any symptoms beforehand. When heifers or cows abort in the early stages of pregnancy, the fetus will be expelled enclosed in its membranes, but when the abortion occurs after the fifth month of gestation, the membranes (afterbirth) are frequently retained. The largest percentage of observed abortions take place between the fifth and seventh months of pregnancy, altho abortion may occur at any time during the period of gestation. An animal may abort during the first or second month of pregnancy and the act pass unnoticed. Following abortion, some excitement may be noticed in cows and at times they will show signs of being in heat. The discharges following an abortion continue for two weeks, or longer if the lining of the uterus is severely inflamed. If there is little or no inflammation, only a slight discharge may be noticed, especially in the early abortions (first and second month). The discharge becomes yellowish-gray in color, sticky in character, and accumulates on the tail and other parts with which it comes in contact. The appetite is at times impaired, the back is arched, and there is more or less straining, owing to the irritation of the uterus. The milk flow is slight at first and one or more quarters of the udder may remain swollen for several days.

The calf is born dead, as a rule. If alive, it frequently dies shortly after birth.

The calf born alive is usually weak and undersized and often dies from diarrhea or remains in a stunted condition. In rare cases the fetus becomes mummified (dried up). In every herd where abortion occurs or gains a foothold, some of the animals that have aborted and apparently recovered will fail to conceive (breed), tho served by the bull numerous times. Such animals are known as non-breeders. Enlarged joints, especially the knee and stifle joints, are common in cattle affected with Bang's disease. (See Plate V.)

PLATE V

Big knees of cattle are often associated with *Br. abortus* infection.

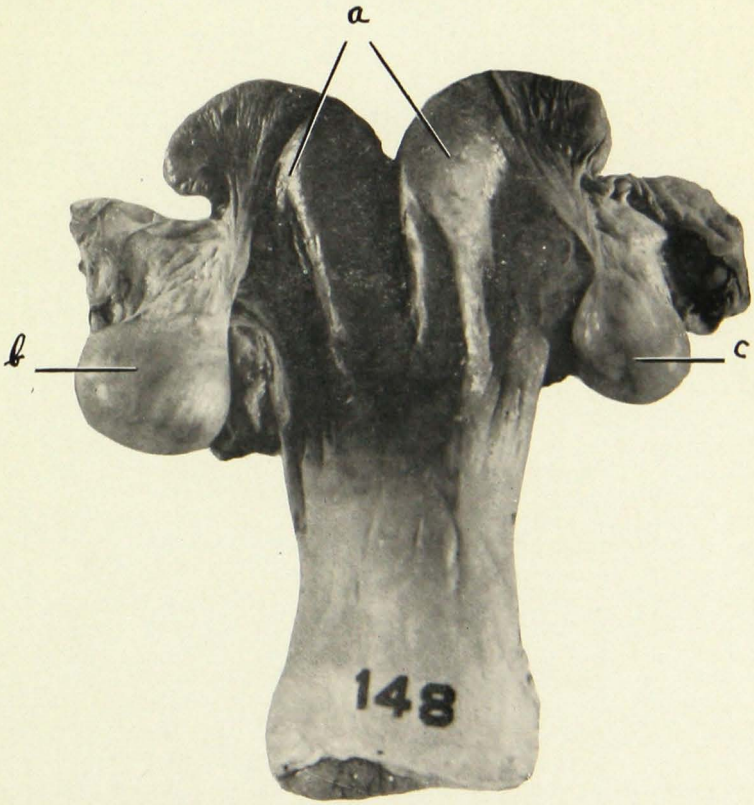
Retention of the Fetal Membranes

Retention of the fetal membranes is recognized as the most common symptom of infection of the uterus. It is a common condition in cows in which infectious abortion is known to exist, and frequently interferes with the future breeding efficiency of the affected animal. The arrangement of the attachments of the fetal membranes is quite complex in the cow, and consists of from 70 to 100 vascular cotyledons (buttons) scattered over the envelopes enclosing the calf and directly attached to the same number of cotyledons on the lining of the uterus of the mother. These areas of attachments, which are round to oval in shape, form the only paths for the interchange of nutrition and waste material. The blood vessels of the fetus (calf) and those of the mother are not continuous, but are separated only by a thin membrane. The fetal membranes have an important duty, but following the birth of the calf they are of no further value. Unless they are promptly expelled or removed

by hand they rapidly undergo putrefactive changes which may be responsible for a decreased milk flow, and for changes in the reproductive organs, resulting in temporary or permanent failure to again successfully get in calf. Retained afterbirth occasionally terminates in death. The fetal membranes of cows free from infection are usually expelled within 4 to 6 hours following birth of the calf. When the afterbirth has been retained for more than 9 or 10 hours, inflammation is evident and the afterbirth should be removed by hand.

Failure to breed, in most cases, probably is due to inflammation of the lining of the uterus, or to pus in the uterus often the result of retained afterbirth. Cystic degeneration of the ovaries is not uncommon in aborting cows and is undoubtedly responsible, in certain cases, for temporary or permanent failure to breed. (See Plate VI.) Cows in which the ovaries are extensively degenerated have irregular and frequent heat periods, and tho they are bred numerous times they fail to conceive. (See Plate VII.)

PLATE VI



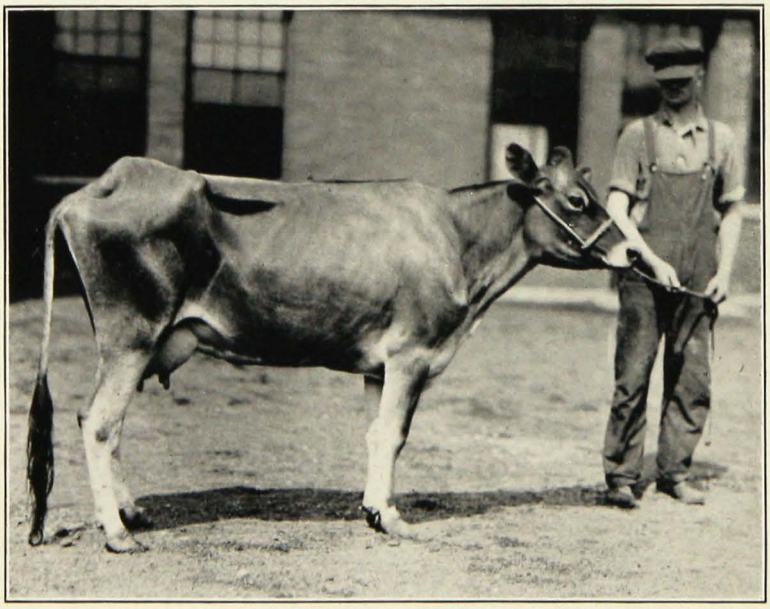
Uterus and Large Diseased Ovaries Which Are Cystic, from a Non-Breeding Cow

a. Horns of uterus
b. Cystic ovary, left
c. Cystic ovary, right

In cattle, as in other mammals, during a heat period an egg bursts from the ovary and is conveyed to the uterus by the Fallopian tube. The union of the egg (the female element) with a spermatozoön (the male element) results in the formation of an embryo, or young. The place left in the ovary by the rupture of the egg sac (Graafian follicle) is taken by cells having a peculiar yellowish pigment, which together make up what is termed the *corpus luteum* or "yellow body." (See Plate VIII.) If the ovum (egg), which was discharged at this time is fertilized and pregnancy results, this so-called yellow body, or *corpus luteum,* grows to considerable size (three-quarters of an inch to an inch in diameter) and remains in the ovary during pregnancy. Following parturition (giving birth) the *corpus luteum* is gradually absorbed. If the ovum is not fertilized, the cells of the *corpus luteum* begin to disappear or to be absorbed within two weeks following a heat period.

It happens, not infrequently, as a result of deranged functions of the genital organs, that the *corpus luteum* is not absorbed or the retrogressive changes do not take place. The *corpus luteum,* tho pregnancy has not taken place, remains unchanged. This condition frequently interferes with the further ripening and escape of ova by mechanical interference and also by an internal secretion. Both of these, that is, the one resulting when pregnancy has not taken place and the one which is not absorbed after pregnancy is terminated, are termed "retained *corpora lutea.*" As a result of these retained yellow bodies the animal may fail to come in heat, often leading the breeder to suppose that the

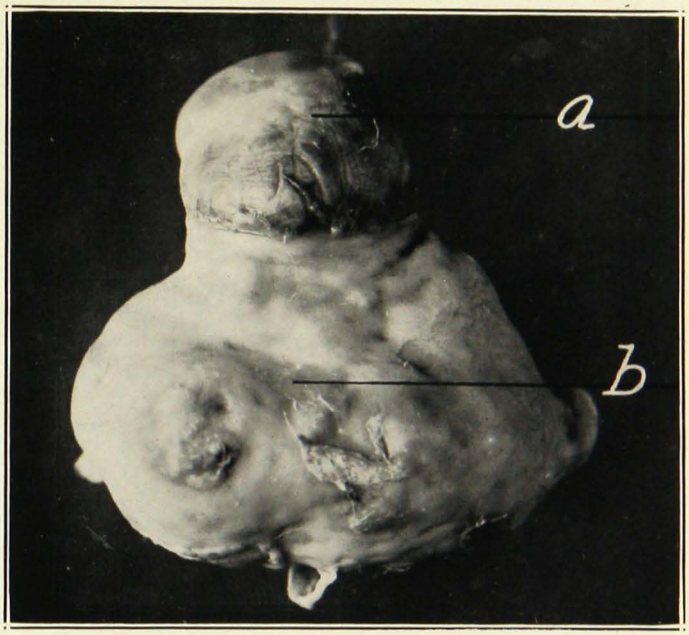
PLATE VII



Sterile Cow as a Result of Cystic Ovaries (Note condition of tail head.)

animal is pregnant or permanently sterile. A retained *corpus luteum* may become cystic (cavities develop within, filled with fluid) which interferes with the function of the ovary and results in constant or irregular heat periods. Animals thus affected imitate the male animal and are often called "bullers."

