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Title: Silk biomaterials

Abstract:

Silk fibers produced by arthropods and aquatic insects are one of Nature's most brilliant material designs; they have a highly ordered hierarchical structure that forms a material with extraordinary physical characteristics, ranging from mechanical performance to adhesiveness. Silk spinning is a complex process that entails careful maintenance and modification of a highly unstable liquid silk feedstock inside the silk gland. It involves several structural transitions, phase separations, and macromolecular assembly events governed by chemical and physical forces. These events dictate material transitions from a liquid protein to a highly organized β-sheet-rich solid fiber. Although extensively studied, silk's material evolution remains largely unknown. In our group we are investigating some of the main unresolved issues related to silk fiber's material design, natural assembly mechanisms, physical properties, environment, and the forces that regulate these processes. We then apply the obtained knowledge to rational design of multifunctional silk-based biomaterials.