gegen den Boden und die Wände des Schälchens drückte, sich zwischen Schwamm und Glas schiebend. Die Würmer hatten das Bedürfnis sich mit einem festen Körper in Contact zu bringen. Dieses Contactbedürfnis wurde aber schon dadurch befriedigt, daß nur eine kleine Strecke des Körpers von der Schwammmasse umhüllt war und zwei lange Enden jederseits von diesem umhüllten Stück frei hervorragten, wie wenn man mit der Nadel einen Stich in die Leinwand gemacht und den nachfolgenden Faden hindurchgezogen hätte. Ähnlich sieht man die Trichocephalen in der Schleimhaut stecken[1]. Das Contactbedürfnis ist auch sonst bei Eingeweidewürmern ausgeprägt. Man liest bisweilen, daß sich *Ascaris* in die Gallenausführungsgänge hineinschieben. Vielleicht geschieht es auch zur Befriedigung des Contactbedürfnisses, daß Bandwürmer und Echinorhynchen ihren Kopf in die Schleimhaut des Darmes senken. Dem mag sein, wie ihm wolle. Die in der Schale befindlichen *Scomber*-Nematoden gediehen sichtlich. Sie wuchsen und verbrauchten von dem Thran, denn die auf dem Salzwasser schwimmende Schicht des Öles nahm bedeutend ab. Am 18. December hatte ich den Würmern das beschriebene Schälchen als Behausung angewiesen und am 25. Januar bemerkte ich zum ersten Mal, daß große Exemplare abstarben und in Stücke zerfielen. Nach drei Monaten waren die meisten Thiere zerfallen; die noch lebenden wurden getödtet und der Versuch wurde abgebrochen.

Auf die Verwendung des Öles war ich durch den großen Ölgehalt des *Scomber* geführt. Vielleicht würden sich auch andere Eingeweidewürmer von solchen Wirbelthieren, deren Organismus von Öl durchtränkt ist, in gleicher Weise am Leben erhalten lassen.

10. Notes on the Development of Ophiura olivacea, Lyman.

By Caswell Grave, Fellow in Zoology in Johns Hopkins University.

(With 5 figures.)

eingeg. 23. Januar 1899.

In 1857 Krohn described and figured some ophiuran larvae which he found at Funchal during the winters of 1855 and 1856 but as the larvae were found floating free at the surface of the water, the species to which they belonged was not ascertained. Aside from the fact that there is a more direct development in some ophiurans than that in which they pass through a pluteus stage, Krohn got little from the larvae.

Last summer while I was working at Woods Holl with the U.

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[1] Vgl. Fig. 92: J. Dewitz, Eingeweidewürmer d. Haussäugethiere.

S. Fish Commission where I had gone for the study of Ophiuran Embryology, it was my good fortune to find that the eggs thrown by the species of ophiuran found at North Falmouth, *Ophiura olivacea*, developed into larvae strikingly like those figured by Krohn. Owing to the shortness of the breeding season only a limited supply of material was obtained, but it is proving to be peculiarly favorable for the study of several questions of Echinoderm morphology, which I hope to discuss in a future paper, the publication of which may, however, be deferred for some time on account of the necessity of my filling in some gaps in the earliest stages, hence the appearance of this preliminary note.

The Species under discussion is found in abundance in the sheltered shallow water of the North Falmouth harbor where it lives in the mat of dead and living grass and algae found on the bottom there. It may be easily collectet by dredging with a long handled garden rake from a row boat, the animals being brought up entangled in the grass.

Artificial fertilization was never successful and in order to get them to spawn in the laboratory the ophiurans were placed in aquaria dishes of fresh sea water. This method produced the desired result, for, between 8 and 10 P. M. on July 16th, eggs and sperm were thrown by animals brought in during the afternoon of that day.

This early evening spawning is probably the rule with ophiurans in general, as it was found to be the case in Jamaica species and the one found at Nahant, Mass., *Ophiophilus aculeata.*

For echinoderms, the eggs of *O. olivacea* are exceedingly large, their size being due to the great amount of yolk they contain. They are quite opaque and vary in color from green to orange yellow, the eggs of one individual, however, are constant in their coloration. This color presists until the larvae are quite well developed.

