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Hierarchical self-assembly of spider silk-like block copolymers SREEVIDHYA KRISHNAJI, WENWEN HUANG, PEGGY CEBE, DAVID KAPLAN, Tufts University — Block copolymers provide an attractive venue to study well-defined nano-structures that self-assemble to generate functionalized nano- and mesoporous materials. In the present study, a novel family of spider silk-like block copolymers was designed, bioengineered and characterized to study the impact of sequence chemistry, secondary structure and block length on assembled morphology. Genetic variants of native spider dragline silk (major ampullate spidroin I, Nephila clavipes) were used as polymer building blocks. Characterization by FTIR revealed increased ?-sheet content with increasing hydrophobic A blocks; SEM revealed spheres, rod-like structures, bowl-shaped and giant compound micelles. Langmuir Blodgett monolayers were prepared at the air-water interface at different surface pressures and monolayer films analyzed by AFM revealed oblate to prolate structures. Circular micelles, rod-like, densely packed circular structures were observed for HBA6 at increasing surface pressure. Exploiting hierarchical assembly provide a promising approach to rationale designs of protein block copolymer systems, allowing comparison to traditional synthetic systems.

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