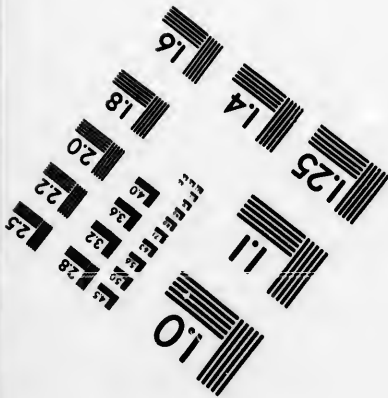
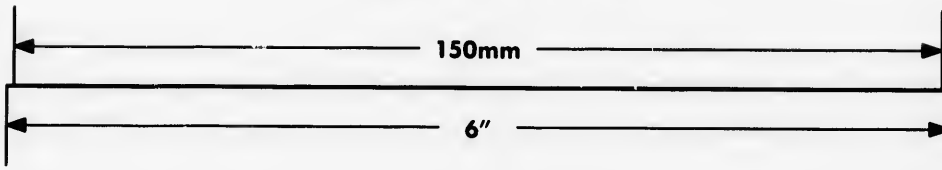
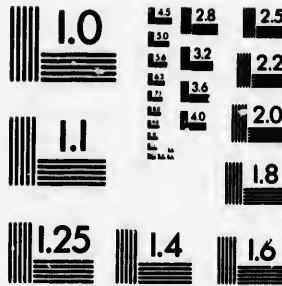
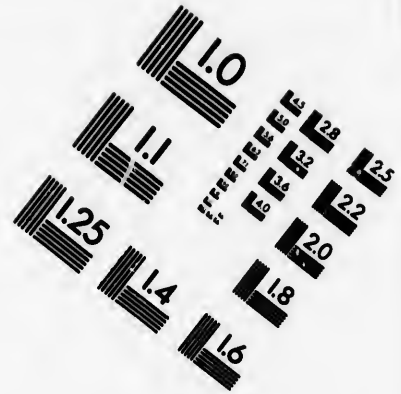
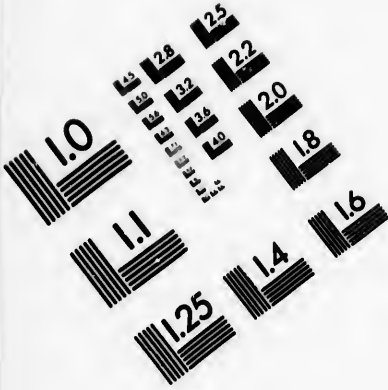


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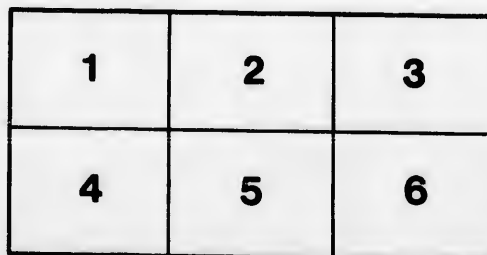
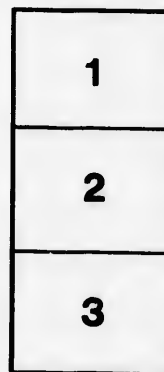
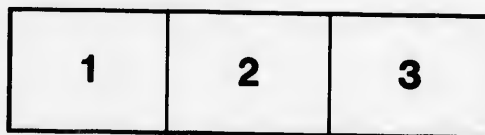
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BULLETIN (SPECIAL).

JULY, 1897.

ONTARIO DEPARTMENT OF AGRICULTURE.

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# TUBERCULOSIS IN CATTLE.

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SPECIALLY PREPARED FOR AND PUBLISHED BY  
THE ONTARIO DEPARTMENT OF AGRICULTURE,  
TORONTO.

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## BULLETIN (SPECIAL).

### TUBERCULOSIS IN CATTLE.

Tuberculosis is one of the diseases of animals which in many countries inflicts great loss on those engaged in agriculture.

