

research problems have been taken up. We have studied the various parasites observed in the intestines of affected birds with a view to determining whether or not they were in any way concerned with the occurrence of the disease. Our results lead us to the belief that no parasites which we have observed are concerned in this affection save the amoebae *meleagridis* described by Theobald Smith.

At one period of our experiments it seemed absolutely essential that we have a means for the accurate diagnosis of this disease. This being the case Mr. Guiou undertook during the summer of 1913 an extended investigation upon this feature. He endeavored to perfect a method for the serum diagnosis of the affection. The results, while not altogether of as satisfactory a nature as we desired, did, however, indicate that providing one had ample time there would be little difficulty in perfecting the method upon which we were experimenting. This used what is known as the "Serum Test" or the Complement Fixation test as a basis. For an antigen Mr. Guiou perfected a liver extract made in much the same manner as is the extract used in the diagnosis of syphilis in the human being. The greatest difficulty which we experienced in this work was the securing of birds known to be free from infection to control our results. We had at this time but a single bird for this purpose and Mr. Guiou found that the blood of this bird constantly failed to fix the complement, whereas the blood of birds known to be actively infected on the other hand gave us at all times positive results. We had in other birds concerning which it was a question as to whether or not they were infected variable results. After a season's work in this direction we decided that the purely technical knowledge to be secured could add but little to the practical knowledge of the disease which was held by all interested to be of first importance. Therefore, in our next season's work Mr. Guiou refrained from experimenting on similar lines devoting his entire time to practical features with the result that we now believe that further ravages of the disease may be controlled by the rigid adherence to the Biological Laboratory System of Raising Turkeys.

During the summer of 1913 in addition to our extensive blood work and parasitic investigations, we also undertook experiments with a view to securing a means of treating affected birds. We did this as we were then of the opinion that if our efforts in raising healthy stock were unsuccessful, we should possess a means of treating birds actually affected in such a way that they could be carried to a marketable age without serious loss in flesh and without representing lesions which could be considered dangerous to human health when the birds were consumed. Following the work done upon the control of human amebiasis, we experienced with Emetine both administered per os and hypodermically. When administering by the mouth we used

keratine coated pills with a view to carrying this pill beyond the point where its effectiveness would be destroyed by the digestive juices in the gizzard, our aim being to get them into the small intestine where their full therapeutic action could be secured. The results from these pills were not very satisfactory. With our experiments in the hypodermic injections of Emetine we were somewhat more successful. In a number of cases we believe that the course of the disease was checked or completely aborted but we cannot leave the description of this method without mentioning the fact that in a number of cases death resulted from an overdose of Emetine.

The labor and care entailed in the administration of Emetine either through pills or hypodermic injection was so great as to render treatment in this manner out of the question for ordinary application. The cost also was a factor that could not be wholly overlooked when considering the requirements of persons raising 100 or more turkeys. We have used extracts of diseased tissues after passing through fine filters with variable results. The detail required in all of the work indicated that the cost of treatment would be greater than the value of the birds, therefore, it was discontinued.

In the progress of our investigations which have been very superficially mentioned we were endeavoring to eliminate such factors as could not readily be applied in the raising of turkeys by the intelligent poultryman whose first consideration is the profit which he may secure from the investment of his money, time and labor. We realize that unless his time were profitably employed he could not be expected to be enthusiastic about turkeys as a source of revenue. Unless labor conducted as a result of scientific investigations proves profitable to the man performing the actual routine duties the results of the research cannot be looked upon as wholly satisfactory even though they are but a step toward the ultimate success which may later be obtained.

We believe that we have by our research and practical experiments been able to present a sufficient amount of data, the results of which will be very far reaching. The full details of our practical recommendations may be found in the bulletins above referred to.

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#### THE WARFARE AGAINST BLACK-HEAD

In the last paper which the writer presented before the Society it was pointed out that blackhead of turkeys is not an infectious or a communicable disease, but a disease of captivity. That yard infection and transmission from poul to poul, or from chick to poul, must be regarded as myths, without the least experimental evidence behind

them. What then are the obstacles in the past toward successful turkey raising?

