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## **UNIVERSITY OF ILLINOIS Agricultural Experiment Station**

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**BULLETIN NO. 152**

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# **CONTAGIOUS ABORTION OF COWS**

**By W. J. MacNEAL In Coöperation with  
HERBERT W. MUMFORD**

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## SUMMARY OF BULLETIN No. 152

1. The existence of a specific contagious disease causing abortion in cows has been recognized for a long time, and it is certain that the disease known abroad as infectious or contagious abortion is also prevalent in the United States.

2. The infectious agent is a bacterium first described by the Danish investigators, Bang and Stribolt. This microorganism has been isolated from aborting cows in various European countries and in the United States.

3. Bacteriological examination of afterbirths from aborting cows at this Station revealed the presence of this germ.

4. To eradicate the disease from a herd, the affected cows should be isolated, and their genital passages cleansed once or twice daily with an antiseptic solution until all discharge has ceased, when they may be returned to the herd; all infectious material (afterbirth and discharges) should be burned; infected stalls should be cleaned and disinfected; the sheath of the herd bull should be cleansed with a disinfectant solution before and after service, and a separate, clean bull should be used for heifers and clean cows.

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## CONTAGIOUS ABORTION OF COWS

By **W. J. MACNEAL**, ASSISTANT CHIEF IN BACTERIOLOGY, IN COÖPERATION WITH  
**HERBERT W. MUMFORD**, CHIEF IN ANIMAL HUSBANDRY

### INTRODUCTION

The premature discharge of the products of conception from the uterus is a not infrequent occurrence among domestic animals, and doubtless various factors may from time to time operate in its causation. For a long time, however, practical husbandmen have recognized an epizoötic or contagious kind of abortion, a definite transmissible disease in which the loss of the fetus is the most prominent characteristic. The transmissibility of contagious abortion of cows appears to have been demonstrated experimentally for the first time by Brauer. Experimental transmission has been performed by a number of investigators subsequently, the work of Nocard (1886) furnishing conclusive evidence upon this point.

It is certain that a disease, or possibly more than one disease, of this nature is a source of serious loss to the live stock industry in the United States, and there can no longer be any doubt that a considerable part of this loss is due to the definite specific disease prevalent on the continent of Europe and in England, and known as Contagious, Infectious, or Epizoötic Abortion. The purpose of this bulletin is the brief presentation of some of the facts concerning the cause, prevention and restriction of this disease, which have been established by modern investigation, for the information of men engaged in live stock production.

### BACTERIOLOGICAL INVESTIGATIONS ELSEWHERE

Nocard carried out the first extensive bacteriological investigation of contagious abortion. In microscopic preparations of the diseased placenta he was able to recognize numerous short bacilli and micrococci. These were also found in the amniotic fluid. He obtained pure cultures of these two organisms, but failed to induce abortion upon inoculating these cultures into other animals. Neither of the germs obtained in culture could therefore be regarded as the causative agent in the disease.

In 1895 Bang and Stribolt undertook the investigation of this disease, and their results are now

