Strategies and Design Principles in Biomineralization

Lia Addadi, Steve Weiner, *Department of Structural Biology, Weizmann Institute of Science*, *Rehovot, Israel*. E-mail: lia.addadi@weizmann.ac.il

Organisms are able to produce mineralized skeletons with complex architectures, having unusual shapes and organization. This is the result of sophisticated strategies that control the design and construction of the materials at all hierarchical levels, from Angstroms to millimeters.

In order to understand the mechanisms used by organisms to build their skeletal materials, we study the various components of the mineralized tissues, the interfaces between them, their structures and relations of structure to function.

The minerals are deposited in a matrix composed of biological macromolecules. Common minerals used are the calcium carbonate polymorphs aragonite and calcite in the form of single crystals or polycrystalline ensembles. Organisms are able to override the crystal natural propensities, and can shape calcite and aragonite almost "at will". These features depend also on the involvement of transient amorphous precursor phases, which transform into single crystals in a slow controlled process [1]. All these properties stem from direct or indirect control of specialized macromolecules, whose sequences, structures and functions are only beginning to be undersood [2].

[1] Politi Y., Arad T., Klein E., Weiner S., Addadi L., *Science*, 2004, **306**, 1161-64. [2] Gotliv B. A., Kessler N., Sumerel J. L., Morse D. E., Tuross N., Addadi L., Weiner S., *ChemBiochem*, 2005, **6**, 304-314.

Keywords: biomineralization, amorphous , calcium carbonate