12.35 pm **Function and Polydispersity Optimization in the Liquid Phase Synthesis of Amphipathic, Self-Assembling Polypeptides**

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One of the main limitations to modern peptide synthesis is the relatively high cost of the products relative to the reagents. Liquid-phase synthesis offers the possibility of forming low-cost polypeptides, but the condensation reaction comes with the potential for high polydispersities when forming high molecular weight polypeptides. To overcome this, we engineered and synthesized amino acid dimers that are both amphipathic and water-soluble. When polymerized, these dimers form repeat sequences in polypeptides with alternating hydrophilic/hydrophobic side groups, and, therefore, the polypeptides are designed to develop a periodicity conducive to the formation of ß-sheets. We then decrease polydispersity of the growing polypeptide chains by modifying the kinetics of growth through transport-limited chain elongation. Our experiments show that in the absence of a surfactant interface, standard bulk-phase condensation polymerization occurs. In contrast, in the presence of surfactant, the amphipathic character of the polypeptides results in the transport-limited elongation as the polypeptide partitions into micellar assemblies. This partitioning, taking place during chain growth, serves to narrow the polydispersity of our periodically-sequenced polypeptide. We quantify polypeptide size and assembly using multiangle light scattering and mass spectrometry and define evolving secondary structure using circular dichroism. Our results show that peptides grown in the presence of surfactant micelles show significantly enhanced self-assembly and narrowed polydispersity indices. We conclude that the transport-limited chain elongation polymerization in a surfactant-laden solution can be used in the manufacture of low-cost, self-assembling polypeptides. Finally, purified polypeptides were compressed on a Langmuir-Blodgett trough and imaged using Brewster angle microscopy, yielding surface pressure data characterizing the ß-sheets on an air water interface.