generally regarded as the most important of all the contributions to the study of this subject. A cow showing all the symptoms of impending abortion was purchased and slaughtered. The unopened uterus was removed to the laboratory where it was opened with special precautions to avoid all contamination. An abundant, grayish yellow, odorless exudate was found between the ovum and the inner wall of the uterus. Upon standing this exudate separated into two layers, a reddish yellow serum above, and a grayish yellow partly solid layer below. In microscopic preparations of this exudate, stained with Loeffler's methylene blue, numerous very small bacilli were found, apparently in pure culture, some of them lying free, but large numbers of them crowded together inside cells. These latter appeared at first to be micrococci, but more careful examination proved them to be really short rods. Bang and Stribolt were able to cultivate this organism in tubes of a gelatin-agar-serum medium, the germ developing only in a particular zone beginning about 5 mm. beneath the surface of the medium and extending downward 10 to 15 mm. After considerable work with cultures, they concluded that the bacillus is neither an aerobe nor an anaerobe, in the ordinary sense, but exhibits a very peculiar behavior in respect to oxygen, requiring for its development a partial pressure of oxygen somewhat less than that present in the atmosphere. They were unable to obtain growth of the germ in the presence of the ordinary atmosphere, nor in the absence of oxygen (Pyrogallol method). Curiously enough, by placing their tube cultures in an atmosphere of pure oxygen, they obtained cultures developing in two zones, one near the top and the other near the bottom of the tube, indicating that there are two optima in the oxygen requirement of the organism. This very interesting character of the organism received great attention at their hands, but nevertheless Bang points out that typical development such as he has pictured was not always obtained, a number of factors seeming to cause variation in the position and extent of the developmental zones in these tube cultures. By exhausting the air above the medium in the tube, the growth was made to extend to the surface. In this way they were able to obtain growth of the bacillus on plates, but they did not work out a reliable plate method, preferring to employ the dilution tube cultures for separation in all their work. Bang and Stribolt subsequently examined pieces of placenta from a large number of cases of contagious abortion, and found the bacillus microscopically in practically all cases. Sometimes they were abundant, in other instances very scarce. Most of this material was badly contaminated, yet, from that sent in during the colder season they successfully isolated the bacillus in pure culture in a majority of the cases. In three fetuses the bacillus was found in the intestinal contents in pure culture; in one fetus it was isolated from the blood. Two cows with mummified fetus *in utero* were examined *post mortem*. These fetuses had been dead 9 months and 5 months respectively but the surrounding exudate still contained the abortion bacillus and pure cultures of it were obtained from each case. Uterine exudate kept in the refrigerator still contained living abortion bacilli after seven months.

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Having found the same bacillus microscopically in a series of cases of abortion, and having obtained it in pure culture from a number of them, it now remained for Bang and Stribolt to produce the disease by inoculation of these cultures into healthy animals. Four pregnant cows were obtained without knowledge of their previous history. Two of them were inoculated by intravaginal application of pure cultures, and two by intravaginal application of pieces of afterbirth from aborting cows. No abortion resulted in any of the cows and at slaughter 19 to 29 days after inoculation, there was no evidence of the disease. This result was surprising, as Brauer had induced abortion by the second of the above-mentioned procedures in from 9 to 21 days, Lehnert in from 12 to 20 days, and Trinchera in 9 to 13 days. The authors thought that the animals may have been immune on account of a previous attack of the disease, or that possibly the interval between inoculation and slaughter (19 to 29 days) may have been too brief for the disease to have developed. For the next experiment two cows were purchased from a region where abortion was unknown. Pregnancy began January 14 and January 16, 1896. On April 14, a rich culture of the abortion bacillus was injected well up into the anterior end of the vaginal canal of each of these cows. The inoculation was repeated in the same way on May 23, and again on June 4. One cow aborted June 24, the fetus evidently having been dead some days. The abortion bacillus was isolated from the afterbirth. The other cow showed the signs of impending abortion on June 23, and was slaughtered on June 24. The condition inside the uterus resembled in every respect that observed in the cow from which the original culture had been isolated, and the bacillus was present in pure culture. In these cows the disease had appeared 10 weeks after the first inoculation. A third cow was inoculated by intravaginal application January 19, 1897, and subcutaneously March 6, in both instances with pure cultures of the bacillus. Premature delivery of a living calf occurred April 9, 80 days after the first inoculation. Abortion was also caused in sheep by intravaginal application and by intravenous injection of pure cultures. Inoculation by the latter method proved to be more certain in these animals, and the incubation period after intravenous injection was only 7 days in one case and 12 days in another. Intravenous inoculation of a mare resulted in a premature delivery after 28 days. In all these cases the bacillus was recovered from the afterbirth.

