DIGEST

The transmissible diseases of plants and animals spread more rapidly as the commerce in plant and animals increases. Diseased plants and animals form a constantly increasing percentage of the total number transferred as the infected centers become more numerous. Pages 3 to 4.

Johne's disease is not wide spread at present, but may become so. Now is the time to fight it. Page 4.

Intermittent diarrhea and emaciation mark Johne's disease. It affects cattle primarily. Pages 4 to 5.

In all the chief cattle raising countries Johne's disease is found. In some it causes considerable losses. Pages 5 to 8.

An organism that grows in the intestinal wall causes Johne's disease. The effect on the animal is to produce a progressive emaciation. A thickened and much wrinkled intestinal wall is the most marked lesion of the disease. Pages 8 to 13.

The organism causing the disease is brought into a herd in the body of a diseased animal. If the disease is far advanced in any of the affected animals, the organism will be given off in great numbers and the disease will spread rapidly in the herd. Pages 13 to 15.

The disease can be detected in the animal by the use of Johnin which causes a temporary rise in temperature in affected animals and has no effect on non-affected animals. Pages 15 to 19.

Repeated tests of entire herds and removal of reacting animals may free the herds from Johne's disease. Pages 19 to 20.

An animal may be affected for a number of years and show no symptoms. The calves of affected animals are undoubtedly free from the disease at the time of birth. Pages 20 to 21.

Johne's Disease

B. A. Beach and E. G. Hastings

EVERY FARMER REALIZES that diseases both in his crops and herds are more numerous than a generation ago.

He may conclude from this observation that new diseases are appearing in the world. So far as our present knowledge goes the conclusion is undoubtedly a false one, but something which is quite akin to the arising of new diseases in its effect on the farmer's business is taking place. This is the continued spread both of plant and animal diseases which have previously been confined to limited areas of the world. Bovine tuberculosis is an example. No one knows where or when it originated, but it is definitely known that through the export of cattle from northwestern Europe during the last eight or ten decades the disease has been carried to all parts of the world. A considerable part of this distribution took place before much was known concerning tuberculosis, and especially concerning its detection. The task of eradicating bovine tuberculosis seems to many, one that cannot be accomplished on account of its present world-wide distribution.

Avian tuberculosis is an example of a disease, the spread of which has taken place in very recent years. It was not known to occur in Wisconsin before 1906. At present thousands of the flocks of the state are tubercular. If the knowledge now possessed concerning both bovine and avian tuberculosis had been available and had been applied while these diseases were still localized, neither would be a serious problem for the present-day farmer.

Since the organisms causing any particular disease are carried from place to place primarily in the diseased animal or plant or in their products, it is evident that with the increase in number of animals and plants shipped from one part of the world to another or transferred from place to place in a more limited area, the spread of any disease gains impetus. If there are few infected centers, the great part of the animals and plants transferred

will be free from the disease. As the centers of infection increase, a greater part of the individuals transferred will be diseased and hence, again, the spread of the trouble will be accentuated.

Johne's disease, the subject of this bulletin, is one that is not at all widespread in Wisconsin or in any part of our country at present. It does occur, however, and as the years go by it will become more and more common and will place a greater tax on the cattle industry unless some consideration is given to it by those engaged in the raising and sale of cattle. It is not a new disease, but one which until recent years was confounded with other diseases. Its cause was discovered in 1895. The disease was first found in this country in Pennsylvania in 1908. The purpose of this bulletin is to call it to the attention of those interested in the cattle industry in order that steps may be taken to protect the herds still free from it and that the few herds now affected may be freed from the disease. A little work done now may have far more effect than a hundred times as much a decade hence, if inferences can be drawn from the experience of other countries with this disease.

The successful fight against any transmissible disease necessitates some means of detecting it at such an early stage in its development that the affected animal can be removed before the disease-producing organism has spread to other animals. Such methods are now available for Johne's disease. They are herein described and the experience which the Experiment Station has had with them is presented. The struggle against this disease as against any other is one which the breeders must carry on, each for himself with such aid as the state may be able to give.

CHARACTERISTICS

The disease affects cattle and, in rare instances, sheep and goats. It has been found in deer. The affected animals lose flesh very slowly until they become virtually walking skeletons. The unthrifty condition of animals, in spite of abundant feed, is occasioned in part by this disease. Tuberculosis is another cause of the condition that makes the common English term, "piner", a fitting one. The term "canner", referring to the use which is made of the meat in the packing houses, is the more common American term applied to sick emaciated animals. It is believed that once Johne's disease is under way

in the animal, death is certain to result from it. The progress is so slow that its contagious nature is usually not recognized since one usually thinks of a transmissible disease as progressing rapidly to death or retrogressing quickly to recovery.

