

Important work has been done by the Stations in New York, Massachusetts, Maine, West Virginia, Canada, and in a lesser degree in several other stations. Considerable work has been done by private individuals. It should be considered in this connection, but in the present state of our literature on the subject the task of collating and summarizing the data which has accumulated demands an amount of leisure that the writer cannot possibly command. He has therefore been compelled to submit the following imperfect summary, which is to be taken rather as an evidence of good will than an attempt to execute the commission assigned to him.

The subject may properly be subdivided into the following divisions:

1. Value of animal food for young chickens.
2. Value of animal food for maturing pullets.
3. Value of animal food for laying hens.
4. Value of animal food for fattening chickens.
5. Value of animal food for ducks, turkeys, etc.
6. Sources of animal food.
7. Substitutes for animal food.

1. In feeding animal food to young chicks it has been found that meat-fed chicks made quicker and cheaper gains than others regardless of size, and that chicks started on a ration deficient in animal food never regained their lost ground. The results of private experimenters generally lead to the same conclusion.

2. The writer has not been able to learn of any direct comparison of rations with and without animal food in their relation to the effect on the period at which egg laying begins, except some experiments of his own a few years ago in which the pens without meat generally began laying before the others and maintained their position for weeks and even months, on such rations.

3. The work done by most investigators has usually shown decided superiority for the meat-fed laying pens, but there is sufficient evidence the other way to warrant further investigation, especially in view of the fact that certain substitutes have been very successfully used.

4. In the fattening of fowls, animal food has appeared to be essential to best results except when milk has been used. The effect of animal food on the quality of the flesh seems to demand further investigation.

5. Little work appears to have been done in this line, but so far as it has gone animal food has seemed more important, at least with ducks, than is the case with fowls.

6. The common sources of animal food are meat scraps and other forms of packing house products, green bone, cooked meat, and insects and other natural sources. Comparisons have been made between different forms of prepared animal foods and green bone which indicate that there is little to choose in the matter of efficiency. The choice of sources appears to be pretty well established as a matter chiefly of convenience or economy.

7. The substitutes for animal food in common use are milk, milk albumen, or dried milk, vegetable sources of protein, bone ash or phosphate sources. Milk albumen appears to be waning in popularity, not only on account of its high cost, speaking relatively, but because it has not generally given as good results. Milk, sour or otherwise, has given conflicting results, and the writer would call attention to the fact that comparative experiments with milk as a factor are especially difficult to handle, and the results of such work should be accepted less freely. Vegetable protein, when used under favorable conditions, has often given as good results as when protein from animal sources has been used. It is to be noted that the exact terms of the project have a good deal of bearing on the outcome of the test, particularly in this line. Bone ash or some carrier of phosphorus has been tried occasionally with results that indicate that some of the advantage that has been claimed for animal protein may possibly be due to the mineral matter contained in the meat scrap or cut bone.

HOMER W. JACKSON.

STERILITY IN BIRDS SOMETIMES DUE TO CLOSURE OF THE OVIDUCT.¹

Probably every large flock of birds possesses one or more birds which have every external appearance of being good layers, but never lay an egg. A number of such cases which have occurred in the Maine Agricultural Experiment Station flock have been investigated. These cases have shown that some birds which possess the hereditary possibilities for high laying cannot lay because of some defect in the sex organs, usually the oviduct or egg tube. This defect may be a closure of the duct at the funnel by adhesion of the lips so that a yolk cannot enter the duct, or a closure at any level of the duct due to the formation of a tumor on the inside of the oviduct wall, or it may be that the wall is ruptured so

¹ The original account of the case here briefly described was published in Biol. Bul.

that an egg cannot pass. In all such cases the sex organs of the bird pass through the same changes from non-laying to laying condition as in the birds which actually produce eggs. When the eggs cannot enter the egg tube they are discharged into the body cavity and absorbed. When they can enter an obstruct duct they pass down as far as the obstruction and receive in the passage as many of the other egg parts as are normally formed by the portion of the oviduct above the obstruction. They are then returned up the duct and extruded into the body cavity. In case of rupture of the duct the eggs are formed normally until they reach the rupture through which they pass into the body cavity. Eggs set free in the body cavity are absorbed. A surprisingly large number can be absorbed without causing any apparent inconvenience to the bird.