The fact that at the slaughter-house in Copenhagen, Denmark, during the year 1895, more than twenty-nine per cent. of all cattle killed were tuberculous, and of 53,303 animals examined by Prof. Bang, of that city, during years 1893-1895 no less than 39.7 per cent. were found to be affected with tuberculosis, shows the hold the disease has on the cattle of Europe. The United States and Canada are not so seriously affected as the older countries of Europe, but occasional examinations show that the disease has obtained a foothold here and is now causing considerable loss.

So gradually has the disease progressed in Europe, and so widespread has it become, that it has come to be looked upon as a necessary or at least an unavoidable condition against which there is no use struggling. During the past ten years, however, a more correct knowledge of the disease and its manner of spreading has been obtained, and now it is generally conceded that the disease can be completely wiped out, and healthy herds obtained and kept for the future. It is to help the Canadian farmers to keep their herds free from this disease that this bulletin is issued. Those who will carefully study what is here presented will acquire a clear knowledge of tuberculosis, the manner in which it afflicts the individuals of a herd, and how its ravages may be successfully prevented. By proper management, as here directed, cattle owners may succeed in keeping healthy herds without the great loss entailed by the indiscriminate slaughter of all animals showing traces of tuberculosis.

Dr. Leonard Pearson, State Veterinarian for Pennsylvania, says: "It is my opinion that the disease will eventually be thoroughly eradicated. The fact that this has already been done on some farms, and even in some larger districts, indicates that it is not impossible for states to achieve the same results."

The disease, as discovered by Koch, is due to a germ or bacillus which enters the stomach with the food, and finds its way eventually into the circulation, or enters the lungs with the air, and lodging in the tissue begins its work. Thus it is seen that the disease is contagious, and not hereditary; that is, it is acquired, and not transmitted, except in very rare instances, directly from the parents to the offspring. Mr. H. L. Russell, Bacteriologist to the Agricultural College, University of Wisconsin, Madison, Wis, says: "Tuberculosis is rarely hereditary. It is contracted, in almost all cases, after birth, by breathing contaminated air, or consuming diseased food. If the source of contagion be removed the young stock will remain healthy."



Prof. Nocard, of the State Veterinary School, Alfort, France, says: "It is not necessary to contest the question whether contagion is the principal cause of the rapid and incessant progress of bovine tuberculosis; heredity contributes very feebly to it, and it may be said its agency in spreading the disease is insignificant and may practically be disregarded. Thousands of cases may be quoted, both with respect to man and beast, where the offspring of parents, either or both of which were tuberculous, have lived without having presented the least symptoms of tuberculosis. In the course of a large number of examinations that I have been able to make, I have found adult cows in a tuberculous state, and I have seen their places in the herd subsequently taken by their own calves which were perfectly healthy."

It is thus against contagion that all efforts to stamp out the disease should be directed. The spread of the bacillus is largely caused by animals being put together in the same stable. The discharge from the lungs of an affected animal is spread around it in the bedding and mangers, during its fits of coughing, and becoming dry it is reduced to powder and floats in the air, and is then inhaled by the animals in adjacent stalls, and even animals in the same stable, although some distance removed, are not free from danger. When it is remembered that millions of these small germs are coughed out with a small quantity of the secretion it may be seen how easily a whole stable may be affected from one animal.

A source of very great danger is putting healthy animals into stalls once occupied by diseased ones, as the mangers are usually contaminated unless a thorough disinfecting process has been carried on. Animals drinking from the same trough, particularly a trough running in front of stalls from which they all drink, are subjected to a great source of infection.

Transmission of the disease from one animal to another is not very frequent in the pasture.

Now since contagion is the principal cause of the spreading and keeping alive of the disease, it is necessary, in order to put an end to it, that all the healthy animals should be separated from the unhealthy. Up to this time this has been a very difficult undertaking, as it was almost impossible to say with certainty which animals were affected and which not, as some may be considerably diseased (enough to spread the contagion), and yet not show any signs of sickness—in fact, look to be in almost perfect health. These facts are made known particularly by the study and experiments of Prof. Bang, of Copenhagen, Prof. Nocard, of France, and Prof. H. L. Russell, of Madison, Wis.

