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Interrelations between Protein Elaboration and Calcification in Molluscs *

Gerrit Bevelander New York University

Examination of several different species of molluscs was undertaken to ascertain (1) the origin of the minerals, (2) origin of the protein matrix (periostracum) and various aspects of mineral and protein matrix in reference to shell formation.

The protein or organic part of the shell is secreted by epithelial cells: one group located on the outer surface of the middle mantle fold gives rise to a transparent pellicle-like portion which is somewhat basic in its reaction to dye stuffs. The remainder of the periostracum is secreted by epithelium of the mantle folds and also the epithelium located on the portion of the mantle situated distalward to the folds. The latter is acidophilic and gives a positive test for acid-polysaccharides and muco-polysaccharides.

One important source of calcium carbonate crystals which come to be incorporated into the mollusc shell are the numerous mucous glands which are present in the mantle. The crystals arise in an environment (in the glands) containing acid-polysaccharides, muco-polysaccharides, ribonucleic acid, glycogen, and phosphate, but do not contain alkaline phosphatase.

These studies show that calcium carbonate crystals are very abundant and wide spread in the mantle tissues; that they are either pre-formed or formed in the mantle. Further, the protein secretion of the mantle which becomes part of the periostracum contains optically recognizable mineral crystals. These crystals undergo subsequent "crystal growth" in the newly elaborated periostracum which lies outside of the mantle tissues proper. The process of mineralization of the shell takes place in two phases: (1) the elaboration of small crystals within the mollusc tissues and (2) the extrusion and incorporation of crystals in the protein matrix where crystal growth subsequently occurs.

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