PLATE VIII



Ovaries Showing a Large Retained *Corpus Luteum*

a. Retained yellow body or *corpus luteum*
b. Body of ovary

To sum up, then, the observed act of abortion is only one of the symptoms of this disease. The animal may abort during the early stages of pregnancy and the fact pass unnoticed, the owner simply thinking that she did not conceive at the previous service. Discharges from the vagina, especially of a brownish or yellowish color, abundant, and at first odorless, indicate infection. Failure to breed is frequently the result of an initial infection by *Brucella abortus*.

HOW BANG'S DISEASE (CONTAGIOUS ABORTION) IS SPREAD

The introduction of diseased females into healthy herds is the most common method of spreading the disease from one herd to another. Traffic in cattle has been a most important factor in the dissemination of this disease into the large number of herds in which it exists at present. Owners of cattle should be exceedingly cautious in selecting animals to be added to healthy herds. Not all diseased females abort

their young. The fact that a female has a normal calf is not conclusive evidence that she is free from this disease. Many cattle buyers have been misled by the appearance of a normal number of calves in ratio to the number of females in a herd from which purchases are to be made. The only reliable or practical method of selecting animals for introduction into healthy herds is the intelligent use of the agglutination blood test.

Susceptible females may contract the disease if they are housed in stalls in which animals have aborted. Common carriers (trucks and railroad cars) should be considered as possible sources of infection unless they have been thoroly cleaned and disinfected.

Diseased females are a constant source of danger to other animals in the herd. They are particularly dangerous at the time of calving or aborting and during the period preceding and following the expulsion of the fetus from the uterus, during which there is a discharge from the genital organs. The contents of the uterus (fetus, fetal membranes, and fluids) contain myriads of the germs and when expelled become agents by which the disease spreads. A diseased female may give birth to a normal calf and yet be an important source of danger to healthy animals. Experimental work has shown that 25 days is the maximum time following abortion that the germs will be spread by the discharges, and they are scattered only a few days before.

Abortion germs are commonly discharged in the milk of diseased cows. Mature animals do not usually have an opportunity to contract the disease from this source. However, the milk of diseased cows should be considered an infective agent. The openings in the teats of a few animals are excessively large (leakers) so that milk is more or less continuously discharged. In these cases, when the milk contains abortion germs, they may contaminate grass or other foodstuffs. Careless handling of milk, such as milking onto the floor of the barn, may provide an opportunity for the abortion germs in the milk to gain access to healthy animals.

Young calves are usually not susceptible to infection with abortion germs. It is advisable to allow the newborn calf to get the first milk (colostrum). The first milk of diseased cows can usually be fed without serious danger to a young calf, altho the calf should not be fed milk from diseased cows any longer than is absolutely necessary. In most cases it is possible to select healthy animals to provide milk for calf feeding. Considerable evidence indicates that some young heifers take in abortion germs with milk and retain them without showing any evidence of the disease until later. This is not, however, a common occurrence. When heifers have reached the age of sexual maturity, some of them are very likely to contract the disease if allowed to drink milk containing abortion germs.

The germs taken in with the milk are eliminated through the manure of young calves. The statement has frequently been made that heifers under 6 months of age are the safest females to add to healthy herds. Such animals are usually safe provided they are negative to the blood test and are isolated for 2 or 3 weeks, until the germs are eliminated

from their bodies, before they are allowed to enter the premises used by healthy animals. The feet, legs, and abdomen of such calves should be washed with an antiseptic solution (2 per cent sheep dip) before they are moved to the quarters occupied by the abortion-free animals.

This disease probably spreads as frequently in the pastures and paddocks as in the barns. Animals abort without giving any warning and the fetus has been expelled before the herdsman realizes that anything is wrong with the animal. Many early abortions pass unnoticed. Pasture calving has been advocated by some persons, but it frequently is responsible for the spread of abortion disease. The use of clean maternity stalls for all calving or aborting animals is of great value in preventing spread of the disease.

The segregation of infected and healthy animals in different parts of the same barn will not prevent the spread of this disease if a common pasture or paddock is used.

The bull is not an important factor in the spread of abortion disease. It has been stated that the sire may carry the germs on his penis. This is not an important method of spread. The bull himself may become infected and eliminate the germs in his semen. When the bull is harboring abortion germs they may be discharged into the vagina of the female at the time of service. As a rule the germs will not enter the circulating fluids (blood or lymph) of the cow's body from the vagina. The germs that enter the vagina at the time of breeding may later pass out of the genital tract and contaminate the tail and external genitals and drop onto grass or other foodstuffs. Other females may then take these germs into their bodies through the mouth by licking the cows or consuming foodstuffs that became contaminated in this manner. In the present state of our knowledge, the digestive tract is the chief way by which the animal becomes naturally infected with the germ.

While it is not a desirable practice, experience has shown that the breeding of healthy bulls to diseased and healthy cows rarely, if ever, results in the spread of Bang's disease if the mating occurs on neutral ground, that is, not used by healthy or diseased animals. Some other germ diseases of the genital organs of cattle are regularly transmitted by the bull from one cow to others through the act of service.

There are numerous other ways, such as drainage, contamination of barn equipment and shoes and clothing of attendants, and pastures separated by single fences, in which infective material may be transmitted to healthy females. It is likely that not all of the methods of spread of this disease are understood. When the various ways in which this infection spreads are considered, the difficulties met with in its control are realized. It is not easy to prevent the spread of this disease, but experience has shown that it can be done successfully. Light, cleanliness, and ventilation are prime factors from the standpoint of control and should be observed as carefully and rigidly as possible. Taking into consideration the foregoing facts, the breeder will readily appreciate the need of good stable sanitation, the proper disposal of infective material, and the danger of introducing new animals into the herd.

DIAGNOSIS

The history of abortions in a herd may be strongly suggestive of this disease, but an absolute diagnosis of Bang's disease cannot be made without a laboratory examination. Two facts must be remembered: (1) Some cows may never abort, yet they are dangerous spreaders of Bang's disease; (2) some cows that are not infected abort. Since we cannot rely entirely on the history and symptoms for an accurate diagnosis, and since approximately 85 per cent of abortions are due to Bang's disease, it is far safer to have a laboratory examination made in all cases. This diagnosis may be a bacteriological examination of such material as milk, aborted fetuses, afterbirths, or vaginal discharges, or it may be a blood test.

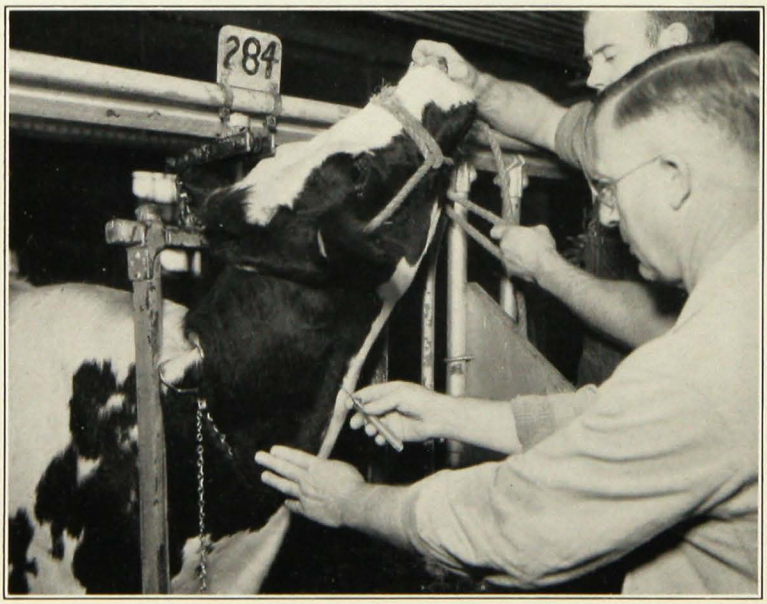
Bacteriological Examinations

By bacteriological examinations it is possible to isolate the bacteria and to grow and study them in the laboratory. These methods are too expensive and require too much time to be adaptable for the routine diagnosis of this disease in a large number of animals. The blood test is as reliable, less expensive, more rapid, and therefore more practical for examining large numbers of cattle. In the past, bacteriological examinations have demonstrated the dependability of the blood test.

Blood Tests

A safe, reliable, and practical method of diagnosis of abortion disease is available in the blood test known as the agglutination test. (See

PLATE IX



Simple and efficient method for collecting blood for testing for Bang's disease.

Plate IX.) This test will not determine which of the diseased females have or will abort. It will determine which are or have been harboring the Bang germ and are consequently possible sources of infection.

It is not claimed that the agglutination test is 100 per cent reliable, but it is *sufficiently reliable to permit the successful control of abortion disease.* Animals that are tested for Bang's disease are divided into three groups: (1) positive or reactor, (2) suspicious, (3) negative.

Positive animals are or have been harboring the germs and should be considered dangerous to other animals.

Suspicious animals are those in which a single blood test does not justify classifying them either as positive or negative. They should be retested in about 30 days.

