

DOMINION OF CANADA  
DEPARTMENT OF AGRICULTURE  
HEALTH OF ANIMALS BRANCH

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BULLETIN No. 18

# AVIAN TUBERCULOSIS

BY

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Pathologist

AND

A. B. WICKWARE, V.S.,  
Assistant Pathologist

OTTAWA  
GOVERNMENT PRINTING BUREAU  
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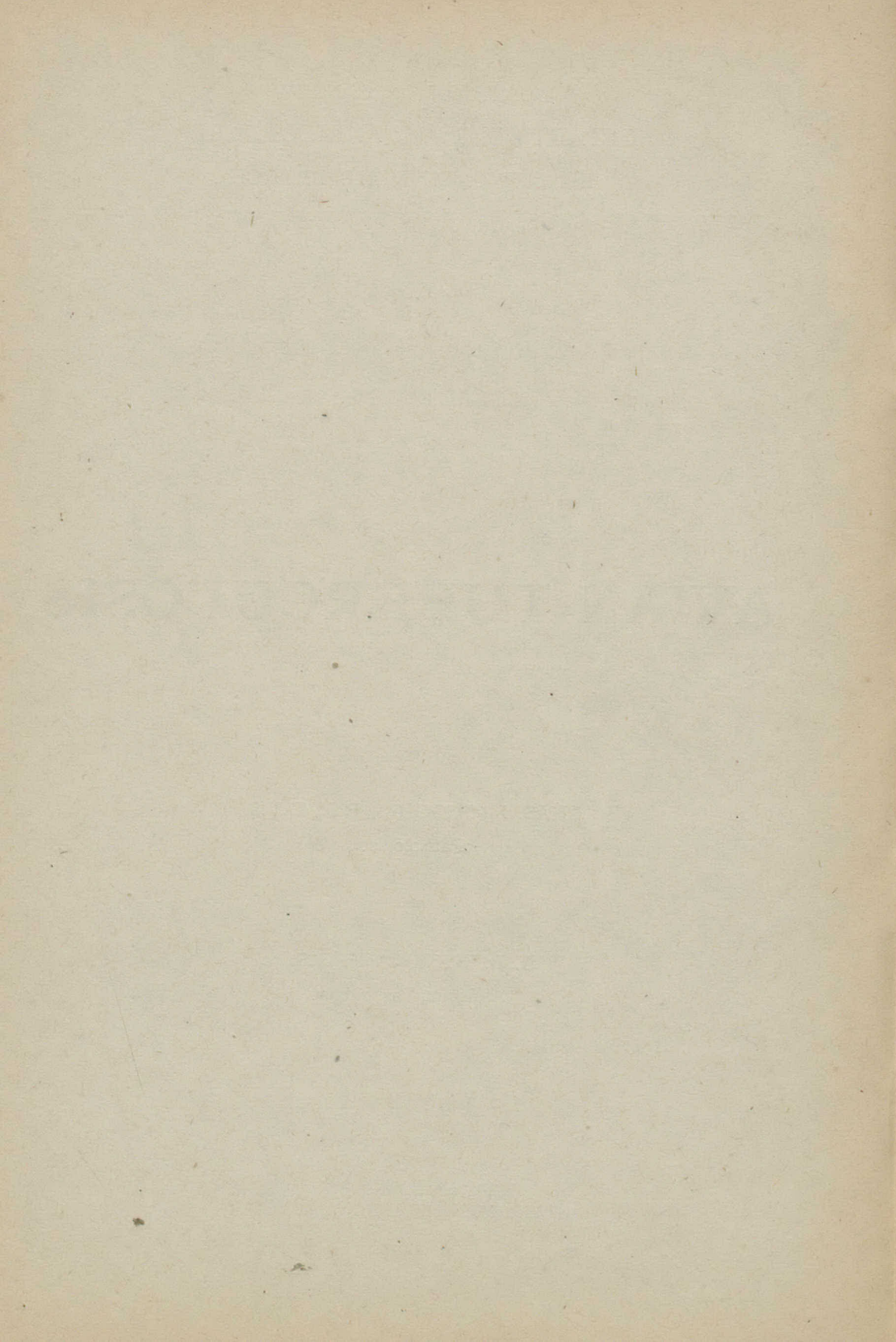
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## AVIAN TUBERCULOSIS

The disease known under the synonyms, consumption, tuberculosis, and the great white plague (the latter applying more especially to the affection as found in human beings) is of such widespread importance as to warrant careful consideration whether appearing in men or animals.