The disease is known under a number of names. The one used in this bulletin is the most common and owes its origin to the discoverer of the organism. Paratuberculosis is used by

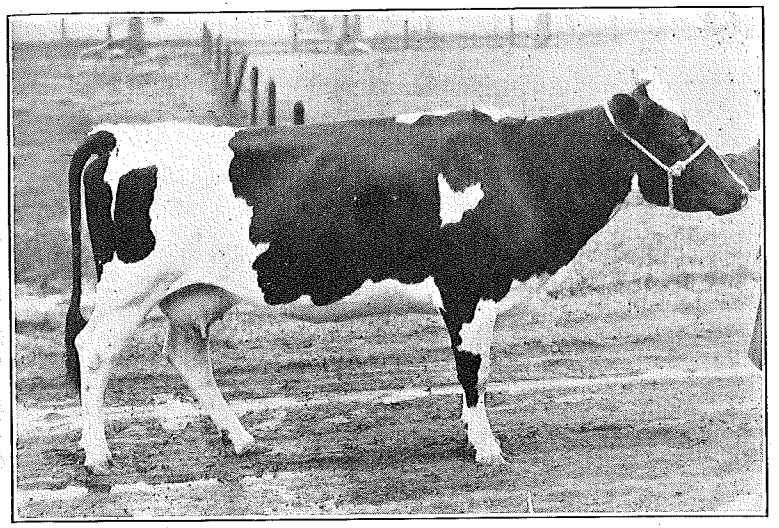

FIG. I.—AN INFECTED ANIMAL.
This animal reacted to Johnin.

some writers, chronic bacterial dysentery by others, while in Norway the trouble is known as Laaland's disease, because of its prevalence on the Island of Laaland, a part of Denmark. The common Swiss name for the disease is "Kaltbrandigkeit", which signifies a thirst without fever. The thirst is due to the watery condition of the feces. In England and Scotland the disease as it occurs in sheep is called scrapie.

OCCURRENCE

The disease causes considerable losses in several European countries. No definite data as to the extent of the losses are available. In Denmark the disease was first recognized in 1904 by B. Bang in two cows of the red Danish breed, the cattle most widely kept by Danish farmers The disease has also been found

in the Jutland breed, while it is especially important in the Jersey herds of Denmark. Its widespread occurrence in this breed gave rise to the statement by B. Bang that the future of this breed of cattle in Denmark depends on the ability to eradicate Johne's disease from the herds. In Denmark 3.5 per cent of the total value of the cattle insured by one company was paid yearly for losses due to this disease. It has caused great losses in Switzerland, and in Germany, and is quite widespread in England and in the Channel Islands It has been estimated by those most familiar with the conditions in England that 1 per cent of the cattle are affected. In Birmingham, England, on the average six cases are found in each 1,000 cattle killed in the municipal abbatoir. It seems quite probable that the occurrence of the disease in the Jersey herds of Denmark reflects the condition in the island of Jersey. In our experience some of the Guernsey cattle imported from the island of Guernsey have been found affected.

The trouble was first recognized in this country by Dr. Leonard Pearson of Philadelphia in 1908. Little can be said of the extent to which the disease occurs here. It has been reported to us from eight states. It seems probable that the conditions in other of the important dairy states will be much the same as in Wisconsin. It is impossible to obtain data that will enable one to make even an estimate of the number of affected herds in Wisconsin. Definite knowledge of its occurrence in 18 herds in 13 different localities has been obtained. It is certain that the disease is more widespread than our present data indicate. The disease is not recognized by many practicing veterinarians. Opportunity to make a post mortem examination is rare in the case of this disease, due to its slowly progressing nature and the opportunity thus presented to the owner to sell the animal for slaughter.

The prevalence of the disease is not such as to cause great alarm, except that it is likely to be present in pure bred herds from which animals are being sold in great numbers. A few such distributing centers may in a few years infect many herds and the disease will thus spread with a constantly increasing rapidity unless more attention is paid to it than is done at present.

The extent to which the disease may spread in a herd is shown by the results of O. Bang who examined a considerable number of herds, using tuberculin prepared with the avian tubercle bacillus. The danger of confusing tuberculosis and Johne's disease was avoided by testing only cows that had not reacted to ordinary tuberculin. Table I. was compiled from the data collected by Bang. The extent to which a herd may be affected is comparable to that found with tuberculosis.

TABLE I—THE EXTENT TO WHICH JOHNE'S DISEASE WAS FOUND IN SOME DANISH HERDS

Herd	Number of animals over two years old	Infected	Number of animals under two years old	Infected
		Per cent		Per cent
1	139	45.3	31	0.0
2	69	37.7	25	0.0
3	67	34.5	26	4.0
4	148	10.8	73	5.5
5	99	10.0	78	10.0
6	291	13.0	77	8.0
7	85	23.5	29	0.0
8	89	9.8	19	0.0

IMPORTANCE

The importance of a disease is measured to a large extent by the number of herds affected, and by the proportion of the diseased animals that succumb to it each year. The decreased productivity of diseased animals is also to be considered. In many instances the highest producers of the herd seem to be the ones affected. A case in point is the following. Seven young cows and heifers were found affected in a herd that came under our observation. The five highest producers of the herd were found among these diseased animals.

The importance of the disease is made more real when the actual losses from herds are presented. The losses in five dairy herds concerning which we have been able to secure rather complete histories are presented in Table II.

TABLE II—LOSSES FROM JOHNE'S DISEASE IN A NUMBER OF WISCONSIN HERDS

	Number in herd	Duration of infection	Number removed because of infection	Yearly losses
1	45	8 years	30	8.5%
2	50	17 years	41	4.7%
3	40	15 years	20	2.2%
4	35	10 years	22	6.2%
5	18	10 years	22	12.0%

An annual loss of from 2 per cent to 12 per cent over a period of years is a serious matter to the breeder. It is a tax from which he may well attempt to escape.