### I. Improper Feeding

There are five great obstacles in the path of the turkey raiser: 1. Improper feeding; 2. Improper housing; 3. Exposure to wet and cold; 4. Improper range conditions; 5. Lice and other parasites. If these difficulties could be simultaneously removed, raising turkeys would be as easy as raising chickens. Of the mortality in growing stock, due to each of these causes, the percentages may be reckoned something as follows: improper feeding, 50; improper housing, 12; exposure, 25; improper range, 8; lice and other parasites (internal or external), 5. In most cases these conditions are not presented singly; two or more are usually working together to cheat the turkey raiser out of his profits. But among them all, it is seen that to improper feeding must be attributed the greatest loss. To feed right carries the poultryman a long way way toward the season's success.

The larder for the young poults should contain, from first to last, the following supplies:

1. Ample green food (dandelion, onion tops, spinach, lettuce, nettles, turnip tops, carrot tops).
2. Boiled eggs.
3. Cracker crumbs.
4. Chick grain.
5. Rolled oats.
6. Hominy chops.
7. Middlings.
8. Beef scrap.
9. Soured milk.
10. Oyster shells and grit.
11. Mixed hard grains (whole).

Out of these constituents the rations of the turkey may be made up from the time it has its first meal to the time it is ready for the Thanksgiving market. The feeding of the young poults under one month old has been considered in detail in a previous article. We may now consider the feeding for the second month, which, for average eastern stock begins about the first of July.

The poults have by this time been weaned from their cracker and egg mixture and the ration now consists of a mash, rolled oats and sour milk, or, sometimes, limited amounts of chick grain. The number of feeds per day must depend upon the daily program of the turkey raiser. The birds will do well on three feedings, but they will grow faster on five. The schedule for poults in their fifth week on three feedings per day might be as follows:

- 8 A. M., mash.
- 12 M., rolled oats thrown in the grass.
- 4 P. M., mash.

Under this plan a dish of soured milk would be put out for them both morning and night.

On the five-feeding basis the schedule might be:

- 7 A. M., mash, followed by milk.

- 10 A. M., rolled oats.
- 12 M., mash, followed by milk.
- 2:30 P. M., rolled oats.
- 4:30 P. M., mash followed by milk (in the house).

In this five-feeding system a small amount of well clabbered milk is placed in dishes before the birds, after each mash feeding, at the rate of about one tablespoonful for every eight to ten poults. The mash fed is the Bennett mash, formulated by one of Rhode Island's most successful turkey raisers and made up as described in the preceding articles of this series.

Inquiries are frequently made regarding the use of hard grain for young turkeys. We may therefore compare the advantages and disadvantages of this procedure. The advantages are as follows: For the raiser who has little time to devote to his birds the feeding of grain twice a day is far easier than mixing and feeding the more complex mash. In the second place the absence of bulk causes the turkeys to range more freely and obtain more natural food in the form of insects. This is, in itself, an advantage. Among the disadvantages of grain feeding during the earlier months may be mentioned first the more difficult digestion of the hard particles and the consequently greater tax upon the digestive system, accompanied by slower growth. Mash-fed birds develop far more rapidly than grain-fed stock during the first four months of life. The difference becomes less significant during the later months, and grain must be used in the final preparation of the birds for market.

In the second place a very fundamental objection to unrestricted grain feeding is the lack of a suitable vehicle for the administration of green food. If left to themselves, young turkeys will never consume as much green material as they require. The most satisfactory method of giving green stuff is in the mash, in which fully one-third to one-half the bulk should consist of chopped greens. The turkey raiser will find that to supply this need requires forethought and perseverance, but upon his strict adherence to this rule much of his success depends.

We may conclude then, that if hard grain is to be fed to young poults under two months old it must be fed sparingly, and the best type is commercial "chick grain" in which the particles are small and easily handled by the digestive organs. The use of hard grain in the later feedings will be considered in a subsequent article.

Whether grit is necessary before the poults are a month to six weeks old is doubtful. At any rate no harm is done to include a small amount in the mash, and to feed by itself if grain feeding is employed.