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In 1902, Preisz at Budapest isolated the same bacillus from two cases of contagious abortion in cows. He confirmed the findings of Bang in respect to the oxygen requirements of the organism, and was able to obtain cultures by a variety of methods on ordinary media. Apparently his cultures were less vigorous than those of Bang, for they soon died out, their resistance to germicides was slight, and all his inoculations into animals, including two pregnant cows, two pregnant guinea pigs, and one pregnant rabbit, as well as a number of other small animals, were without positive result. Preisz named the organism "*Corynebacterium abortus endemici (s. infectiosi)*."

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In 1908, Nowak at the University of Krakau in Austria made a very important contribution to

the study of this disease. He found the culture method of Bang and Stribolt very useful for the identification of the organism when obtainable in pure culture, and when the contaminating bacteria were few in number. When other bacteria were numerous, as is frequently the case in material obtained for examination, he found this method difficult. The pyrogallol method of Preisz also proved to be unreliable in his hands. Eventually he devised a method of plate culture which proved to be very useful. Ordinary agar was melted and cooled to 50° C. then mixed with about one fourth its volume of naturally sterile blood serum, and poured into sterile Petri dishes where it was allowed to solidify. The piece of placenta or other material to be examined was then streaked over several of these plates in succession, and the plates were incubated for 24 hours at 37° C., to allow contaminating bacteria to develop. The plates were next placed in a glass jar together with a culture of *Bacillus subtilis*, one square centimeter of culture surface of the latter organism being provided for each 15 cc. capacity of the jar. The jar was sealed and placed at 37° C. for three days, at the end of which time excellent surface colonies of Bang's bacillus were obtained. By the application of this method Nowak has succeeded in isolating the bacillus from the blood and intestinal contents of a number of fetuses, and from uterine discharge, when other methods failed. He has also observed that one could gradually decrease the amount of culture surface of *B. subtilis* employed in succeeding cultures and eventually get the bacillus of Bang to grow in the presence of atmospheric air, altho the cultures were relatively poor ones. Nowak also confirmed Bang by obtaining cultures in an atmosphere of nearly pure oxygen, as well as in ordinary air under a pressure of three atmospheres. His cultures were evidently vigorous for some of them were successfully transplanted after two years. Nowak used ordinary agar as a medium with considerable success, and found glucose agar to be almost as favorable to the growth of the bacillus. For the detection of the germ in pathological material, however, these media proved to be inferior to the serum-agar mixture in several cases. Cultures were obtained in broth and in milk without coagulation, contrary to the statement of Preisz. No gas was produced in sugar broth. Nowak inoculated a number of pregnant laboratory animals, and produced abortion with great regularity in guinea pigs and rabbits by subcutaneous, intravenous and intraperitoneal injection. He did not succeed in producing abortion by intravaginal application nor by feeding. No tests were made upon larger animals much to his regret, as in his opinion the experiments of Bang upon cows still left something to be desired in the way of experimental evidence.

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McFadyean and Stockman (1909) have investigated the contagious abortion of cattle in Great Britain, and have found it to be identical with that studied by Bang in Denmark. They were able to produce the disease in cows by intravenous injection of natural virus and of active pure cultures, without a failure in eight experiments. By intravaginal application they caused the disease twice with cultures and three times with natural virus, but also failed to obtain any result in three trials with the natural virus. Subcutaneous inoculation was successful three times in five trials. By feeding they produced the disease three times in four trials. These authors consider ingestion to be an important mode of contracting contagious abortion in nature.

Zwick (1910) has made a preliminary report of the bacteriological investigation of contagious abortion at the German Imperial Health Office. By a comparative study of cultures, the unity of the disease in Denmark, Germany, England, and Holland has been established. Certain individual differences were detected in the various culture strains examined, and it was found that the bacillus could be readily cultivated upon various ordinary laboratory media, and that it could also adapt itself to an aerobic existence, thus confirming the work of Nowak. In one instance the bacillus grew aerobically immediately upon isolation from the animal body. Abortion was induced in sheep, goats, and rabbits by intravenous injection, intravaginal application, and also by feeding. Work upon the use of abortin (analogous to tuberculin) for diagnosis, and upon the agglutination and complement fixation tests, was in progress at the time the report was made.

