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DEPARTMENT OF AGRICULTURE
HEALTH OF ANIMALS BRANCH

BULLETIN No. 17

ENTERO-HEPATITIS

OR

BLACK-HEAD IN TURKEYS

BY

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Pathologist

OTTAWA
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HONOURABLE MARTIN BURRELL,
Minister of Agriculture.

SIR,—I have the honour to submit to you a report on Entero-Hepatitis or Black Head in Turkeys, by Dr. C. H. Higgins, of the Biological Laboratory, Ottawa, and request that it be printed as Bulletin No. 17.

I have the honour to be, Sir,
Your obedient servant,

F. TORRANCE,
Veterinary Director-General.

OTTAWA, 11th January, 1915.

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BLACK-HEAD IN TURKEYS.

(ENTERO-HEPATITIS)

Enterohepatitis or black-head is a disease of fowl, infectious in its nature, usually seen in its most aggravated and fatal form among turkeys. Other fowl may be subject to the disease, but losses among them are small compared with the loss among turkeys. The first investigations as to the nature and cause of the malady were made by Dr. Theobald Smith, in Rhode Island, under the joint auspices of the United States Department of Agriculture and the Rhode Island Agricultural Experiment Station, during 1894 and 1895. Various investigators have since taken up the study of the disease as it has become more widely distributed and a distinct menace to the turkey-raising industry.

In Canada the disease was first mentioned by Gilbert in the Experimental Farms Report for 1900. It has since been repeatedly reported upon evidence obtained at this laboratory and at the Bacteriological Laboratory of the Guelph Agricultural College.

Detailed information relative to the manner in which the disease is transmitted from an affected to a healthy bird is lacking. It is believed that this infection is direct from the droppings or from the ground on which they have been deposited. There is still some difference of opinion as to the exact organism responsible for the lesions produced, but it is generally conceded to be a minute protozoan parasite.

We are not prepared to enter the controversy over this purely technical phase of the problem, assuming for the present that the entero-hepatitis parasite, described by Dr. Theobald Smith under the name of *Amaba melcagridis*, is responsible for the lesions found at autopsy.

An investigation of the problems connected with this affection has been in progress for some years, and during the last two seasons we have been able to more fully comprehend the many factors concerned than formerly, owing to the increased facilities available for our studies. The object of these experiments has been to determine whether or not it is possible by any means to overcome the losses from this affection. A practical method for so doing is of great importance at this time, for, on account of the European war, food supplies are commanding more than ordinary attention. This is particularly noticeable in a recent issue (September 1914) of the Journal of the Board of Agriculture (England), which takes up the necessity for giving more attention to the raising of all classes of poultry in the British Isles. The possibilities ahead for a turkey market are set forth as follows:—

“With few exceptions the larger farmers have hitherto failed to realize the profitable nature of turkey raising, which is not suited to small holdings, as the birds require an abundance of range. It is possible that, in spite of reduced imports for the Christmas markets, the demand at that season may be comparatively low. . . .

On the 14,513 agricultural holdings in England and Wales above 300 acres in extent, comprising 25 per cent of the total cultivated land, if only one adult turkey were kept for every 10 acres, there would be 673,676 birds all told. According to the Poultry Census of 1908 there were only 172,000 on all holdings above 1 acre in extent. There is, therefore, very great room for increase.”

With the large areas suitable for this purpose in Canada, the production of turkeys should receive greater attention than has been the case during past years. No doubt this attention would have been given but for the fact that great difficulties have been encountered, thus discouraging many who have made an attempt in this direction. These difficulties have, during the last decade, become almost insurmountable. While to a certain extent this may be the result of the tenderness of these animals, there is little doubt but that the major portion of the fatalities after the first two weeks result from infection with the parasites of entero-hepatitis or black-head.

The Rhode Island Experiment Station has undoubtedly been privileged to give the entero-hepatitis or black-head problem greater consideration than any other institution engaged in its study, yet, in their report for 1912 (page 206), after eighteen years' experimental work, they state:—

"With reference to the black-head situation as a whole the work of the past eight years has led to the conclusion that, in Rhode Island at least, it is now useless to talk of *escaping infection*. A large number of experiments and observations demonstrate that it is practically impossible, in this State, for young turkeys to escape the parasites of black-head."

In an address before the Ontario Poultry Association (1913), Mr. W. J. Bell, an experienced turkey raiser of Angus, Ont., states:—

"When people say that turkeys are hard to raise, I think one of the causes is the large number of other fowl that are left in closed yards with the turkeys. Turkeys cannot stand filth. . . . I am a strong believer in preventing disease instead of curing it. When a turkey gets thoroughly sick with me it is dead."

Our experiments have led us to believe that the only means of overcoming the ravages of entero-hepatitis or black-head is by preventing infection. To do this, methods must be employed that will admit of application by the average person interested in the rearing of turkeys, and our investigations have been carried out with this end in view. A necessary step preparatory to the prevention of the disease is a consideration of the ways by which the infection is spread. That method which will best stop these avenues of infection will be most efficient in preventing the disease.

The most satisfactory theory, and one which is substantiated by experimental evidence secured at the laboratory, is that the parasites are discharged with the excrement of the infected bird and picked up by the young poult while feeding. That the infection enters by the mouth is more than probable from the fact that the lesions are sometimes found in the proventriculus, or dilation between the crop and the gizzard. The possibility of infection through the egg is the only exception to this theory.

LOSSES.

