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On the embryology of *Gebia littoralis*

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water shells in this country who have not the opportunity of consulting scientific libraries, and to these a book like the present is particularly welcome.

The printing, paper, and general appearance of the work are all that can be desired; the figures, as a whole, are very good indeed, but to state beneath each by whom the specimen was collected appears rather unnecessary, being practically of no interest whatever to the general student, although perhaps gratifying to the individuals named, especially when the same illustration is employed several times and the personal information is repeated in each instance. The coloured plate, produced by chromo-lithography, is also very successful; the outlines of the different forms represented exhibit great accuracy, and the coloration is not exaggerated.

Considering the need of such a work, the style in which it is issued, and the completeness aimed at, there seems every probability of its gaining a wide circulation, and, in fact, superseding all previous works on the subject.

MISCELLANEOUS.

On the Embryology of Gebia littoralis *. By P. BUTSCHINSKY,
of the University of Odessa.

So long ago as the year 1882 a segmentation of the ova of *Callianassa*, belonging to the family Thalassinidæ, was described by C. Mereschkowski †. I am now in a position to furnish a complete account of the development of *Gebia littoralis*. The definite facts which I have obtained supplement in many respects the conception of the embryonic development of the Decapods as it is generally represented.

The ova of *Gebia* ‡ possess a great abundance of food-yolk. The initial segmentation takes place with them in the interior of the ovum; the first segmentation nucleus divides, together with the accumulation of protoplasm surrounding it, into two, four, and eight segmentation nuclei. All these nuclei travel towards the surface of the ovum. The food-yolk takes no share in this process; it commences to collect more closely round the nuclei, and partly unites

* I shall publish in Russian a complete memoir on the development of *Gebia* in the 'Mémoires de la Société des naturalistes de la Nouvelle-Russie à Odessa.'

† C. Mereschkowski, "Eine neue Art von Blastodermbildung bei den Decapoden," Zool. Anz. v. Jahrg. no. 101 (1882).

‡ For fixing the ova I have employed boiling Perenyi's and Kleinenberg's solutions, or alcoholic sublimate solution. The best staining reagents are Grenacher's borax-carmin, Kleinenberg's hæmatoxylin, and hæmatin-alum. The objects after being saturated with evaporated photoxylin and stained, were placed in a mixture of chloroform and paraffin at a temperature of 40°-45° C., and then in pure melted paraffin.

with the unsegmented central yolk-mass, but in part separates entirely therefrom. With further multiplication of the blastoderm cells the division in the yolk diminishes and soon completely disappears. Finally we get a blastula stage, consisting of a superficially situated uniform layer of cells and an internal yolk-mass.

I must here remark that at this time some of the cells migrate into the yolk and give rise to a small number of yolk-cells (vitellophaga). These latter undergo a regressive metamorphosis and soon disappear almost entirely.

The rudiment of the embryo subsequently appears on the ventral side of the ovum in the shape of a thickening of the blastoderm. In the region of this rudiment there may be observed three separate swellings or thickenings—a posterior thickening in the shape of small groups of cells (caudal section), and, a little later, the anterior paired rudiment of the optic lobes.

The formation of the germinal layers commences very early from the cells, which, in consequence of the speedy multiplication of the blastoderm cells, appear in the region of the posterior thickening. It must be remarked that the entrance of the cells into the yolk takes place either in the shape of compact masses or of a sac-shaped depression.

On further multiplication the cells of the posterior thickening become dispersed in the shape of a fan, for many of them penetrate deep into the yolk, while others, fewer in number, spread out on the ventral surface. The former, on all sides separating equally one from another, commence to permeate the yolk. Subsequently, on the appearance of the thoracic appendages, all these cells pass through the yolk and collect their scattered units on the surface of the yolk-mass. They form the commencement of the endoderm layer.

As regards the middle layer, this is also formed from the above-mentioned cells of the posterior thickening, which spread out upon the ventral surface. To these must further be added those cells which arise, owing to the multiplication of the ectoderm cells, upon the lateral thickenings of the embryo. The mesoderm cells at first lie upon the ventral surface, and collect for the most part in the protuberances, which subsequently give rise to the limbs. On its first appearance the mesoderm layer has a paired structure, and consists of cells arranged in two longitudinal rows.

The nervous system already commences in the *Nauplius*-stage to develop from in front backwards in the shape of paired thickenings of the ectoderm. In the stage which is just commencing to lead an independent existence we may count eighteen ganglia, of which the last is double.

The eyes are developed from the anterior thickenings of the ectoderm, which for a very long time present the appearance of an undifferentiated aggregation of cells; and it is only at the period of

the formation of the whole of the limbs that the outer layer is divided off in the shape of more columnar cells. Subsequently, in the stage which is ready to emerge from the egg, we observe the appearance of the refractile nuclei and the pigment-mass in this ectodermal rudiment.