To-day by the use of tuberculin it is possible to tell a diseased animal even if it is in the earliest stages and the parts affected very insignificant. In this connection Mr. H. L. Russell, Bacteriologist to the Agricultural College, University of Wisconsin, says: "The efficiency of the tuberculin test in recognizing tuberculosis, both in its incipient and well developed stages, is now unquestioned. As a means of diagnosis, it is so far superior to any previous method, that its use is now regarded as essential by all progressive veterinarians. It detects a diseased condition long before any physical symptoms are apparent.

A re-acting animal of this sort, though tuberculous, might remain in the herd for considerable time and still be regarded as perfectly healthy, but in a great many cases it is a centre of contagion, and from such an one the seeds of the disease are sown throughout the remainder of the herd. Herein lies the great advantage of the tuberculin test, as it permits of a recognition of the disease sufficiently early to prevent further spread, if proper measures are at once instituted."

If a small quantity of the tuberculin is injected under the skin of a suspected animal, in the way that will be described later on, and the animal shows no elevation of temperature, that is has no fever afterward, then the animal is not tuberculous. On the other hand if the animal is ever so slightly tuberculous the injection is attended in a few hours with fever, an elevation of  $2\frac{1}{2}$ ,  $3\frac{1}{2}$ ,  $4\frac{1}{2}$ , or more, degrees Fahrenheit.

The tuberculin does not give any indication of the extent of the disease, as an animal with a very small lesion will often react more markedly than one which is largely affected.

Some will naturally be afraid of doing some harm to their cattle by the injection. Prof. Nocard in this connection says: "The injection presents absolutely no danger and the reaction passes off completely in a short time. If milch cows are injected the quantity or quality of the milk is in no way affected; it brings no trouble to cows carrying calves or about to calve."

Prof. Bang says: "An acute development of tuberculosis as a result of tuberculin injection is to be feared only exceptionally and then in cases of advanced tuberculosis." He further says: "The testimony of many owners of large herds of cattle which have long been injected is to the same effect. I will adduce statements from several. A farm tenant whose cattle were injected twenty months previously, when eighty-two per cent. of the grown animals reacted, wrote me recently as follows: 'Only two cows from the division of 100 head had been sold as decidedly tuberculous. The majority appeared afterwards, just as before, entirely healthy. The fat animals which had been slaughtered had been pronounced healthy by the butchers.' Another farm tenant with a herd injected in 1894 had not been obliged to remove a single animal from the tuberculous division numbering seventy head. A large farm owner in Jutland states in September that he had traced no undesirable results from the injection. His herd of 350 had been injected in February and about seventy-five per cent. reacted. Similar answers have been given by other owners and veterinarians."

On a large farm, on which, before the injection, tuberculosis had appeared in a vicious form, the owner had the impression that the severe cases had afterwards become more numerous. He had, however, not suffered severe losses, and eight months later the large reacting division by no means made a bad impression. Finally it is to be noticed that tuberculin has been employed on a large scale in Denmark for years, and still the demand from farmers constantly increases. This could certainly not be the case if the injections were generally followed by bad results.

Now that we have found out that in tuberculin we have an admirable means of recognizing tuberculosis, and its application is not attended with any particular danger, the question remains as to how best to use it against tuberculosis. First, every herd in the country should be inoculated in a way that will be described and every cattle owner should see to it that his herd is tested, as in this way only can he expect to be freed from the losses which are constantly taking place on account of this disease, and thus help to put a stop to one source of tuberculosis in man.

After inoculation there must be a separation of those animals which react, that is, those which show some amount of fever after injection and are clearly tuberculous, from those which do not react and are healthy.

The healthy ones should be put in a new stable if possible, or if not, in a stable which has been thoroughly disinfected, separate from the diseased ones, and great care exercised that they are not allowed to come in contact in any way. As an example, you may separate your herd and take the utmost care to keep them from infecting one another and then allow them to drink at the same trough, although at different times. This will entirely undo all the good you can do in months of careful handling.

