renders the crayfish less conspicuous and it probably profits by the arrangement in much the same was as do various shore-crabs which are decorated with sponges, algæ or cœlenterates. Whether the water bug improves its chances against racial extermination by the adoption of such a pugnacious protector it may be too much to assume, but at any rate whatever the utilitarian value of the habit it must be of the same nature as that which obtains in the widely distributed genus, *Zaitha*. An observation of the manner of egg laying on the crayfish would be of much interest.

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DOUBLE EGGS[1]

UNDER some such caption as the above there have appeared from time to time in zoological literature various accounts of anomalous eggs, chiefly of the common hen. These have naturally elicited more or less popular interest, and various explanations have been proposed concerning them. While it is no part of the present purpose to review the history of these phenomena it may not be amiss to merely call attention to a few of the more striking titles under which they have been described. For example, Barnes ('63, '85) has described cases under the title "Ovum in Ovo"; and Schumacher ('96), "Ein Ei im Ei"; Parker ('06), "Double Hens' Eggs"; and quite recently Patterson ('11), "A Double Hen's Egg," are typical of numerous titles appearing in the literature. The chief purpose of the notes which follow is to call attention to an earlier paper by the writer ('99) and to describe subsequent facts which have come to his knowledge. The only reason for specially referring to the earlier paper ('99) is that it seems to have been wholly overlooked by later observers of these phenomena, and this is the more strange in that both Parker ('06) and Patterson ('11), to whom the journal (*Zool. Bull.*) was quite familiar and accessible, make no mention of it.

In Fig. 1, which is reproduced from the article just cited, are shown the essential features of the first case which came to my direct knowledge some time prior to the date of the paper in question. As will be noted this presents a very clear illustra-

[1] Contributions from the Zoological Laboratory, Syracuse University.

tion of that class of egg anomalies known as "ovum in ovo," and its simplest interpretation appears to be that originally given to it by Schumacher ('96), namely, that it is the result of a return of the egg up the course of the oviduct by an anti-

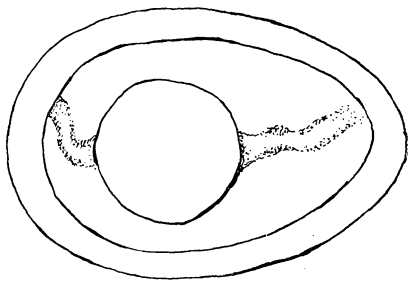

FIG. 1.

peristalsis of that organ, and then later a descent during which the egg would receive a second deposition of albumen, shell membrane and finally a second shell, giving it just the constitution shown in the figure, and described in my paper (p. 228).

In Fig. 2 is shown a case which differs in essential respects from the preceding. The egg came to my knowledge through the kindness of my colleague, Dr. C. G. Rogers, in whose father's

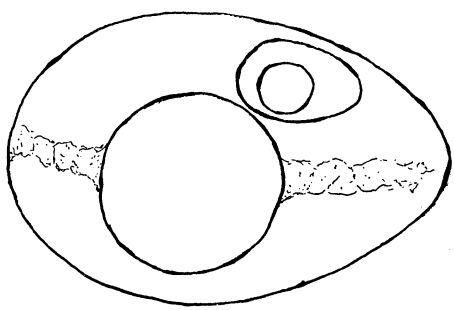

FIG. 2.

poultry yard it was produced. This egg, as will be observed, was double in a rather unusual way. Here we have as shown from the outside an egg of rather larger size than usual, but otherwise apparently perfectly normal. When broken to be used in the kitchen the anomalous internal condition was revealed. The sketch will make clear in just what this anomaly consisted,

namely, the inclusion of a miniature egg within the larger and in about the position and relation shown in the figure.

A double egg of similar character has been recently described by Patterson (AM. NAT., Jan., '11), though differing in that the anomaly comprised two fairly large eggs, as shown in his sketch (Fig. 4), while in my own specimen the inner egg was quite minute though otherwise normal. Some further discussion of these cases will appear in a later section of the paper.

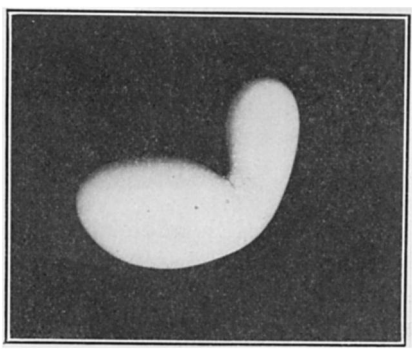

FIG. 3. Abnormal hen's egg × ½.