In preparing an article dealing exclusively with this malady as observed in fowls and birds in general, no presumption is made of bringing to light new disclosures, but rather an endeavour will be made to deal with the affection in a general way, from a pathological as well as economic standpoint, and also to record such of our experiments as have a practical bearing on the prevention and eradication of this disease.

It is only within comparatively recent times, slightly over a decade, that tuberculosis has been observed among fowls in Canada. The affection had probably existed for many years, but its true nature and significance was not recognized until diseases of poultry commenced to attract the attention of workers in comparative pathology. Even up to the present time, the importance of the conservation of domestic fowls is scarcely realized, and apart from the purely technical considerations of the disease which they may contract, very little thought has been exercised as to how the fostering of the industry will affect our domestic economy.

The losses from tuberculosis have been large to poultry owners, but there is at present no means of arriving, even approximately, at an accurate estimate. Theoretically, poultry offer one of the best investments for capital, but the losses are so great that the theoretical estimate of anticipated profits should not be taken at its face value. Properly organized and managed poultry plants, however, do give a fair return on the investment. All farms can with advantage carry more poultry than are usually found, and poultry if properly cared for will prove a valuable source of revenue.

Once tuberculosis makes its appearance in a flock, the aggregate losses are large although a great number of birds do not usually die at one time. The general unthriftiness of the fowls, however, renders them unsuitable for table use and the non-production of eggs, makes the industry very unprofitable as well as discouraging to the poultry owner.

As avian or fowl tuberculosis, viewed from a causative standpoint, is almost identical with the disease as found in human beings and cattle, it is imperative that further research work be conducted in order to establish, if possible, its exact relation as a source of infection for other animals and man. This is more pertinent since Mohler and Washburn, of the United States Bureau of Animal Industry, have reported the transmission of avian tuberculosis to mammals by the direct feeding of diseased organs, and also the infection of guinea-pigs by artificial inoculation with the whites of eggs from affected fowls. That there is considerable variation in the morphology of the causative organisms found in the different forms of tuberculosis cannot be disputed. Extensive investigations have shown that even these apparently specific characteristics can be altered by artificial cultivation upon various laboratory media, and also by growth in the tissues of different animals.

The fact that avian tuberculosis is transmissible to mammals, and the mammalian type communicable to human beings, serves to substantiate the theory that changes may occur in the human host whereby the avian and bovine types of organisms may undergo transformation into the human type.

Recent statistics show that the bovine type of organism was present in 90 per cent of the cases of *cervical adenitis* (enlarged glands of the neck) occurring in children in the vicinity of Edinburgh, Scotland, infection probably arising

through the consumption of non-pasteurized milk. As these and many other cases of human tuberculosis have been traced to infection through the medium of raw milk, it is only natural that one should consider the possibility of transmission of this insidious disease through the medium of raw eggs. This assumption does not seem unreasonable in view of the fact that raw eggs form the principal article of diet for invalids and individuals whose natural resistance may be lowered, and whose systems are impoverished from any one of a number of causes.

Himmelberger, of the Michigan Agricultural College, has recently succeeded in transmitting avian tuberculosis to a bovine in which latter he obtained a reaction with avian tuberculin although unable to elicit a response when using the bovine tuberculin.

During investigations conducted at this laboratory throughout the past three years, our attention has been chiefly directed towards the microscopic detection of tubercle bacilli in eggs, the infection of experimental animals with these eggs, and the perfecting of a method of diagnosis whereby latent and incipient cases may be identified.

The possibility of congenital tuberculosis being present in chicks has been given considerable attention, but our experiments in this connection have thus far given only negative results. Eggs from tuberculous fowls have been artificially incubated and the chicks immediately transferred to new quarters where special precautions were taken to prevent infection from outside sources. The most careful autopsies, however, failed to reveal lesions of tuberculosis, while cultures from splenic tissues gave negative results.

