



UCSD NANOENGINEERING SEMINAR

Monday, January 25

Seminar Presentation: 11:00am – Noon

SME 248 - Cymer Conference Center

Molecular Control of Biomimetic Self-Assembled Materials

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Abstract:

The self-assembly of polymers is inherently tied to biological function, particularly in the extracellular matrix (ECM) where there is a complex feedback between the material niche and cells that changes during development and disease. To recapitulate aspects of the ECM in vitro, an ongoing challenge is the structural control of sequence specific and dynamic materials. This presentation will discuss two biomimetic systems in which molecular level design has afforded enhanced structural control of bulk polymer systems, and, in doing so, led to new strategies for answering biological questions. First, the speaker will discuss the self-assembly behavior of polypeptoids. These non-natural molecules hold promise for relaying biomimetic cues to cells or microorganisms due to their sequence control, enzymatic stability, and hierarchical structure. Studies using small angle scattering techniques have demonstrated the impact of monomer sequence on peptoid block copolymer nanostructures, allowing for controlled presentation of certain motifs. Second, we will discuss the rational design of a 3D cell culture matrix with a light-based mechanism for the reversible control of modulus using azobenzenes. The modulus of biological tissues increases and decreases during cycles of disease progression and resolution (e.g., fibrosis), although these mechanical effects are difficult to study in vitro. The incorporation of azobenzenes into hydrogels yields a direct way to modulate viscoelastic cues to entrapped cells, enabling a unique approach to the study of mechanical dosing effects on cellular phenotype. By understanding the structure property relationships involved in self-assembly, the advanced polymer systems described here can be broadly used in applications ranging from in vitro disease models to device coatings.

Biosketch:

Adrienne Rosales received a B.S. in Chemical Engineering from the University of Texas at Austin in 2007 and a Ph.D. in Chemical Engineering from UC-Berkeley in 2013. She is currently a NIH postdoctoral fellow at the University of Colorado in Boulder. Her research interests sit at the interface of materials science and biology for applications in human health and environmental sustainability.