#### BACTERIOLOGICAL OBSERVATIONS AND EXPERIMENTS AT THIS STATION

In the United States contagious abortion is widespread, and has been recognized for a number of years by practical husbandmen as an important economic factor in animal industry. Epidemiological studies have recently been reported from Arizona and Connecticut. At the Illinois Agricultural Experiment Station the beef cattle herd has suffered considerable loss from abortion for several years past, and the presence of contagious abortion had been recognized by Professor Mumford, altho this diagnosis was disputed by other authorities. In order to settle the question it seemed best to undertake a bacteriological study of the disease. This seemed the more desirable because, so far as we have ascertained, there was no known microorganism generally recognized and accepted as the cause of the disease in this country, the bacillus described by Bang having been found only in Europe and his work having failed to be confirmed by American investigators.

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Altogether eighteen parturient cows have been examined bacteriologically. Ten of these calved at term and the births appeared to be normal. The abortion bacillus was not found in any of these. Eight were cases of premature delivery, and of these, six appeared clinically to be cases of contagious abortion. Placental tissue from two of these cases was examined by the Nowak plate method and a bacillus isolated, apparently identical with that isolated by Bang in Denmark and by Nowak in Austria.

The organism is a very small short rod, usually oval in shape, from 0.8 $\mu$  to 2.0 $\mu$  long by 0.7 $\mu$  wide, practically always single, rarely in short threads of two to four cells. It is not motile, and does not form spores. It stains with moderate rapidity with the ordinary anilin dyes, and is decolorized by Gram's method. The colonies on serum-agar are raised, with smooth circular borders, appearing almost like drops of dew. They are transparent and very clear, with a bluish

gray color by transmitted light. Under the microscope a few coarse granules may be seen near the center of the colony but the greater part of it appears very homogenous and almost water-clear. The appearance of the colony is really a very characteristic feature of the organism and enables one to distinguish readily the colony of the abortion bacillus from other colonies on the serum-agar plates.

The behavior toward oxygen is another character upon which considerable reliance may be placed in the identification of strains recently isolated from the animal body. This is tested by transplanting the colonies from the serum-agar plates to two series of agar streak sub-cultures, of which one series is incubated in the atmospheric air and the other in the closed jar together with cultures of *B. subtilis*. Unless the growth under the latter condition is much better than the growth outside the jar, the culture may be discarded as one not belonging to this species.

A final important test in identification is that of pathogenicity. Nowak induced abortion in pregnant guinea pigs with great regularity by subcutaneous, intraperitoneal, and intravenous injection of pure cultures of the abortion bacillus. So far, four pregnant guinea pigs have been inoculated subcutaneously with the pure cultures isolated by us, and the inoculation has been followed by premature evacuation of the uterus with death of the fetuses in 3½, 8, 6, and 7 days respectively. In the first guinea pig the two fetuses were practically fully developed and covered with hair. In this instance the abortion bacillus was isolated only from the subcutaneous tissue of the mother at the point of inoculation, the cultures from the uterus, the placenta, and the fetuses remaining negative. In the other three cases the fetuses were undeveloped and the condition was that of a true abortion. In these instances the abortion bacillus was demonstrated by culture tests at the point of inoculation in pure culture in two, in mixed culture in the other one; in the interior of the uterus in pure culture in all three; in each of the four placentæ of two cases in mixed culture, as these placentæ had been passed some time before they were found, and in the three placentæ of the other case in pure culture; in the livers of all three fetuses of the one case in pure culture, but not in the other four fetuses; in the heart blood of the mother in pure culture in one case, but not in the other two cases. In all these tests the mother guinea pig was killed by chloroform soon after the abortion had occurred.