The losses from this disease have been enormous, and I believe that it is a factor responsible for the high price of turkeys. The extent of these losses is well indicated from the fact that two decades ago a single small island (Block Island), off the Rhode Island coast provided 2 tons of marketable birds each year, while today but 500 pounds are available from the same locality. Statements are also current that in localities in Ontario where ten carloads of birds were available eight years ago it is now difficult to secure two carloads. The reason given for this falling-off in production is the difficulty of rearing stock that can withstand this affection.

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From the information which we have obtained through communications received at this laboratory, it is evident that there is not a province in Canada where entero-hepatitis does not make its presence felt with more or less severity each season. In some portions of the country the disease has made such inroads on the turkey industry as to almost prohibit the raising of this class of fowl.

The usual story concerning losses is that an individual having a few fowl desires to supplement his poultry operations by raising a few turkeys. He is an unsuspecting buyer of parent stock until experience has made him painfully aware of the fact that he has bought with the birds the infective agent of this disease which later separates him from his original investment and the time he has spent in caring for the young poults. The season is then too late for him to attempt another start, his premises are infected, and, discouraged at the result, he decides to relinquish further effort in this direction. There is also the possibility of other fowl harbouring the entero-hepatitis parasite, yet no suspicion of this may exist even though all the poults may have contracted the disease from them and died. It is quite common where entero-hepatitis makes its appearance to lose 70 per cent of the young stock before they are sufficiently mature for table purposes.

NATURE OF THE DISEASE.

The early symptoms presented by affected birds are not particularly characteristic. Affected birds, however, will separate from the remainder of the flock. This separation or lagging behind does not appear to be a desire for seclusion but the result of being unequal to the task of keeping up with the others from physical exhaustion. The droppings are more fluid than normal, and may be streaked with yellow. Gas bubbles may be sufficiently numerous to give a frothy appearance.

The head may be, and usually is, darker in colour than normal. This dark colouration may disappear and reappear at irregular intervals while the bird is at rest, but excitement usually causes a bright red colouration.

The best means of early diagnosis is the examination of the droppings for evidence of diarrhoea or a yellow colouration of the faeces. Feeding time may prove the most appropriate for such observation. Where this is not convenient, owners should provide some means of determining an infection at the earliest possible moment.

COURSE OF THE DISEASE.

Affected birds, if untreated, may die in a few days or may linger for a week or longer after the first appearance of symptoms, according to the virulence of the infecting agent. In some cases the onset is so rapid and free from outward manifestations as to be recognizable only by an autopsy. Without treatment, or a complete change in diet and surroundings, the course is usually fatal.

POST-MORTEM FINDINGS.

The post-mortem findings are characteristic. The lesions are confined to the liver and intestinal tract. The liver is the seat of lesions (Plate IV. Fig. 1) which appear on the surface as circular spots about the size of a five or ten-cent piece, yellow or whitish yellow in colour, and surrounded by what to the naked eye appears to be normal liver tissue. At the point between the lesion and the liver tissue, a ring almost bright red in colour is observed. These lesions in the liver, if cut open, may have a uniform colour throughout or, in the more chronic cases, there may be a core in the centre. The intestines

may be the seat of a chronic inflammation. The caeca or two blind guts which lie along the course of the intestine and enter it about 6 inches from the vent are usually inflamed and in either or both a single or a number of lesions the size of a walnut are usually present. These lesions are yellow in colour, have a thick wall and a degenerated centre. There may be, in addition to the above, in severe, acute, or chronic cases, either a localized or general peritonitis (inflammation of the outside wall of the intestines) with adhesions and fluid in the cavity.

PREVENTION AND TREATMENT.

The placing of the poults on clean, sanded board floors in a dry, well-lighted, and well-ventilated building with a southern exposure, is considered a means of prevention. The continued contact with the floors, however, tends to weaken the poults. I believe it to be an advantage to see that they are quartered on sanded board floors at night, and prevented from ranging in the early morning when the grass is wet. When the birds are older, the roosting places should receive consideration. The free application of lime and sulphur wash (that used in spraying fruit trees is suitable) on the ground under the roosting places, and the ground on which they are reared, two or three times during the season, will destroy any infection on the ground. We believe that persons raising turkeys should be very careful not to introduce the disease when making additions to improve their stock. A turkey tom may be a source of infection when he heads the flock of a neighbourhood. The greatest care should be exercised to prevent any possible source of infection reaching a flock or locality now free from disease.

The early diagnosis of the first case is an essential feature in connection with the prevention and treatment. The isolation of the first case may often prevent further manifestations of the disease. From our experiments, however, it appears that there may be chronic carriers of the disease whose droppings are continually infected, notwithstanding the fact that they exhibit very slight, if any, symptoms. This suggests that isolation may not be as potent a factor in preventing losses as desired, but I believe that it should be enforced to such an extent as will prevent the old and young flocks intermingling after the first appearance of blackhead.

Our experiments in the treatment of entero-hepatitis have been directed to the finding of some agent that will successfully carry affected birds over an acute attack, and enable their being conditioned for market.

