

bicularia adunca of Gould is said to be a synonym of *Neæra cochlearis*, but is only known to me from its brief description in the 'Otia'; its characters do not harmonize with those of *L. gravida*.

On the Relations of *Rhabdopleura*.

By Professor G. J. ALLMAN, M.D., LL.D., F.R.S., President.

[Read December 19, 1878.]

SOME years ago I founded this genus for a very remarkable Polyzoal form dredged by Mr. Gwyn Jeffreys and the Rev. A. M. Norman from a depth of 90 fathoms in the Shetland seas*. My observations were made on specimens which had been preserved in spirit; and, as far as the condition of these would allow, some interesting results were obtained. G. Ossian Sars, however, had nearly at the same time the good fortune to dredge, from a depth of 120 fathoms, at Lofoten, off the Norwegian coast, examples of another species of the same genus; and he has been thus enabled to make a very careful and complete examination of the living animal†, and has in many important points rectified and supplemented the observations made by myself on spirit specimens.

At first sight *Rhabdopleura* would seem to find its proper place among the Phylactolamata, to which it has the appearance of being allied by its crescentic lophophore and by the homologue of an epistome, if we so regard the remarkable shield-like organ which in the adult animal is situated between the two orifices of the alimentary canal.

The crescentic lophophore of *Rhabdopleura*, however, is very different from that of the hippocrepian or crescentic-disked Phylactolamata, from which it is widely separated by its interrupted series of tentacles; while I am by no means ready to admit that the shield which constitutes so important a feature in this genus is the homologue of an epistome. A comparison of the more striking characters of *Rhabdopleura* with those of a typical poly-

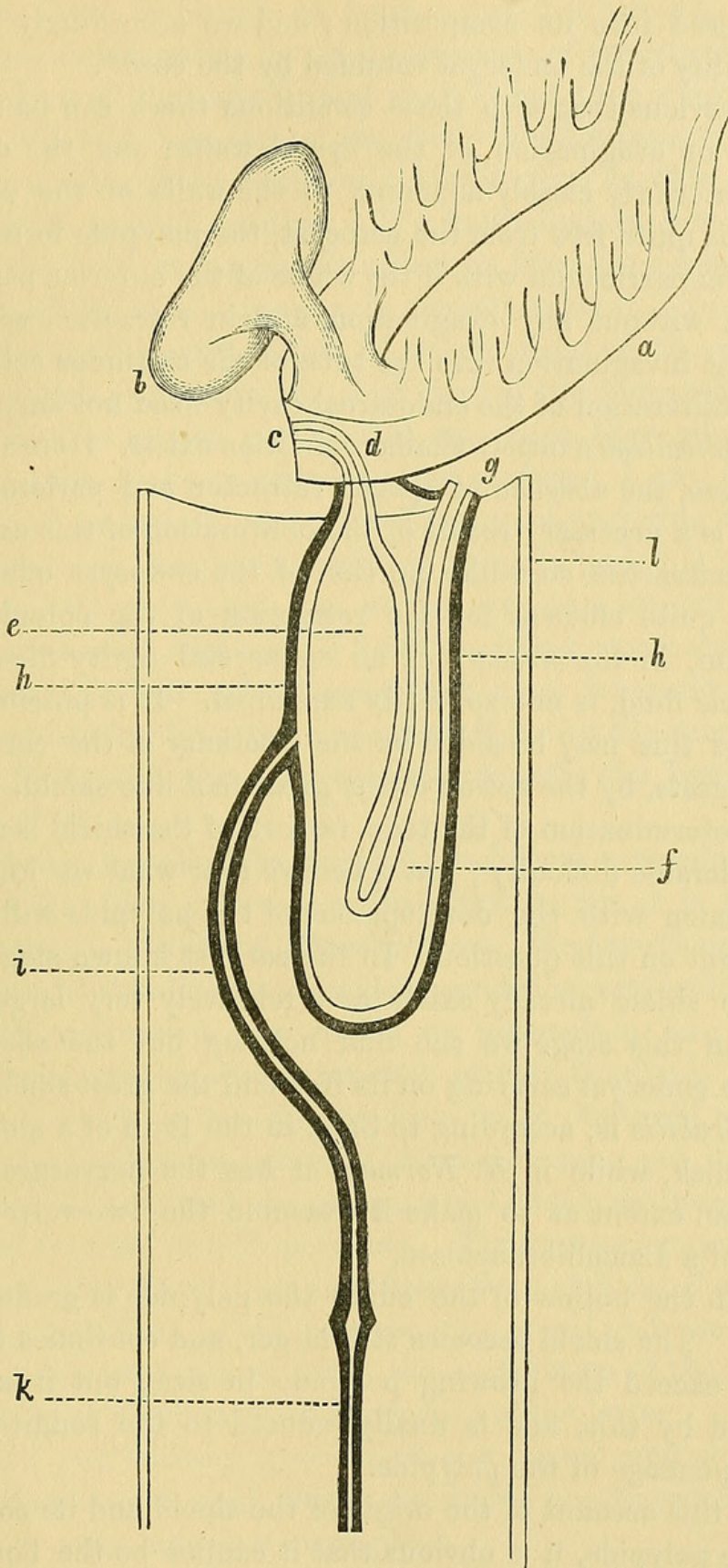
* Allman, on *Rhabdopleura Normani*. Quart. Journ. Micr. Sc., January 1869.

