Biomolecular Self-assembly of Functional Molecules and Nanomaterials

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I will present the use of peptides and proteins as a functional platform for the assembly of various functional molecules and materials. I will introduce shell cross-linked nanocapsules prepared by emulsifying an organic solution of amine-reactive six-arm-branched polyethylene glycol into an aqueous solution of human serum albumin followed by cross-linking at the organic/aqueous interface. The hybrid nanocapsules are utilized as a biocompatible, tumor-targeted delivery platform for paclitaxel, quantum dots, and iron oxide nanocrystals. In the second part, I will introduce genetic engineering of the viral genome to display a variety of peptides on the coat proteins. This approach is often called 'phage library,' which can be used to identify peptide motifs that can selectively bind to molecules and materials of interest. The identification of specific peptide building blocks enables us to synthesize novel nanostructures on the surface of genetically engineered viruses. I will discuss how this virus-based strategy can be extended to various practical applications.