Periodically Sequenced Peptides - A New(ish) Tool for Nanoscale Materials Synthesis

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Periodically sequenced peptides can be confined to interfaces and assembled into patterns that present chemical functionalities with exceptional spatial precision. These rationally designed peptides and polypeptides are rapidly becoming useful components in nanostructured materials for applications ranging from drug delivery to energy storage. This presentation will examine several fundamental aspects of self-assembly and pattern formation of well-defined sheet forming peptides confined at interfaces. Our approach involves three steps. (1) We design and synthesize simple periodic peptide sequences, yielding surface-active β-strands that self-organize into aggregates to form patterns as a function of the peptide sequence. Rational peptide design allows us to systematically explore the role of hydrophobicity, electrostatics and molecular size on materials properties. (2) We use a set of interfacial characterization tools to examine in intermolecular assembly and supramolecular mechanics of the self-assembled structures. (3) We apply two-dimensional equations of state that define both the phase behavior and the critical surface concentrations of nascent aggregates at the interface. Subsequently, we can apply these parameters to predict the dimensions of pattern formation and to determine the potential of the peptide assemblies as biomimetic materials.