Negative animals are not at the time of the test infected with *Brucella abortus,* except those that have very recently contracted the disease and have not yet developed evidence of it in their blood. An occasional diseased animal will have a negative test if the blood sample is obtained either a few days before or after a calving or abortion. The explanation of this negative phase is not known, but in such cases it often causes persons to unjustly question the accuracy of the agglutination blood test. The fact that an animal has a negative test does not mean that it will remain negative, because there is always danger of subsequent infection. Too much reliance should not be placed on a single negative test, especially if there is evidence of active infection in the herd or if the blood sample has been taken a few days before or after a calving or abortion.

It is of interest to note the percentages of cattle tested in Minnesota that fall in the foregoing groups. Approximately 12 per cent are positive, 2 per cent are suspicious, and 86 per cent are negative. Recent extensive experiments have shown that the slight discrepancies in the results of the agglutination blood test are confined to the tests of the group of suspicious animals. Even in this group, the blood test has been perfected to a high state of efficiency. This means that the agglutination blood test has an efficiency considerably in excess of 95 per cent, which is as near perfect as is necessary for its successful and practical use as a diagnostic method.

Two methods of conducting the agglutination test are in use:

(1) The "test tube" method in the State of Minnesota is done only by trained technicians at the laboratory of the State Live Stock Sanitary Board, University Farm, St. Paul. Blood samples are collected by the veterinarian and sent to this laboratory for the test.

(2) The "plate test" during the last two years has been done in the field by veterinarians especially trained and instructed in the application of this method.

Both tests involve similar principles and differ only in the method of applying the agglutination blood test. The plate test has the advantage of saving two days in obtaining results and offers promise of supplanting the old "test tube" method. Either test if properly conducted is equally satisfactory.

One of the principal factors limiting progress in the control and eradication of this disease is a lack of faith on the part of many cattle owners in the results of the agglutination blood test. When this test is thoroly understood, properly conducted, and rightly interpreted, it is an invaluable aid in the recognition and control of this disease and has been found to be as reliable as the tuberculin test.

PREVENTION AND CONTROL

The most successful method of treating contagious abortion is to prevent its spread. Various drugs have been used for its prevention and treatment, and while the results obtained vary considerably, none have proved of value. *There is yet no reliable cure for contagious abortion.*

The most active source of spread of this disease is the recent aborter. Sometimes a cow may calve normally and still scatter the abortion germs with the fetal and uterine fluids. It is therefore very important that animals be kept apart from the herd at the time of calving. Usually the germs disappear from the uterus in a few weeks. The longer isolation can be continued, up to 30 days, the safer, but if this period is not practicable on the farm, all animals that have recently calved should be classed as infected and kept apart until all discharges cease. Cleaning and carefully disinfecting the parturition stall are important. All infected material and bedding soiled by discharges should be burned. The bull should be kept apart from the herd and breeding should be only on neutral ground (that is, ground not used by other cattle). After breeding, cows should be confined in stanchions where there is little danger of licking themselves or being licked by other animals. It is an excellent precaution to wash with soap and water the back parts of the cow which has been bred before allowing her to associate with other animals. It is always advisable to keep her confined until the heat period passes.

It has been stated that many cows give off the germs of abortion in their milk. This is true of animals that have never aborted. Milk, therefore, should be considered an infective agent and carefully kept from contaminating the food of heifers or cows. Milk does not seem to be infective to young calves. Infection can take place through the teat canal, altho this is probably an unusual channel. Care must, however, be taken to have the hands clean and the suction cups of the machine disinfected before the milking of each animal.

These precautions do not eliminate all the possible sources of infection, but they dispose of certain of the most active sources of infection and go to make up good stable sanitation, which should be practiced by every breeder whether or not his herd is infected with Bang's disease or contagious abortion.

Various bacterins, vaccines, and serums are on the market for the prevention and control of Bang's disease. Numerous experiments have been conducted at University Farm to determine, if possible, the actual value of these agents. As a result of our experiments, we have come to the following conclusions:

1. The living vaccine produces some immunity to invasion of the

placenta by *Brucella abortus*. The degree of immunity varies according to the individual, and the variations are marked.

2. The dead bacteria or bacterins have very little immunizing value.

3. Abortions occur in animals that have been treated with vaccines. It is true that living vaccines may reduce the abortion rate, but not to the desirable minimum. A large dairy herd in which we conducted experiments for three years showed an abortion rate of 11.9 per cent among the vaccinated animals. In the controls, or unvaccinated cattle, the rate was 16.6 per cent.

Experiments conducted by the Federal Bureau of Animal Industry, Washington, D.C., with calf vaccination have yielded interesting results. This plan of vaccination provides that calves shall be tested by the agglutination method for the presence of Bang's disease, and if negative shall be injected with a living vaccine of reduced virulence between the ages of five to seven months. These vaccinated individuals are again tested when they reach breeding age. If they are positive to the agglutination test at this time, they should be eliminated from the herd. Adult animals or animals positive to the agglutination test are not vaccinated. It is thought that in this way sufficient resistance can be given to the vaccinated calves so that they will be able successfully to resist infection in badly diseased herds. If the plan is successful, the positives will gradually be eliminated as they become unprofitable, and a completely negative herd will result. *This vaccination method is still in the experimental stage.* Results of its use will be watched with interest to determine accurately its value in Bang's disease control.

If a breeder should desire to have his herd vaccinated under Federal supervision, he may apply to the office of the U. S. Bureau of Animal Industry, 1047 Post Office Building, St. Paul, Minnesota. If a breeder desires his herd vaccinated without Federal supervision, his veterinarian can obtain a permit for the use of vaccines by applying to the office of the State Live Stock Sanitary Board, State Office Building, St. Paul, Minnesota.

A breeder can never expect to eradicate the disease from his farm if he employs living vaccines on all animals both old and young. It should be borne clearly in mind that the disease is kept alive on the farm where living vaccines are improperly used.

The only feasible method for controlling Bang's disease, in the light of our present knowledge, is on the basis of the agglutination blood test and the maintenance of a herd free of the disease. Before we outline the methods that may be used in freeing herds from this disease, we wish to point out several important things: (1) Traffic in cattle indicates that it will not be long before all animals sold for dairy or breeding purposes will have to pass a negative blood test for Bang's disease. At present 34 states require a health certificate for this infection and 8 additional states will not allow an animal positive or suspicious to a blood test to enter. (2) Altho the public health aspects of undulant fever in man, in our judgment, are not prominent, nevertheless they cannot be ignored. Consumers of raw milk, pasteurized milk, butter, and cheese are already demanding that these products come from animals

free from Bang's disease or contagious abortion. (3) Herd owners should fully understand that even tho Bang's disease is entirely eliminated from the herds, some abortions may occur. We estimate, as stated before, that the Bang organism is responsible for approximately 85 per cent of the abortions. Occasionally abortions occur in any medium-sized herd. Sterility may also occur in herds free of Bang's disease. The number of abortions and sterile cows, however, is materially reduced when this disease is eliminated from a herd.

During the summer of 1934, owing to extraordinary drouth conditions, several million dollars were set aside by the AAA to provide indemnity for cattle slaughtered because of infection with Bang's disease. This was a cattle reduction program. This Federal Bang's Disease Project was set up in many states. One of the earliest states to take advantage of the federal indemnity was Minnesota. Already many cattle owners of this commonwealth had taken advantage of the plans offered by the State Live Stock Sanitary Board to free their herds of Bang's disease by means of the agglutination test. No indemnity had been available. These owners as well as many others were ready to take advantage of any indemnity provided. This project started, as above stated, on a cattle reduction basis. It has now become a disease control project and is officially known as "The Federal-State Bang's Disease Program." It operates approximately as follows: The cattle owner signs a contract with the Federal Government and usually at the same time signs the special modified agreement with the Minnesota State Live Stock Sanitary Board for owners whose herds have been tested under a federal contract. Both of these contracts are given in full in the latter part of this bulletin. The federal contract provides for indemnity up to a maximum of $25.00 for grade and $50.00 for purebred cattle for all animals condemned as reacting to the agglutination test for Bang's disease. The reacting animal is appraised at the time it is branded. The owner receives the amount of indemnity noted above up to the appraised value of the animal. If the appraised value is less than the salvage plus the full indemnity, the difference is deducted from the indemnity. The owner cannot receive more than the appraised value. Provided the owner has signed the special modified agreement with the State Live Stock Sanitary Board, after two negative tests, he receives a special certificate accrediting his herd for a period of three months as free of Bang's disease. If a third negative test is obtained, the herd is accredited for six months, and on the fourth negative test it is accredited for one year. Approximately 750,000 cattle have been tested in this state in 40,000 herds within a two-year-period. This represents about 25 per cent of the dairy and breeding cattle of Minnesota. A large number of herds have been retested and altho the special modified state agreement has not been in use very long, a considerable number of herds have been accredited under this plan.

The advantages to cattle owners who take up this plan are obvious. They are enabled to free their herds of Bang's disease with a minimum of expense. The work of testing is carried out either in the laboratory of the State Live Stock Sanitary Board at University Farm or in the field by accredited veterinarians using test fluid prepared at the above

laboratory. The cattle owner has to bear none of the expense of testing. Application for a federal contract may be made to the U. S. Bureau of Animal Industry, 1047 Post Office Building, St. Paul, Minnesota. It is also quite likely that a local veterinarian or county agent will have a supply of these contracts on hand.