The stables should be clean and well ventilated, and cattle allowed a large air space to each animal. In hospitals and army barracks men are allowed 1,500 to 2,000 cubic feet of air space, and as cattle have the same relative amount of lung tissue in proportion to their size as man, they should have considerably more air space than this, yet every one knows how common it is to see cattle in stables so close together that they have just barely room to lie down. The ceilings are low and the space behind small. The drainage is poor and the light and window space small, and no provision made for ventilation. Of course this process tends to warmth, but it is at the expense of the health of the animal. Statistics show that there is a much larger proportion of cattle tuberculous among those that are constantly housed, as is the case very largely with extensive city dairies, than among those which spend much of their time out of doors or in open sheds.

In the same way fancy herds have a larger amount of tuberculosis on account of their close housing. So it may be stated that to prevent diseases of this kind ventilation and sanitary conditions of buildings should be well looked after.

After the herd has been separated care should be exercised on the part of attendants who care for the two divisions. If possible separate men should care for each so as to prevent contagion being carried on their clothes and shoes.

Then all the calves from the diseased division of the herd should be removed as soon as born, for it has been proven beyond dispute that the calves of diseased cows are, in ninety-nine per cent. of cases, healthy when born, and do not inherit the disease. If they are removed at once and fed on healthy milk and prevented from living with the diseased mother and thus becoming infected by inhaling the disease germs, they will grow up to be healthy cattle.

They should be fed on milk from the healthy cows, or if the milk of the diseased cattle is used it should be heated to a temperature of 175 degrees Fahrenheit for ten or fifteen minutes before feeding. Although it is claimed by experts, notably Russell, Nocard and Bang, that the milk from an affected cow, if the udder is not diseased, will not contain the germs of the disease and thus cannot infect the calves, yet it is better to be on the safe side and heat all such milk up to 175 degrees for ten or fifteen minutes, which will destroy all germs, if there are any, and thus preserve the calves from contagion from this source.

If at the time of testing any animal shows symptoms of advanced tuberculosis, that is, if any are clearly sick, coughing and losing flesh, they should be slaughtered at once and the flesh destroyed.

It is advisable also to fatten quickly the animals that give a reaction with tuberculin, but are apparently healthy, and sell them to the butcher, making calculations to get rid of all reacting animals in the course of eighteen months or two years. The healthy division and the calves should be injected at least every six months and if any show signs of tuberculosis they should be removed to the other division and the stalls thoroughly disinfected. The best way to disinfect the stable is to clean it out thoroughly, sweep down walls, ceilings and mangers, and then spray with hose or force pump a five per cent. solution of carbolic acid (made in a manner described later) all around walls, ceilings, stalls, mangers, etc. Scrub out mangers with the same solution and afterwards whitewash walls, ceilings and sides of stalls. It can be readily seen that if this process of injection and separation of the herd, with proper care to protect healthy division and calves, is carefully and faithfully carried out, one can stamp out this disease in a whole herd in about two or three years at a very small cost.

Summarized the above is as follows :

First, test the herd with tuberculin. Second, separate the reacting animals, as far as possible, from the healthy. Third, carefully disinfect the stable. Fourth, kill the evidently sick animals (as above stated), either at once or after rapid fattening. Fifth, rear the calves of the cows which react, but otherwise appear healthy or at least only slightly attacked. Sixth, remove the same immediately after birth from the infected stable, place them in the healthy division and protect them from farther infection, especially from feeding suspected milk. Seventh, inoculate with tuberculin the animals of the healthy division once or twice yearly.

The last precaution is taken to permit the quick removal from this division of animals which in spite of previous precautions appear to be infected.

This method rests upon the assumption, first, that infection is the single cause of tuberculosis ; and, second, that the germs are not present everywhere, but that infection is caused by the continued living together through a long period of time of tuberculous cattle, and further by the rearing of calves on raw milk from tuberculous cows.

With regard to use of a bull in the herd it is almost certain that the bull if diseased cannot transmit the disease directly to the offspring, but in some

cases it may be transmitted to the cow. It is therefore wise to have a healthy, that is, a non-reacting animal, as sire. The short time in which he comes in contact with a cow even if she is diseased will not in many instances infect him. The bull, of course, should be inoculated with tuberculin two or three times yearly in order that he may be isolated quickly if at any time he shows signs of tuberculosis.

