Biomineralization-Inspired Life Engineering of Materials

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Abstract
Nature uses biomineralization as a tool for making organic-inorganic composites through precise control of nucleation, growth, and assembly. Based on these principles, biomineralization-inspired life engineering of materials has been advanced through inorganic ionic oligomerization and programmable material-biological interfaces. These approaches enable the rational design of functional materials and the engineering of bioinspired mineralized collagen scaffolds, demonstrating how nanoscale understanding of natural interfaces can translate into effective regeneration of complex tissues such as the enthesis, the fibrocartilage junction between tendon and bone that remains a major clinical challenge. By integrating materials science, chemistry, and biology, biomineralization-inspired strategies open new avenues for regenerative medicine, CO_2-related chemistry, and adaptive hybrid systems with emergent, non-genetic biological functions.

Selected references

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