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## Significance of the Ligament in the Classification of the Bivalvia

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## Significance of the ligament in the classification of the Bivalvia†

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This survey, based throughout on knowledge of the *epithelia* which secrete the various regions of the primary ligament and also their periostracal extensions sometimes resulting in the formation of separate secondary ligaments, provides evidence in justification of the following:

- (1) Union of the Carditacea and Astartacea in the superfamily Crassatellacea.
  - (2) Total distinction between the equally heteromyarian Mytilacea with primary opisthodontic ligament and Dreissenacea with added secondary ligament.
  - (3) Major differences between ligamental and hinge structure (i.e. mantle/shell) in Pectinidae and Spondylidae although the visceropedal mass in both is similar.
  - (4) Major differences between both mantle/shell and visceropedal mass separate Plicatulidae from Pectinacea.
  - (5) Major resemblances between both mantle/shell and visceropedal mass associate Plicatulidae with Dimyidae in proposed superfamily Plicatulacea.
  - (6) In the Unionacea, extension of the exclusively primary ligament with accompanying loss of teeth permitted evolution of the cemented Etheriidae with a unique change in the position of the ligament during growth in the monomyarian *Acostaea*.
  - (7) Adaptive radiation in the Anomiacea largely involving the ligament has resulted in evolution of the motile limpet-like *Enigmonia* and, by appearance of a new hinge line attached by a secondary ligament, that of free (but immobile) window-pane shells of the genus *Placuna*.
  - (8) Influence of a tangential component in shell growth associated with cementation by one or other valve in living Chamacea provides a possible understanding of the course of radiation within the extinct Hippuritacea (rudists).
  - (9) Common possession of a unique combination of 'sunk' primary ligament, with centrally running calcareous lithodesma, and superficial secondary ligament represents a unifying character within the order Anomalodesmata, including the septibranchs.
- Indication is finally given of the extent to which evidence concerning the nature of the long-decayed ligament may be available in fossilized material.

† The full text of this paper appears in *Proc. R. Soc. Lond. B* **202**, 231–248 (1978).