There is, to our knowledge, no known specific for controlling the ravages of this affection. The use of muriatic acid in the drinking water was found some ten years ago to be followed by beneficial results on affected turkeys which I was trying to raise at my home. Later it was given a further trial, and seven years ago a single turkey at this laboratory made an apparent recovery. During the past six years we have recommended it as being the best medicinal agent which we know to assist in overcoming the affection. A few years ago five affected birds recovered after receiving liberal allowances of this acid. One of these which was later autopsied to determine the presence of lesions, was found to be normal in every respect, so far as we could determine. Some apparently remarkable recoveries have followed the use of this acid, but one cannot hope to bring all affected birds through an attack. I was first prompted to use this acid as I found that the contents of the digestive tract in turkeys dead of entero-hepatitis or black-head to be more alkaline in reaction than is usually observed.

The acid to be used is a teaspoonful of muriatic acid (Acid. Mur. Dil. B.P.) in a quart of drinking water. This acidulated water should be placed in a porcelain or glass vessel, and is suggested in the hope that the birds may be

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carried over an acute attack. At the outset, when the birds show evidence of being severely affected, it may be of advantage to triple the amount of acid (using three teaspoonfuls to the quart of water) for the first three days. This amount will not injure the turkeys, and may assist them in more rapidly overcoming the infection.

They should be confined during this period on dry, sanded board floors in well-lighted and well-ventilated quarters, and allowed access to no other liquid. If allowed to roam they may obtain sufficient water for their requirements from the dew-laden grass or other sources and, therefore, will not drink the acidulated water. If confined, green food should be supplied in addition to the grain ration.

Other medicinal agents may give equally satisfactory results in the treatment of affected birds as that above outlined, in which case my advice would be to stick to the remedy that has proven the most effective. If such other medicinal agents are effective we will appreciate learning of them. We will also appreciate information as to the success or otherwise of the treatment herein recommended.

HOW DO TURKEYS CONTRACT ENTERO HEPATITIS OR BLACK HEAD?

The different methods by which turkeys may become infected are classified as follows:—

1. Infection from other turkeys—Chronic carriers.
2. Infection from other poultry, e.g. chickens which can harbour the parasite without being seriously affected by it.
3. Infection from ground previously occupied by affected flocks.
4. Infection from boots and clothing of attendants, birds, insects, food, feeding utensils, etc.
5. Infection by means of the egg.

(1) *Infection from other turkeys—Chronic carriers.*—The ordinary way in which the young poult receives the infection is from the infected hen turkey. Cases of black-head are commonly seen in which recovery takes place, and it is in these cases that the parasites persist, as do typhoid bacilli in the human intestine after some cases of typhoid fever. These are the birds which act as chronic carriers of the disease. Thus a flock may appear apparently healthy, but as soon as young poults are allowed to run with them nearly all the young birds die of entero-hepatitis or black-head. Such was the case with the flock, some of whose members are shown in Plate I. Fig. 1.

Thus, if the young poults can be kept away from the old birds this danger of infection may be eliminated. This separation may easily be accomplished by incubating the eggs and removing the poults to isolated quarters as soon as they are hatched.

(2) *Infection from other poultry, e.g. chickens which can harbour the parasite without being seriously affected by it.*—The keeping of poults away from old birds is not sufficient to prevent the disease. A flock of twenty-four splendid incubator-hatched poults at the Experimental Farm were allowed to run on the same lawn which chickens had been frequenting. Entero-hepatitis appeared and devastated the flock, leaving but one survivor. The caecum from a sick chicken that had been running on this lawn showed the ulceration typical of entero-hepatitis in the turkey, and this was confirmed by microscopic examination. Thus direct proof was afforded of the suspicion long entertained by poultrymen that turkeys cannot be successfully raised with chickens. To eliminate the channels of infection the poults must be kept from contact not only with adult turkeys but from other fowl as well. The artificially (incubator) hatched poults must be isolated from all other fowl and housed in a suitable brooder.

(3) *Infection from ground previously occupied by affected flocks.*—The danger from infected ground must not be neglected. Just how serious this feature is, our experiments up to the present have not definitely determined, for a possible source of infection was present (that described under 4, *Infection from boots, etc.*). Our plans for the coming season contemplate the elimination of this factor in so far as this is practicable, and we do not wish to make a statement until we have more information in this connection.

(4) *Infection from boots and clothing of attendants, birds, insects, etc.*—We have, by the precautions noted under 1, 2, and 3, stopped the main channels of infection, and all that remains is to observe sanitary precautions in the care of the birds so that any danger of accidental infection may be entirely eliminated or reduced to a minimum. The most important are: the possibility of accidental infection carried on the boots of the attendant, the food and water, and the utensils.

(5) *Infection by means of the egg.*—While we have not proven that the infection is not transmitted by the egg, at the present time, we have no reason for believing that it is. If it were so transmitted, like all other affections, it would present itself very early. Black-head could appear early if the infection were present, for we have frequently seen it in 1-month-old poults. Since an infection has not appeared in our isolated poults when infection from sources 1 and 2 have been eliminated, we can conclude that it was not present in the egg. The eggs were obtained from various sources and, as black-head is so prevalent, some of the eggs probably came from infected flocks. The question, however, is still an open one.

THE PREVENTION OF BLACK-HEAD BY THE BIOLOGICAL LABORATORY METHOD OF ARTIFICIAL INCUBATION AND ISOLATION.

GROUND AND BUILDINGS REQUIRED.

