

**ON THE SYSTEMATIC
POSITION OF
THE BRACHIOPODA**

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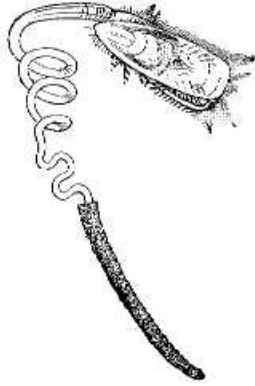
EDWARD S. MORSE

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SYSTEMATIC POSITION
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BRACHIOPODA.

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LINGULA PYRAMIDATA STIMPSON. FROM LIFE.

BOSTON:
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1873.

THE SYSTEMATIC POSITION OF THE BRACHIOPODA.

BY EDWARD S. MORSE.

To Japetus Steenstrup,

Who first recognized the Annelidan Affinities of the Brachiopoda, this Contribution is respectfully dedicated.

PREFACE.

To the systematic zoologist it is instructive to mark the changes that have taken place in the classification of animals within the last thirty years, changes not only resulting from farther knowledge of the internal structure of animals, and of their embryology and early stages, but changes resulting from a new interpretation of data previously well known.

Up to comparatively recent times, such distinguished authorities as Agassiz, and Vogt, have suggested the association of the Vorticellidae¹ and Foraminifera² and the Ctenophora³ with the Mollusca.

Not only were these additions rejected, but already have been removed the Cirripedia, and the shell-bearing Serpula, Spirorbis, and other forms originally grouped with the Mollusca. Are we now to believe that this work of elimination has ended? If further dismemberment of this perplexing branch is to take place, one would naturally look for it in that association of classes called the Molluscoi-

¹ Louis Agassiz, *Essay on Classification*. 8vo, ed., p. 138.

² *Ibid.*, p. 113.

³ Carl Vogt, *Zoologische Briefe*.

dea, first separated by Milne Edwards, and afterwards adopted by Dana, with pregnant suggestions as to its value as a group by itself.

Recently Kowalewsky, Kupffer, Schultze and others, have assailed the Tunicata, and demonstrated their kinship with the lower Vertebrata through Amphioxus. Leuckart has long maintained that the Polyzoa have no sort of relation to the Mollusca, but belong to the Vermes, and recently the distinguished Gegenbaur, in the second edition of his *Outlines of Comparative Anatomy*, not only assigns the Polyzoa to the Vermes, but places there also the Tunicata. And now in this paper I wish to show that in every point of their structure, the Brachiopoda are true worms, with possibly some affinities to the Crustacea, and that they have no relations to the Mollusca, save what many other worms may possess in common with them.

In nearly every case the unnatural association of certain groups with the Mollusca has been due entirely to superficial resemblances, to "formal analogy," as Forbes would say.

The same reason that first led conchologists and zoologists to include Spirorbis and Serpula and the Cirripedia, as well as the Foraminifera, with the Mollusca, namely, the presence of a calcareous shell, also brought the Brachiopoda into the same category. But while there was some resemblance between the cases of certain tubicolous Annelids and the shell of Vermatus, or the flattened form and lateral shells of Anatis, and the Lamellibranchiate shell, or the chambered shell of certain Foraminifera and the Nautili, there was but little to suggest an affinity with the lateral lamellibranchiate shells, in the dorsal and ventral plates of the Brachiopoda.

The mere possession, however, of a calcareous shield of some sort, whether in one piece, or several pieces, whether a tubular or a chambered shell, furnished sufficient reasons for most zoologists to include creatures bearing such shelly coverings with the Mollusca. Hence we find Lamarck, at one time placing Anonita and Discina together. And Cuvier, allowing the accepted views of the time to lead him astray, forsook his principles based upon internal structure, and regarded the relations of the Cirripedia as molluscan.

It is amusing now to look back and see with what quiet resignation the conchologists (for such they were rightly called) permitted the removal of those forms which possessed no shelly covering, with what solid indifference they allowed other unprotected forms being forced upon them, and with what obstinate pertinacity they withstood the removal of such groups as possessed a limy shell.

Says Mr. G. B. Sowerby, the great English conchologist, after Thompson had so clearly shown that the Cirripedia were crustaceans and not molluscan; "Without describing the facts, or entering upon the arguments, with which he (Thompson) supports this opinion, we must be permitted to say that we do not think he has fully demonstrated it; at the same time, considering that, as far as we hitherto knew, the Cirripeds were all attached, the circumstances of their being free when very young accounts well to our mind for the fact of each species being found attached to peculiar situations, which would only be compatible with the notion of their being at one time free agents, and possessed of an intuitive volition, determining their choice of situation."¹

Every worker knows how blindly one will work, when his mind is imbued with the accepted views of the subject, when he does not dream of questioning what he has always been taught to believe, particularly when those teachings come from the highest authorities. Even so distinguished a naturalist as Prof. Huxley, after he had repeatedly observed the external openings of the oviducts in *Rhynchonella*, confesses that "pre-occupied with the received views on the subject (namely, that oviducts were hearts), I at once interpreted them as artificial."² In the same way Prof. Owen thought he saw a minute perforation at the extremity of the intestine of *Terebratula*, where no such opening exists. As *Lingula*, and *Discina* had an anal opening, it was quite natural to believe that the other Brachiopoda formed no exception to the rule.