Sufficient appropriations have been made by Congress to insure the continuance of the Federal-State Bang's Disease Program during the fiscal year 1936-37. (July 1, 1936 - June 30, 1937)

Care of Animals During Pregnancy and Parturition, and Care of Newborn Calf

The proper handling of cows during advanced pregnancy is a very important part in the general campaign against abortion. Place the animal in a clean disinfected box-stall. It should be kept clearly in mind that thoro cleansing is worth as much as disinfection, if not more.

When the calf is born, rub it dry with a clean cloth. Disinfect the stump of the navel cord with a 1 to 1,000 corrosive sublimate solution (tablets of this material may be purchased at any drug store) or tincture of iodine. Place the solution in a tumbler, stand the calf on its feet, and immerse the stump in a tumbler of disinfectant. Keep it submerged from 15 to 30 seconds. The stump may then be dusted with an antiseptic powder composed of equal parts of boric acid and powdered alum.

All calves should be allowed to remain with their dams for the first day in order that they will get enough colostrum (first milk), which has certain properties that aid in protecting the newborn calf against various diseases. Cows with retained afterbirth should be kept separate from the rest of the herd, and the udder should be carefully cleaned before the calf is permitted to nurse. Retained afterbirth is accompanied by discharges that stain the udder, and if not carefully watched may cause scours in the calf. Milk from the cows with retained afterbirth, if mixed with other milk being fed to calves, may be responsible for causing a sudden outbreak of scours, in which a large percentage of the animals will become ill at or near the same time.

Researches have shown that most newborn calves do not become actively infected with *Brucella abortus* from milk. The organisms may, however, locate in the lymph glands in the region of the throat where they remain for a few weeks.

Treatment of Animals Affected with Bang's Disease

No attempt should be made by the layman to irrigate or disinfect the uterus (womb). Not only is it impossible to disinfect the cavity of the uterus, but it is also dangerous as the lining is easily injured and at times the walls of the uterus may be ruptured. Rupture, or severe injury, to the lining and walls of the uterus reduces the fertility of the animal or renders it a permanent nonbreeder. In some instances death follows in a short time. The vagina only should be irrigated, with a mild saline solution.

Coal tar disinfectants should not be employed as douches for the genital tract of cattle. The apparatus used in douching aborting cows

should not be used around Bang-abortion-free cattle. The vagina can be douched by the use of a soft rubber tube one-half inch in diameter, one end of which is introduced into the vagina, the other end being furnished with a funnel into which the solution is poured, and which is then elevated so that the fluid will gravitate into the vagina. It is not necessary to siphon the fluid off. The cow that has recently aborted or has failed to expel the fetal membranes (afterbirth) should be isolated and not permitted to mingle with other cattle until all discharges have ceased. The irrigation should be repeated daily for 10 days and then twice a week until there is no further evidence of discharge. Retention of the fetal membranes requires early treatment in order to maintain the health of the cow and in order to prevent the development of disease conditions which may seriously interfere with her ability to again get in calf. Successful handling of cows that fail to clean is very important and the advice or services of a veterinarian should be obtained early.

Heifers and cows in herds free from Bang's disease or in herds in which the control of Bang's disease by use of the blood test is being attempted, may abort from causes other than the Bang germ, but they should be separated from all other cattle and not returned to the herd until it can be definitely determined by repeated agglutination tests that they are not affected with Bang's disease.

Breeding Cows that Have Aborted

An animal that has aborted should not be rebred until her genital organs are healthy. A healthy condition usually can be restored with proper care, altho some animals will remain diseased even after the best treatment known has been applied. It is folly to breed a cow that has a discharge from the uterus. She will not only be unlikely to conceive but she may also expose the bull to a virulent infection other than Bang's disease, thereby tending toward the spread of the disease in the herd. Further, in case the cow does conceive, the fetus will frequently be expelled while quite small, and in a short time the heat period will recur. As stated, many abortions of this type are not noticed.

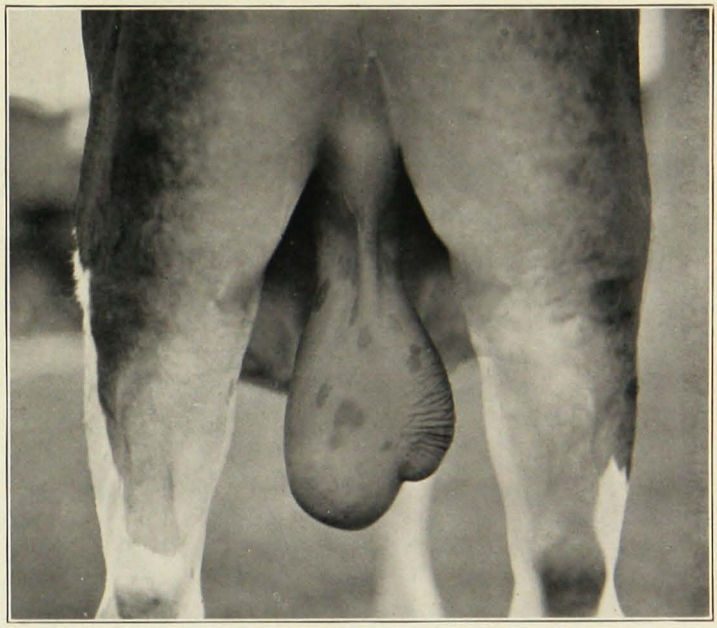
It is impossible to say how long a time is necessary for the genital organs to become healthy. In some animals, with the proper treatment, it may not be more than from 30 to 60 days. In other animals it takes months of careful treatment. The advice and services of a competent veterinarian are necessary in cases that stubbornly refuse to respond to treatment.

Treatment of the Sire

It is highly advisable to have all bulls used for service tested for Bang's disease. In this way actively infected animals can be removed from the herd and this source of spread of the disease eliminated. Sterility is not uncommonly induced in the female by bulls infected with pus-forming bacteria. Tuberculosis, also, may be transmitted during copulation. Sires developing sudden or spontaneous inflammation of one or both testicles should be carefully examined for Bang's disease.

(See Plate X.) Those with unnatural discharges from the sheath should not be mated.

PLATE X



Enlarged Left Testicle of Bull, Resulting from Inflammation

Treatment of Sterile Cows

Sterility, temporary or permanent, is a frequent sequel to abortion and is often the result of retention of the afterbirth, cystic ovaries, or inflammation of the uterus. In cows that fail to clean, certain pus-forming organisms gain entrance to the genital passages, where they cause temporary or permanent changes. In herds in which reduced fertility exists, there is a decrease in milk production as well as a failure to produce calves. In many instances sterile cows are bred every time they appear in heat. Frequent service not only aggravates the condition of the cow but endangers the health of the sire as well. The treatment of sterility requires skill and should be attempted only by veterinarians. All cows that fail to breed should be examined, the incurable ones sent to slaughter, the others treated and put into service again as soon as possible.

Stable Sanitation

Intelligent sanitation practices are generally recognized as an important part of the successful management of any livestock enterprise. Just as a matter of precaution it is advisable to clean thoroly and disinfect the barns once or twice a year.

Disinfection, as it is frequently practiced, is of little or no value. The most common cause of failure is inadequate cleaning of the walls and floors that are to be disinfected. As germs are so small and can be carried about in numerous ways, they may lodge in the smallest and most remote parts of the stable and in places most difficult to reach with a disinfectant. Hence, the usual so-called "disinfection," which consists in scattering a strong-smelling substance about the barn, cannot be efficient. No disinfectant can destroy germs unless it comes in contact with them. Unless a thoro job of cleaning has been done before the disinfectant is applied, it cannot reach the germs and destroy them. If only part of the germs are destroyed, little real good has been accomplished, because in most cases only a very few live germs are necessary to produce disease if they are taken into the body. In other words, the most important part of the job is frequently slighted. A large part of the time and money spent in this operation should be used in cleaning the barn; otherwise the expense of disinfection is wasted.

The use of boiling hot water and soap or lye or washing powders with stiff scrub-brushes can hardly be overdone. Rotten woodwork and loose boards should be removed. Iron work should be repainted. It must be remembered, however, that paint usually contains lead and that lead, even in small amounts, is poisonous to animals, especially cattle. It is *not advisable to use paint containing lead in or around the cow barn.* All manure and litter should either be burned or placed where animals cannot come in contact with it. Manure should be put on fields that are to be plowed in the near future, or upon fields that are not to be used as pastures. Old straw stacks to which the diseased animals have had access should be handled in the same way, or fenced off to prevent healthy animals from coming in contact with them. If the floors of stables or sleeping sheds are earth, it is advisable to remove 4 to 6 inches of the surface soil. This should be replaced with soil from an uncontaminated source, or, better, install a new floor of concrete or some other permanent type.

Water troughs that are used by groups of animals should be carefully cleaned and disinfected.

The coal tar products, commonly sold under various trade names, such as cresol, kreso dip, sheep dip, lysol, and others, are among the most efficient disinfectants available. Their value depends upon the amount of the active material known as cresylic acid. Products that contain 50 per cent of this active material are highly destructive to germs in a 3 to 4 per cent solution in water. These products are nonpoisonous to livestock in these dilutions and can be used freely in the disinfection of water tanks, mangers, and feed boxes. Two gallons of a coal tar disinfectant containing 50 per cent cresylic acid dissolved in 60 gallons of warm water are sufficient to disinfect 1,000 square feet of surface.

These products all have a strong, pungent odor which makes them undesirable for use in dairy barns, because milk readily absorbs them and renders it unsalable. This objection can be largely overcome by removing the milk from the barn as soon as it is taken from the animals. After a thoro disinfection of a dairy barn with any of the coal tar

products, it is usually necessary to guard against odors in the milk for approximately two weeks.