CAUSE

The organism causing the disease is one of an important group of bacteria. The other disease-producing members of the group are the human tubercle bacillus, the bovine tubercle bacillus, the avian tubercle bacillus and the organism causing leprosy. These organisms have certain common properties, one being their very slow growth both in the animal body and in the artificial cultures in the laboratory. None of the diseases mentioned is of an acute nature; the organisms named and the Johne's bacillus have much the same appearance under the microscope. Indeed the Johne's bacillus cannot with certainty be recognized from the tubercle bacillus in the microscopic examination of specimens from cattle. It was at first thought to be the avian tubercle bacillus which when growing in the tissues of cattle produced lesions unlike those which it produces in the tissues of the bird.

Johne's bacillus undoubtedly enters the body of the animal through the food and drink. It finds favorable conditions for growth in the wall of the intestine and in the neighboring lymph glands. The bacilli may be found in enormous numbers in the affected tissues of some animals, while in the tissue of other animals, their presence is detected with great difficulty. During the early stages of the disease it is probable that the organism is so confined within the tissues that it is unable to get out of the body of the affected animal. As the disease progresses, the organisms get into the intestinal contents and are excreted in the feces. Opportunity is therefore presented for them to be swallowed by a healthy animal.

It is not certain whether the evident symptoms of the disease precede this excretion or follow it. If the former condition is true, then the removal from the herd of any animal that shows physical symptoms should prevent the spread of the disease in the herd. From what is known of other diseases, it seems

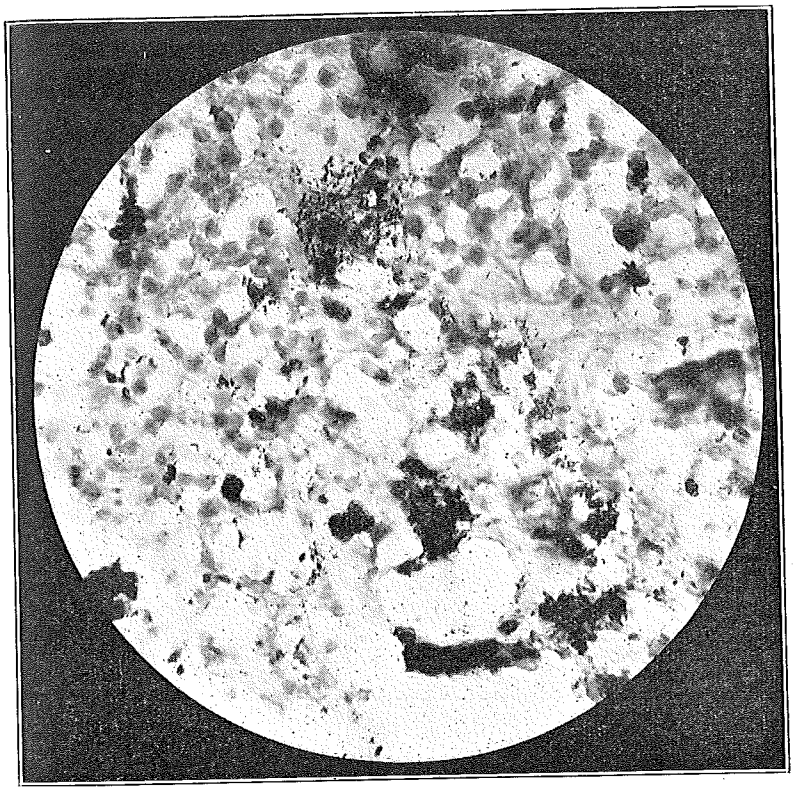

FIG. II.—A PHOTOMICROGRAPH OF A SECTION OF A DISEASED LYMPH GLAND.
The dark areas consist of masses of Johne's bacillus.

probable that the organisms are excreted before any certain symptoms are evident. This implies that some means of detecting the disease in its early stages is essential in combating its spread both in the herd and from herd to herd.

The ability to grow the causal organism of any disease is likely to be of great assistance in gaining information of value concerning the disease, and especially in detecting it in the

