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Stasek

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VIEWS ON THE COMPARATIVE ANATOMY OF THE BIVALVED MOLLUSCA

CHARLES R. STASEK

California Academy of Sciences, San Francisco, California, U. S. A.

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ABSTRACT

Comparative anatomical studies of the Bivalvia have commonly resorted to uncritical use of superficial conchological characters and reliance upon overly emphatic generalizations. These tendencies have inhibited evolution of comparative anatomical concepts of the class.

Often put forth is the point of view referred to by Allen (1963) that the shell and mantle of the bivalves, and of all other Mollusca as well, comprise an entity evolutionarily separable from the rest of the body; albeit these entities are said to profoundly influence one another. Yet, so profoundly do the presumed entities interact that no separation, in the sense usually expressed, can be shown to exist; for the anatomical bases of the concept of independent entities are invalid in precisely all those genera hitherto used to prove the view. The most famous in this regard is *Tridacna*, in which the mantle, and hence the shell, has been said to have literally rotated 180° about the body.

The "demarcation line" of the shell, now necessarily used in support of the concept, is unreliable, as demonstrated by the cardiid series *Clinocardium*, *Dinocardium*, *Fragum*, and *Corculum*. In this series of genera all of the same family, and also in the related Tridacnidae, the demarcation line is variously located and does not correspond to anatomically comparable regions of the body, nor even of the shell alone.

Cartesian, or deformed coordinates, such as used by D'Arcy Thompson, can be successfully employed in the Bivalvia, both ontogenetically (illustrated by *Isognomon*) and in comparisons between groups (illustrated by *Clinocardium*, *Corculum*, *Solen*, and *Chlamys*). Pallial innervation, which was not used in construction of the coordinates, follows the "deformations" in every instance where it is known and thus provides a proof of the applicability of this graphic technique to bivalves. That this technique is applicable disproves the concept of independent entities since the "deformations" affect as a unit the mantle and the remainder of the body.

Such "deformations" not only aid in visualizing comparative differences and similarities, but they may lead to lines of approach for other kinds of study. For example, their application to a size series of *Isognomon* (Pteriacea) illustrates differential enlargement of the posterior portions of the shell and body. Relative and absolute phylogenetic enlargement of these portions seems to have occurred in the Paleozoic pteriacean genus *Myalina*, judging from the diagrams by Newell (1942, p. 47). [It may be noted that while Newell regarded the Myalinidae to be Mytilacea, it was Nicol (1958) who held the family to be pteriacean in character.] By comparisons with dimyarians, similar enlargements of the posterior regions are to be

found in the Tridacnidae and in the Pectinacea (Stasek, 1962, 1963).

The ostensible significance of this relative and often absolute enlargement, which involves the water-circulating and primary feeding structures, is hypothesized to be that all such suspension-feeding monomyarians evolved but have not necessarily remained fixed organisms in geographical regions or in environmental situations where the ambient water contained a relative paucity of useable food material. It is suggested that because food was relatively scarce, natural selection led to increase in the size of the water-circulating and feeding equipment, with all adjacent structures, such as the posterior adductor muscle, being similarly affected by the "deformation". The foot remained relatively small and became ineffective in locomotion, for increase in the size of the anterior and locomotory regions of the body would have negated the adaptive significance incurred through differential augmentation of the quantity of water circulated and potential food collected. Hence, with few exceptions, these organisms are inactive and attached, one implication being that the less energy expended in moving about the better. Clear, tropical waters may exemplify one of the general environmental situations in which this evolutionary process could have occurred, although few details are definitely known of the specific ecology of the bivalves under consideration.

Behavioral modifications utilizing the expanded siphonal regions often followed the resultant exposure of these bivalves to predators. Examples are the swimming ability of *Pecten* and the aiming-spurting behavior of *Tridacna* (Stasek, 1965).

The view here briefly outlined seems to offer frontiers for comparative studies, perhaps throughout the Mollusca, that would not have been conceivable had the concept of independent entities gone unchallenged. Other applications along these lines are now in progress.

REFERENCES

ALLEN, J. A., 1963. Ecology and functional morphology of molluscs. *Oceanogr. Mar. Biol. Ann. Rev.*, **1**, 253-288.

NEWELL, N. D., 1942. Late Paleozoic pelecypods: Mytilacea. *State Geolog. Surv. Kansas*, **10**, 1-115.

NICOL, D., 1958. A survey of inequivalve pelecypods. *Journ. Wash. Acad. Sci.*, **48**, 56-62.

STASEK, C. R., 1962. The form, growth and evolution of the Tridacnidae (Giant clams). *Arch. Zool. Expér. Gén., Paris*, **101**, 1-40.

STASEK, C. R., 1963. Orientation and form in the bivalved Mollusca. *Journ. Morph.*, **112**, 195-214.

STASEK, C. R., 1965. Behavioral adaptation of the giant clam *Tridacna maxima* to the presence of grazing fishes. *The Veliger*, **8**, 29-35.