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The sensorial function of the girdle of the Polyplacophora

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The polyplacophorans or chitons are characterized by the presence of eight dorsal overlapping shell plates that are embedded in a thick mantle tissue and surrounded by the girdle (also called perinotum). In chitons, the hard layers of plates consist of the uppermost tegmentum, the articulamentum whose projections form the sutural laminae and insertion plates, and the underlying hypostracum. The tegmentum, which is the visible layer of the chiton shell in life, is infiltrated with a complex, tissue-filled canal system that opens at the dorsal valve surface as sensory or secretory organs known as aesthetes. Structures secreted by the epidermis of the girdle have been mainly described as ornamentation or armature, such as numerous calcareous spines, scales, hairs or bristles, but other studies suggest that the girdle epidermis has other functions such as sensorial (Leise and Cloney, 1982; Leise, 1988).
In chitons, epidermal sensory receptors have been mainly found around the mouth, on the subradular organ, in the buccal cavity, in the pallial grooves and in the shell. During a study of the formation of the cuticle in the mantle girdle of several species of chitons (Lepidozona pectinulata, Ischnochiton rissoi, Lepidochitona cinerea, Leptochiton algesirensis, Lepidopleurus cajetanus), we have observed several sensory structures in the mantle girdle. In the case of fully-grown scales and marginal spines, a group of cells differentiated from the papilla constitutes a stalked body or nodule, which progressively elevates and pushes the spine until it finally, pierces through the cuticle surface. The stalked nodules are more conspicuous in L. cinerea and L. pectinulata than in L. cajetanus. These projections arise from epidermal papillae and have been considered mechanoreceptors. Lens-like structures have been observed inside some stalked nodules in L. cinerea and L. algesirensis. The stalked nodules show dendritic structures underlying the lens-like structure, which point to a photoreception ability. The lens-like structure found in the nodule of L. cinerea seems to be a rigid, possibly mineralized structure. Aragonite lenses have been found in Acanthopleura granulata by Speiser et al. (2011). In L. algesirensis we have observed groups of long microvilli in the top margin of the papillae and in contact with the spines that we consider as mechanoreceptors. As in other chitons, dendritic processes are frequently found in association mainly with dorsal spicules, although not every spine is innervated.

References

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