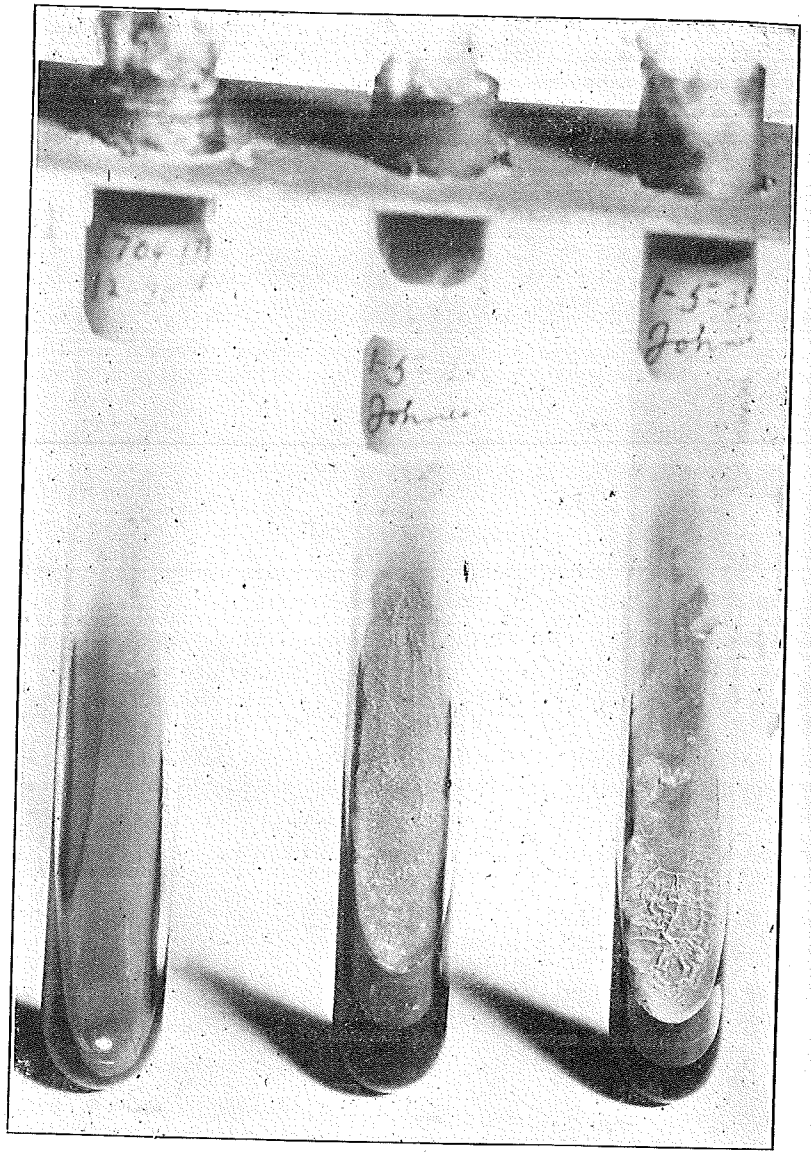

FIG. III.—GROWTH OF JOHNE'S BACILLUS.
The tube on the left shows the meager growth obtained when the culture was first isolated, the other tubes the more profuse growth when the organism had become better adapted to artificial culture media.

early stages. The organism of Johne's disease was not grown in artificial cultures until 1910 and even at present its isolation and continued cultivation is a very difficult task in which the failures far outnumber the successes.

SYMPTOMS

The physical symptoms are slow to develop after the invasion of the animal by the organism. From observations that have been made in England it seems that at least six months must elapse after invasion before symptoms ever become evident. This implies that the disease is not likely to be noted in young animals. Heifers with their first or second calf are more apt to show symptoms than older or younger animals. The strain placed on the animal by pregnancy seems to accentuate the progress of the disease which may have been acquired in early life.

The most striking symptom is the gradual loss of flesh. This continues until the animal becomes a mere skeleton. The eyes remain bright but become sunken due to absence of intra-orbital fat. The milk flow is reduced and finally ceases altogether. Commonly no fever is present and the appetite is not impaired. These conditions are similar to those noted in tuberculosis, especially as it occurs in birds. The first suspicion is of tuberculosis. Marked emaciation and nonreaction to tuberculin should lead to a suspicion of Johne's disease.

The other most marked symptom is a diarrhea which appears and disappears to appear again sooner or later. In the later stages of the disease the diarrhea may be constant and again it may be entirely absent. It should be recognized that there are numerous causes of both marked emaciation and diarrhea. These symptoms become indicative of Johne's disease only when coupled with the characteristic lesions. As has been mentioned before, the appearance of the symptoms is so slow that the suspicion of the owner in regard to a contagious disease is not aroused. Often the infection has an opportunity to become widely disseminated in a herd before serious consideration is given.

In the great majojrity of infected herds but one or two animals are lost per year. This again tends toward the thought of a non-contagious trouble.

POST MORTEM FINDINGS

The lesions found in the tissues of an animal that has died from Johne's disease are usually insignificant as compared to

the physical condition to which the animal is reduced. In many instances the extent of lesions bears no relation to the emaciation or to the diarrhea that the animal shows. Cases of long standing may show very little evidence on post mortem, while in others the tissue changes are comparatively quite marked. It seems certain that this non-relation between the extent of lesions and the condition of the animal has caused many cases of Johne's disease to pass undetected by the examining veterinarian. The lesions of Johne's disease will rarely be discovered unless the intestine is slit and the inner wall examined. In the cases examined by us in which the lesions were insignificant, the organisms have been found by microscopic examination.

