ORGANIC SEMINAR

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"Metal-promoted Hierarchical Assemblies of Coiled-coiled (CC) Peptides: Forming a 3D-matrix from a Pentameric Helical Barrel and Layered Crystals from Trimeric CCs"

Coiled-coil (CC) peptide scaffolds have contributed significantly to the development of functional biomaterials. Sequence-to-structure relationships that govern CC oligomeric states, and their ease of functionalization have resulted in different strategies to assemble these building blocks. In this seminar, I will discuss two CC peptide motifs that use metal-ligand interactions to achieve unique hierarchical assemblies.

First, I will present helical barrels as a building block for higher order assembly. These barrels are composed of pentameric CCs containing a hydrophobic cavity modified with His residues that face away from the central cavity. In the presence of bivalent metal ions, the helical barrels assembled into a 3D-matrix morphology. The hydrophobic cavity and metal-ligand interactions offered two modes of cargo binding without altering morphology, making this material promising for 3D cell culture applications.

In the second part, I will describe metal-directed epitaxial growth of CC peptide materials to form layered crystals. This stepwise crystal growth was initiated with seed crystals composed of a CC peptide modified with His2 and nitrilotriacetic acid ligands with Zn(II). Exposed ligands at the terminal ends of the crystals were used to grow a second layer of material using a difference CC peptide and Cu(II). This process was extended to grow a third layer. His-tagged fluorescent proteins were used to visualize epitaxial growth and demonstrate that distinct proteins can be incorporated into each epitaxial layer. These layered peptide materials show potential for use in enzyme arrays, photonic barcodes, and device fabrication to modulate electronic properties.