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ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ

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Τίτλος

«Σχεδιασμός και μελέτη αυτο-οργανωμένων Βιο-οργανικών Υλικών»
«Design and study of self-assembled Bio-organic Materials»

Αναγνωστοπούλου Ευαγγελία - Ελένη

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Abstract

The present thesis is based in the use of self-assembling peptides as templates for directing formation of inorganic materials. This kind of "biomimetic" approach is based on the ability of biological materials and especially proteins and peptides to act as templates for the deposition of inorganic materials in various natural processes. Such processes include the formation of calcium phosphates in bone and teeth morphogenesis, calcium carbonates in nacre formation, and biosilica formation in sponges. Biosilica formation in sponges involves the protein silicatein, an homolog of the cathepsin family of proteases. The catalytic center of silicateins involves a "catalytic triad" (Ser, His and Asn) that is able to hydrolyse silicon alkoxides in vitro to yield Si hydroxide, followed by polycondensation to form the metal oxide network material.

In our group, it was previously demonstrated that self-assembling octapeptides that contain serine residues in second position from a free amino terminus (eg NH_2-NSGAITIG-$CONH_2$) are able to direct silica deposition. The underlying mechanism was demonstrated and involves activation of the serine residue by the free amino terminus. This mechanism is analogue to the mechanism adopted by a special class of serine proteases, called N-terminal hydrolases. In the present thesis we will show that another self-assembling octapeptide, Ac-HSGAITIG-$CONH_2$ is able to direct silica deposition. We examined the ability of the Ac-HSGAITIG-$CONH_2$ building block to self-assemble into amyloid-like fibers and then the functionality of the serine and histidine residues in the process. We finally show that the arrangement of the silica nanoparticles on the fibril follows the geometry of the underlying fibril template.