The only characteristic lesion is the thickening of the intestinal wall. This may vary widely both in extent and degree. Only a

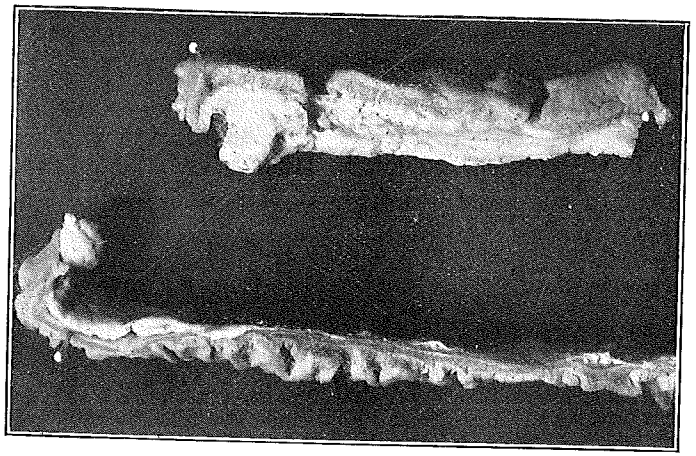

FIG. IV.—HEALTHY AND DISEASED INTESTINAL WALLS.
The intestines were slit open and the cut edge photographed. The one at the bottom represents the thickness of the normal wall, that at the top the thickening due to the growth of Johne's bacillus.

short portion of the tract may show the thickened condition, while again it may extend for many feet. It is most often noted at the opening between the large and small intestine, the ileo-caecal valve. It is here that the change is likely to be most marked. The thickening of the wall results in more wrinkling than is noted in a normal wall. In the normal intestine the folds will disappear when the wall is stretched, while they are permanent in the case of the diseased intestine. The wrinkled condition may occur in patches rather than in a continuous area.

The tissues near the ileo-caecal valve may be swollen and greatly inflamed. There are, however, no hemorrhages nor do ulcerations occur. The mesenteric lymph glands usually appear moist when cut and often a little swollen.

MODE OF SPREAD FROM HERD TO HERD

There is no reason to believe that the disease is transmitted from herd to herd other than through the transfer of an affected animal. Animals may be infected and yet show no symptoms

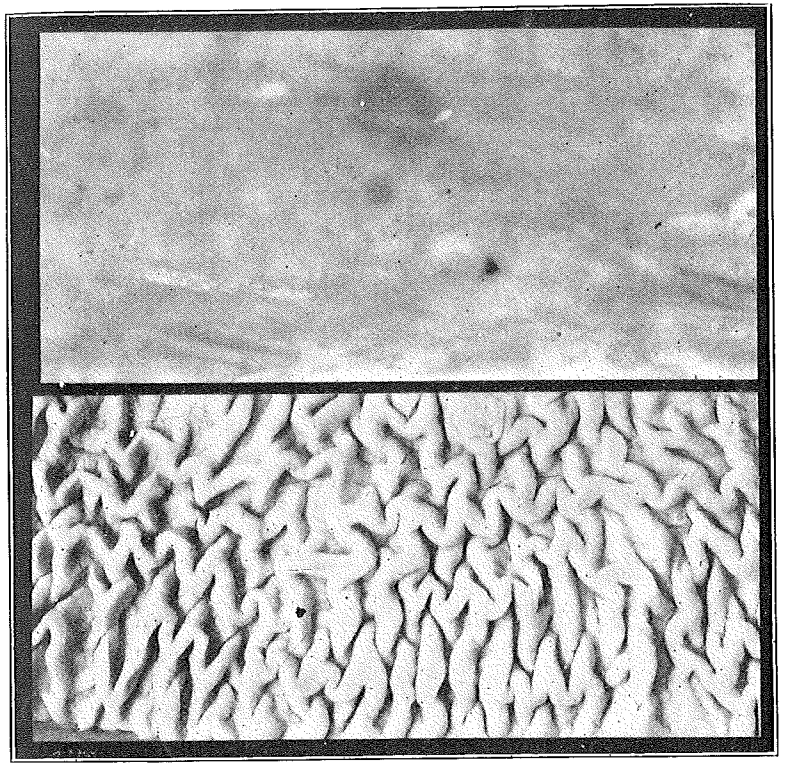

FIG. V.—HEALTHY AND DISEASED INTESTINAL WALLS.
The upper part of the picture represents a normal wall when tightly stretched, the bottom part the wall of an animal infected with Johne's bacillus. It is impossible to remove the wrinkles of the diseased wall by stretching it.

for many months. The seller may have no reason to believe that the animal is other than healthy and so is, as far as the individual animal is concerned, perfectly innocent. Until recently most owners of affected herds have not realized the contagious nature of the malady which was causing them more or less con-

tinuous losses and were again perfectly innocent of any wrong in the sale of animals. At present it is feared that as much cannot be said for all breeders.

The history of a number of affected herds has been obtained with such completeness that the original source of infection could be traced. Without exception a purchase from an infected herd has been the origin of the trouble. The best protection of the buyer is inquiry concerning the general healtth of the herd, and concerning the nature of losses that have occurred, rather than inquiry concerning the individual to be purchased. A general statement concerning the health of the entire herd should be required by the purchasers at any consignment sale of cattle.

RATE OF SPREAD IN INDIVIDUAL HERDS

The rate of spread is dependent on the number of animals excreting the causal organism and the number of organisms given off by each animal. It is also influenced by the conditions under which the animals are kept. Since the organisms are given off in the feces and enter the body of healthy animals in the food or drink, any method that tends to soil the food with manure will hasten the spread of the disease. Yard feeding will favor the dissemination to a greater extent than stall feeding. The keeping of calves in yards with older cattle would seem to be bad practice, since in this way what seems to be the most susceptible part of the herd is brought in contact with the portion that may be excreting the organisms.