Various products that liberate chlorine, a gas, are commonly used in stable sanitation. They are doubtless of considerable value but are not so efficient in destroying germs in these places as are the coal tar products. They readily lose their power to destroy germs when they are exposed to the air. The mistake of relying upon chlorine products exposed to the air for varying lengths of time is common. Chloride of lime is the one most commonly used. Its value as a disinfecting agent is unquestioned, but is probably overrated by many persons because it is a powerful deodorant.

The value and economy of the work will depend in a great measure upon the method of applying the disinfectant. Economy requires that the disinfecting solution be applied rapidly. Efficiency requires not only that it cover the entire surface, but that sufficient force be used to drive the solution into all cracks and crevices. The best method of applying a disinfectant is a strong spray pump equipped with a hose and spray nozzle.

Whitewashing is advisable in many stables, as it makes the interior brighter and lighter. The lime wash should be applied only after the barn has been made scrupulously clean and disinfected. The addition of chloride of lime, 8 ounces to each gallon of whitewash, will increase its disinfecting properties. Whitewash is best applied with a spray pump such as is used in spraying orchards. The solution may then be forced into all the cracks and crevices of the barn with little difficulty.

ABORTION DISEASE OF SWINE

The abortion germ of swine was isolated from an aborted swine fetus in California in 1914. Since this date the disease has been reported in most of the states where swine raising is a major industry. Numerous outbreaks have been reported in Minnesota, and the germ, *Brucella suis,* has been isolated from distinct cases of this disease. There seem to be more affected animals and herds each year. Researches indicate that abortion in swine may be due to several different organisms. However, the germ, *Brucella suis,* is the one most often found. This organism is very similar to *Brucella abortus,* the germ of cattle abortion, and the disease in swine closely resembles that of cattle.

Experiments have shown that the organism is contained in the dead aborted pigs, afterbirths, uterine discharges, and milk of infected sows. Hogs become infected by eating materials containing the germs, such as bedding, afterbirths, and milk. As in the case of cattle, a sow may give birth to healthy pigs and discharge the living and virulent germs at the time of and following parturition. The blood tests will show whether an animal is infected. The boar may become infected and become a carrier of the disease. The testicles often become greatly enlarged, and *Brucella suis* may be isolated from such cases.

The germs may become localized in the udders of infected sows and in this way the sows may be carriers of the infection. Sterility may

follow abortion, altho it is not so commonly reported as in cattle. Prevention and control measures for this disease are similar to those outlined for the disease in cattle. Swine breeders who are having trouble of this nature among their animals are urged to communicate with the Veterinary Division at University Farm. This division will be glad to aid in any way possible and to make an investigation when necessary. Definite information about this disease in this country is still quite limited.

ABORTION DISEASE OF SHEEP

Abortion disease in sheep has long been recognized, but very little attention has been given to this affection which now, on account of the development of the sheep industry, becomes a problem of considerable economic importance. Tho abortion in sheep may be caused by *Brucella abortus,* the most common cause is a vibrio, or S-shaped germ (*Vibrio fetus*) which was first described by English investigators. This organism has been found to be one of the causes of abortion in sheep in Minnesota.

While diseases of the genital organs are not so numerous in sheep as in cattle, they are fairly common and of vast importance. Reports of the presence of abortion in sheep are occasionally received from various sections of the state, but as yet we have made no extensive investigations. The symptoms, treatment, and control of this disease in sheep are similar to those for cattle. We are unable to control abortion in sheep by means of the agglutination test when caused by *Vibrio fetus,* but the agglutination test is a satisfactory method of controlling the disease when caused by *Brucella abortus.* Ewes having aborted as the result of infection with *Vibrio fetus,* other germs, or unknown causes, should be separated from all other animals and not returned until all unnatural discharges have ceased. Certain investigators are of the opinion that the water supply is one of the chief ways by which the infection spreads. This is an additional reason why sheep should be provided with pure drinking water.

BRUCELLOSIS IN HORSES

Horses sometimes give positive reactions to the blood tests for Bang's disease. This is especially true in animals suffering with fistula of the withers and poll evil. These conditions may be recognized in their early stages as soft swellings in the region of the poll or withers. The areas are very sore and sensitive. Later they may open, form a running sore, and large quantities of pus may escape. It is usually advisable to have a veterinarian operate on such cases before the condition spreads far into the surrounding tissues. Altho definite proof has not been established that the Bang germ produces such fistulas, there appears to be a definite relationship between this condition and Bang infection. *Brucella abortus* has been isolated from the pus of 22 per cent of the cases studied at University Farm, and 75 per cent of the cases gave a positive blood

test. Abortions in horses have been reported as being due to the Bang germ. This organism, however, is not to our knowledge a cause of abortion in mares in Minnesota.

RELATION OF BANG'S DISEASE TO HUMAN HEALTH

In recent years it has been shown that undulant fever in man may be caused by the same germ that causes Bang's disease in animals. There have been cases of undulant fever which apparently resulted from the ingestion of Bang's disease germs in raw milk.

Handling meat coming from animals infected with Bang's disease is also a means of transmitting undulant fever to man. This is particularly true in connection with carcasses of swine so infected. The disease is also spread to man by the handling of discharges and aborted fetuses from infected animals. At present we would not classify undulant fever as a major public health problem. The dairyman and the breeder of meat-producing animals should consider the possibility of persons contracting undulant fever from Bang's disease germs in raw milk and other dairy products as well as in the flesh of infected animals, and particularly take into consideration the possible influence that this aspect of the disease may have on the market for their products.

IMPORTANT FEATURES IN THE PREVENTION AND CONTROL OF BANG'S DISEASE

1. All animals in the herd should be blood-tested to determine whether they are infected with Bang's disease.

2. All reactors to the test should be sold for immediate slaughter or isolated from the rest of the herd as they are potential spreaders of the disease.

3. A retest should be made of the herd not more than 30 to 60 days later, and if reactors are again present, they should be disposed of as stated above. Testing should be continued, preferably at 30- to 90-day intervals until the herd has passed three entirely negative tests. These three negative tests should be at least three months apart. A single negative test is not conclusive proof of the absence of Bang's disease.

4. Additions made to the herd should be from herds tested and known to be free from Bang's disease. Negative animals from infected herds may be added but must be kept in quarantine for at least 60 days. If the animal is pregnant, she must be kept in quarantine for at least 30 days after calving. These animals, at the end of the quarantine period, should not be added to the herd unless their blood test is negative.

5. After each test and when the reacting animals have been marketed for slaughter, the premises should be cleaned and disinfected.

6. All females should be isolated at the time of calving or aborting. The afterbirth and aborted calf should be destroyed by burning or proper burial. These animals should be separated from the rest of the herd for

two to three weeks or at least until all vaginal discharges cease. If a cow aborts, she should pass a negative test before she is returned to the herd. Altho most abortions are due to Bang's disease, it is well to remember that *all animals that abort do not have Bang's disease, also that all animals having a positive reaction to the test do not abort.*

7. If calves born from reacting mothers are to be used as additions to the negative herd, they should be isolated for two to three weeks after their last feeding from the dam. Then they should be fed milk from negative animals and should also pass a negative blood test before they are added to the negative herd.

8. Vaccines for the control of this disease are still in the experimental stage.

9. All milk and milk products used in negative herds should be from Bang-free cattle or should be pasteurized. Milk from positive animals is a dangerous source of spread of the disease.

10. Bulls in Bang-free herds should be used for service only on cattle that have been tested and found free from Bang's disease.

SUMMARY

1. The agglutination test (blood test) is an invaluable aid in the diagnosis of Bang's disease and at the present time is the only practical method for its control.

2. The present Federal-State Bang's disease program is an economical method for ridding a herd of this infection.

3. Bang's disease from an economic standpoint is probably the most serious disease affecting cattle. Progressive breeders and milk producers have learned that their herds must be free from this disease in order to have the largest financial return.

DISEASES OF NEWBORN CALVES

The losses occurring in newborn calves are enormous. The great majority of the losses are the result of infection and are classified in three main groups of diseases: (1) Calf scours and navel infection; (2) calf pneumonia, a disease occurring independently of that frequently observed in connection with scours and navel infection; and (3) poisoning, especially from paint containing lead. Scours in calves sometimes results from coccidiosis.

White scours is usually manifested by diarrhea, the result of inflammation of the intestines, but in other forms there is no diarrhea, which makes the recognition difficult. The disease usually attacks the calves suddenly when they are from 48 to 72 hours old, with marked depression and diarrhea (scours). The typical course of the disease is short, and the death rate varies from 50 to 100 per cent. Once the disease has become established, it has little regard for the age limit, often affecting calves several weeks of age. The disease, besides being influenced by age, has a seasonal occurrence. Frequently it begins during the fall, in a mild form, becoming more severe and fatal in late

winter and early spring. The disease may also assume a severe form in summer.

The causes of white scours have been investigated by many workers. Of the causes described, the germ theory gained most prominence. The germ most often found in calves affected with white scours is the colon bacillus, a germ that occurs widely in nature and is always present, sometimes harmful and again harmless. The early investigations led to the production of a serum to be used as a preventive. More recent investigations indicate that the colostrum (first milk) contains antibodies (protective agents) and is beneficial to newborn calves, building up in them a resistance to various diseases, particularly white scours.

