Biosilicification and biocalcification of membrane fibers mantles of the eggshells of ratite birds and archosaurs reptiles (crocodiles)

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Biomineralization processes in nature are associated with a structural control carried out by biomolecules (DNAs, proteins, and polysaccharides). There are two biomineralization processes, which are usually used by living organisms in terms of producing biominerals: (1) organic matrix-mediated biomineralization, known to be highly regulated and homogeneous process; (2) biologically induced biomineralization, where mineralization deposits occur indefinitely and heterogeneously. However, little structural information is known about the macromolecules that constitute and act in the living organisms in these processes, since the level of structural organization of biominerals is often hierarchical in different structural orders to produce a final structure with a unique morphology with properties that until now have not been reproduced by man. Among the processes mediated by a membrane, like in diatoms, of which the importance of biological entities is appreciated, there is a rigid and porous cell wall called a frustule compose of amorphous silica. It also appears in bones comprised mainly of calcium phosphate [1, 2] and in eggshells whose percentage of calcium carbonate can vary depending on the species [3].

However, there is a lack of a universal model that will allow us to obtain information about these two biomineralization processes known as biosilicification and biocalcification. Therefore, this poster presentation will be focused on using the membranes of the eggshells from different species of ratite birds (emu and ostrich) and reptiles (two types of crocodiles) as a model to differentiate synthetic calcification and silicification, ensuring its permeability to stabilize the amorphous mineral part. By introducing nanostructured calcium phosphate or silica within the fibers mantles of the membrane, we will be able to obtain information on the process of formation of the eggshell as well as of the change that occurs in the membrane during the formation of crystals. The topographical analysis was performed via X-ray diffraction (XRD), atomic force microscopy (AFM) or scanning electronic microscopy (SEM). The investigation has an important impact in the fields of biological and materials sciences, which would provide an effective understanding of the biomineralization processes. Additionally, this research will also allow us to know how to mimic them, since most of the studies carried out are focused on immunohistochemical studies on the formation of the chicken eggshell.

References

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