Many elaborate investigations of the Brachiopoda had been made by such eminent naturalists as Cuvier, Vogt, Owen, Hancock, Huxley, Davidson, Lacaze-Duthiers, Gratulet and Carpenter, and in all their memoirs no doubts had been expressed as to their molluscan nature; therefore, on commencing the study of the Brachiopoda, thirteen years ago, I had no more doubt of their molluscan character, than of the vertebrate character of birds, and attempted only to show more closely the homologies which I believed existed between the Brachiopoda and Mollusca. When at last they had been forced into the place where I believed they rightly belonged, the result of that work was published in the Proceedings of the Essex Institute,³

¹ Sowerby, Genera of Shells.

² Huxley, Proc. Royal Soc., London, Vol. VII, p. 133.

³ Classification of the Mollusca based upon the Principles of Cephalization, Proc. Essex Inst. Vol. IV, 1866. And Silliman's Journal, Vol. XLIII, July, 1869.

and afterwards republished in *Silliman's Journal*. The fact that in that paper the Brachiopoda were turned up side down, and end for end, shows the violent methods resulting from faith in accepted views. It is a simple matter of justice to myself that I make this confession, and I may also say that my studies of the Brachiopoda have been made, not for the purpose of describing new species or genera, to show their geographical distribution, or to tabulate the number of species known, but simply and solely, to determine their affinities; and that some weight may attach to the radical views here advanced, I may, with satisfaction, state that my investigations on the subject embrace a series of observations on the anatomy and early stages, of *Discina*, from an immense mass of material in alcohol furnished me by Prof. Verrill. I have also carefully studied living *Lingula*, *Rynchonella*, and *Terebratulina*, and the early stages and embryology, of the latter.

Some of these investigations have already been published, and I had hoped to present them all before publishing this paper, but as some time will be required to prepare the results, and the necessary plates on *Lingula* and *Discina*, I am reluctantly compelled to present this first.

INTRODUCTORY CONSIDERATIONS.

The changes here proposed in the removal of the Brachiopoda from the Mollusca, and their association with the Vermes, make necessary a comparison between the Mollusca, as now restricted, and the Vermes.

Many naturalists now hold the opinion that the Mollusca are descended from the Vermes. Indeed, it would seem from the rapidly accumulating data that the Vermes underlie the whole animal kingdom, with the exception of Protozoa. Only on this hypothesis, that the Mollusca are derived from the Vermes, can we understand the otherwise strange assemblage of characters displayed by such Mollusks as *Chiton*, *Dentalium*, *Pseudorhodon*.

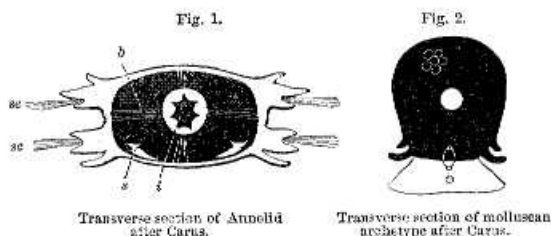
In our comparisons we are justified in selecting as typical Mollusca¹ those groups which have remained unchanged the longest.

¹ We leave out of consideration the Polyzoa, since they are not only related to the Brachiopoda, but because they are regarded as worms by Leuckart, Gegenbaur, and many others, and also the Turbellates, regarded by many naturalists as forming the base of the vertebrate series; others placing them with the Vermes, and by all separated from the Mollusca proper.

A typical Lamellibranch, and a typical Gasteropod, will be admitted by all, as best representing this branch, for while other groups have widely changed since their first appearance in past ages, we find the Lamellibranch and Gasteropod of the lower Silurian as typical as present existing forms, *e. g.*, *Modiolopsis*, *Avicula*, *Murchisonia*, *Pleurotomaria*, and from the tracks and tubes, and still later setae, we are safe to assume that the Annelids were as characteristic of their classes in past geological times, as at present.

We cannot compare the Trematodes and Turbellarians, with the Nudibranchiate Mollusks, for however much resemblance some may see in their adult condition, as among the Planarians,¹ certain characters of external symmetry in common, their respective embryos are identical with their respective divisions, the one being annulated, the other developing a foot, and a nautiloid shell.

Leaving these out of consideration, then, and taking the dominant characters displayed by the Vermes on the one hand, and the Mollusca as cited on the other, we have in the Vermes, a form, whose length is much greater in proportion to its breadth than in the Mollusks; the



b. hands suspending intestine in perivisceral cavity. *i.* intestine. *s.* segmental organ. *sc, sc.* setae.

worms being drawn out as it were, the Mollusk being concentrated. The worm is perfectly bilaterally symmetrical, depressed, flattened or circular, the dorsal and ventral regions so near alike in many cases, as to be distinguished with difficulty, and the body never flattened laterally. The Mollusk is also bilateral, but often asymmetrical, the dorsal and ventral regions are very unlike, and the body almost always flattened laterally. This latter character is so marked, more especially among the Lamellibranchiata, as to have led Prof. Agassiz

¹ Girard placed the Planarians with the Mollusks.