It is interesting to note that at this stage I have observed a formation of the ectodermal invagination in the base of the second antenna. This invagination approaches the closed mesoderm sacs. It is probable that this structure becomes the antennary gland.

At this period I also observed the formation of a pair of ectodermal invaginations into the branchial chamber, which gradually become modified into sacs.

As regards the mesoderm cells, these form no regular somites, but are quite irregularly distributed. Besides the muscles, the heart and the generative organs are also formed from these cells.

Until the appearance of the pigment in the eye, the heart arises at the boundary between the thorax and abdomen. Here there appears the earliest rudiment of the heart upon the dorsal side in the form of a paired aggregation of the mesoderm cells. Cells are protruded from the ventral side of these masses, and form the ventral wall of the groove. The dorsal side of the heart remains for a certain time open and covered by the ectoderm. The mesoderm cells of the back soon appear from these same lateral masses, and thus the oval sac of the heart is constituted.

The sexual organs arise in the latest stages of embryonic life, and are situated as a paired mesodermal rudiment in the region of the mid-gut beneath the heart. Here certain mesoderm cells rapidly increase in bulk, and give rise to the commencement of the genital cells.

The formation of the stomodæum takes place earlier than that of the proctodæum. Both arise as invaginations of the ectoderm. The mid-gut is produced from the cell-material of the endoderm, and its development proceeds from two primitively separate endodermal rudiments. The posterior rudiment has the form of two shells (cups), and lies in intimate relation to the invagination of the hind gut. The lips of the posterior shell are directed forwards. Simultaneously a similar aggregation of endoderm cells is also formed in the region of the stomodæum. The lips of the anterior shell, on the contrary, are directed backwards. At this time the inner lips of the anterior and posterior shell fuse together, and thus there are formed two rudiments, which are composed of columnar cylindrical cells. Their edges grow towards each other, although at the moment of the escape of the embryo from the egg they have not yet united, so that a portion of the dorsal and ventral walls of the mid-gut still consists of scattered cells. At this time there may already be observed in the posterior endodermal sac a division in a longitudinal direction, which leads to the formation of the first hepatic sacs.

The latest changes are accomplished after the escape of the embryo of *Gebia littoralis* from the egg.—*Zool. Anzeiger*, xvii. Jahrg., no. 452, July 16, 1894, pp. 253–256.

On Gill-like Organs in certain Species of Sipunculus.

By Dr. W. FISCHER, of Bergedorf.

That the tentacles in Sipunculidæ possess the faculty of respiration was formerly a matter of almost universal belief. Lately, however, at least in respect of certain genera, many doubts have been expressed as to this. It had already been pointed out by Brandt*, that in the case of *Sipunculus nudus*, L., the extraordinary thickness of the layers of connective tissue in the tentacles would militate against the view that respiration could be effected by means of these organs. The same conclusion is also deduced by Ward†, who had the opportunity of observing the living *Sipunculus nudus* in an aquarium at widely different times and in very various situations. This author states that he has seldom seen the tentacles extruded and never for a longer period than from one to two seconds; in the retracted condition he does not believe that they can be of any importance whatever for the purpose of respiration. Moreover, he adds that since no connection can be shown to exist between the blood-vascular system and the cœlome, the peripharyngeal vascular ring and the two short contractile vessels would present far too small a surface to the body-cavity to be able to convey sufficient oxygen from the blood-vascular system to the latter.

If it was thus impossible in the case of *Sipunculus nudus* to concede to the tentacles the possession of a respiratory faculty, it was natural to suppose that the skin might possibly be able to discharge this function. In his paper on *Sipunculus nudus*, Andræ‡ had already described dermal canals, which traverse the entire body and lie in the region of the cutis close beneath the cuticle and hypodermis; the author terms these structures integumentary canals (Integumentalcanäle). He found them generally packed with ova and blood-corpuscles, and he maintains that the dermal layer, which separates them from the exterior, is sufficiently thin to enable an exchange of gases to take place between the cœlomic fluid and the sea-water. Ward, too, agrees with this

* Alex. Brandt, "Anat.-histologische Untersuchungen über *Sipunculus nudus*, L.," Mémoires de l'Acad. imp. des Sciences de St. Pétersbourg, 1870, tom. xvi. no. 8.

† H. B. Ward, "On some points in the Anatomy and Histology of *Sipunculus nudus*, L.," Bull. Mus. Comp. Zool. xxi. (1891) pp. 143–182 (3 pls.).

‡ Andræ, "Beiträge zur Anatomie und Histologie des *Sipunculus nudus*," Zeitschrift f. wiss. Zoologie, Bd. 36, pp. 201–208.