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From the results of these tests we have concluded that the bacillus isolated by us from aborting cows is identical with that isolated by Bang and by Nowak. Further, the investigations of Bang, Preisz, Nowak, McFadyean and Stockman, and Zwick, seem to justify the acceptance of this organism as the infectious agent in the contagious abortion of cattle.

The principles of bacteriological nomenclature have not as yet been universally adopted, and most of the investigators quoted in this paper have avoided the use of a specific name for the abortion bacillus. Bang himself seems not to have given it a binomial designation, but he repeatedly employed the term "Abortusbacillus" as a specific term. Chester (1901) has named the organism "*Bacterium abortivum*" with the synonym "Bacillus of contagious abortion in cows, Bang." Preisz (1902) suggested the name "*Corynebacterium abortus endemici (s. infectiosus)*." This generic name *Corynebacterium* appears to be incorrect, as the organism is very different from those to which this name has been previously applied. It would seem best to employ the more general term *Bacillus* (or *Bacterium*) as a confessedly temporary generic name until a more definite generic nomenclature of bacteria shall have been developed and generally adopted. In determining the specific name it would seem that the term "Abortusbacillus" employed by its discoverer as early as 1907 should receive first consideration. We<sup>[1]</sup> have therefore suggested the name *Bacillus* (or *Bacterium*) *abortus*, Bang, for this organism. The term "*abortus*," being in the genitive case, may be employed with either generic term.

#### FOOTNOTE:

[1] MacNeal and Kerr, 1910.

#### RESTRICTION AND ERADICATION OF THE DISEASE

Reliable methods for restricting the spread of contagious abortion and for eradicating it from a herd may be expected as the result of more complete and accurate knowledge of the nature of the disease and its mode of spread. Some of these methods, such as that of artificial immunization, are being tested experimentally by the Departmental Committee appointed by the British Board of Agriculture and Fisheries to inquire into Epizootic Abortion. Until these methods have been developed beyond the experimental stage, the older more or less empirical methods will have to be relied upon. Fortunately these older methods can now be subjected to careful scrutiny in the light of modern knowledge of the disease, and they have been studied in this way by the British Committee mentioned above. The following summary has been copied, with only slight abridgment and very few alterations, from the report of this Committee.

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"The methods which have been relied upon in the past for the prevention of abortion and its eradication from a herd are:—

- (1) Periodical spraying of the external genital organs and hind quarters with disinfectant solutions.
- (2) Isolation of animals as soon as they show the premonitory signs of abortion.
- (3) Internal administration of carbolic acid to animals supposed to be infected or exposed to infection.

(4) Irrigation of the genital organs of animals which have aborted with antiseptic solutions.

(5) Removal and disposal of animals which have aborted.

(6) The keeping of a special bull for serving animals which have aborted, or, what is based on the same idea, the disinfection of the external genital organs of the bull with antiseptic solutions after he has served such a cow.

(7) Destruction of the abortion membranes, and disinfection of the parts of the buildings, litter, etc., with which the infective material has come in contact.

(8) The keeping of a goat, especially a male goat, in a byre with the cows."

It cannot be said of the above measures that either singly or collectively they have brought about any material improvement in the general condition of our herds in relation to abortion. According to reports, decided improvements have been effected in individual herds by the adoption of isolation and disinfection, while in others very little has been accomplished. Some of the above methods are founded on nothing more than ignorant empiricism, while others are based upon pathological and physiological considerations which are only partially correct in their applications. Since most of them have obtained a certain amount of hold, at least on the minds of stockowners, it may be useful to discuss each measure separately in the light of our recent investigations.