The demonstration of acid-fast,\* organisms in eggs was also undertaken and in nearly 20 per cent of the latter, bacilli microscopically indistinguishable from those of tuberculosis were found to be present. The subsequent inoculation of guinea-pigs with material from these eggs produced a generalized tuberculous infection, from which typical avian cultures were procured.

#### PREVALENCE.

The prevalence of avian tuberculosis throughout Canada is, every year, becoming more apparent. This is evidenced by the fact that enquiries from widely separated sources are from time to time received at the laboratory concerning this affection. These enquiries usually come from individuals extensively engaged in poultry production, while a few are received from farmers. There appears, however, to be a striking apathy on the part of the latter in regard to the diseases and the care in general, of poultry, due in no small measure to the false impression that the fowls are of small economic importance as compared with other species of the live stock. In the fall of 1913, while on an official inspection trip, one of us had the opportunity of visiting a locality where large numbers of poultry were being lost. On making enquiries it was found that the farmers in the vicinity had been losing immense numbers of fowls for which no cause could be assigned. Autopsies on several hens revealed the affection to be tuberculosis and, on one farm, a clinical observation showed several to be suffering from lameness which was apparently tubercular in nature.

#### SYMPTOMS OF THE DISEASE.

The causative organism or germ of tuberculosis gains entrance to the system usually with the food, and, finding a favourable location, grows and extends to the various tissues. This growth of the germ induces symptoms of unthriftiness, and this unthriftiness is followed sooner or latter by death.

\*Tubercle bacilli from any source possess the peculiarity of retaining the dye material used for their study in the presence of acid, hence the term acid-fast.

The detection of tuberculosis from symptoms is not always easy. Some may be observed to be *going light* yet they are seen to be good feeders. If picked up it is found that the flesh has almost entirely disappeared from the breast bone, and this should make one suspicious that something is wrong. A yellow or greenish diarrhoea is frequently present in affected birds, and where this is present the type of the disease is most dangerous to the remainder of the flock, as the germs are to be found in the droppings in immense numbers.

One of the most frequent symptoms seen early in the course of the disease is lameness, a result of the infection involving a joint of the leg. Lameness is mentioned by persons forwarding fowls for diagnosis more frequently than any other symptom where our subsequent examinations have proven the trouble to be due to tuberculosis. So frequently is lameness the principal symptom observed that we are at once suspicious of tuberculosis whenever the symptom is mentioned.

#### COURSE OF THE DISEASE.

Fowl affected with tuberculosis may die in a few days from the first appearance of symptoms, or they may linger for weeks, gradually becoming more emaciated as the disease progresses until they die from exhaustion. The progress is largely dependent on the strength of the invading germ and the natural resistance of the bird. Some outbreaks of the disease follow a more rapid course than others; usually however, the course in an individual extends over weeks, and sometimes months may intervene before death takes place.

#### POST-MORTEM FINDINGS.

The post-mortem findings in fowl tuberculosis, when considered in relation to the symptoms and general history, are characteristic. The liver is usually the principal organ affected, and there are lesions, from the size of a pin point to that of a large pea, which are white or yellow in colour. The larger lesions when cut into give a gritty sensation as the knife passes through them. These lesions are distinct from the liver tissues, and may be quite easily separated from the liver itself. In the more acute cases the liver may be greatly enlarged, even to twice its normal size. This enlargement in chronic cases is noticeable. The spleen is usually involved, the lesions, having the same characteristics as mentioned for those in the liver. The enlargement of the spleen is usual, and it may be four times its normal size. The intestines may or may not be involved. When lesions are present we find nodules from the size of a small pea to that of a medium-sized nut. The minute dissection of these usually presents a free opening into the inside of the bowel, and at this point of entrance there is an ulceration. It is through this opening from the nodule on the intestine to the interior of the bowel that the bacilli gain access to and are so easily distributed by the droppings.

Other visceral organs are seldom involved. It is frequently observed that the joints, notably that of either or both hips may be the seat of tubercular ulcerations. Such an ulceration is the cause of lameness during life.