The grounds and buildings required are neither extensive nor expensive. A fenced field of approximately 1 acre, and containing a colony house, is sufficient to raise a flock of about twenty-five turkeys. The section of the farm to be used for this purpose is, therefore, divided into plots of about this size, which may be square or oblong. The whole is surrounded by a suitable wire fence (chicken wire [2-inch mesh] 5 feet high, with posts 20 feet apart and slats or supports at intervals of not more than 7 feet will prove sufficient). Each individual plot is entirely surrounded by such a chicken wire fence and separated from its neighbour by a vacant strip or dead line from 3 to 5 feet wide. This is to prevent contact between the turkeys and outside live stock, and between turkeys in adjacent fields. On one side of the grounds the turkey plots are separated from the boundary fence by a space of about 10 feet, which serves as a laneway. Turkey plots may be placed on either side of the laneway if a large number of flocks are to be kept, but the gates into each should be so placed that an attendant cannot pass directly from one plot to another. This will reduce the infection hazard through the removal of infecting material from his boots by the earth and grass travelled over. When plots are placed on either side of a laneway this laneway should be increased in width to 15 or 20 feet. Each plot contains a colony house 10 by 12 feet (see plate III) which is open at the front. This open side is fitted with expanded metal lathing (a protection against pilfering, which is ever present in a settled community) and is again covered with a 1-inch mesh poultry wire to prevent the entrance

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of birds. At one end is the entrance door and a smaller door for the turkeys. The open front is provided with cotton on a roller which can be pulled down at night if desired during the cold winter weather. The roosts are placed across the corner opposite to the door and well up from the floor, with suitable arrangements to permit easy access. Thus, while the shelter is abundantly ventilated there is no direct draught through the building.

A plan for three turkey plots showing the double fencing, etc., is given in the accompanying diagram Plate II. This diagram readily admits of modification to suit the section of ground to be used. Thus a plan for four plots could have two on each side of the laneway, etc., or any other arrangement that may be considered most expedient.

CARE OF THE POULTS.

The eggs are artificially incubated in the same manner as hen's eggs, the only difference being that the period of incubation is 28 days. After hatching, the young poults are transferred directly to the hover* in the colony house, the floor of which has been sanded. A board is nailed across the corner where the hover is situated, for a day or two, so that the poults will not wander away and get chilled. They are not fed for three days, as there is abundant nourishment still in the yolk sac within the abdomen. At the end of this period they are fed on a soft mash diet composed of bread crumbs, cracked wheat, cracked corn, oatmeal, etc., mixed into a sticky mass with milk, and having some chopped onion tops, lettuce, clover, alfalfa, lambs quarters or similar greens mixed with it. This should be fed about five times a day at first. In addition, fresh water, preferably in a globe or bottle fountain, a dish of sour milk, and a dish of fine grit should be provided; after a few days beef scraps may be added to the mash. In about two weeks time, by the end of which they have become quite strong, the poults may be allowed out of the colony house, but since there are no old birds present the poults fall easy victims to hawks and crows unless provided with a covered runway. The covered runway used by us consists of frames of 1-inch mesh poultry wire provided with hooks and eyes which can be set up as required. Each side is composed of two pieces, each 10 feet long and 2 feet wide. One of these set up with its open end against the small door of the colony house is shown. (Fig. 2, Plate III.).

After a few weeks the feeding may be cut down to three times a day, and by about the second month a hopper of mixed grain (wheat, cracked wheat, cracked corn, etc.) may be placed in the colony house and the feeding reduced to twice a day. By this time the poults are large enough to hold their own against the crows, and allowed to roam at will in their plot.

They are now getting an abundance of grass-hoppers, and mash feeding is stopped. The hopper of mixed grain is kept well replenished, and coarse grit or oyster shell is substituted for the fine grit. By this time a change from sand to shavings, chaff or straw on the floor of the colony house will improve the appearance. As winter approaches and the young turkeys have become quite large, the bedding must be changed to straw.

At this time it is desirable to make a selection of the birds to be kept through the winter, preparatory to the operations during the following spring and summer. A separate colony house should be set apart for this purpose. To introduce new blood and maintain the stamina of the stock we believe that this is best accomplished by securing eggs from a source that will ensure the desired results, and the breeder making his own selection from the adult birds. It is understood that the introduction of new blood through the egg is to be conducted along the lines already described for rearing the turkeys by artificial methods.

*Electric hovers are best if the current is available, but any well made hover will prove satisfactory.

During the winter the curtain on the front of the colony house may be pulled down and hooked at the bottom at night. On particularly cold and stormy days it may be kept down during the day.

SANITARY PRECAUTIONS.

In cleaning out a colony house the refuse should be destroyed by fire as near the shelter as is safe. This overcomes the danger of carrying the infection from one pen to another. The board floor of the shelter should be disinfected 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. Corrosive sublimate should not be used, owing to danger from poisoning. In making the rounds while feeding, etc., care must be taken that nothing is tracked from one plot or colony house to another. In no case go in with the old infected flock and then into a plot or colony house of young isolated poults, without thoroughly disinfecting your boots.

CONCLUSION.

Partial success has attended the prophylactic procedures outlined for two years on the laboratory premises. The first year, covered runs were not employed and the crows secured some of the poults; this interfered with the experiments.

That black-head will not occur where this system is used we are not prepared to say. It is only after the method has been tried by others throughout the country that a final opinion can be expressed.

As it is not yet known what role birds, insects, and other uncontrollable factors play in the dissemination of the disease, we are not prepared to say that accidental cases may not occur after all the precautions outlined have been taken. In the event of the infection breaking out, through the agency of these factors or through carelessness on the part of the attendant, clean out the house, burn the refuse and disinfect the premises as outlined under "*Sanitary Precautions.*" The infection may thus be checked before it has wiped out the flock on one plot, and certainly before it has extended to the flocks on other plots.