† G. O. Sars, on *Rhabdopleura mirabilis*. 'The University Programme' for 1869. Christiania, 1872. Reprinted in Quart. Journ. Micr. Sc., January 1874.

zoon will help us in arriving at a conclusion regarding these points.

The more important features by which *Rhabdopleura* differs from the typical marine Polyzoa will be found (1) in its crescentic lophophore ; (2) in the tentacular series not being continued from the bases of the arms round the body of the lophophore ; (3) in the lateral rather than terminal position of the mouth ; (4) in the possession of a remarkable shield-like organ which is attached to the body of the lophophore between the mouth and anus ; (5) in the possession of a chitinous rod which extends through the tubular cœnœcium, and gives attachment to one end of a contractile fleshy cord, which at the other end is fixed to the body of the polypide ; (6) in the absence of an endocyst lining the cavity of the zoœcium, and in the further absence of a tentacular sheath.

A somewhat closer comparison of *Rhabdopleura* with an ordinary polyzoon will bring out some points of great interest, and will, I think, suggest the true significance of its singularly aberrant features. One of its most anomalous characters is the apparent absence of an endocyst and tentacular sheath. In the spirit specimens I failed to find any thing but what seemed the obscurest indications of them ; and on these I would lay no stress, for the careful investigations of Sars on the living animal render it highly probable that neither endocyst nor tentacular sheath as usually understood are to be found. I believe, however, that *Rhabdopleura* is not without their homologues. These may be partly recognized in the fleshy contractile cord. This cord may be regarded as an endocyst which has become separated from the chitinous ectocyst, while the approximation of its walls has brought about the almost complete obliteration of its cavity. Where, however, the cord is attached to the polypide, it spreads in the form of a membrane over the whole of the alimentary canal. This membranous extension of the cord represents the anterior part of the endocyst with the tentacular sheath ; and Sars has already suggested the possibility of the endocyst being here found. Posteriorly a still greater transformation has taken place ; for in all the older parts of the cœnœcium we find the continuation of the cord in the condition of a chitinous rod, which, however, still presents in its lumen a trace of the original endocystal cavity. The endocyst in receding from the ectocyst carries with it the longitudinal muscular fibres which



Schematic and hypothetical diagram of *Rhabdopleura*. *a*. Lophophore, with origin of tentacles; *b*. Shield; *c*. Mouth; *d*. Œsophagus; *e*. Stomach; *f*. Intestine; *g*. Anal orifice; *h h*. Endocyst; *i*. Contractile cord; *k*. Commencement of the chitinous rod; *l*. External chitinous tube.

The representative of the endocyst is indicated by the broad dark line.

had entered into its composition ; and we accordingly find the contractility of the endocyst retained by the cord*.

It is obvious that with these conditions there can be no invagination or evagination of the cystid walls ; and the endocyst being anteriorly closely adherent to the walls of the polypide, while it is quite free from the ectocyst, the polypide in the act of protrusion carries out with it the whole of the anterior part of the endocyst without any evagination, and in retraction withdraws it without invagination into the tube of the chitinous ectocyst.

The obliteration of the endosarcal cavity need not surprise us ; for in *Pedicellina* a nearly similar condition exists. Here also, as in *Pedicellina*, the absence of special retractor and parieto-vaginal muscles is a necessary result of the obliteration of this cavity.

The contractile cord-like portion of the endocyst offers a mechanism quite efficient for the retraction of the polypide. Its protrusion, in the absence of an endocystal cavity filled with a perigastric fluid, is not so easily explained. It is possible, however, that this may be aided by the elasticity of the cord, or, as Sars suggests, by the action of the great foot-like shield.

The determination of the true import of the shield is a matter of considerable difficulty ; but I believe that what we know of it in connexion with the development of the polypide will tend to throw light on this question. In the earliest known stage of the bud, the shield already exists as a relatively very large organ. Indeed in this stage we can find nothing but the short thick cord-like endocyst carrying on its free end the great shield, which in *R. mirabilis* is, according to Sars, in the form of a moderately curved disk, while in *R. Normani* it has the curvature carried to such an extent as to make it resemble the two-valved fleshy mantle of a Lamellibranchiate.

