

MATERIALS FROM LIVING ORGANISMS AND LIVING ORGANISMS AS MATERIALS: POSSIBILITIES AND CHALLENGES IN BIOMEDICINE

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Abstract:

Several living organisms can be seen as a plentiful source of micro/nanostructures, polymers, and molecules suitable for use as materials for biomedical applications. In many cases, the organisms themselves can be engineered or exploited as functional materials for specific technological and therapeutic purposes.

In contrast to traditional industrial processes, biosynthetic routes operate under mild conditions, often in water and at room temperature, and typically have a much lower environmental footprint. This strategy therefore offers a promising pathway toward sustainable, large-scale production of advanced nanomaterials for use in biomedicine and related fields. However, several challenges still need to be addressed to improve their biocompatibility, therapeutic safety, and long-term stability when this is necessary.

In the lecture, I will present emblematic examples such as biosilica, cellulose, lignin, polydopamine, and silk fibroin, and I will discuss how microalgae and other photosynthetic microorganisms can be harnessed as renewable sources of functional materials for a broad range of biomedical applications.

Finally, the lecture will explore both the opportunities and current limitations of this bio-based approach, outlining key challenges, technological needs, and possible future directions.

Key words: *biomaterials, living materials, hybrid materials, biopolymers, microalgae*