In the conduct of the work upon which the foregoing has been based, I wish to express my indebtedness to the Poultry Division at the Experimental Farm, to Dr. A. B. Wickware, Assistant Pathologist, and to Mr. N. M. Guiou, who for the past two years has had in his immediate care the detailed practical and technical features of our studies.

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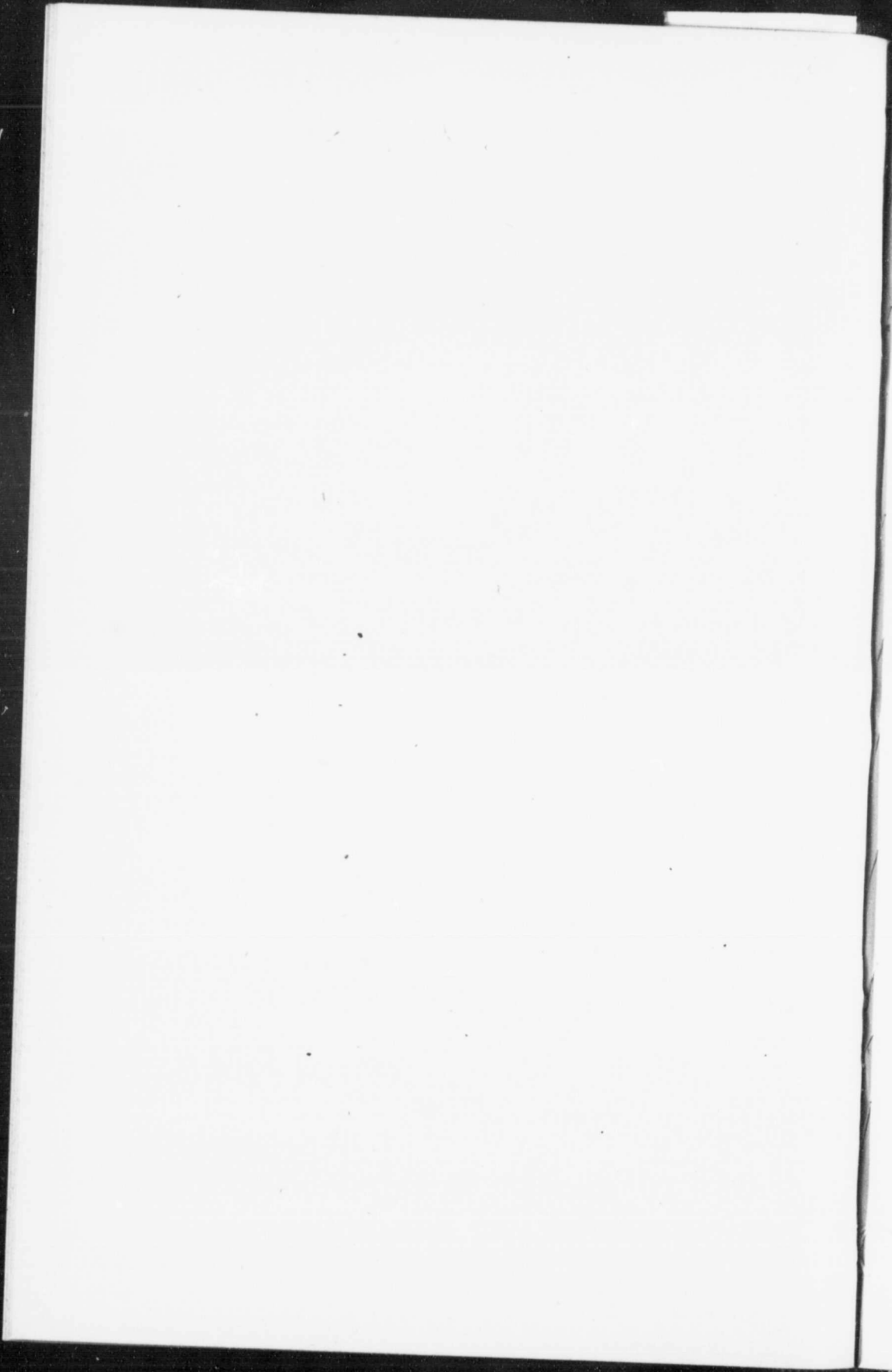
INSTRUCTIONS FOR SENDING MATERIAL FOR EXAMINATION.

Where it is desired to determine the nature of any condition causing losses among turkeys, an examination will be undertaken provided suitable material is supplied. It is preferable to have affected turkeys forwarded alive by express in order that a thorough autopsy may be made. The express charges are paid by the Biological Laboratory. When the condition has been found at autopsy the tissues may be sent by mail if properly packed and preserved. Tissues may be preserved in alcohol or a solution of one part of formaldehyde to nine parts of water.

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

Specimens and enquiries should be addressed to the Biological Laboratory, Ottawa, Canada.