The following are some of the cases that have come to our attention: A dairyman purchased three young cows at a sale in 1910. The animals were in good condition at the time of purchase. In 1912 two of these cows became poor; they had diarrhea at intervals and were sold as canners. In 1913 the other animal showed symptoms and was sold. In 1914 an animal of his own breeding was sold because of her condition. Up to 1920, 15 head have either died or have been sold for slaughter because of Johne's disease. The average size of the herd during this ten year interval was 18 head. When the herd was first tested in 1920, seven reacting animals were found in the herd of 18.

Another dairyman purchased a two-year-old heifer with her first calf in October, 1910. This heifer had been imported four months. At the time of purchase she was thin in flesh. The owner, who was unacquainted with Johne's disease, attributed her

condition to other causes. This heifer died the following March. At the time the heifer died, two others were scouring badly and were sold. Still another was isolated and died in August, 1911. Up to 1920, 20 head have been lost from this herd of 35 to 40 animals. These were mostly heifers with their first or second calf. None were under two years old and the symptoms were shown always just after calving, during the period of heaviest milk flow. In this herd also, many of the highest producers were taken. One interesting observation in connection with this herd was the fact that a middle aged or old animal has never shown symptoms of Johne's disease.

In 1913 a dairyman bought four heifers. Among them was a yearling which developed in a normal manner as far as was observed. In 1919 this cow exhibited symptoms of Johne's disease and was sold. It seems probable that the infection was introduced in this yearling heifer. A few additional animals were purchased but no history of Johne's disease could be found in the herds from which they came and they have not since developed it, and are still in the herd. No animal which had been raised on the place and sold between 1913 and 1919 was in an unthrifty condition when sold. These facts indicate that the infection was inactive in this heifer for six years and then became active. During the past two years two additional cases have developed in this herd.

A breeder of purebred dairy cattle purchased a bull in 1903. This bull became thin and died of Johne's disease in about one and one-half years after reaching the farm. Up to the year 1917 this herd has lost 20 head. One noteworthy observation on this farm was a 10-year-old cow that exhibited symptoms of Johne's disease. The specific organisms were found on postmortem.

THE JOHNIN TEST

It has been pointed out that there is opportunity for the disease to be transmitted by an animal before the condition of the animal is recognized. The recognition of this fact has been the stimulus to seek for more perfect methods of detecting the disease in its early stages before the organisms have been given off.

The supposed relation of the avian tubercle bacillus to the disease led to the use of tuberculin prepared with this organism. The results obtained by various workers were fairly satisfactory. The cultivation of Johne's bacillus by Twort and Ingram of England

in 1910 enabled them to prepare a product similar to tuberculin in its mode of manufacture and use and in its effect on the diseased animal.

The preparation of the Johnin, as the diagnostic agent is called, is briefly as follows: The organisms causing the disease are grown in a specially prepared beef broth for at least three months. The flasks containing the cultures are heated in order to kill the organsims; and a small amount of carbolic acid is added as a preservative. The product thus consists of an extract of the organism. It will contain some of the dead bacilli. It is, of course, impossible for it to cause the disease since any organisms that it contains have been killed by heating.

A large percentage of cattle infected with Johne's disease when injected with Johnin will respond with a rise in temperature, muscular tremors, or diarrhea. In order to get the best results with this agent it is necessary to inject the Johnin into the blood stream. The manner in which this test is conducted is as follows: The cattle to be tested are confined and handled in the customary manner. The surroundings should be such as to cause as little excitement as possible, since the results of the test are based largely on a rise in temperature. Any outside influences, therefore, that tend to cause variations in temperature may give rise to erroneous results. Feed and water should be as usual except that water should be given just after a temperature is taken and not just before, as large quantities of cold water lower the temperature for a little while. One or two temperatures are taken before the injection of the Johnin. Any animal with a temperature higher than 103 degrees should not be tested. If there are any animals in the herd with a high temperature without apparent reason, such as recent calving, vaginal discharge, garget, etc., none of the animals should be tested at this time. Leaving those with high temperatures and testing the remainder is poor practice for the reason that the same factor that is causing the high temperature, may at some time during the test cause a fever in animals that at the beginning showed a normal temperature.

The head of the animal to be injected is secured with a halter as high up as possible and to one side. A rope is placed around the neck just in front of the shoulders and drawn taut enough to distend the jugular vein. For the average cow 10 cc. are injected into the vein. Cows showing symptoms should receive 15-20cc. If possible the first temperature is taken within thirty

minutes after the injection of the Johnin. Temperatures should then be taken every two hours up to and including the 12th hour. Care should be exercised to deposit the Johnin in the blood stream, for if it is injected into the tissue around the vein, the reaction may fail to develop in the usual manner. The extent of the rise in temperature is much the same as in the tuberculin reaction. Usually the rise and fall of temperature is gradual. Figure VI shows typical reactions to the Johnin test.