Another point where great care should be exercised is in the purchase of bulls or breeding animals. After your herd is clear of disease, you can readily infect the whole herd again by bringing in an animal suffering from tuberculosis. So one should not purchase an animal without first submitting it to tuberculin test and proving it free from tuberculosis, or else demand a certificate that such animal has been so tested recently and found free from disease.

On the other hand no one should try to sell an animal, except to the butcher, which has at any time reacted to the test.

Up to the present time these tests for tuberculosis by means of tuberculin have been carried on by experts, veterinary surgeons, etc., but there is no reason why any intelligent man, who makes an effort to post himself as to the methods of keeping clean and using the various instruments should not test his own herd from time to time. With this in view a complete description of all instruments used in the testing are given here with instructions as to the way to keep them clean or sterilized, and the method of preparing the animal—inoculating the tuberculin and taking temperature. With this information each stock owner may either test his own cattle or employ a veterinarian, as many men are favorably situated will do, and in the latter case he will be in a position to know if approved methods are used and correct deductions drawn from results obtained.

This description is especially written for those owners who wish, either from choice or compulsion, to test their own cattle.

The tuberculin will be supplied free of cost to any cattle owners who desire it, by making application to the Agricultural College, Guelph; but only in limited quantity and for the sole purpose of testing their own herds, and under such regulations as the Minister may enact.

Lieut.-Col. David McCrae, of Guelph, has been employed to give demonstrated instructions concerning the detection and treatment of tuberculous animals to those who require his services. He will attend meetings called by officers of Farmers' Institutes and deliver addresses on this subject, and give full instructions concerning the use of the instruments, fluids, etc., that are used. He will at all times be prepared to properly test the animals.

The secretaries and officers of Farmers' Institutes are particularly requested to give this matter their immediate attention, and do all in their power to awaken and instruct farmers in their respective districts. One or more of such meetings should be held in each Institute district during the coming year.

Compulsory legislation will no doubt be pressed in the Commons at an early day, and farmers will act wisely in their own interest by taking immediate advantage of the instruction offered by the Department as outlined above.

For further particulars as to practical instruction address F. W. HODSON, Supt. Farmers' Institutes, Parliament Buildings, Toronto.

#### UTENSILS USED.

*Syringe.* Any strong, well made veterinary hypodermic syringe, holding about 85 minims, will do. In purchasing a syringe care should be taken to examine all parts carefully to see that the needles are strong and sharp, that the piston rod is properly graduated, and that the syringe does not leak. The needle should fit on the syringe by friction and not screw on. When the needle fits in this manner (friction tight) inoculation is accomplished more easily. (See photo A, p. 13.)

*Thermometer.* The common thermometer used in the house or in the dairy is not sufficiently accurate or delicate to use for taking the temperature of animals

For taking the temperature of men or animals a clinical thermometer is necessary. The peculiarity of this instrument is that there is a cut-off formed in the bore of the thermometer, which allows the mercury to rise freely but prevents its receding into the bulb, it therefore remains at its full height after the temperature of the animal is taken, and thus affords plenty of time to get an accurate reading. Great care should always be taken in using these thermometers, and the mercury should be well shaken down before using. To shake down, grasp the thermometer by the top, and give it two or three vigorous shakes, in the same manner as if you were trying to crack a whip.

Some clinical thermometers are triangular in form, and are thus prevented from rolling when laid down, and danger of breakage through accident is materially lessened. The column of mercury is also magnified, by which an accurate reading of the instrument is greatly facilitated.

With the best thermometers a certificate from some well known observatory is given, which shows variations of the instrument from the true standard. English thermometers have certificates from Kew Observatory; American thermometers from Winchester Observatory, Yale College, or from the observatory of some other recognized institution. (See photo B, p. 13.)

*Graduate.* A graduate, or small glass cylinder, marked so as to show its capacity should be obtained. One holding about 60 minims is sufficiently large. See photo C, p. 13. The one on the left of the figure holds 60 minims; the one on the right, 120 minims. This graduate is used for making dilutions of the tuberculin, or carbolic acid.