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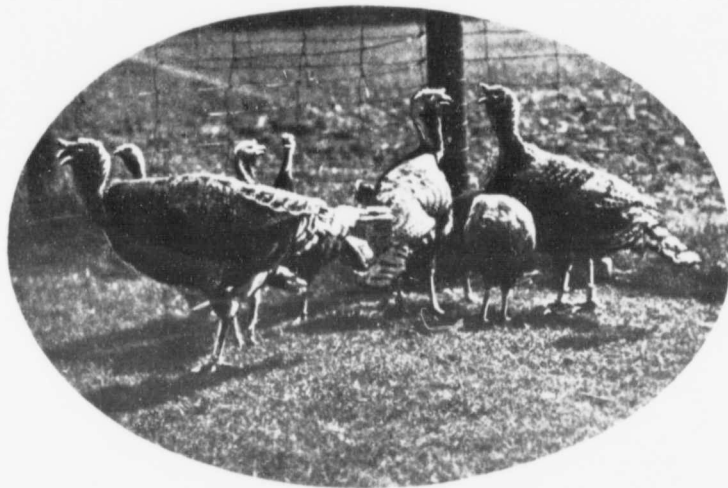


Fig. 1. A group of adult turkeys apparently healthy but in reality chronic carriers of the entero-hepatitis or black-head parasite. Such is the condition of the average flock in which the affection has appeared. Young poults allowed to run with these birds nearly all died of black-head, the usual experience.

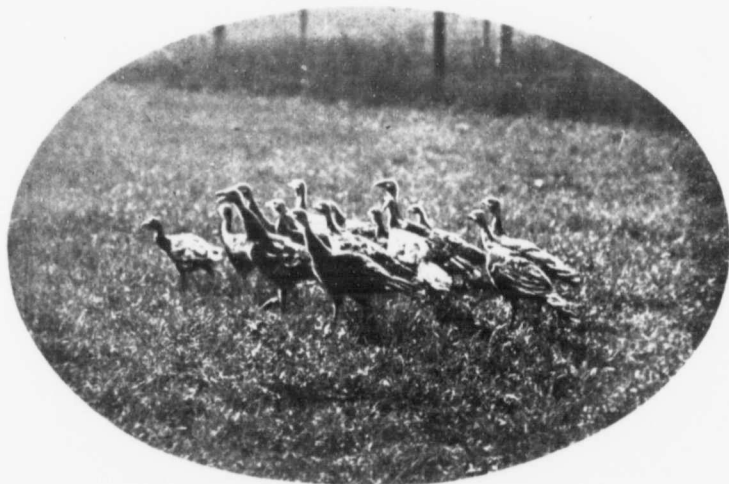


Fig. 2. A flock of artificially incubated and brooded poults roaming in their isolated plot.

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"B"
"C"
"E"
"F"

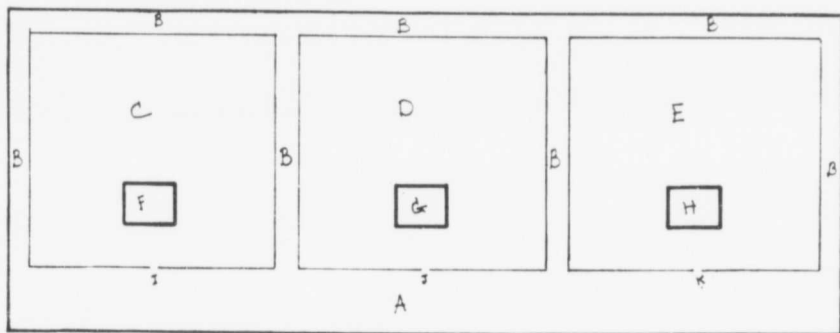
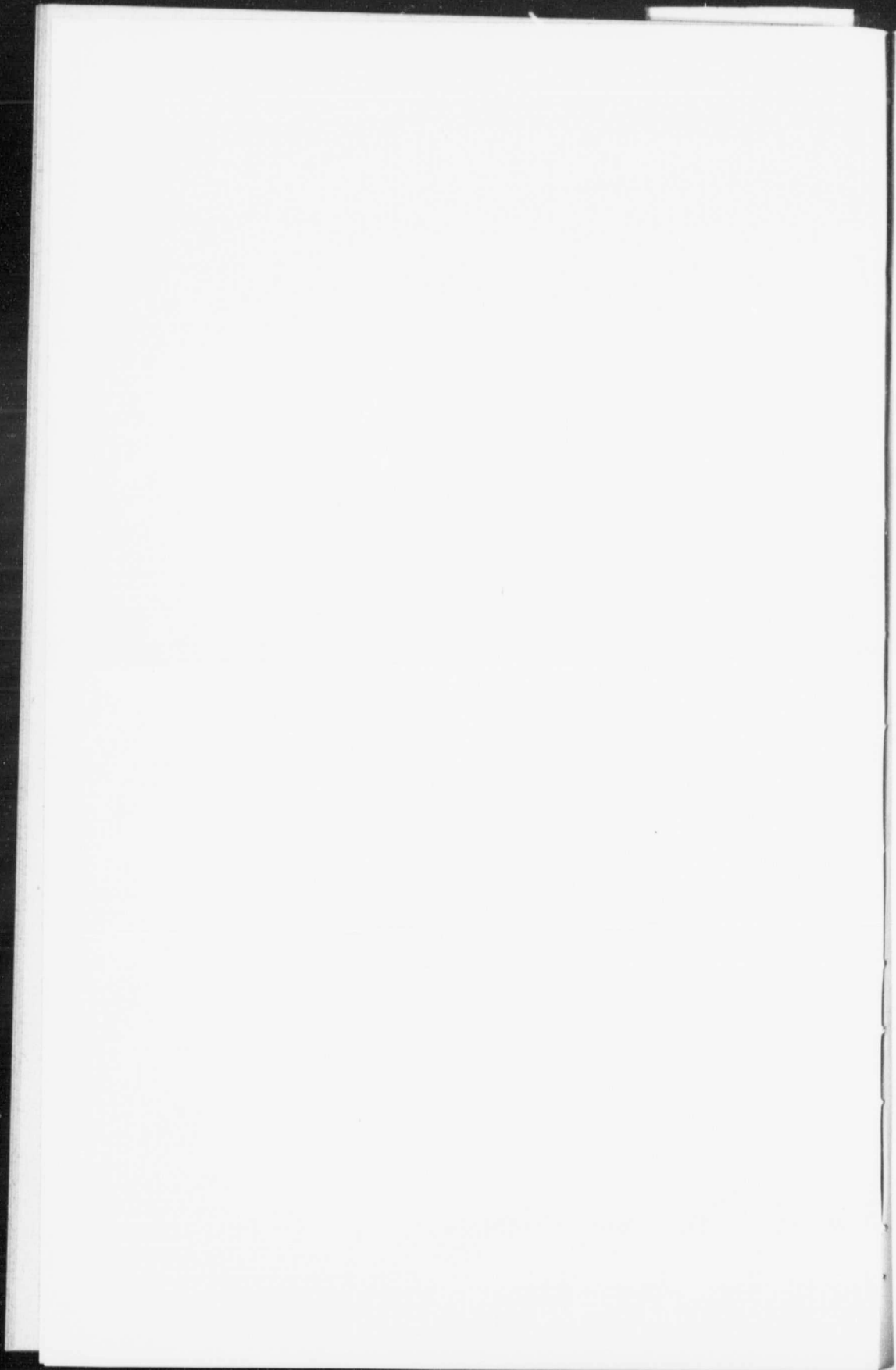


