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On the existence of a nervous system in Peltogaster; a contribution to the history of the Centrogonida

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On the contrary, after a series of observations upon the most different objects, I have arrived at the conviction that this view is erroneous. I have succeeded in demonstrating the following facts:—

1. The vessel-like dilatation of the canals of the caudal setæ in the last abdominal segment is directly connected with the dorsal vessel. During the contractions of the heart it receives a portion of the blood which may be in the hindmost division of the vessel, and which it then by its own contractions drives into the canals of the caudal setæ.

2. A communication of this vessel with the body-cavity, so as to permit the entrance of blood into it in accordance with the above-mentioned opinion of Verlooren's, I have been unable to observe. There rather seems to me to be a firm union with the dorsal vessel.

3. The valvular apparatus situated at the anterior end of the vessel consists of two membranes parallel to the plane of symmetry of the body, which, as processes of the dorsal vessel, are directed backwards and attached in an inversion of the vessel.

4. These membranes, like the other valvular apparatus of the dorsal vessel, are set in motion by its action, only in the opposite way. They apply themselves together when the dorsal vessel expands, and open when it contracts, by which of course a flow of blood directed from before backwards is produced.

The latter fact is probably the best proof of the untenability of Verlooren's opinion. For if the vessel were to be furnished with blood from the body-cavity by the action of the valvular apparatus, the movement of the membranes must have stood in some relation to the phenomena of contraction of the vessel, which, however, is by no means the case.

On the other hand, scarcely any argument can be brought against the proposition established by me; on the contrary, we may easily convince ourselves by direct observation of the correctness of my statements.—*Zool. Anzeiger*, April 27, 1885, no. 193, p. 246.

On the Existence of a Nervous System in Peltogaster; a Contribution to the History of the Centrogonida. By M. Y. DELAGE.

Until quite recently the Centrogonida (*Rhizocephala* of Fritz Müller) were regarded as destitute of a nervous system. In a communication to the Academy*, and, more recently, in a more extended memoir†, I have shown that the nervous system exists in *Sacculina*. After this it was almost certain that it existed also in

* 'Comptes Rendus,' tome xcvi. (October 29, 1883).

† "Evolution de la Sacculine, Crustacé endoparasite de l'Ordre nouveau des Centrogonides," Archives de Zool. expér. sér. 2, tome ii. 1884. [We do not see why Fritz Müller's name *Rhizocephala* was not retained for the new order; but, while accepting the new name, we shall not disfigure the pages of the 'Annals' by adopting the author's barbarous spelling.]

Peltogaster, which is closely allied to *Sacculina*. Having succeeded, not without difficulty, in obtaining some *Peltogasters*, I have dissected them and succeeded in discovering the nervous system.

The central organ (as in *Sacculina*) consists of a single ganglion. This ganglion is situated in the sagittal plane in the interior of the mesentery which unites the cloaca to the peduncle, almost between the cement-glands*, but, nevertheless, a little beyond towards the cloaca, exactly at the level of the testicular cæcum. Its situation is therefore very superficial, as it is separated from the outer world only by half the thickness of the mantle. It is an elongated ganglion which measures about $\frac{1}{10}$ millim. ; hence it is hardly visible to the naked eye, even when it has been completely prepared by dissection under the microscope with the aid of the erecting prism. It is absolutely simple, and by no means composed of two approximated symmetrical masses. Its constitution includes small, fusiform, peripheral cells, and large central multipolar cells with a large rounded nucleus furnished with a punctiform nucleolus. It gives origin to numerous nerves, which, however, are very fine and extremely difficult to trace by dissection, since they are hardly distinguishable from the muscular and connective fibres in the midst of which they twist about. On the side of the cloaca it gives off four long filaments, two of which, superficial and forming a pair, run to that organ, and particularly to its sphincter ; while the two others, also a pair, penetrate the visceral mass between the two symmetrical halves of the ovary. From its opposite extremity it gives origin to a large median trunk which insinuates itself between the two symmetrical masses of the ovary, giving off from place to place ramifications to each of them. From the origin of this trunk, or perhaps from the ganglion itself, originate two small nervous filaments, which follow the inner margin of the testes, and are distributed to those organs. Upon the sides originate three pairs of nerves—two in the cloacal half of the body, one in the opposite half. The former two run obliquely outward, and penetrate into the mantle at the point where this splits to form the lamellæ of the mesentery. The last passes between the cement-gland and the testis, then outside the latter, taking a direction towards the deferent canal. Near its origin it furnishes two branchlets for the cement-gland, one for the gland itself, the other for its lateral parts, and no doubt for its sphincter. Not far from its termination it gives off a nervous filament, which passes under the margin of the mesentery, to run, no doubt, to the wall of the visceral mass or to the mantle.

Just as these nerves are difficult to trace, so are the central ganglion and the origin of the principal trunks easy to see, *when one knows where to look for them* ; but this last condition is indispensable.

* The cement-glands, which have been regarded as absent, really exist ; but they are reduced to two very wide sacs with glandular walls, but without ramifications.

It is from not having had it at their disposal that the authors who have investigated *Peltogaster* (Rathke, Anderson, Lilljeborg, Kossmann, and so many others) have not succeeded in finding these parts. In fact the absence of the digestive tube and of the limbs, and the want of determination of the cephalic and caudal extremities, deprive us absolutely, in the Centrogonida, of the marks which serve to guide us in more regularly constructed animals. And how, without reference-marks, is one to find an imperceptible ganglion, lost in an innumerable mass of ova, each of which is at least twice its size? Thus I only succeeded in finding it in *Sacculina* after two years of investigations. In *Peltogaster*, on the contrary, although the absolute difficulties of the search are exactly the same as in *Sacculina*, I found it in the first individual dissected after less than an hour's work. I mention this particular only to show the value of the morphological method; for if I have found this nervous system it is by no means due to particular address in dissection; it is because, armed with the morphological data derived from the study of *Sacculina*, I sought for it precisely where it ought to be found.

The type *Peltogaster*, although notably different from the type *Sacculina*, may be regarded as derived from the latter in consequence of certain modifications. The body is depressed and elongated; the mesenteric or ventral side* has diminished in length to the advantage of the dorsal side, so as to carry the cloaca to one of the extremities of the cylinder; on the dorsal side a new mesentery has been developed; lastly, and this is the principal modification, the cement-glands have ascended and, quitting the declivous parts of the ovary, have gone to place themselves close to the peduncle and the male sexual glands.

In these displacements of the organs was the nervous ganglion to retain its original situation at the bottom of the ovary, or was it to follow the cloaca, or the mesentery, or the cement-glands? Observation has shown that it did not remain immovable; therefore its relations with the declivous pole of the ovary are not at all essential; it had followed the cloaca and the mesentery, but especially the cement-glands, in their movements; hence it is with these organs, and chiefly with the last-named, that it has fundamental relations. On the other hand, we see that the close relations of the ganglion with the testes in *Peltogaster* are quite accidental, since in *Sacculina* those organs are as far apart as possible. Henceforward in seeking for the nervous system in other Centrogonida, in which the viscera may again affect new relations, we see that we shall not have to pay any attention to the testes or to the antipeduncular pole of the ovary, and that it is between the cement-glands, in the sagittal plane, and perhaps slightly towards the cloaca and the cement-glands, that we must direct the forceps and

* For the orientation of the animal, see the memoir cited, pp. 440 and 695.