Composite materials in biologically controlled mineralization

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Biologically controlled mineralization gives rise to a variety of composite materials in which organic matrix and inorganic crystals are intimately mixed into hierarchical structures built to fulfill specific biological functions.

Many attaints have been made to mimic biological mineralization because of the complex, tailored morphologies and mechanical properties, testing the organic matrix's role and the interplay among inorganics in scaffold-driven mineralization. In some cases, the synthesis of biomimetic analogs of biominerals is well-mastered at the laboratory scale: many wet and dry methods achieved the mass crystallization of nanosized crystals applied as a scaffold for medical purposes [1].

It is needless to say that interactions in composite materials work through the interfaces. Back in 1988 [2,3] Mann wrote that the cooperation among phases in biomineralization must fulfill stereochemical and structural requirements. Structural (epitaxial) relationships must be considered at the chemical and crystallographic levels.

Considering these tenets, we will discuss biological mineralization and composite biominerals. Carbonates, phosphates and oxalates will represent interesting biologically controlled and induced mineralization case studies, emphasizing the interplay with the organic matrix or the inorganic competitors.

The comprehension of the mechanisms underlying biomineralization allows the production of analogs of biological materials but, maybe more critical, the understanding of the mechanisms that underlie pathological mineralization [4].

References

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