#### EXPERIMENTS AT THE BIOLOGICAL LABORATORY WITH THIS DISEASE.

We have conducted experiments with the view of determining the possibility of transmitting tuberculosis through the eggs laid by tuberculous fowls. For these transmission experiments we secured a flock of tuberculous fowls, quartered them in special quarters, hatching the eggs in an incubator.

When sufficient eggs had accumulated to fill the small incubator secured for the purpose (one of sixty-egg capacity) the fowls from which they had been obtained were autopsied. Prior to autopsy, however, they were tested with tuberculin prepared from an organism of the avian type, with negative results. Negative results also followed the use of a special tuberculin intra-ocularly (dropped in the eye) and intra-dermally (injected into the skin).

Ten of the fowls above referred to were affected with tuberculosis in various stages, while one failed to show lesions. The principal organs affected were the livers and spleens; the other organs did not show lesions save in one instance. In this hen a chronic tubercular peritonitis had developed, with adhesions. Small tuberculous nodules adhered to the outer coat of the intestines. Ascitic fluid was present, and emaciation marked.

The transmission experiments were not of as conclusive a nature as we desired, owing principally to the fact that the incubator which we were using did not give satisfactory results. Nine chicks only were secured from sixty eggs, of which over 80 per cent proved to be fertile. This machine later failed to give satisfactory results with eggs from another source.

Some of the chicks were autopsied at intervals, the last being destroyed when eight months old. In none of these chicks were we able to detect lesions of tuberculosis.

These negative findings, however, did not prove that tuberculosis may not be transmitted in this manner, for, at the autopsy of the fowls providing us with the eggs used in this connection, lesions were present in over 90 per cent, and in no instance were they of special character. At the autopsies we did not find evidence of tuberculosis involving the ovaries or the oviduct.

With these organs involved the probability of the chicks becoming affected would naturally be greater than was the case with the birds above referred to.

#### DETAILS OF EXPERIMENTS WITH TUBERCULIN.

In an endeavour to test the merits of tuberculin as a practical method of diagnosis, experiments were conducted on twelve tuberculous fowls, four birds being used for each test.

A specially prepared avian tuberculin was used for subcutaneous, intra-dermal, and ophthalmic (eye) tests.

EXPERIMENT No. 1.—Four fowls were used for the subcutaneous test, temperatures being taken every two hours until six had been recorded. At the expiration of this period each hen was injected with 2 cubic centimetres of avian tuberculin. The recording of temperatures was again continued after an interval of eight hours and taken every two hours until twelve readings had been made.

RESULT.—In none of the four cases under observation was any marked variation of temperature noted.

EXPERIMENT No. 2.—Four fowls were each given 1 c.c. of concentrated tuberculin intra-dermally, the thickened skin of the breast being chosen.

RESULT.—No evidence of any local or thermal reaction was observed.

EXPERIMENT No. 3.—Four fowls were used, each receiving one drop of concentrated tuberculin in the eye.

RESULT.—No evidence of an ophthalmic or thermal reaction noted.

It was then decided to conduct a test with the view of ascertaining the possibility of a thermal reaction occurring during the first or second hour following the injection. Similar parallels had been noted by many observers while applying the tuberculin test in cattle and, in view of the circumstances, tests were conducted after this manner.



The results are tabled below:—

Date.	Time.	HENS.		
		No. 1.	No. 2.	No. 3.
June 22, 1912.....	1 p.m.	106.2	106.2	108
	2 "	106.4	106	106.4
	3 "	106	106.2	106
	4 "	106	106.4	106.4
	5 "	105.6	106	106.4
	6 "	105.8	106	105.8
	7 "	105	105.4	105.6
	8 "	105.8	104.6	105.4
	9 "	105	104.8	105
June 23, 1912.....	5 a.m.	106	106	106
	6 "	105.6	106.4	106
	7 "	105.6	106	106
	8 "	105.6	106	106.2
	9 "	105.8	106.2	106
	9 a.m. Injection			
	9.30 a.m.	106	106.2	105.6
	10.00 "	106	106	105.8
	10.30 "	106	106.2	106
	11.00 "	105.8	106	106.2
	11.30 "	106	106	106.2
	12.00 "	105.4	106.2	106
	12.30 p.m.	105.4	106.4	106.4
	1.00 "	106.2	106.8	106.4
	1.30 "	106.4	106.6	107
	2.00 "	106.2	106.8	106.8
	2.30 "	106.6	107.2	106.8
	3.00 "	107	106.8	107
	3.30 "	107.4	106.6	106.8
	4.00 "	106.4	106.4	107
	4.30 "	106	106.2	106.4
	5.00 "	106.6	106.4	106.4

