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Hybrid Self-Assembled Nanomaterials from Protein, Peptides, and DNA

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Abstract: The ability to design materials that mimic the complexity and functionality of biological systems is a long standing goal of nanotechnology, with applications in medicine, energy, and fundamental science. Biological molecules such as proteins, peptides, and DNA possess a rich palette of self-assembly motifs and chemical functional diversity, and are attractive building blocks for the synthesis of such nanomaterials. In this talk, we will describe research in creating hybrid materials that incorporate proteins and peptides with DNA nanotechnology to create cages, nanofibers, and 3D crystals with a high degree of programmability and nanoscale resolution. Key to these endeavors will be (bio)molecular design, organic chemistry for linking components in a site-specific fashion, and the tuning of multiple self-assembly "modes" to create hybrid structures. Although the talk will focus on the fundamental chemistry and self-assembly of these systems, we will also discuss potential applications in areas such as targeted cargo delivery, biomaterials for regenerative medicine, and synthesis of virus- and antibody-mimetic nanostructures.