*Where instruments may be obtained.* Veterinary hypodermic syringes, clinical thermometers and graduates may be obtained from: Alex. Stewart, druggist, Guelph, Ont.; Thos. B. James (Agent for F. Hartz), 71 Borden St., Toronto; S. B. Chaudler, Sons & Co., 103 Victoria St., Toronto, and others.



*Prices.* Veterinary hypodermic syringes, from \$2.50 up to \$4. Clinical thermometers, from 75c. up to \$1.50. Graduates, from 25c. to 50c.

Carbolic acid should be bought in the pure crystallized form. From this form of the substance different strengths of the solution can be made by adding cold boiled water. For instance, to make a five per cent. solution take five parts by volume of the melted crystals and add ninety-five parts of cold boiled water.

Thoroughly sterilise the syringe and needle (*i. e.*, destroy all germs that may be on or in them) by soaking them in a five per cent. solution of carbolic acid for several hours.

*Dose.* The amount of tuberculin for one dose for an average-sized animal is always indicated on the bottle. If the animal is small, use two-thirds of the indicated dose. In the case of a large bull, use one-third more than the indicated dose.

*Dilution of the tuberculin.* In order to prepare the tuberculin for injection pour the amount of the dose, as printed on the bottle, into a small glass, previously well washed with boiled water, and for every minim (drop) of the tuberculin add three minims (drops) of a one per cent. carbolic acid solution. (One part of carbolic acid melted crystals with ninety-nine parts of boiled water.)

*Example.* If the dose on the bottle is 12 minims, pour the 12 minims (or drops) into a clean glass and add 36 minims (or drops) of the one per cent. carbolic acid solution. This would be the prepared dose for an average sized animal. For a large bull use 16 minims of tuberculin and add 48 minims of the one per cent. carbolic acid solution.

Tuberculin prepared at the Ontario Agricultural College can be sent to farmers in small bottles holding seven doses, or it can be sent in bottles (if so requested), each holding one dose of concentrated tuberculin. For use in this latter case, break the seal, withdraw the cork and fill the bottle as far as the top of the label with a cold solution of one per cent. carbolic acid (that is one part of carbolic acid with ninety-nine of boiled water), re-cork and shake. After this procedure pour the diluted tuberculin into a clean cup, insert the syringe and draw the liquid into it by slowly and steadily pulling out the piston.

*Disinfection of skin before inoculation.* The actual inoculation is performed by selecting a spot close to the shoulder, (see photo D, p. 15), clipping off the hair, and saturating and rubbing the spot with five per cent. solution of carbolic acid. If this is carefully done, there is less danger of any local swelling or lesion taking place.

*The actual injection.* The skin is then pulled up a little between the thumb and finger of the left hand, and the needle thrust through the skin by the right

hand. The nozzle of the syringe is then pushed into the needle, and the contents forced out, by steadily pressing the end of the piston. A light pressure on the spot with the fingers after withdrawing the needle distributes the fluid. The needle should be immersed in five per cent. carbolic acid after each injection to disinfect it.

*Directions for taking the temperature.* As the temperature of an animal varies somewhat from time to time, it is necessary to obtain the average temperature of the animal before the inoculation with tuberculin, in order to interpret correctly any changes that may take place after inoculation.

As the test depends entirely on a fever reaction, or an increase of two degrees Fahrenheit above the highest normal temperature, too much stress cannot be laid on the importance of correctly taking and correctly writing down the different temperatures.

*Where the temperature is taken.* The temperature of animals is always taken in the rectum or vagina. The thermometer should be thrust in at least half its length, and allowed to remain for at least three minutes.

In conducting the test, the following course is recommended to those who wish to obtain the most accurate results:

1. Begin to take rectal temperature at 6 a.m. and take it every hour thereafter till midnight.
2. Make the injection at midnight.
3. Begin to take the temperature next morning at 6 a.m. and continue as on preceding day.

