Biomaterials and processes: Structure-function relations in hierarchical self-assembly

The challenge in development of surrogate extracellular matrices, ECMs is to design and prepare synthetic materials capable of influencing cell differentiation, proliferation, survival and migration through both biochemical interactions and mechanical cues. Current effort in the engineering of synthetic ECM has focused on installing molecular features (peptides, proteins and bio-interactive polymers) within insoluble scaffolds, either by self-assembly or through covalent modifications of polymer or biopolymer networks. Apart from their *direct* role in cell interaction, bioactive molecules or peptide sequences are found to affect the hierarchical structural organization and mechanical properties of the resulting material, thus affecting *indirectly* the cellular response.

Our research focuses on understanding the structure- mechanical properties-function relationships of potential ECM mimetics toward developing new approaches for engineering bio-related materials.

Small angle scattering, X-ray (SAXS) and light enable us to characterize structural features in both solution and solid states at multiple length scales. Thus allows us to explore the hierarchical structure of complex materials. Specifically our research deals with (1) studying multi-component polysaccharide hydrogels by characterizing the self-assembled nanoscale morphology and local stiffness of their building blocks and evaluating the hydrogel resulting macroscale properties. (2) Investigating the use of stimuli responsive peptide amphiphiles as building blocks for self-assembling bio-materials with tunable nanoarchitecture and physical properties.