Of oyster shell, turkeys naturally will consume large amounts, but it is scarcely advisable to feed it before the fifth or sixth week. It may then be placed on boards or rocks about the range where the poults may find it.

To conclude, the watchword of the turkey raiser during the second and third month of feeding must be "moderation", moderation and green food. More young turkeys die between the ages of four and eight weeks than at any other life-period and it is during this time especially that the poultryman must be "onto his job". Until he has learned by experience how much to feed he must feed by time. If on the five-feeding plan, two minutes must be the time limit for each meal. If only three daily feedings are given, three minutes to clean up may be allowed.

But "prophylactic feeding" is not the whole story in the fight against black-head. There are still other obstacles to be met. The next article will deal with the subject of safe and sane housing for the growing poults.

## II. Housing the Young Stock

Although safe and sane methods of feeding probably count for more than half the battle in successful turkey raising, one must not discount the importance of proper housing and other means of protection against cold and dampness. By the amateur, accustomed to methods of rearing common chickens, this phase of turkey raising is regarded lightly. From the expert, next to feeding, it receives the most thorough consideration. Methods of housing and management that may serve to rear ninety-five per cent of a flock of chicks may mean the utter annihilation of a turkey flock during the critical days of the second month, or even earlier. Exposure to wet and cold is an important predisposing cause of the blackhead disease. Young poults must be kept dry and they must be kept warm.

The size of the house is important, it should afford ample room for a hen and her fifteen poults to scratch and exercise. There are on the market good houses for this purpose having a single pitch, hinged room (covered with roofing paper) and a floor area of about 3x5 or 3x6 feet. The front contains one door with a window on each side. The door and windows are wire covered and have removable cloth screens. These houses may easily be equipped with handles to facilitate moving. The floors should be mounted on blocks to raise them about three inches above the ground. The inside, including floor, should be lightly coated with Carbolineum some weeks before use. The floor should be covered to a depth of about one inch with barn sweepings and these should be renewed every few days, or whenever damp from rain or from droppings. Such a house as this does not require an outside run.

A somewhat less expensive house, but at the same time less satisfactory is the 18"x18", or the 24"x24" brooder coop with removable cover. A small house of this sort must be accompanied by a covered run. The house proper should be equipped with a good floor, covered with barn chaff. Though on the whole satisfactory, a house of this type is less desirable than the larger type because of the limited floor space. In stormy weather this is scarcely made up for by

the additional run. The fact of the matter is there is very little "half-way" weather for turkeys; if it is not good enough for them to be out free on the range, they should be well housed on a dry floor.

As to the use of these houses the following points may be recommended. For the first two days after hatching the young birds are not let out at all. On the third day, between ten and three they may be allowed to range within a strip of twelve inch wire (one inch mesh) looped in a circle (about six to eight feet in diameter) before the door. In damp and rainy weather they should be kept strictly to the house. As days go by the size of their range may be gradually increased until the age of a week they may be allowed to range freely with the old hen. Even now, however, they should not go out in the morning before the grass has fully dried and should be enticed back into their house by the feeding of milk by four or five o'clock. If the day is cold and damp, even though the grass is dry, the poults will be better off indoors. Of course they must be carefully looked after in case of sudden showers.

The function of the removable screens is to protect against wind and rain. In good weather they may be out, but at night all except one of the window screens should be in place. The houses should be faced according to the sun and the direction of the prevailing wind, so far as possible toward the former and away from the latter. Considerable damage may sometimes be done as a result of rain accompanied by a veering wind. Sometimes a strong wind entering the front of the houses may take away the roof unless hooked in place. On sunny days the roof may be thrown back to permit the sun to dry out the floor and litter.