The colon germ and its associates frequently do not attack the calf unless the resistance is lowered. Calves of the dairy breeds are surrounded by more hazardous conditions than those of the beef breeds. They are removed from their dams usually very early and fed a mixed milk from pails. It is difficult to keep the milk at a certain temperature and often the calves are greatly overfed during the first few days or weeks. The pails may also frequently be a contributing factor to scours, as they are hard to keep scrupulously clean and sanitary. Many calves have a ravenous appetite and often receive more milk than they can consume. We are of the opinion that overfeeding is the most common contributing cause of scours. The symptoms are, as a rule, not difficult to recognize. Often the calf is dull and will be found to have a high temperature before diarrhea begins. Diarrhea begins suddenly, the depression is more marked and the calf eats sparingly or not at all. Death may follow within a day or two following the first signs of illness. The disease soon spreads, as it is contagious.

Systematic and careful feeding will do much to prevent scours. The calf should be allowed to remain with its dam for 12 to 24 hours in order to obtain sufficient colostrum. After that it must be carefully fed to develop a strong, vigorous calf. Some authorities recommend giving the calf only 5 per cent of its own weight in milk the first day and increasing this one per cent daily for 10 days, when it will be receiving daily 15 per cent of its own weight. *Calves affected with scours should not be given any milk,* but fed on barley water, being given the same quantity as they were receiving of milk. This method should be carried out for 4 or 5 days, or until the calf has recovered. The use of muzzles to be worn between feeding periods is highly recommended. The muzzle prevents the calf from eating its bedding and other material, the result of a depraved appetite, which often occurs in connection with scours. The drug that may be given by the layman is 2 to 4 ounces of castor oil. Six to 8 ounces of soda water or lime water every 4 hours is beneficial. Scours is so destructive and spreads so rapidly that the services of a veterinarian should be obtained early in order to prevent heavy losses.

Calf Pneumonia

Pneumonia, or inflammation of the lungs, of a primary nature, not the type associated with scours, is hard to control. It attacks calves

at from one to three months of age. Coughing is one of the first symptoms to be noticed, and tho the disease may produce death in a short time, the course is usually prolonged. The temperature of the calf is slightly above normal and the appetite is more or less deranged. The disease spreads rapidly in certain herds, particularly during the winter months, while in others it spreads slowly. Death results from extensive involvement of the lungs, in which small abscesses (boils) are of common occurrence. Some calves will recover, others only partially, being left with large cavities in the lungs, which are evidenced by a chronic cough, a roughened coat, and a more or less stunted condition.

Prevention consists in good housing. Provision should be made for well-lighted, roomy stalls or pens and ample room for play and exercise outdoors. The calf with pneumonia should immediately be removed from other calves. Medicinal treatment is of little value.

Lead Poisoning

Lead poisoning is by far the most common form of mineral poisoning occurring in farm animals. Of the domestic animals cattle and especially calves are very suceptible, and only a small amount of the poison when taken into the digestive tract is required to produce fatal results. A very high percentage of lead poisoning in cattle occurs in the acute form, tho chronic lead poisoning is occasionally observed. Paint containing lead carbonate, a combination commonly known as "white lead," is the most frequent cause of poisoning, but poisoning from arsenate of lead such as is used in spraying orchards is not at all uncommon. Cattle apparently relish the taste of white lead paint, as is evidenced by their licking painted fences or cast-off paint pails, the contents of which may be fresh or thoroly dried. While fresh white lead is the most destructive, fatal cases of poisoning occur from consuming the dried material. When a number of animals are simultaneously exposed to lead poisoning, as is the case when white lead is used in painting barn equipment or in painting paddock fences or where a paint pail has been carelessly discarded in a pasture, the disease thus caused is very confusing in nature and may readily be mistaken for a contagious disease.

The symptoms of lead poisoning consist of loss of appetite, elevation of temperature, and constipation followed by diarrhea. The feces in the latter stage are very dark and fetid. When the nervous system becomes involved the patient staggers, bellows, walks in a circle, often running into objects because of impaired vision or blindness. Convulsions and grinding of the teeth may also be observed. Because any of these symptoms may be seen in other diseases the determination or recognition of lead poisoning is not always an easy task. The disease runs a short course, usually terminating in sudden death.

The treatment of lead poisoning should be performed by a veterinarian. Preventive measures consist of careful herd management. Cattle should not be pastured where the grass has been sprayed with lead arsenate or be permitted to have access to barrels or tubs formerly containing this product. All receptacles having contained paint should be

destroyed or placed where they will not be contacted by any animal. The installation of lead-painted sign boards in pastures is also a source of danger. The use of any paint containing lead in any form should never be tolerated around the barn, pasture, or paddock.

Coccidiosis

Coccidiosis affects calves at a later period in life than does scours or pneumonia. The cause is a small parasite, which may be found on the ground. The parasite may be taken up through the drinking water or the feed. The symptoms consist of a diarrhea containing small clots of blood. The presence of blood clots in the passages of calves affected with scours should be looked upon as suspicious of coccidiosis. The fact that young cattle and even aged animals may contract this condition is helpful in differentiating this disease from scours as a result of overfeeding or infection. The droppings of calves affected with coccidiosis contain the parasites, which can easily be seen through a microscope. Treatment consists of removing the animals to new pastures or fencing off the low, badly drained places to prevent contact with the parasite. A veterinarian should be called to medicate the animals.

REGULATIONS GOVERNING THE MOVEMENT OF CATTLE THAT HAVE RECENTLY ABORTED

Adopted by the Minnesota Live Stock Sanitary Board at a Special Meeting January 11, 1922; Approved by Attorney General, February 7, 1922

Section I. No person, firm or corporation shall expose in a public market, sale yard, fair ground, exhibition or show, a cow or heifer which has been known to calve prematurely within two months immediately preceding the exposure. This section shall not apply to cattle that are shipped to public markets for the purpose of immediate slaughter.

Section II. No person, firm or corporation shall sell a cow or heifer for breeding or dairy purposes, which has been known to calve prematurely within two months immediately preceding, without previous written notice to the purchaser.

Section III. No person, firm or corporation shall send or cause to be sent to a bull for service, a cow or heifer which has prematurely calved within the previous two months, unless before the service, the person, firm or corporation shall have given notice in writing of such premature calving to the owners of the bull.

Section IV. No person, firm or corporation shall

(a) Cause or permit to be turned out on any common or unenclosed land, or in a field or other place insufficiently fenced, or in a field or other place adjoining a highway (unless that field or place is so fenced or situated that cattle therein cannot stray or graze along the highway); or

(b) cause or permit to graze on pasture being on the sides of a highway, a cow or heifer which to his knowledge, or according to information furnished to him, has calved prematurely within the two months immediately preceding such turning out or such grazing.

SUPPLEMENTAL AGREEMENT TO ELIMINATE CATTLE REACTING TO THE AGGLUTINATION BLOOD TEST FOR BANG'S DISEASE[1]

This agreement made this ..... day of ...., between ....., herein referred to as the owner ....., who
(Post-office address)
represents that he is operating the farm known as ..... farm situated ..... from .....
(Miles and direction)
on ..... Road in ..... County, State of ....., and the Secretary of Agriculture for and in behalf of the United States.

WITNESSETH:

WHEREAS, It is desired to eliminate cattle reacting to the agglutination blood test for Bang's disease.

NOW, THEREFORE, in consideration of the premises and the mutual covenants of the parties herein contained and the Secretary's initial blood test for Bang's disease, it is hereby mutually agreed as follows:

I. DEFINITIONS

1. The term "Secretary" when used in this agreement shall mean the Secretary of Agriculture.

2. The term "Bureau" when used in this agreement shall mean the Bureau of Animal Industry of the United States Department of Agriculture.

3. The term "test" when used in this agreement shall mean the agglutination blood test for Bang's disease.

II. COVENANTS OF THE OWNER

The owner agrees:

4. To permit the application to each animal of his herd of such number of separate tests, not more than four, as the Secretary or his authorized agent shall determine to be necessary.

5. That, upon each and every test made hereunder, he will market or cause to be marketed for slaughter, under State or Federal supervision, within a reasonable time, all heifers (over 6 months of age), cows and bulls in his herd which, after each test, are designated by the Secretary, or his authorized agent, as reacting to the test; and all such animals to be marketed hereunder shall, until marketed and removed, be kept in quarantine at a substantial distance from nonreactors which are to remain on the premises.

6. To confine additions to his herd:

(a) To animals from herds known to be definitely free from Bang's disease;

(b) To nonpregnant animals from other than Bang's-disease-free herds, which must pass the test and then be placed in quarantine for at least 60 days, at which time such animals must pass a second test before being added to the herd.

(c) To pregnant animals which after passing the test must be kept in quarantine after calving for at least 60 days without being rebred, at which time they must pass a second test before being added to the herd.

7. That after his herd has been tested and the reactors thereto marketed for slaughter, he will continue testing the animals in his herd in accordance with the accredited Bang's disease herd plan of his State, if and when his State adopts such a plan, and that his efforts in this direction will be continued until his herd is eligible for accreditation.

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[1] Members of, or Delegates to, Congress cannot participate in the benefits of these contracts because of the provisions of title 18, sec. 204, and title 41, sec. 22, of the United States Code.

8. That he will at his own expense, after each test and the removal of the reactors, clean and disinfect his premises under the supervision and direction of the Chief of the Bureau, or his authorized representative.

9. To see that all trucks, cars, or other conveyances delivering animals to be added to his herd are thoroughly cleaned and disinfected before the animals are loaded and, if such animals are unloaded in transit, to see that they are unloaded only into pens which have been cleaned and disinfected.

10. To see that bedding and manure are removed as often as practicable from those places where reactors to the test have been lodged within the 6 months preceding such reaction; and to dispose of said material in such manner as to guard against exposure.