Diagram of the Experimental Turkey Plot at the Biological Laboratory.

- "A" Laneway from which entry is secured to each individual plot.
- "B" Dead line around the experimental plots to prevent the transmission of infection by contact.
- "C" "D" "E" Individual plots. Approximately one acre each.
- "F" "G" "H" Turkey Shelters. See Plate.
- "I" "J" "K" Gates to enter plots from "A".



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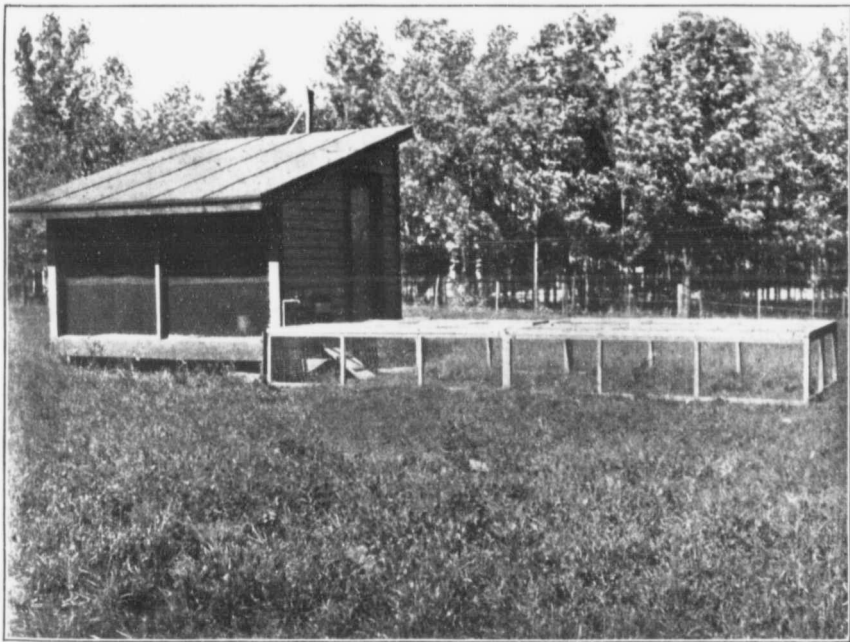


Fig. 2. Turkey shelter showing covered runway used for young poults at the Biological Laboratory.

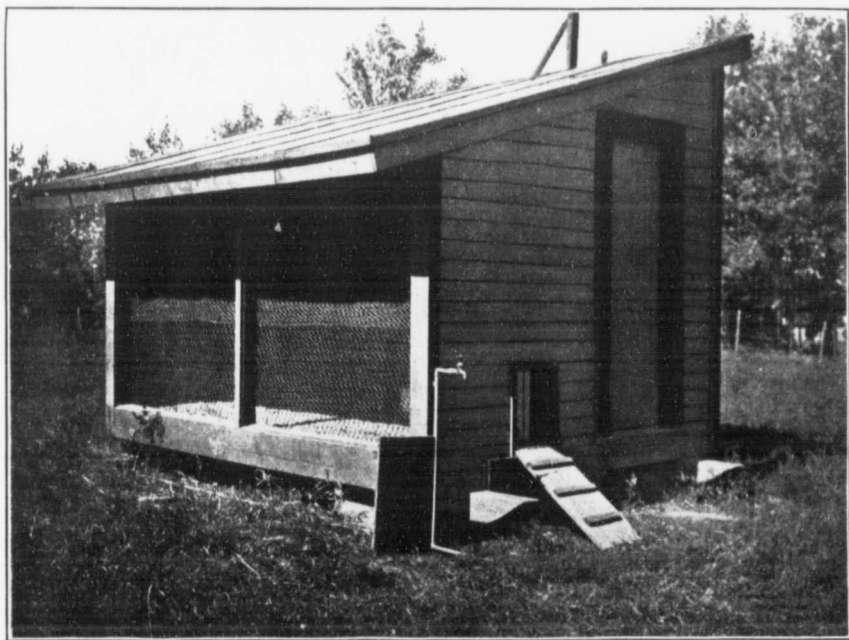


Fig. 1. Turkey shelter used for experimental work at the Biological Laboratory.