Soon after fertilization the eggs throw off two membranes the first being much thicker than the second.

When thirty-six hours old the larvae are oval in shape, the axis passing through the anterior and posterior poles being twice the length of the transverse diameter.

They swim actively by means of the coat of cilia which at this stage covers their entire surface.

The blastopore has been shifted from the posterior end of the larva to a ventral position. This shifting is caused by the unequal growth of the ventral and dorsal sides.

From the blastopore protudes the end of a cellular mass of material which almost fills the cavity of the archenteron and also extends

into the cavity of the pouch which at this stage is being constricted from the free end of the archenteron. The only way I can account for the presence of this cellular mass is that it is the core of a once solid archenteron.

Larvae twelve hours older than those just described show two bulges a little posterior to the median transverse line, one on the left the other on the right side. The blastopore has closed and the posterior end of the archenteron has broken away from the ectoderm and lies loose in the larvae except for its support by the mesenchyme which fills all the space not occupied by other organs. The anterior end of the archenteron has bent over and fused with an invagination of the ectoderm thus forming the oesophagus and mouth, the latter being situated at a point on the ventral surface about equidistant from the anterior and posterior ends of the larva.

Encircling the oesophagus lies the already five rayed but horseshoe shaped hydrocoel with ray number three pointing directly toward the anterior end of the larva. Lying on top of the stomach and connected with it, is the pouch which will form finally the Hypogastric enterocoel of Goto 1898. This large pouch has arisen through a longitudinal constriction of the archenteron, and as stated above is in this stage not entirely cut off.

On the left side at the point where the hydrocoel and enterocoel are in open connection, the pore canal arises and passes towards the dorsal surface but its walls have not fused with the ectoderm in larvae of this stage. Dorsal to the stomach lies the pouch which will ultimately form the epigastric enterocoel of Goto. Figure 1 is a reconstruction of a larva at this stage, and shows it with the ventral half of the ectoderm removed and the oesophagus cut across just ventral to the hydrocoel. Figure 2 is a section through such a larva at the plane indicated by the line *a b* on Figure 1, and shows the connection of the stomach and hypogastric enterocoel pouch. In a sixty-hour larva the external appearance has quite changed, for instead of the coat of cilia, we find the cilia restricted to four transverse bands. The anterior end of the larva, which will enter directly into the formation of the star, is very much widened and gives to the whole a club shape. Encircling the mouth are five groups of rounded elevations of the ectoderm, three in each group. They are caused by the pushing out of the end tentacle and first pair of foot tentacles which in this stage are quite large, behind these is the much smaller second pair of foot tentacles.

Figure 3 is the ventral view of the larva just described and Figure 4 is a reconstruction of the anatomy of the same.

In a five day embryo, the ectoderm lying under the water ring

and its radial tubes has thickened and invaginated to form the nerve ring and its five radial branches.

Fig. 1.

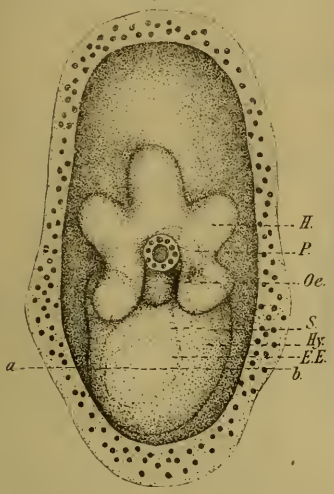

Fig. 2.

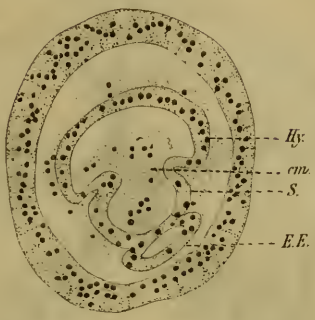

Fig. 3.

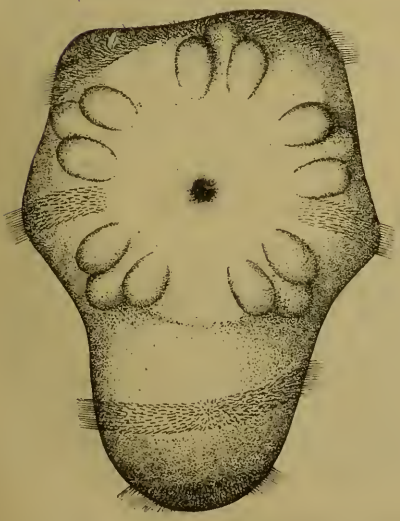

Fig. 4.

