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II. Wissenschaftliche Mittheilungen.

1. Note from the Chesapeake Zoological Laboratory. Development of *Serpula*.

By H. W. Conn.

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During the last summer I have had the opportunity of studying the development of *Serpula* and the work done in which I have been assisted by Mr. E. A. Andrews has given some quite important results. *Serpula* has been hitherto studied as to its development by only a single naturalist, Stossich (Sitz. d. k. k. Akad. Wiss. Wien 77. Bd. 1878), and the results he obtained were in some respects quite surprising. In four points in particular it has seemed to me desirable to endeavour either to corroborate the work of Stossich or to correct it. These four points are, 1) the regular segmentation, 2) the fact that the egg chorion becomes the larval cuticle, 3) the conversion of the blastopore into the anus, 4) the presence and relation of a peculiar body known as the anal vesicle. As will appear from the following brief account of our investigations, in three of these points the work of Stossich is corroborated, while in a fourth Stossich is found to be in error.

Two polar globules are extruded from the egg and in all cases observed after contact with the spermatozoan. The opacity of the egg prevented observations on the internal changes accompanying fertilization.

The segmentation which immediately follows the protrusion of the polar globules is a perfectly regular one, not the slightest difference can be seen in the size or appearance of the segments. In this point *Serpula* differs from all Annelids with a very few exceptions (*Thalassema*, *Sabellaria*).

The chorion of the egg is very thick and is never thrown off but remains as the cuticle of the larva. There is therefore no true hatching of the embryo.

As regards the relation of the blastopore and the formation of the mouth however, Stossich was undoubtedly in error, the conversion of the gastrula into the trochosphere being in the species studied at Beaufort essentially different from his account. The gastrula itself has three noticeable features. At one point is found the blastopore which is not round but is an elongated slit. Around the blastopore is a circular band of strong locomotor cilia. At the extremity opposite the blastopore is an ectodermal thickening accompanied by a tuft of long sensory cilia. This thickening is the beginning of the nervous system (Scheitelplatte) and we know consequently that it occupies the anterior end of the embryo. The blastopore which is directly opposite would seem also to be at the posterior end. But a study of the further growth of the embryo shows that this is not so. When the body begins to elongate, the elongation is not in the line of the axis of the gastrula but obliquely to this axis in such a way as to pass through one end of the slit-like blastopore. Moreover this elongation chiefly concerns that portion of the body within the circumblastoporal ring and not that portion anterior to it. The result of this oblique elongation is that one end of the slit-like blastopore is carried backwards away from the other end which remains in its original position near the ciliated band. This causes the blastopore to become still more elongated, and its lips meantime close. For some time the digestive sac remains attached to the ectoderm throughout the whole course of the blastopore; but after a little it loses this connection at the middle of the long blastopore and only retains it at its two ends. At this time therefore the embryo consists of an irregular shaped body with a sensory tuft of cilia at one end, and with a circular band of cilia at some little distance behind (originally the ring around the blastopore). Just posterior to this band is one end of the closed blastopore while the other end is at the extreme posterior of the lobe produced by the elongation of the body. The endoderm is a solid mass of cells united to the ectoderm at two regions, one just behind the ciliated band and the other at the posterior end of the elongated lobe. Between these two points

which are the extremities of the blastopore is a part of the body formed by the closure of the blastopore lips.

And now but little is required to convert this embryo into a typical trochosphere larva. The digestive tract becomes hollow, and acquires two openings to the exterior at the two points of its previous connection with the ectoderm. The one nearer to the ciliated band becomes the mouth, while the other becomes the anus. The region between these two openings, formed as we have seen by the closed blastopore lips, becomes the ventral surface. The ciliated band originally around the blastopore becomes the preoral band of the trochosphere, showing that the body of the trochosphere (the postoral lobe), is formed, as above described, by the elongation of that part of the gastrula situated within this circumblastoporal band. According to this description it will be seen that the blastopore does not form the mouth nor anus exclusively. It elongates and closes but the mouth subsequently appears at one of its extremities and the anus at the other, while the intervening portion closing becomes the ventral surface of the animal.