#### SPECIES OF BIRDS AFFECTED WITH TUBERCULOSIS.

The affection has been demonstrated in canaries, lesions having been observed by one of us in two birds autopsied at the Pathological Laboratory of Queen's University, during the past winter. These birds were obtained as domestic pets from a dealer in Toronto, and shortly after being received showed clinical manifestations of a respiratory affection, death taking place in the course of a few weeks. Gross lesions were present in nearly every organ, and microscopic examination showed myriads of acid-fast bacilli of the avian type.

We have observed the disease in turkeys in a number of instances. In one instance when a turkey was affected the history seemed to indicate the possibility of its having been transmitted from a bovine source. We were unable, however, to follow this up and absolutely determine this possibility.

#### TRANSMISSION OF TUBERCULOSIS FROM BIRDS TO MAN.

A recorded instance of the danger of transmission of tuberculosis by birds to the human being is given in the following extract from a lecture by Dr. H. Roger, professor of Comparative Pathology of the Faculty of Medicine, Paris, and is very significant:—

"Animals that live in close proximity with man frequently contract tuberculosis, and may transmit it. By opposition to the belief of times gone by, the dog is often suffering with it. It may localize itself in the kidney, giving rise to lesions of softening, and throwing in the urine considerable quantities of bacilli. Again, see the danger of the propagation which is so much greater that canine tuberculosis is easily overlooked. It is often manifested by productions of neoplastic appearance which resemble more those of cancer than of tuberculosis.

"These home pet animals are yet more dangerous. Those among you who have been in my laboratory have seen a parrot, now dead, which had cutaneous tuberculosis. As is commonly the case, this bird had been infected by her owner who had advanced tuberculosis, and the bacilli of human origin had invaded the skin of the head of the bird and prompted the growth of the warty lesions. In cases of this kind the animal, annoyed by these growths, scratches itself as it can; scabs of the skin get loose. These are particularly rich in virulent bacilli. Their dissemination spreads the disease, and the infection is so much more dangerous when passing from the parrot; the pathogenous agent seems to have gained more infectious power. What is the end of the history of this bird? The first owner died. By his will the parrot went to a young woman, healthy and strong. After a few months she began to cough, to lose flesh. Affected with acute tuberculosis, she died in less than a year. No one around her had suspected the cause or origin of her disease. Her physician had never suspected it. Having become too homely, no one wanted the bird any more, and he was sent to my laboratory, where, for those of you who have seen his lesions, a diagnosis will remain evident and easily confirmed by bacteriological examination."

#### PREVENTION AND TREATMENT.

In the prevention of tuberculosis and other infectious diseases of fowls, sanitary surroundings, with plenty of sunlight and fresh air, are requisites of prime importance. In our opinion these features are best obtained by the use of the modern cotton-front house, a number of types having been described by various poultry authorities. Circular No. 7, prepared by the late Prof. A. G. Gilbert of the Experimental Farm staff, describes in detail the method of construction, and may be obtained on application.

The best means of preventing and treating tuberculosis in fowls is to destroy the entire flock if all have been running together, and to thoroughly cleanse and disinfect the quarters which they have occupied with any good disinfectant, one of which is a 5 per cent solution of crude carbolic acid. This may be made by adding two teacupfuls of crude carbolic acid to a pail of hot lime wash. Cresol Compound U. S. P. may be used instead of Crude Carbolic Acid in the proportion of a teacupful to three-fourths of a pail of hot lime wash. This should be applied with a spray pump, brush or old broom, to all parts of the house occupied by the fowl. This method of disinfection is suggested owing to the fact that in tuberculosis or consumption in fowls, as has already been indicated, the bacilli or germs are found in the droppings in great numbers, and these should be destroyed. This action is further recommended as it has been shown that fowls, dead of tuberculosis, if eaten by hogs, communicate the disease to them and it is probable that the droppings would also communicate the disease in a similar manner.

