

REVIEW

Biosilica as a source for inspiration in biological materials science

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ABSTRACT

Biom mineralization is an evolutionarily ancient phenomenon and one of the fundamental biological processes by which living organisms produce minerals with multifunctional properties. Among the more general biomineralization processes, those involving silica (biosilicification), calcium-based biominerals (calcification), and iron-based biominerals (biomagnetism) have been described in a wide pattern of living organisms, from single cells to higher plants, animals, and even humans. After 25 yr of extensive studies of biosilicification, diverse biomacromolecules have been proposed and confirmed as active players in this special field of biomineralization. Despite these discoveries, biosilicification is still a paradigm and a cause of scientific controversy. This review has the ambitious goal of providing thorough and comprehensive coverage of biosilicification as a multifaceted topic with intriguing hypotheses and numerous challenging open questions. The structural diversity, chemistry, and biochemistry of biosilica in viruses, bacteria, plants, diatoms, and sponges are analyzed and discussed here. Special attention is paid to prospects and trends in applications of biosilica for technology, materials science and biomedicine.

Keywords: Biosilica, biosilicification, diatoms, sponges, biomineral, biocomposites; Review article; Biomaterials—Mineralogy Meets Medicine