Within the hollow of the curve the polypide is gradually developed. The shield becomes still larger, and continues for some time to exceed the growing polypide in size ; but it is at last surpassed by this, and is finally reduced to the condition of a mere appendage of the polypide.

From this account of the origin of the shield and its connexion with the polypide, it is obvious that it cannot be the homologue of the epistome of the proper phylactolæmatous Polyzoa. Though our knowledge of the development of the epistome is by no means

* If such be the true interpretation of the contractile cord of *Rhabdopleura*, this cord cannot be homologous with the *funiculus* of *Alcyonella* &c.

complete, there is reason to believe that it is formed, like the lophophore and tentacles, by an introversion of the polypide walls in the region of the mouth, and that it has thus a significance entirely different from that of the shield of *Rhabdopleura*.

The formation of the chitinous ectocyst offers another question by no means easy of solution. We know that in the ordinary Polyzoa the ectocyst is a simple excretion from the surface of the endocyst, which is continually in contact with it. In *Rhabdopleura*, during the early stages of development of the polypide, the cord which represents the chief part of the endocyst is much thicker than at a later period, and may have then allowed the chitinous tube to be moulded on its surface. I am, however, well inclined to believe that the function of excreting the ectocyst devolves on the shield, which at an early period is relatively very large. It possesses, too, at this period a structure which might quite accord with such a function, being composed of elongated prismatic cells whose ends abut upon its outer surface. Indeed we can hardly avoid comparing it in this function, as well as in its form, with the shell-secreting mantle of a Lamellibranchiate mollusk.

If we bring together the morphological facts here adduced, we shall find that they give us a series which, so far as it goes, represents the life-history of *Rhabdopleura*. We have the endocyst, which, notwithstanding its anomalous condition, retains its normal faculty of originating new zooids by gemmation. In *Rhabdopleura*, however, the direct product of this faculty is a shield-like zooid, which by its bivalve form in *R. Normani* may even suggest the *Cyphonautus*-stage of *Membranipora*; and it is from this that we find emitted the ultimate bud which becomes directly developed into the proper polypide. The developmental phenomena here differ from those in *Alcyonella* mainly by the intercalation of a scutiform zooid between the cystid and the polypid. This zooid does not perish after the completion of the polypid, but remains as a subordinate appendage of the latter.

We are yet entirely ignorant of the sexual reproduction of *Rhabdopleura*; and until this is discovered our knowledge of its life-history must continue incomplete.

It must be now evident that whatever apparent resemblance there may be between *Rhabdopleura* and the proper Phylactolæmata, this genus essentially differs not only from the Phylactolæmata, but from all other Polyzoa to such an extent that it will

be necessary to place it in an independent section of the class. To this we may assign the name of POLYZOA ASPIDOPHORA. Indeed I regard *Rhabdopleura* as entitled to a rank at least as high as that of the ECTOPROCTA and ENDOPROCTA; and the ASPIDOPHORA will thus constitute a third great section of the class.

The hydroid affinity attributed to *Rhabdopleura* by the elder Sars, and accepted by his son, is based on a misconception of hydroid structure and development, as doubtless the distinguished Scandinavian zoologist would, on more mature consideration, have been among the first to admit*.

MOLLUSCA OF H.M.S. 'CHALLENGER' EXPEDITION.

III. TROCHIDÆ, viz. the Genera *Sequenzia*, *Basilissa*, *Gaza*, and *Bembix*. By the Rev. R. BOOG WATSON, B.A., F.L.S., &c.

[Read December 5, 1878.]

THE following group of genera are of considerable interest. They are nearly all from very deep water. Of the *Sequenzias*, two species are new; and some additional information of interest has been obtained regarding the genus. *Basilissa* is a new genus whose labial and basal sinus connect it with *Sequenzia*; while both genera present *Pleurotomaria* features hitherto unknown among the Trochidæ. *Gaza* is utterly distinct, not alone from these two genera, but from any thing known in the family, in which a reverted thickened lip is an entire anomaly. The genus *Bembix*, here proposed, is made for a new form of the Trochidæ, presenting an epidermis.

SEQUENZIA, *Jeffr.*

J. G. Jeffreys, Report on the Biology of the 'Valorous' cruise, Roy. Soc. Proc. No. 173, 1876, p. 200.

In all the species of this genus I have seen, besides the infrasutural sinus resembling that of *Pleurotoma*, there are two others—one, which is rather sharp and slight at the carina, and another, opener, on the base: between all of these the lines of growth curve out strongly towards the mouth. This might probably be accepted as a generic character. It is a feature very difficult to trace; but it certainly exists. In a perfect shell the mouth-edge

* See Ray Lankester in Quart. Journ. Micr. Sci., Jan. 1874.



Allman, George James. 1879. "On the Relations of Rhabdopleura." *The Journal of the Linnean Society of London. Zoology* 14(78), 581–586.

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