An interesting case of a bird which was laying into the body cavity was lately brought to the Maine Agricultural Experiment Station. The bird was a year and a half old Rhode Island Red hen which had been killed for meat. She was well grown and in good flesh. When the body cavity was opened it was found full of membrane covered eggs. They represented every possible stage of absorption from a normal membrane shelled egg to collapsed empty egg membranes. Some of the eggs and empty membranes were free in the body cavity. Others were walled off in pockets either singly or in aggregates. There was one large mass (twice the size of a hen's egg) of empty tightly packed egg membranes. At the time of examination 15 absorbing eggs and a very large number of membranes were found. Eleven of the 15 eggs had evidently been normal eggs although many of them contained a homogeneous mixture of yolk and albumen at the time examined. Four were double eggs. That is, one egg enclosed within another. One of the four was made up of a series of four concentric eggs. The inner egg being a small "witch" or "cock" egg.

The ovary of this bird was in the same condition as the ovary of any laying bird. It had a normal series of enlarging yolks and resorbing follicles. The oviduct as far as the posterior end of the isthmus or egg membrane secreting portion was also in normal laying condition. At the posterior end of the isthmus the duct ended blindly, although the ligament which suspends the duct from the body wall continued normally to the end of the body cavity. There was no shell gland or vagina. The only opening to the duct was the funnel mouth.

It was evident that this bird was in the midst of a normal period of reproduction and was producing eggs in a normal manner as far as her oviduct allowed. The

membrane shelled eggs then backed into the body cavity from whence they were being absorbed at a rapid rate. The occurrence of double eggs shows that one egg did not always get out of the duct in time to make way for the succeeding egg. The occurrence of the egg composed of four concentric eggs suggests that the direction of the movements of the egg must have been considerably disturbed so that this egg passed up and down the duct several times before it was discharged into the body cavity. The condition of the internal organs of the bird indicates that the physiological processes of digestion, absorption and secretion were not seriously disturbed.

The forward end of the oviduct or egg tube arises very early in the development of the chick embryo. The tube then grows backward until it reaches the region of the vent. The most probable explanation for the occurrence of the oviduct found in the case described is that in early embryonic development (probably on the sixth or seventh day of incubation) the backward growth of the oviduct stopped permanently while the differentiation of the part already formed continued in the normal manner.

As in other cases where the passage of the egg is prevented the sex organs passed through their normal reproductive cycles; the oviduct functioned as far as the point where the passage was interrupted; the eggs were then returned to the body cavity and resorbed. The number of eggs and empty egg membranes found in this fowl which was apparently in a perfectly normal physical condition show that a bird may possess very great power of resorption of its own eggs.

MAYNIE R. CURTIS.

THE EFFECT OF CORPUS LUTEUM SUBSTANCE UPON OVULATION IN THE FOWL.¹

It has been shown by Loeb² that one function of the well developed corpus luteum in the mammalian reproductive cycle is to inhibit ovulation. This fact appears to be firmly established for mammals by his observations and experiments. Ruge's³ observations seem also essentially to confirm this result. This suggestion was also made

¹ This is an abstract of a paper with similar title published in the *Journal Biol. Chem.*, Vol. XIX, pp. 263-278, October, 1914.

² Loeb, L. *Jour. of Morphol.*, XXII, pp. 37-70, 1911; *Zentrabl. f. Physiol.*, XXV, No. 9; *Virchow's Archiv*, CCIV, pp. 278-303, 1911; *Deutsch. med. Wochenschr.*, 1911, No. 1 and other papers.

³ Ruge, H. *Arch. f. Gynaek.*, C, p. 1, 1913.