When destroying the birds after it has been demonstrated that tuberculosis is present, some may be suitable for food if, on examination, the liver shows no white or yellow spots from the size of a pin point to that of a pea, and there are no nodules or lumps on the intestines. When these lesions are present the flesh cannot be considered suitable for human food.

We have found that eggs from tuberculous fowls may contain the bacilli or germs in the white, and we, as well as others, have demonstrated that they are in sufficient numbers to infect small experimental animals. This suggests a possible source through which tuberculosis may be introduced into a flock, namely by the unsuspecting purchase of eggs from someone who has tuberculosis among his fowl.

The drastic measures above recommended should be followed in all cases when tuberculosis appears among fowls. These measures, while temporarily entailing a considerable loss, will in the end prove the most economical to the owner and the community.

#### INSTRUCTIONS FOR SENDING MATERIAL FOR EXAMINATION.

Where it is desired to determine the nature of any condition causing losses among fowl, an examination will be undertaken by the Biological Laboratory Ottawa, providing suitable material is supplied. If possible, two live but affected birds should be forwarded by express in order that a thorough autopsy may be made. It is not necessary to prepay the express. When the condition has been found at autopsy by the owner, the diseased tissue may be sent by mail, if properly packed and preserved. Tissues may be preserved in pure alcohol or a solution of one part of formaldehyde to nine parts of water. After an examination has been made, suggestions will be forwarded for the prevention of further losses.

Information concerning the losses which have been experienced should be sent with the material in order that it may be properly identified. The name and address of the sender should be written plainly so that the result of the examination may be forwarded with the least possible delay.

Specimens sent by express or mail should be addressed to the

Biological Laboratory,  
Ottawa, Canada.