This is a point of considerable importance. It will be noticed that the history of the blastopore in *Serpula*, is very similar to that of *Peripatus* as described by Balfour, and it is also strictly in accordance with the view of Sedgwick as to relation of the blastopore to the future digestive system. It is certainly an important corroboration of this view of Sedgwick's, that Annelids which show other evidences of a primitive development should so closely agree with the theory.

Just before the formation of the anus, a number of endodermal cells near the region of the future anus become separated from the rest of the digestive tract and form a mass of cells lying outside the alimentary canal in the body cavity. These cells form the mesoderm. Some of these cells increase in size and form stellate mesenchyme cells, and finally a few of them stretch across the body cavity near the anus forming a membrane which separates a small portion of the body cavity from the rest. This small portion at the extreme posterior, is the anal vesicle described by Stossich. It has no connection with the alimentary canal. It is always a very characteristic feature of the *Serpula* trochosphere and will readily distinguish it from others. Occasionally another partition grows across it separating it into two smaller divisions as was observed by Stossich.

Certain others of the above mentioned mesoderm cells have a different history and form the true mesoderm. They multiply quite rapidly and soon give rise to two bands of cells one on either side of the alimentary canal and extending forward toward the mouth. They

are in fact the mesodermal bands so well known and so beautifully described by Hatscheck in *Polygordius*. They grow forward broadening as they grow, become segmented in a perfectly normal manner and give rise to the usual mesodermal structures.

One quite peculiar feature was noticed in regard to the eye spots. It is the universal rule that one of these spots appears two or three days before the other, so that for four or five days the animal is unsymmetrical with an eye spot on one side only. This spot may be either on the right side or on the left, but never do two appear simultaneously. Later on the second spot develops and the animal becomes symmetrical.

Beyond the point described above there is nothing remarkable in the development, *Serpula* in its later stages agreeing almost exactly with other Annelids.

2. Über vielzählige Lymphherzen bei *Salamandra maculosa* und *Siredon pisciformis*.

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Bisher waren bei *Salamandra maculosa* nur zwei hintere (hinter den Ossa ischiä) und vier vordere (unter den Scapulae) Lymphherzen bekannt. Schneidet man aber bei einem lebenden Exemplare die Hemisphaeren ab und beseitigt auf diese Weise den Einfluß derselben auf die in den Sehhügeln und zum Theil in der Medulla oblongata befindlichen hemmenden Centren der Lymphherzen, so kann man an vielen Stellen längs des Sulcus lateralis unter der Haut zwischen den Drüsenanhäufungen mehrere rhythmisch pulsirende Punkte bemerken, und dies gilt sowohl für den Schwanz- als den Bauchtheil des Thieres. Nach der Ablösung der Haut kann man sich überzeugen, daß diese Pulsationen von kleinen, ovalen, mit Lymphe erfüllten Bläschen ausgehen. Im Schwanztheile befinden sich, außer den altbekannten zwei Lymphherzen, jederseits noch vier, bei einigen Individuen sogar fünf solcher Art Bläschen. In dem Bauchtheile kann man vom Sitzbeine nach oben deren drei oder vier jederseits zählen; dann sieht man noch ein oder zwei Herzen im Zwischenraume zwischen den Drüsen und Intercostalmuskeln, etwas hinter dem Hinterrande der Scapula. Außerdem kann man durch histologische Untersuchung einiger anderer Stellen längs des Sulcus lateralis die Anwesenheit kleiner mit charakteristischen Lymphherzmuskeln versehener Bläschen nachweisen. Bei *Siredon pisciformis* haben wir eben so längs des Sulcus lateralis pulsirende lymphatische Bläschen, und zwar acht jederseits

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