PB 4 - Myosin-dependent Chitin Synthesis: new Perspectives for Mollusk Shell Biomineralization

I. M. Weiss, V. Schönitzer, F. Lüke, N. Eichner

Universität Regensburg, c/o Lehrstuhl Biochemie I, D-93053 Regensburg/ Germany

Chitin is a key component in mollusk shell formation - not in terms of quantity, but in terms of structure. Solid-state investigations revealed that β-chitin is present in mollusk shells in highly ordered arrays with a preferred orientation over length scales of several microns. The chitin fibers are well aligned under individual crystal tablets in nacre with respect to certain crystallographic axes of the aragonite mineral phase. Biomineralization proteins show aragonite inducing activity only in the presence of β-chitin and a silk-like protein gel.
We recently demonstrated that chitin is present in very early stages during mollusk larval shell formation. Confocal microscopy investigations using a GFP fusion-protein with a chitin binding domain revealed that the structure of the chitinous matrix changes with the functional development of the larvae. As the enzyme complex responsible for chitin deposition in the mollusk shell remained unknown, we cloned and characterized the chitin synthase of the marine bivalve mollusk *Atrina rigida* (ORF ~7.8 kb; MW: 264 kDa). This is the first chitin synthase sequence from invertebrates containing an unconventional myosin motor head domain (3). Fluorescent RNA in-situ hybridization showed that a homologous gene for chitin synthase is expressed in the shell forming tissue of larval *Mytilus galloprovincialis* even in early embryonic stages. The intracellular myosin domain of the mollusk chitin synthase raises new questions regarding the cellular control of biomineralization. Currently, we hypothesize that a direct link between chitin synthesis and cytoskeleton mechanics allows a distinct cellular control over extracellular chitin self-assembly and mineralization, which results in hierarchical composite materials like nacre.