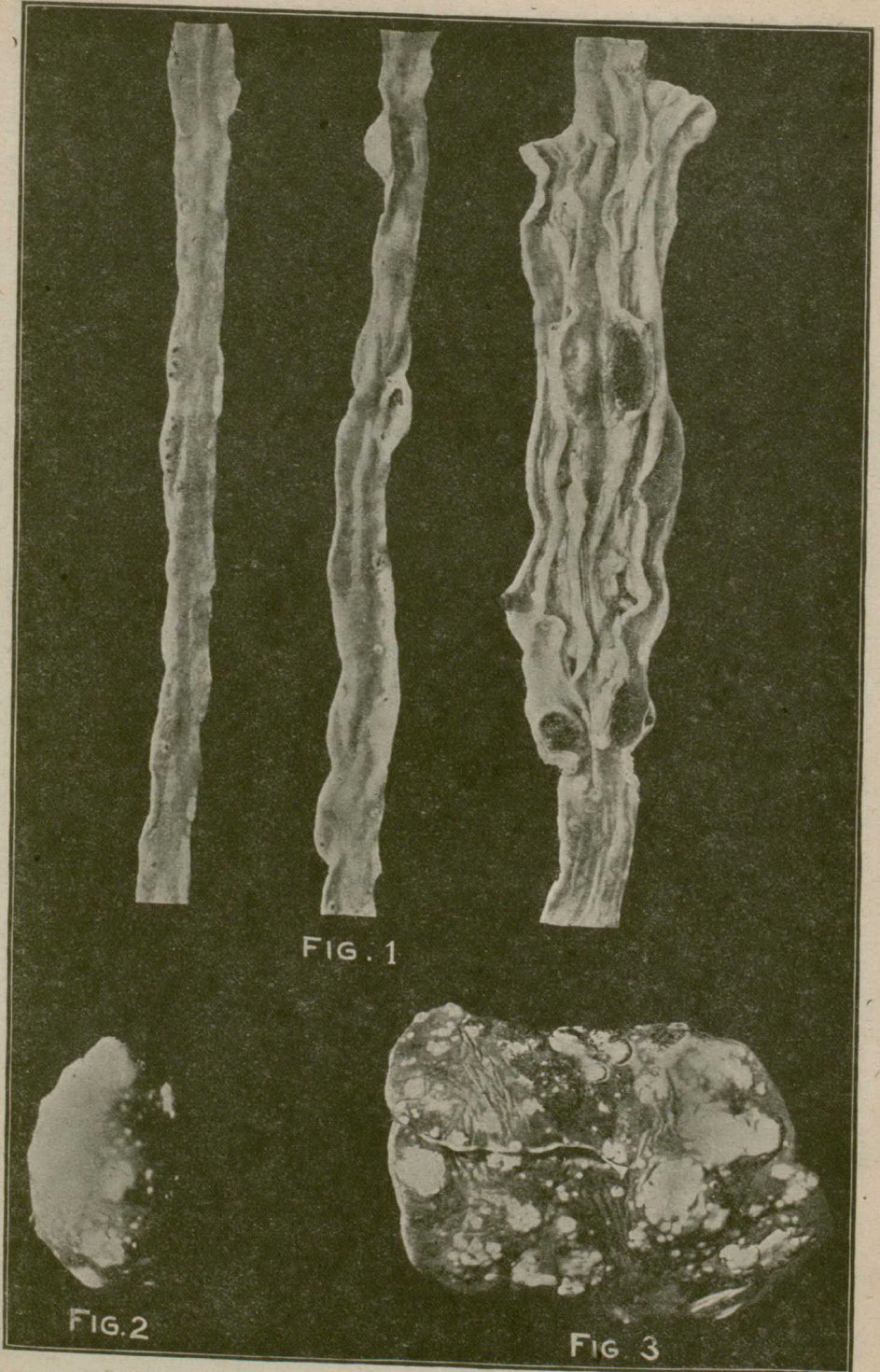
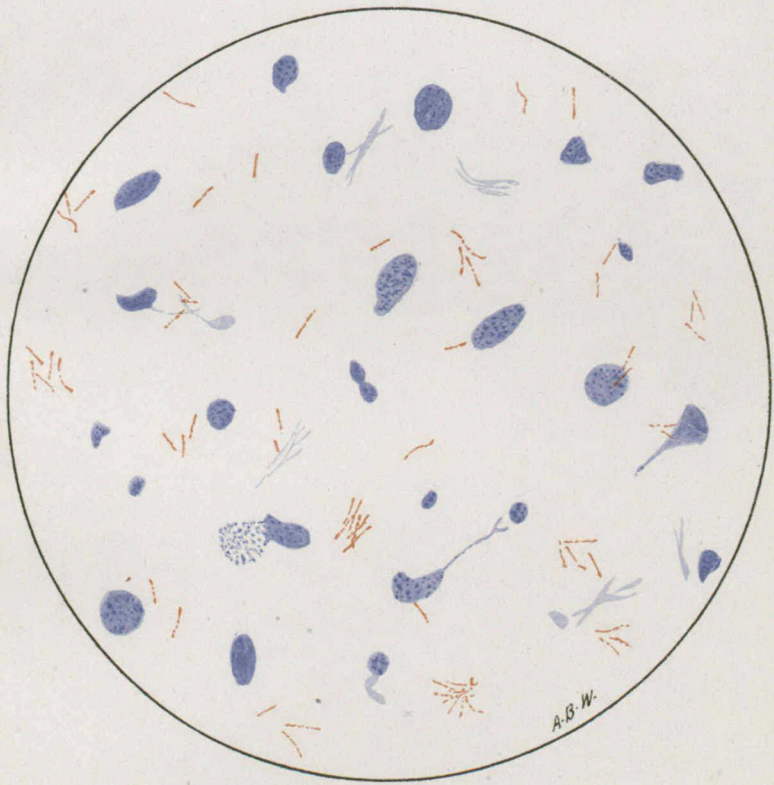


FIG. 1. Tubercular enteritis in a fowl. The right portion of intestine shows the caeca, also affected. One half normal size.  
 FIG. 2. Tubercular spleen from a fowl. Actual size.  
 FIG. 3. Tubercular liver from a fowl. Actual size.



Drawing of a microscopic field showing Avian tubercle bacilli. Preparation made from the liver of a bird affected with tuberculosis. The red rods are tubercle bacilli. Magnified 1500 diameters.





