Chemical Engineering Distinguished Young Scholars Seminar

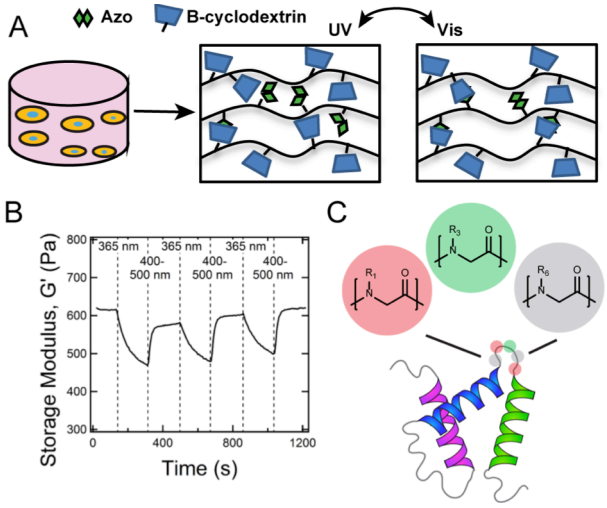
Dynamic Self-Assembled Materials to Control Cellular Microenvironments and Mimic Biological Phenomena

Adrianne Rosales
Post Doc
University of Colorado - Boulder

Date: Monday, July 20, 2015
Time: Lecture: 4:00-5:00 p.m.
Place: PAA A110
Happy Hour in Benson Hall Lobby

Abstract

Dynamic self-assembly of polymers is inherently tied to biological function, especially in the extracellular matrix (ECM). Importantly, the ECM is constantly changing, which enables natural processes like wound healing and can lead to disease-like states when not regulated. Recapitulating these *dynamic* properties of the ECM is a key challenge in current biomaterials development, especially in a reversible way to mimic disease resolution and potentially understand mechanisms for healing. This presentation will discuss self-assembled polymer systems that capture the dynamics of both physical and chemical cues of the native ECM. The first part of this work will describe the rational design of a 3D cell culture matrix with a light-based mechanism for the reversible control of modulus using azobenzenes. Azobenzenes change their isomeric structure in response to specific wavelengths of light, and their incorporation into hydrogels yields a direct way to modulate physical cues to entrapped cells (A). The relationship between molecular design and the resulting change in viscoelastic parameters such as storage modulus (B) will be described, as well as ongoing work with encapsulated cells. The second part of this work will discuss the self-assembly of sequence-specific polymers, polypeptoids (C), as applied to anti-biofouling surfaces. These non-natural molecules hold promise for relaying biomimetic cues to cells or microorganisms due to their sequence control, enzymatic stability, and structure. 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.



A) Azobenzene and β-cyclodextrin forms reversible non-covalent crosslinks in self-assembled polymer hydrogels for cell culture. B) The storage modulus of the matrices in A can be modulated with different wavelengths of light. C) Peptoid chains can fold to mimic biomolecules in solution.

BIO
Adrianne 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 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.