11. To abide by and conform to all regulations, administrative rulings, and orders of the Bureau heretofore and hereafter issued by the Secretary relating to this contract, which regulations, administrative rulings, and orders are and shall be a part of this contract.

12. Not to sell or assign in whole or in part this agreement, or his right to or claim for payment under this agreement, and will not execute any power of attorney to collect said payment or to order that any such payment be made. Any such sale, assignment, order, or power of attorney shall be null and void.

The owner represents:[2]

13. To accept an appraisal of reactors made in accordance with Order No. 347 of the Bureau.

14. That no abortion vaccine, abortion bacterin, nor preparation made from or through the agency of *Brucella* micro-organisms has been used in any of the animals to be tested hereunder within 6 months prior to the date hereof.

15. That he has not acquired cattle for the purpose of entering into this agreement knowing that such cattle would react to the test.

16. That the herd of said farm consists of—

Breed .....

	Grade	*Purebred*	*Total*
Females over 1 year			
Males over 1 year			
Calves over 6 months			
Calves 6 months or under			

III. COVENANTS OF THE SECRETARY

The Secretary agrees:

17. That the owner's herd shall be tested for Bang's disease under the direction of the Bureau without expense to the owner except for necessary handling of the animals incident to collecting blood samples.

18. To pay to the owner, upon such proof of compliance with the terms hereof as the Chief of the Bureau may require, an amount for each animal, except unregistered bulls marketed in accordance with this agreement, equal to the appraisal less the net proceeds of marketing the animal and less any other moneys received because of the elimination of the animal but in no event to exceed $25 for a grade animal and $50 for a registered purebred animal. (Registration certificates covering cattle over 3 years old shall be presented at time of appraisal.)

19. It is mutually understood and agreed that the Secretary may, in his discretion, determine that a second, a third, and/or a fourth test shall be made of the owner's herd hereunder, and that in the event of such second, third, and/or fourth test, reactors to each such test shall be eliminated and payment made therefor in the same manner as for reactors to the first test.

WITNESS:

....

(Signature of owner)

Date .....

HENRY A. WALLACE,
Secretary of Agriculture,
for and in behalf of the United States.

By .....
Authorized representative of the Secretary of Agriculture.

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[2] Any intentional misrepresentation of fact made in this contract for the purpose of defrauding the United States will be subject to the criminal provisions of the United States Code.

Lien Holder-Owner Agreement:

The following statement must be signed by the owner if there is no mortgage on his cattle:

I hereby certify that there is no mortgage against my cattle.

.....
(Owner

The following agreement must be signed by the owner and lien holder jointly if someone other than the government holds a mortgage against the cattle:

AGREEMENT:

The undersigned, holder of a lien covering the cattle described in the above contract hereby consents to permit ..... ,
(Owner)
to comply with the terms of said contract providing that if animals covered by said lien are required to be marketed for slaughter pursuant to the contract, the "net proceeds of salvage" shall be made payable to the undersigned jointly.

.....
(Owner)

.....
(Lien holder)

I hereby consent to comply with above.

.....
(Owner)

MINNESOTA STATE LIVE STOCK SANITARY BOARD

AGREEMENT
FOR THE TESTING OF HERDS OF CATTLE FOR THE CONTROL AND ELIMINATION OF BANG'S DISEASE
SPECIAL MODIFIED AGREEMENT FOR OWNERS WHOSE HERDS HAVE BEEN TESTED UNDER AGREEMENT B.A.I. FORM TE 33 (REVISED), UNITED STATES DEPARTMENT OF AGRICULTURE

In compliance with the agreement I have executed with the Secretary of the United States Department of Agriculture for the purpose of eliminating Bang's disease from my herd I ..... do hereby agree to cooperate with the Minnesota State Live Stock Sanitary Board and to meet all requirements and provisions incorporated in this agreement.

I agree to furnish sufficient help to assist the veterinarian in securing the necessary blood specimens, tagging and identifying my cattle.

I agree not to allow any vaccine, bacterin or other biological product to be used on my herd for the prevention or treatment of Bang's disease.

I agree to clean and disinfect my premises that are contaminated by animals infected with Bang's disease as indicated by the agglutination blood tests and re-tests, at my own expense under the direction of the officials or the authorized representatives of the Federal Bureau of Animal Industry or the Minnesota State Live Stock Sanitary Board.

I agree to continue to comply with all the conditions of the agreement I have executed with the United States Secretary of Agriculture for the testing and re-testing of my herd of cattle, the shipment of the reactors for slaughter, and after the agglutination blood testing made at the expense of the Federal Government has been

discontinued in my herd, I will comply with the provisions of this agreement until my herd is officially accredited as free from Bang's disease.

I agree to comply with the Rules and Regulations providing for the control of Bang's disease printed on the other side of this agreement and the same are adopted by all parties concerned and entered as a part of this agreement. Failure on my part to comply with these rules and regulations shall be sufficient cause for the cancellation of this agreement.

It is understood that:

(a) The necessary work for the accreditation of herds as free from Bang's disease shall be conducted cooperatively by the Federal Bureau of Animal Industry, the Minnesota State Live Stock Sanitary Board and the owner. The tagging and proper identification of each animal and the collection of blood from each animal and sending the same to the laboratory or making the plate test, shall be made by a veterinarian approved by the Board at the expense of the Federal Bureau of Animal Industry and the Minnesota State Live Stock Sanitary Board. The payment of this expense on the part of the Sanitary Board will be limited to the moneys appropriated for this purpose.

(b) Blood tests shall be made at the laboratory of the State Live Stock Sanitary Board or a laboratory approved by the Board or by licensed veterinarians who have received instructions in the technique of the plate test and have received a certificate from the Secretary and Executive Officer of the Minnesota State Live Stock Sanitary Board approving them as qualified to make the plate test. The antigen that is used must be approved by the Board.

(c) Herds of cattle in which all of the animals, six months of age or over have passed one or more completely negative agglutination blood tests under the administration of the Federal Government, may have credit for passing a negative test, provided the owner signs this agreement, and provided all of the cattle in the herd six months of age and over pass a completely negative test.

A "Special Modified Bang's Disease-Free Accredited Herd" certificate will be issued to owners of herds that have passed two completely negative tests in which all the animals six months of age or over are tested at least three months apart under the administration of the Federal Bureau of Animal Industry, and such certificate shall be valid for three months from date of issue unless cancelled, provided the owner signs the Special Modified Agreement, and further provided he has complied with these rules and regulations. If such herds pass a completely negative test after three months from the date of the second negative test, a "Special Modified Bang's Disease-Free Accredited Herd" certificate will be issued and shall be valid for six months from date of issue unless cancelled.

This "Special Modified Bang's Disease-Free Accredited Herd" certificate will be renewed for a period of one year provided such a herd passes a completely negative test after six months from the date of the third negative test.

(d) No herd will be placed under supervision, the owner of which is not practicing measures against tuberculosis and cooperating in its eradication.

My herd consists of .....

Breed	Grade	Purebred	Total
Females over 1 year	.....	.....	.....
Males over 1 year	.....	.....	.....
Calves over 6 months	.....	.....	.....
Calves 6 months or under	.....	.....	.....

IN WITNESS WHEREOF, I have signed this agreement this ..... day of ..... one thousand nine hundred and thirty.....

Witness ..... Owner .....

Address ..... Township ..... County.....

Post Office ..... County.....

MOST ACCESSIBLE POINT TO MY FARM BY RAILROAD.....

MINNESOTA STATE LIVE STOCK SANITARY BOARD

RULES AND REGULATIONS PROVIDING FOR THE ELIMINATION OF BANG'S DISEASE IN CATTLE IN MINNESOTA UNDER SPECIAL MODIFIED AGREEMENT

Adopted January 18, 1936

Approved by Attorney General, February 6, 1936

(1) The owner must sign the Special Modified Agreement placing his herd under the supervision of the Minnesota State Livestock Sanitary Board for the prevention and control of Bang's disease.

(2) All animals in the herd six months of age or over must be tested under the administration and supervision of the Federal Bureau of Animal Industry or the Minnesota State Live Stock Sanitary Board. Retests of herds in which reactors are disclosed will not be made earlier than thirty days from the date of the last test of such herds.

(3) A list in duplicate, of the cattle tested shall be furnished to the Board at each time a test is applied so that every blood sample can be identified by the name and registry number of animal, herd tag number, or by the official identification or tag number.

(4) All reacting cattle shall be marketed or caused to be marketed for slaughter on a permit issued by the Federal Bureau of Animal Industry or the Minnesota State Livestock Sanitary Board, or shall be placed in a quarantine satisfactory to the Board.

(5) After each test and when the reacting animals have been marketed for slaughter, the owner will, at his own expense, clean and disinfect his premises under the supervision and direction of an authorized representative of the Bureau of Animal Industry or the State Live Stock Sanitary Board.

(6) All milk and milk products used in a Special Modified Bang's Disease-Free Accredited Herd or a herd that has been once tested in the process of accreditation shall be either produced by a Bang's disease-free herd or shall be properly pasteurized.

(7) Bulls, in herds which have been once tested and are in the process of accreditation, must be used for service only on cattle which have been tested and found free from Bang's disease. Service must be on neutral ground.

(8) Additions to Special Modified Accredited Bang's Disease-Free Herds or herds in the process of accreditation shall be confined to the following:

- (a) To animals from herds known to be tested and found free from Bang's disease.
- (b) To non-pregnant animals from other than Bang's disease-free herds which must pass the test and then be placed in quarantine for at least sixty days, at which time such animals must pass a second test before being added to the herd.
- (c) Pregnant animals which after passing the test must be kept in quarantine until after calving for at least thirty days without being re-bred, at which time they must pass a second test before being added to the herd.

