ABSTRACT
Natural materials can serve as great inspirational sources to develop next-generation polymeric materials for human health care, defense and industrial applications, attributed to their exceptional physical, chemical and biological properties including biocompatibility, biodegradability and potential nontoxicity. Typically, the unique properties of natural materials are related to their biopolymer elements, particularly multi-functional proteins, and the structural organization of biopolymers in materials. To mimic the superior properties of natural materials, well-characterized functional protein building blocks can be engineered into artificial protein polymers, which can then be hierarchically assembled into nanostructured polymeric materials, in contrast to constructing the entire complex natural system. Based on this bioinspired approach, I will discuss the mechanical protein building blocks responsible for muscle toughness and red blood cell deformability as well as a proper crosslinking strategy to potentially construct mechanically responsive polymeric materials for biomedical applications. I will also discuss the first artificially engineered protein polymer hydrogels that mimic the enhanced selective transport function of the nuclear pore complex and their potential applications for advanced separation technology.

BIOSKETCH
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