To those who have large herds to examine, or who are unable to give the time required by the above directions, the following shortened course is recommended:

1. Begin to take the temperature at 8 a.m., and continue every two hours until 10 p.m. (Omitting at 8 p.m., if more convenient.)
2. Make the injection at 10 p.m.
3. Take the temperature next morning at 6 or 8 a.m., and every two hours thereafter until 6 or 8 p.m.

The fever reaction in tuberculous cattle following the injection of tuberculin, begins from 4 to 10 hours after the injection, reaches the maximum in 12 to 20 hours after the injection, and returns to normal 18 to 26 hours after the injection.

*The reaction.* A rise in temperature on the day following the injection of two or more degrees Fahrenheit above the maximum (highest) temperature observed on the previous day, is regarded as an indication of tuberculosis. For any considerable rise less than this, a repetition of the injection after two or three weeks is desirable.



Table showing temperature before and after injection of tuberculin of—

1. A healthy animal.
2. A tuberculous animal.

*Healthy :*

Before injection.	After injection.
8 a.m. .... 100.	+6 a.m. .... 100.7
12 noon ..... 100.2	8 a.m. .... 101.
4 p.m. .... 100.8	10 a.m. .... 100.8
8 p.m. .... 100.4	12 noon ..... 101.2
*10 p.m. .... 101.	2 p.m. .... 101.
	4 p.m. .... 101.8

*Tuberculous :*

Before injection.	After injection.
8 a.m. .... 100.4	+6 a.m. .... 101.
12 noon ..... 100.8	8 a.m. .... 102.4
4 p.m. .... 101.7	10 a.m. .... 105.9
8 p.m. .... 101.6	12 noon ..... 106.9
*10 p.m. .... 101.2	2 p.m. .... 106.
	4 p.m. .... 105.

*Animals to be tested in the stable.* During the test animals must not be turned outside, as this procedure may excite them, or if the weather be cold the temperature record may be affected. The drinking of large quantities of cold water may also affect the animal's temperature. Always inoculate, feed and water the animals in the stable.

*Cases in which tuberculin does not always act.* The tuberculin test is not infallible. Cows with advanced tuberculosis sometimes fail to react, because the tuberculin present in such animals has already caused fever so repeatedly that no further reaction is obtainable. In such cases as this the disease can easily be recognised by physical symptoms, and these animals do not require tuberculin injection to reveal the presence of the disease.

Animals that have been previously inoculated and have given a reaction, often give a smaller reaction at a later test.

Cases of very recent infection sometimes give no reaction, but these can be secured by testing the herd again at a later date. The amount of reaction is often in inverse ratio to the extent of the disease and in direct ratio to its activity.

\* Injection took place at 10 p.m.

+ 8 hours after injection.

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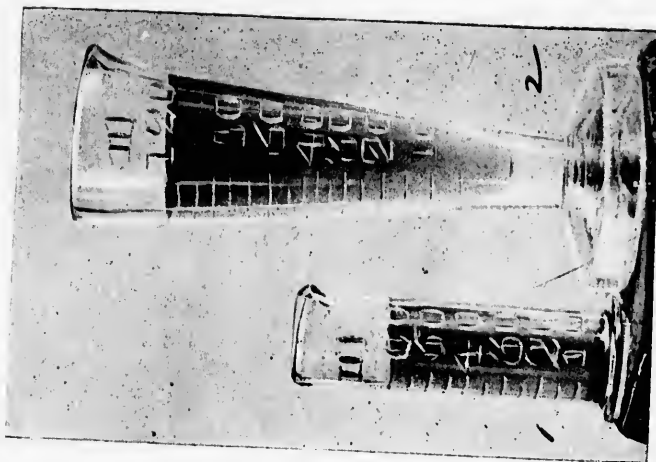
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C.—Two graduated, actual size. No. 1 holds 60 minims or drops; No. 2 holds 120 minims or drops.



B.—Clinical Thermometer. The long marks are degrees; the short marks fifths of a degree.



A.—Hypodermic Syringe, with needle affixed. The syringe is standing on the piston, which is partially drawn out. To the right is an extra needle.





D.—How and where to inject the tuberculin.

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Copies of this Bulletin may be had by applying to the Department  
of Agriculture, Toronto, Ont.

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