When the poults are six to eight weeks old they should begin to roost. For this there are several possibilities. In the first place a roost may be set in the house where they have been reared. This may accommodate them for a time, but eventually they will of course need to go into a larger house. This may be advisable also, even at an earlier date, in order to relieve the brooder house for the use of younger stock. In such a case it is a saving of time and trouble to construct a roosting house where the birds may be kept until they are wanted for the Thanksgiving market. This is merely a wired-in enclosure surmounted by a roof with sides coming down about two feet below the eaves. This is mounted on posts so that there is head room below the roof top on all sides. The roosts are set on level with the bottom of the house, that is at about the level of the tops of the posts upon which the roosting shed is supported. A ladder of poles should be constructed by means of which the turkeys can reach the roosts. Here they are at least partially protected from wind and rain during stormy weather, and also which is sometimes more important from thieves.

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## Editorial

An organization of individuals and institutions primarily engaged in instruction, investigation and extension in poultry husbandry.

### Publication Committee

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### Washington Meeting Postponed

On account of the recent international situation, the Executive Committee has voted to postpone the Washington meeting indefinitely. It has been suggested by some members that in view of the absence of the annual meeting, it might be very appropriate for different members to organize sectional meetings; for instance, one in the New England and Atlantic Coast states, one in Canada, one Central meeting, with possibly one Western meeting, and one Southern meeting. The idea was expressed that the members at these local meetings could best discuss their local problems, especially in so far as the relation of the various departments to furthering the production of poultry products was concerned. It was deemed urgent by most of the members that their entire time should be spent at home this summer and that the expense of attendance at our national meeting would be inappropriate under present conditions.

The Executive Committee stands ready to call the annual meeting at any time it may seem appropriate.

If sectional meetings are held, notice of intention to hold same should be sent to the secretary, and all papers and minutes of such meetings become a part of the records of the Association, and all such papers will be available for publication in the Journal. Suggestions will be gladly received from all members by the Executive Committee, and we want you to be free to advise us in this matter.

### Emergency Issue

It has been suggested that we make our June issue a War Emergency issue and every member of our Association write to the editor immediately, accompanying the same with a short paper surveying the means which are being used in his state to maintain poultry production. The publication of this paper will be of great value to all of us, and the editor will be glad to have any information for such issue.

### Write Now

(Continued from page 60)

Of course these precautions involved in the housing of the poults are devised to meet unfavorable weather conditions. If one could always count on fair weather during the rearing season, or if all stormy periods were limited to two or three days, such precautions would not ordinarily be required. But although some seasons are favorable for turkey raising, they cannot be counted on, and a week or ten days of cold stormy weather, with strong winds and no sun, may do much damage to the young flock unless it is housed warm and dry and with ample facilities for scratching and exercise.

By Philip B. Hadley  
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### THE REPAIR OF BONE IN THE DOMESTIC FOWL

This paper takes up first, the development of bone in the domestic fowl. Second, the kind of fractures and the reparative processes and third, the means of control of the bird and care of the fracture.

A comparative study of the bones of the fowl and that of mammals shows these differences. Many of the bones of the birds contain air spaces. These air spaces occupy the so-called marrow spaces or medullary canals. The respiratory apparatus consists of the upper and lower larynx, trachea, two lungs provided with bronchial tubes which extend lengthwise of the lung and from these, radiating secondary tubes are given off at right angles. From some of these tubes there are sent out extensions communicating with bladder like expansions known as air sacs. These air sacs in many instances send prolongations into the bone cavities and thus the respiratory processes are carried to the sac like expansions and to the bones. It was found that in some bones red marrow was found and that the structure of cancellated and of compact bone in the birds is similar to that of mammals.

A fracture is defined as a sudden solution of continuity in a bone. The causes of fractures in the fowl are: First, injury or trauma. Receiving a blow as from a stone or stick or being stepped upon by a large animal as a horse or cow or by a gun shot wound. Second, muscular action. Bones are most resistant to traction, next to pressure and less resistant to flexion or bending and least of all to torsion. External violence may be direct or indirect. In fractures from direct violence the bone is broken at or near the spot where the violence is applied. As a rule the soft structures around the fracture are more or less injured and more serious results may follow than in fractures by indirect violence. In this kind of fracture the bone may be comminuted or fissured and perhaps driven into vital organs, as the liver or lungs, if the fracture be near those regions, or into the brain if the fracture be near the brain. Fractures from direct violence are the most common kind in the