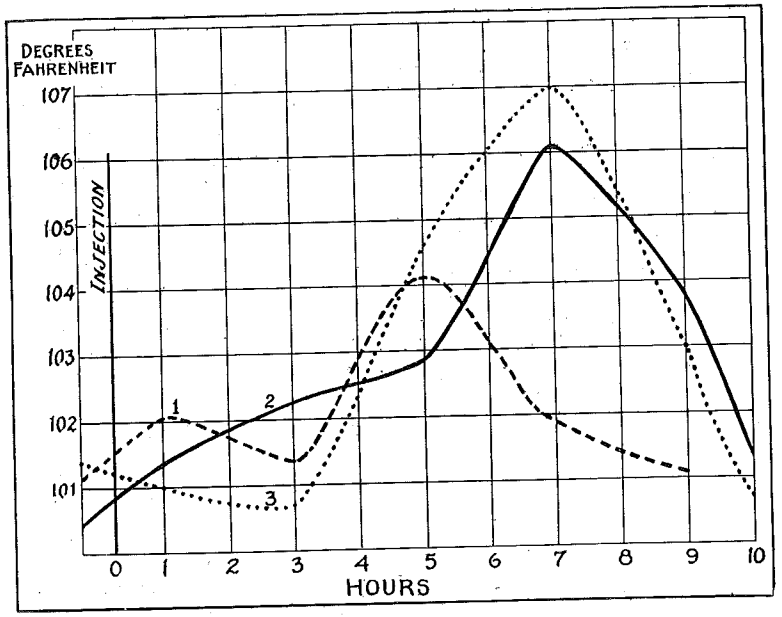

FIG. VI.—REACTION CURVES.

The temperature curves of three animals. It is to be noted that the maximum temperature is reached more quickly than in the tuberculin test, although the height of the reaction is very similar.

The initial increase in temperatures may come at any time between thirty minutes and ten hours after injection. The third to the seventh hour is the usual time for the temperature to start rising if a reaction is going to take place.

The following table shows the hour at which the highest temperature was reached in 79 head which reacted to the Johnin test:

TABLE III—HOUR AT WHICH MAXIMUM TEMPERATURE WAS REACHED AFTER INJECTION OF JOHNIN INTO DISEASED ANIMALS

Hour after injection	Number reacted	Per cent	Hour after injection	Number reacted	Per cent
1	None	None	7	18	22.7
2	None	None	8	4	5.5
3	8	10.12	9	1	1.16
4	5	6.32	10	3	3.70
5	34	43.	11	1	1.16
6	5	6.32	12	None	None

It will be seen from the data that approximately 80 per cent of the highest temperatures fell between the fifth and eighth hours.

As in the tuberculin reaction there is considerable variation in the maximum temperature reached by the reacting animal. The character of the reaction gives no idea as to the extent of the disease. Animals in the last stages of the disease often fail to react. It is necessary, therefore, to take this fact into consideration in dealing with infected herds.

TABLE IV—PERCENTAGE DISTRIBUTION OF REACTING ANIMALS ACCORDING TO MAXIMUM TEMPERATURE ATTAINED ON INJECTION OF JOHNIN

Maximum temperature	Number	Per cent
103-104° F.	26	31.3
104-105° F.	35	42.1
105-106° F.	11	13.2
106-107° F.	8	9.6
107-108° F.	3	3.6

A summary of the maximum temperatures reached by reacting animals is presented in Table IV, from which it appears that the majority of reactions reach their maximum between 104 and 106 degrees F.

This test should not be attempted by other than a skilled veterinarian. The success or failure is determined largely by the expertness of the operator in being able to deposit the Johnin into the blood stream and not in the tissue around the vein. The injection of the Johnin beneath the skin, as is done with tuberculin, does not give good results.

Muscular tremors and a diarrhea are frequently shown by reacting cattle.

The diagnostic fluid, Johnin, was first prepared and used by the Englishmen, Twort and Ingram. In their work the test was applied only to animals that had been artificially infected with

the disease organism or to animals that showed symptoms of the disease. No effort was made to test an entire herd, and to determine thus all or part of the infected animals, the removal of which from the herd should tend to decrease the disease and possibly to actually free it from the infection.

FIRST APPLICATION OF JOHNIN FOR HERD TREATMENT

In 1915 we were fortunate enough to isolate a culture of the organism from tissue submitted to us for diagnosis. Johnin was prepared and through the assistance of the State Department of Agriculture and of a number of breeders whose herds were known to be infected, efforts have been made to determine the value of the agent. More than one thousand cattle have been tested.

In any such test it is evident that errors may occur in two ways. Non-infected animals may react to the test or infected animals may fail to react. The latter is the more serious error when one is interested in freeing a herd from the disease. It is also an error that only long continued testing of an infected herd can evaluate. The other error can more easily be measured by the detection of lesions of the disease or the causal organism in the tissues of reacting animals.

It has not been possible to obtain a post mortem examination on all of the animals that reacted to Johnin. Such observations have been made on thirty animals. In twenty-nine clear evidence of the disease was found. It would thus seem that few if any non-infected cattle are so affected by the Johnin as to be classed as having given a reaction. The Johnin test seems as accurate as the tuberculin test in this respect.

The evidence that has been accumulated in connection with the other error, the non-reaction of infected animals, is small in amount. One herd in which the disease had been known to be present for a number of years has been tested nine times in the period from June, 1917, to December, 1921. Reactors have been found in all except the last two tests. A summary of these tests is presented in Table V.

