

Proteins as tools for engineering functional structures and materials

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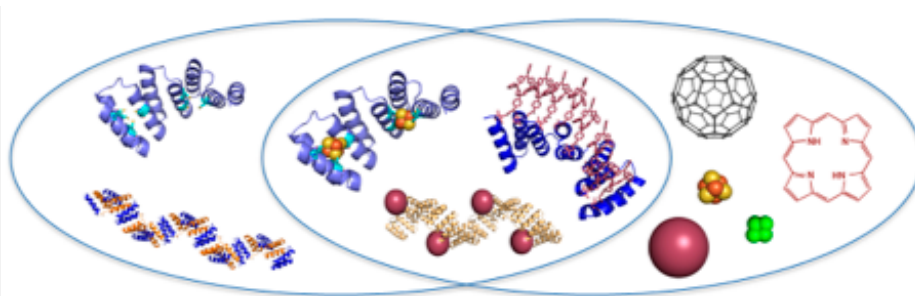
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Proteins are the most versatile biological building blocks, composed of amino acids offering rich chemistry. Proteins present enormous diversity in 3D structures that translates into amazing functional diversity. Thus, proteins have great potential for use as building blocks in order to construct tailored designed systems, including nanofabrication and generation of novel protein-based biomaterials. We explore the potential of proteins as building blocks toward the generation of functional nanostructures and bioinspired materials for applications in nanobiotechnology and nanomedicine. In particular, our main objective is to develop versatile platforms based on simple protein building blocks for the fabrication of multiple protein-based hybrid functional nanostructures and biomaterials.

Among other applications we work on the use of designed proteins as building blocks to template:

- (1) Photoactive molecules, in a defined distance and orientation that lead to an improvement in the optoelectronic properties. In addition, the unique self-assembly properties of CTPR scaffolds have been exploited to generate ordered conductive films of the protein-porphyrin conjugates.
- (2) Carbon nanomaterials, using proteins as wrapping agents for carbon nanotubes (CNTs) in order to form stable protein-CNTs conjugates.
- (3) Electroactive clusters, designing protein scaffolds to coordinate redox active metallic FeS clusters to mimic the redox centers and chains of natural proteins.
- (4) Gold nanomaterials, using designed and natural fibril proteins to conjugated gold nanoparticles and nanorods for nanometer-precise arrangement of the nanomaterials.
- (5) Fluorescent nanoclusters, by specific design of metal coordination sites. As a proof of concept, a repeated module with specific binding capabilities has been successfully used to stabilize nanoclusters and applied as a sensor.



Biomolecular Nanotechnology: design of novel nanostructures and efficient nanomaterials