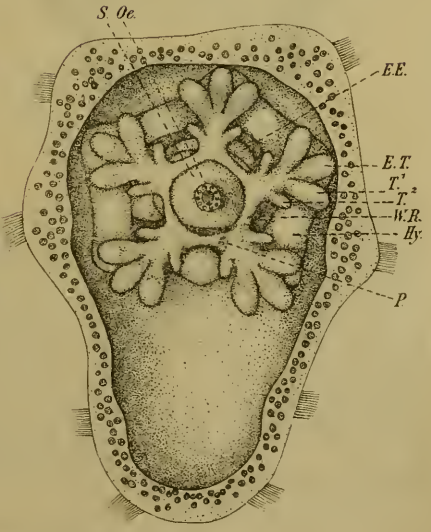

Fig. 1—5. *C.M*, Cellular mass; *E.E*, Epigastric Enterocoel; *E.T*, End Tentacle; *H*, Hydrocoel; *H.E*, Hypogastric Enterocoel; *M*, Mouth; *Oe*, Oesophagus; *P*, Pore canal; *S*, Stomach; T^1, First pair Foot Tentacle; T^2, Second pair Foot Tentacle; *Wr*, Water ring.

Protruding from the furrows caused by the sinking in of the nervous system, are to be seen the five tentacles now present in each radius.

The two anterior bands of cilia have shifted their positions on the ventral side to such an extent that they now lie in interradii of the developing star. In proportion to the size of the star in three and five day embryos, the larval organ in the latter is much smaller.

Fig. 5.

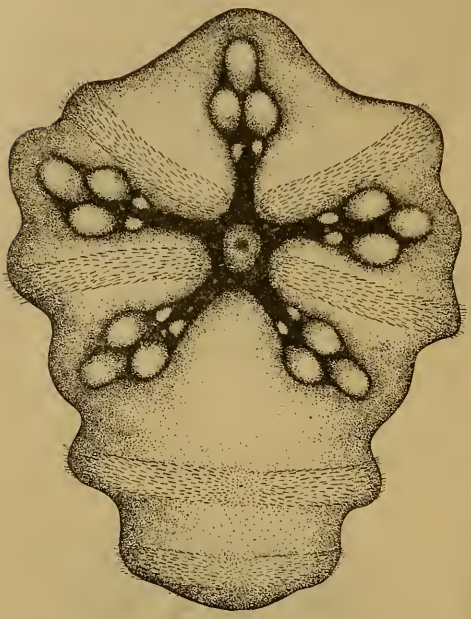

Figure 5 is a sketch of a five day larva, and is about the same stage as the youngest figured by Krohn.

It will be noted that from the very first appearance of any part of the adult structure, it has had a direct and constant relation to the larval body. That pouch of the hydrocoel, which by any method of numbering would be 3, points towards the anterior end of the larva and opposite it is the interradius which contains the pore and stone canals. The plane which cuts the larva into two bilaterally symmetrical halves, also divides the developing star symmetrically, that is, in the axis of its radial symmetry. We have in the live history of *O. olivacea*, a complete verification of the conclusion arrived at by Goto in his study of the relation of the adult form to the larva in *Asterias pallida*. Here, however, there is nothing to obscure the relations referred to while in *A. pallida*, there are several factors which so complicate the question as to allow of other conclusions than the one arrived at by Goto, viz: in *A. pallida* the rotation of the oral and aboral disks brings into the same radius arm III and radial water tube 2.

Baltimore Md., 24./12. 1898.

III. Personal-Notizen.

Necrolog.

Am 18. Januar starb in Wien Dr. Karl Friedr. Wilh. Claus, Professor der Zoologie emer. der dortigen Universität. Am 2. Januar 1835 in Kassel geboren, studierte er in Göttingen und Gießen, wurde Professor in Göttingen und Marburg und später nach Wien berufen.

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