In Fig. 3 is shown a third anomaly differing from either of the preceeding in a very marked way. The photograph of the specimen, about one half natural size, gives a better impression of the specimen than any verbal account could do. The most striking feature is that of shape, which is rather gourd-like, and was sent to me by the father of Dr. Rogers with the rather facetious suggestion that the contiguity of the poultry lot to the garden, over whose fence hung a squash vine, might afford a clue to an explanation! The egg was laid aside for a time awaiting photography, and when later I opened it for a critical study it was found to have lost so largely by evaporation that an exact account of all its details could not be made. This may be stated, however, that in the larger end of the egg was an apparently normal yolk and normal albumen. The smaller end seemed to have had only albumen, though it was yellowish, as if there might have been yolk matter distributed through it. Of this one can not be certain, and I must leave the matter as doubtful. However, I am disposed to submit the general statement given above, namely, that the egg was comprised of about nor-

mal parts in the larger end, and the smaller probably having only albumen, its yellowish tint having resulted perhaps from the evaporating process which had taken place.

In the matter of explanation or interpretation of these facts I have little to add to what has been presented in the earlier paper or by other observers. Of the literature at my command the paper of Parker (*op. cit.*) seems to me to present upon the whole the best discussion. And I may add in this connection that Parker's paper is further valuable in its rather full bibliography of the subject. As already mentioned in connection with the account of Fig. 1, the true interpretation seems almost certainly that there cited. One has but to apprehend the essential physiological operations involved in the process of the so-called antiperistalsis to perceive just how there would result the structures present in the egg. If it should be queried why such deposition might not have taken place on the ascent of the egg by antiperistalsis as well as during the later descent, it may suffice to admit that perhaps it did occur. However, in case the return of the egg up the oviduct took place soon after its original descent the glandular structures would be in a state of exhaustion and hence capable of only slight discharge; but in either case, save only the action of the shell gland whose only effect would be to add to the thickness of the original shell, the effect would prove the same, namely, a second layer of albumen, a second shell membrane and finally a second shell just as was the case. Parker's contention as to the fact of antiperistalsis seems to me conclusive. The facts of normal eggs in the body cavity of hens, cases of which I have known, seem impossible of explanation by any other view.

The case involved in Fig. 2 is rather more complex, though not so difficult of correlation with known processes as might seem. First, let us direct attention to the minute inner egg. Such miniature eggs are fairly familiar to any one who has much to do with poultry culture or care. They are oftenest found with the first ovulation of young hens, and the writer has known of them from boyhood as pullets' eggs. They probably represent an early or premature ovulation at the beginning of sexual activity. The discharge of such minute yolk would involve only comparatively slight stimulus of the uterine glands and hence a meager discharge of albumen, etc., hence the minute size. Except in matter of size such eggs are usually normal and call for

small account in themselves. Now in the second place, let us consider what might happen at any time with the discharge of such premature eggs from the ovary. If followed soon by the discharge of a mature egg from the ovary and its normal descent it might well overtake the smaller specimen at some portion of the oviduct and easily include it within the larger mass of albumen. This, it seems to me, is probably just what happens in the majority of such cases, possibly in all. I do not overlook the still more anomalous case cited by Herrick ('99), in which the smaller included egg is in the yolk instead of the surrounding albumen. Of this Herrick offers no definite explanation; indeed, there may be some doubt as to exact facts in this case, the inclusion having been found in a cooked egg and details being uncertain.

Concerning the specimen of Fig. 3 there is little to be said. Its bizarre shape is remarkable, but here again the element of doubt as to the definite composition of the contents of the smaller end—handle of the squash—render unprofitable any attempt to discuss or speculate as to its real significance. Whether there may have been some rupture of the original yolk and the segregation of a portion in one end with the extruded part in the other may be a possible explanation; or whether some malformation of the oviduct may have been a disposing cause must remain open questions. Various egg shapes are familiar to those handling large numbers of eggs. I have myself seen many such, though none resembling the one here under consideration. That conditions of confinement, close inbreeding, or other features of habit or environment may have an influence in such matters are altogether possible. Association with unusual shapes, colors, etc., at certain times may affect domestic animals variously; *e. g.*, witness the very interesting story of Jacob's spotted cattle (!), still the contiguity of garden and poultry yard referred to above can hardly be considered as a *vera causa* in this instance!

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