

SOLVAY COLLOQUIUM



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Emulating Nature's Way of Making Materials

From harvesting solar energy to capturing CO₂ to purifying water, living organisms have solved some of the most vexing challenges now faced by humanity. They have done so by creating a vast library of proteins and other macromolecules that can assemble into complex architectures and direct the mineralization of inorganic components to produce materials characterized by a hierarchy of structure. While the high information content contained within the intricate sequences of the proteins is crucial for accomplishing these tasks, self-assembly and mineralization are nonetheless constrained to proceed according to the physical laws that govern all such processes, even in synthetic systems. An understanding of the mechanisms by which biological systems successfully manipulate those laws to create hierarchical materials would usher in an era of materials design to address our most pressing technological challenges. In this talk, I will present the results of recent research using in situ atomic force microscopy and in situ transmission electron microscopy to directly observe interfacial structure, protein self-assembly, and nanocrystal formation in biomolecular and biomimetic systems, including protein-directed nucleation of calcium carbonate and calcium phosphate and mineral-directed nucleation of two-dimensional assemblies of proteins. The results elucidate the mechanisms by which biomolecules and interfaces direct crystallization processes, leading to unique materials and morphologies. The results reveal the importance of surface charge, facet-specific binding, solvent organization near interfaces, and, more generally, the balance of protein-substrate-solvent interactions in determining how ordered materials emerge in these systems.

Thursday 8 December 2022 at 4:00 P.M.

COFFEE AND TEA WILL BE SERVED AT 3:45 P.M IN FRONT OF THE SOLVAY ROOM

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