*Spraying of the External Genital Organs.*—This is a procedure which probably has little or no value. (*Abridged.*)

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*Isolation of Animals as soon as they show Signs of Abortion.*—The necessity for this measure is obvious, and its importance cannot be too much insisted on. An infected animal only becomes infective to others immediately before the act of abortion, and may remain so for some weeks afterwards. However, only a proportion of the affected animals show premonitory signs, and quite a number may abort amongst their companions without warning. Under such conditions, then, measures of immediate isolation lose much of their undoubted theoretical value, owing to the difficulty in the way of carrying them out in practice. There is not likely to be any serious difficulty in diagnosing the bacterial disease after an act of abortion, even in an isolated case, if the membranes are available in a reasonably fresh state. (*Abridged.*)

Isolation of the affected animals, however, must be complete before and after the act to be of any real value. Having regard to what appears to be the most common form of infection, viz., by ingestion, we do not think that anything material is to be gained by merely putting all the cows about to abort and those which have aborted at the lower end of a byre, so that the infective discharges may not come in contact with the external genital organs of their fellows, unless we assume that infection frequently takes place by an animal licking virulent material from a part of its body where it has been deposited by flicks of the tail which has been contaminated by lying in the gutter behind the stalls.

*Internal Administration of Carbolic Acid.*—The uselessness of carbolic acid and other antiseptics as curative agents has already been referred to. As a preventive agent by internal administration we believe carbolic acid to be equally useless. Even if it were possible to administer very large doses of this poisonous substance, one could not expect to be able to give enough to destroy the bacilli which have been swallowed and mixed with the contents of the enormous stomachs and intestines, and it would be equally hopeless to expect to destroy in this way the bacilli which have already reached the womb. This alleged measure of prevention must be regarded as an absurdity which has gained a certain amount of support owing to observations carelessly collated and carelessly interpreted.

*Irrigation of the Genital Passages after Abortion.*—With the act of abortion the greater part of the uterine exudate is immediately ejected. That some of it remains behind for a short period is certain, since we were able to demonstrate abortion bacilli in material obtained from the vagina of a heifer three days after she had aborted. On the other hand, no abortion bacilli could be found in the uterus of another heifer a month after she had aborted. It seems probable that, as a rule, the genital organs cleanse themselves by natural means a comparatively short time after abortion has taken place. Almost immediately after abortion and expulsion of the membranes the uterus contracts, and its internal surfaces come into apposition. Its condition is such that it would not be possible to force fluid into it with a pump from the vagina. Apart then, from the probability that disinfection of the uterus by antiseptics is not necessary to rid the organ of abortion bacilli, we are of opinion that it is futile to attempt it by irrigation methods. So long as a discharge continues to come from the genital passages, we think that for hygienic and therapeutic reasons they ought to be cleansed once or twice by the intravaginal injection of tepid antiseptic solutions, such as a 2 per cent solution of carbolic acid or a 1 in 3,000 solution of corrosive sublimate, but not on the ground that the injections will disinfect the uterus. We are of opinion that it will seldom be necessary to continue the injections for more than a month, and that after three months there should be small risk in putting the cow to the bull, provided she is afterwards protected from fresh infection.

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*Removal and disposal of Animals which have aborted.*—It is quite a prevalent custom to feed for the butcher cows which have aborted. It is also customary to sell such cows alive in the open market. The second custom we consider likely to introduce disease to other establishments, unless the animals have ceased to discharge; they should, we think, be kept for at least three months after abortion before being sent for sale.

The first custom is less objectionable than the second, but we think that a breeder will be more likely to get rid of abortion from his herds by keeping such animals than by disposing of them and

bringing in new ones before his entire herd is free from the disease. There can be no doubt that in most cases an attack of the disease greatly increases an animal's resistance to future attacks, and that in a large proportion of the affected, probably in the majority, this resistance is sufficient to fortify them against infection during their next pregnancy. It is beyond doubt that a considerable proportion may abort twice in succession, but it is not improbable that inoculation methods may now be successfully employed to exalt their resistance. In the midst of infection there is no better guarantee against the disease than the possession of an immune stock, and for this reason we consider that on infected premises the animals which have already aborted are to be looked upon as valuable assets for purposes of eradication, much more valuable than the new and susceptible animals brought in. We find, however, that a small proportion of cows will not hold to the bull for an indefinite period after abortion, and it may be found better to fatten off such animals, unless they are of high value.