(9) All trucks, cars, or other conveyances delivering cattle to be added to the herd shall be thoroughly cleaned and disinfected before the animals are loaded, and if such animal or animals are unloaded in transit they must be unloaded only into pens which have been cleaned and disinfected.

(10) Cattle removed from the farm to community pastures shall not be allowed to again associate with the herd or other cattle until they have been held in isolation for a period of at least sixty days and have then passed a satisfactory test.

(11) No cattle shall be removed from the premises for exhibition purposes except to exhibitions that require a satisfactory negative test for Bang's disease for all cattle exhibited.

(12) Any animal which aborts in a Special Modified Accredited Bang's Disease-Free Herd or a herd in the process of accreditation must be immediately isolated. The place where the abortion occurs must be immediately cleaned and disinfected; the fetus and membranes must be promptly disposed of by burning or proper burial.

(13) The premises must be maintained in a sanitary condition.

(14) A "Special Modified Bang's Disease-Free Accredited Herd" certificate will be issued by the State Live Stock Sanitary Board to owners of herds that have passed two completely negative tests in which all the animals six months of age or over are tested at least three months apart under the administration of the Federal Bureau of Animal Industry, and such certificate shall be valid for three months from date of issue unless cancelled, provided the owner signs the Special Modified Agreement, and further provided he has complied with these rules and regulations. If such herds pass a completely negative test after three months from the date of the second negative test, a "Special Modified Bang's Disease-Free Accredited Herd" certificate will be issued and shall be valid for six months from date of issue unless cancelled.

This "Special Modified Bang's Disease-Free Accredited Herd" certificate will be renewed for a period of one year provided such a herd passes a completely negative test after six months from the date of the third negative test.

MINNESOTA STATE LIVE STOCK SANITARY BOARD

AGREEMENT
FOR THE TESTING OF HERDS OF CATTLE FOR THE CONTROL AND ELIMINATION OF BANG'S DISEASE
BANG'S DISEASE-FREE ACCREDITED HERD (PLAN A)

For the purpose of freeing my herd of Bang's Disease, I..... do hereby agree to cooperate with the State Live Stock Sanitary Board and to meet all requirements and provisions incorporated in this agreement.

I do further agree to furnish sufficient help to assist the veterinarian in securing the necessary blood specimens, tagging and identifying my cattle.

I do further agree to cause all animals that react to the test, and also all animals showing physical evidence of Bang's Disease, to be promptly disposed of in a manner satisfactory to the State Live Stock Sanitary Board.

I do further agree not to allow any vaccine, bacterin or other biological product to be used on my herd for the prevention or treatment of Bang's Disease without first securing a permit for its use from the State Live Stock Sanitary Board.

I do further agree to allow any premises contaminated by animals infected with Bang's Disease, as indicated by a blood test or by a physical examination, to be thoroughly cleaned and disinfected, at my own expense, under the direction or supervision of the State officials.

I do further agree to comply with the eighteen (18) Rules and Regulations providing for the control of Bang's Disease by Bang's Disease-Free Accredited Herd Plan A, and the same are adopted by all parties concerned and entered as a part of this agreement. Failure on my part to comply with these rules and regulations shall be sufficient cause for the cancellation of this agreement.

My herd is composed of.....
(Breed)

Number of Cattle.....
(Pure Bred) (Grade) (Total)

IN WITNESS WHEREOF, I have signed this agreement this..... day of ....., one thousand nine hundred and thirty.....

Witness..... Owner.....
(Print Name Plainly)

Address..... Township..... County.....

Post Office..... County.....

MOST ACCESSIBLE POINT TO FARM BY RAILROAD.....

MINNESOTA STATE LIVE STOCK SANITARY BOARD

RULES AND REGULATIONS PROVIDING FOR THE CONTROL OF BANG'S DISEASE IN CATTLE IN MINNESOTA BANG'S DISEASE-FREE ACCREDITED HERD (PLAN A)

Adopted May 2, 1935

Approved by Attorney General June 13, 1935

(1) A "Bang's Disease-Free Accredited Herd" is one in which no evidence of Bang's disease has been found in three blood tests, at least six months apart, of all cattle, six months of age and over in the herd.

(2) The owner must place his herd under the supervision of the Minnesota State Live Stock Sanitary Board, for the prevention and control of Bang's disease.

(3) A list in triplicate of cattle tested shall be furnished to the Board at each time a test is applied so that each blood sample can be identified by the name and registry number of animal, or herd tag number.

(4) All reacting animals shall be placed in a separate herd, preferably on a different farm, entirely separate from the non-reacting herd.

(5) Retests of herds in which reactors are disclosed shall not be made earlier than thirty days nor later than six months from the date of last test of such herds.

(6) A "Bang's Disease-Free Accredited Herd" shall be retested at least annually. If reactors are disclosed in such herd it shall be subjected to the tests as required in paragraph (1).

(7) Animals which have reacted to the blood tests or which have showed physical evidence of the disease, may be added to accredited herds or herds in the process of accreditation after they have passed three negative blood tests, six months apart. Provided, however, all such animals have been held in strict isolation for a period of at least sixty days immediately preceding the last test.

(8) Herd bulls must not be used for service on cattle which have not been tested and found free of Bang's disease. Service must be on neutral ground.

(9) All milk and milk products used in a "Bang's Disease-Free Accredited Herd" or herds in the process of accreditation, shall be either produced by a "Bang's Disease-Free Accredited Herd" or shall be properly pasteurized.

(10) Cattle from "Bang's Disease-Free Accredited Herds" may be added to such herds or herds in the process of accreditation without test. If shipped, the railroad car or truck used must be cleaned and disinfected, and public stockyards must be avoided.

(11) All cattle, with the exception of calves under six months of age and pregnant animals to be added, other than those from "Bang's Disease-Free Accredited Herds," must pass a blood test approved by the State Live Stock Sanitary Board and must be isolated; they must pass a second blood test approved by the Board, made not earlier than sixty nor later than one hundred and twenty days, or preferably approximately three weeks after calving. Calves under six months of age may be added to the herd after having passed one satisfactory test. Pregnant animals to be added, must be isolated and must pass a satisfactory blood test not earlier than three weeks after having calved, and a second blood test not earlier than sixty days after the first test.

(12) Cattle removed from the farm for exhibition, community pasture, or any other purpose shall not be allowed to again associate with the herd or other cattle until they have been held in isolation for a period of sixty days and have then passed a satisfactory blood test.

(13) Any animal which aborts in any "Bang's Disease-Free Accredited Herd" or herd in the process of accreditation, must be immediately isolated and reported to the State Live Stock Sanitary Board. The place where the abortion occurred must be immediately cleaned and disinfected; the fetus and membranes must be promptly disposed of by burning or proper burial.

(14) The premises must be maintained in a sanitary condition. After removal of infected animals the stable must be cleaned and disinfected under official supervision or direction.

(15) No herd will be placed under supervision, the owner of which is not practicing measures against tuberculosis and co-operating in its eradication.

(16) The necessary work for the accreditation of herds as free from Bang's Disease shall be conducted co-operatively by the Board and the owner. The collection of blood from each animal to be sent to the laboratory or to be subjected to the plate test by an approved veterinarian, the tagging and proper identification of each animal and the

supervision of the necessary sanitary procedure shall be made by the approved veterinarian at the expense of the owner, or by a duly authorized representative of the State Live Stock Sanitary Board without expense to the owner.

(17) Blood tests shall be made at the laboratory of the State Live Stock Sanitary Board or a laboratory approved by the Board or by veterinarians who have been approved to make the plate test.

(18) A "Bang's Disease-Free Accredited Herd" certificate shall be issued to owners of herds in which no reactors have been found as required by paragraph (1) and provided all rules and regulations have been complied with, and further provided that the cooperative agreement executed by the owner has been fully complied with. This certificate shall be valid for one year from date of issue unless cancelled.

SIGNIFICANCE OF THE RULES AND REGULATIONS

The purpose of these different rules and regulations in respect to Bang's disease is to aid in the efficient control and to prevent the spread of the infection. It will be noted that already 34 states require a health certificate stating that a satisfactory agglutination test has been passed for cattle shipped within their borders. The Minnesota State Fair officials require that all animals shown pass a satisfactory test for Bang's disease within 60 days of the date of the Fair. It is a very easy thing to act as an agency for the distribution of this infection. For example, if a laboratory or a practicing veterinarian tests the blood of a cow and she is found positive and if there were no rules or regulations preventing it, the owner would be at perfect liberty to sell this animal to a cow dealer and the dealer in turn sell to another individual. This latter person might take this infected animal into a clean herd and as a result start an infection that would entail the loss of hundreds of dollars. It is to avoid instances of this kind and of a similar nature that certain rules and regulations have been passed to guard against the further spread of this infection to the herds of cattle in Minnesota. At the present time, the owner of reacting animals may not dispose of them except under permit from the Sanitary Board. This permit is always given when the circumstances surrounding the sale are explained. The essential thing is that this animal shall not be disposed of to an unsuspecting individual who might place her where she would spread the infection. It should be clearly understood that animals positively known to have Bang's disease can only be shipped to South St. Paul or other public stockyards *under permit.* Animals tested under the Federal-State Bang's Disease Program which are positive to the agglutination blood test are tagged and branded. All cattle positive to the test and not sold for immediate slaughter are quarantined by the State Live Stock Sanitary Board.