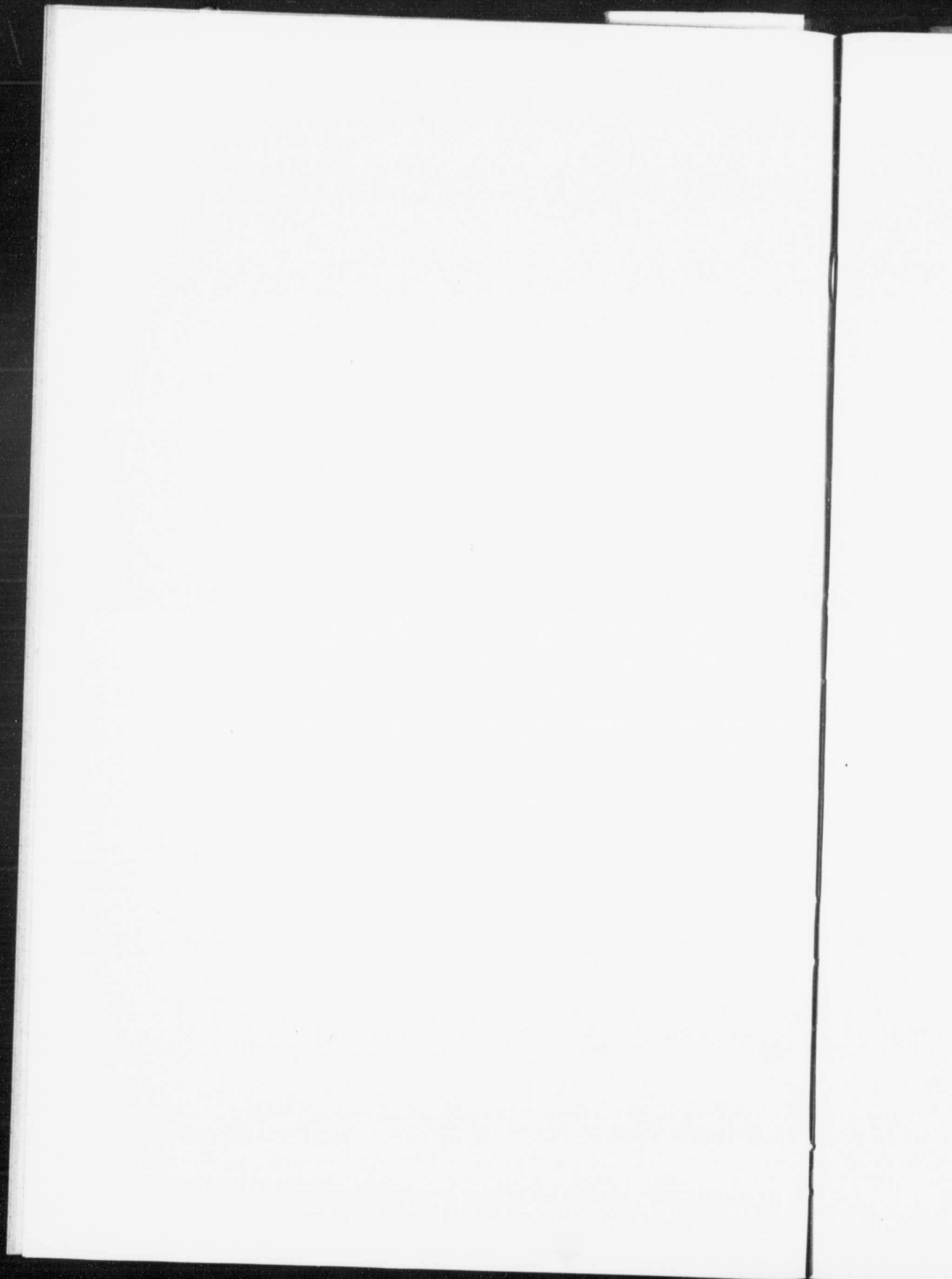


PLATE IV.

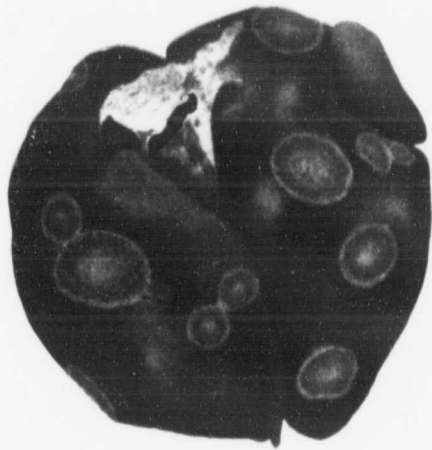


Fig. 1. Appearance of the liver of a turkey affected with Entero-hepatitis or Black-head. (Original)





Fig. 2. Cells containing the entero-hepatitis parasite (diagrammatic) from a fresh microscopic preparation of caecal content in neutral red solution. (Original)