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*The Keeping of a Special Bull for Cows which have aborted.*—We have already stated that we do not consider the bull a factor of the first importance in the dissemination of abortion but that infection by means of a contaminated bull must be looked upon as a distinct possibility. We think, therefore, that there is something to be said in favor of keeping a bull for the service of cows which have aborted, and, when that is not possible, of disinfecting the external genital organs of the bull after he has served such cows. Of course, if the cows can be immunized the same bull might be used for all. We do not think that cows from a clean establishment should be sent even to a clean bull on infected premises, and it is also inadvisable that cows from infected premises should be sent to a bull on a clean establishment.

*Destruction of Virulent Material and disinfection of everything contaminated by it.*—The immediate disinfection of the virulent materials and contaminated objects is of great importance, more especially as it appears that the natural virus may remain active for a long time outside the body. The soiled litter, dung, exudate, membranes, and fetus should all be removed at once, preferably after they have been treated with caustic lime. After removal they should be soaked in paraffin and burned, or buried in a deep pit, preferably the former. On no account should the fetus and membranes be fed to pigs or dogs. When a fetus is aborted alive, as sometimes happens, it seldom survives long, and it is advisable to kill and destroy it, since it may excrete abundance of virulent material from its intestines if allowed to live. If, however, it be decided not to kill it, it should immediately be isolated. The walls of the stall and the floor should be washed or strewn thickly with caustic lime, or drenched freely with boiling water. The temperature necessary to kill the bacillus is not great, and this simple method of disinfection should prove efficacious. Lastly, the boots, clothing, and hands of attendants should be disinfected by making use of any reliable disinfectant, such as 3 or 4 per cent solution of carbolic acid.

*The keeping of a Goat amongst the Cows.*—This, we believe can only have had its origin in ignorant superstition, but we feel bound to mention it, as the question of its efficacy has quite frequently been seriously put to us. We would point out that goats themselves can be infected with cattle abortion, and that both male and female goats were on our premises during the greater part of the time occupied with the cattle experiments, and their presence did not prevent animals from aborting.

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*Preventive Inoculation.*—This is still in the experimental stage and definite results are hoped for. (*Abridged.*)

The Committee refrained from making any recommendations in regard to measures to be taken by the Board of Agriculture and Fisheries for the prevention of the disease.

Experience in connection with the beef cattle herd at the Illinois Agricultural Experiment Station with the methods of isolation, careful disposal of infected material, cleaning and disinfection of infected stalls, antiseptic irrigation of the genital passages of cows which had aborted, and antiseptic irrigation of the bull before and after service, together with the use of a special bull for heifers and clean cows, has been very satisfactory. These measures were applied under the direction of Professor H. W. Mumford and Mr. H. O. Allison. During the year previous to the inauguration of these measures a large percentage of the calves were lost by abortion. A decided improvement in respect to the number of calves saved was coincident with the use of the procedures mentioned above. They were applied to each case of abortion as it occurred, until in the course of two years abortions have become very infrequent and the herd is now considered free from the disease. It should be noted, however, that those cows which had aborted were not necessarily disposed of, but after local irrigation treatment until the discharge had ceased, they were bred again. Some of the improvement in the herd has, therefore, doubtless been due merely to the retention of relatively immune cows.

Altho the experience here has been rather fortunate and the results obtained seem to bear some relation to the employment of the measures deemed worthy by the British Committee, we hesitate to state that there was any necessary relation between them, because cattle men have observed somewhat similar improvement in herds without the use of any treatment at all. In other words, there appears to be a tendency for the disease sometimes to die out in a herd or to become quiescent for a year or two. On the other hand, the recommendations of the British Committee supported as they seem to be by our local experience, certainly warrant the recommendation of these measures for use in combating contagious abortion. In any event good results cannot be expected without intelligent, careful, and painstaking work, and it may be that some of the failures in applying these measures have resulted from lack of efficiency in applying them rather than from insufficiency of the measures themselves.

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