TABLE V—SUMMARY OF RESULTS ON CONSECUTIVE TESTS OF AN INFECTED HERD

Date of test	Number tested	Number reacted
June, 1917	43	5
December, 1917	53	4
February, 1919	51	6
June, 1919	49	4
February, 1920	52	4
June, 1920	54	4
November, 1920	47	6
June, 1921	55	None
December, 1921	51	None

It is impossible to tell at this time whether the herd is actually free from the disease or not. Further tests are needed to demonstrate this. One encouraging fact is that none of the cattle have shown symptoms of this disease since the first test was made. This means that the test is detecting the disease before symptoms become evident.

If it should prove that the test will detect the trouble before the organisms are eliminated, there would remain no doubt concerning the marked diagnostic value of the Johnin. Without the test the infected animals remain in the herd until the disease becomes far advanced with the probability of continued spread of the infection. When the test is employed what seem to be healthy animals are removed, probably before the infection has opportunity to spread from them. In either instance the owner faces loss. If visibly diseased animals remain in the herd, the loss becomes continuous. With some means of early detection, losses from the disease should decrease and finally stop.

Seven herds have been tested during a shorter period of time. The observations are not extended enough to warrant any statement as to the results. It is only through the co-operation of the breeders and veterinarians that the value of these methods can be determined by the Experiment Station. The writers will appreciate any information concerning suspected herds.

In but one instance have clinical cases appeared in any of the tested herds.

DURATION OF DISEASE IN INDIVIDUAL ANIMALS

With Johne's disease, as with tuberculosis, the infection may be present for long periods before symptoms become evident. In one of the animals that came under our observation the infection had apparently been present for six years. In another herd a

cow has been reacting to the Johnin for three years, and at present shows no symptoms of the disease. This fact makes it reasonably certain that eradication by elimination of those animals showing symptoms would, in most instances, not be successful.

It is not to be inferred from this that removal of clinical cases will have no effect in decreasing the disease. O. Bang informs us that the disease is apparently less prevalent in Denmark than a few years ago and offers as an explanation the more careful watch of the herds, and the prompt removal of animals showing symptoms. It is evident to the writers that this is the method that must be followed to a great extent in this country. Prompt removal of all suspicious animals from the herd and care in the purchase of animals will certainly do much to limit the continued spread of this disease. In the purebred herds the use of the Johnin test seems advisable.

TRANSMISSION FROM DAM TO CALF

There is no reason to believe that calves of infected dams are infected at birth. The close association of the calf with an infected mother gives opportunity for the young animal to acquire the infection and to develop the symptoms later, most commonly soon after the first or second calving. The prompt separation of calf and dam will, undoubtedly, prevent the infection of the former, as it does in tuberculosis.

SERUM SICKNESS

It is necessary to add to the broth in which the Johne's bacillus is to grow a small quantity of the serum from horse blood. Whenever a small quantity of the serum from one kind of animal is injected into the tissues or the blood stream of a different kind of animal, the treated animal becomes sensitive to a second dose of the same kind of serum. The first application of the Johnin test causes no disturbance in non-infected animals, while infected animals give a reaction as has been described. On a second test of the same animals some disturbance may be noted in all animals. It manifests itself in rapid breathing and drooling from the mouth and nostrils. A swelling of the soft tissues may occur, especially around the eyes, the anus and vulva, and udder. The extent of the disturbance varies markedly from animal to animal. It may be so slight as to pass unnoticed in many, while in a few prostration may occur. There is no rise in temperature. The symptoms

of "serum sickness" last but a few hours, and do not complicate the true reaction of an infected animal to Johnin. It is probable that serum sickness can be avoided by the use of cow blood serum in the preparation of Johnin.

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THE old adage, "an ounce of prevention is worth a pound of cure—" applies especially to Johne's disease or chronic dysentery of cattle, an affection which is found in comparatively few herds at the present time. Like tuberculosis, it progresses very slowly in the animal, which therefore, may show no evident symptoms for many months after the disease is established in the tissues. The transfer of such an apparently healthy, but really diseased, animal from one herd to another is very likely to produce another center of infection from which the disease may spread to other herds. The rapidity of distribution of the disease increases as the centers of infection increase.

The aim of this bulletin is to call the attention of the veterinarians and breeders to Johne's disease, which, it is felt, is not recognized by many, in order that steps may be taken to prevent its introduction into still healthy herds, and to gradually eliminate it from affected herds.

The disease can be detected by the use of a product, Johnin, which is made with the organism causing the disease, and which is similar to tuberculin in its mode of application and effect on healthy and diseased animals. This test is still in an experimental stage. Over one thousand cattle have been tested. The disease was found on post mortem examination in 29 out of 30 reacting animals. Whether all affected animals can be detected by the test can be determined only by a long series of tests on diseased herds. Only one such attempt has been made; one herd has been tested nine times in four years. No reacting animals were found in the tests made during the fourth year. It cannot be asserted that the herd is free from the disease, but the indications are that it is.

That much can be done to decrease the spread of the disease in a herd by prompt removal of animals showing symptoms, has been demonstrated in Denmark.

That much can be done to prevent the introduction of the disease into a herd by inquiry concerning the health of every herd from which animals are purchased is self-evident.