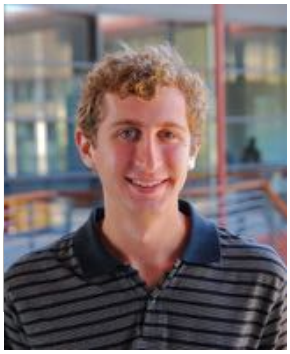
CHEMICAL ENGINEERING

DISTINGUISHED YOUNG SCHOLARS SERIES



CHRISTOPHER MADL

Monday, July 25, 2016

Graduate Student
Stanford University

Maintenance of Neural Progenitor Cell Stemness in 3D Hydrogels Requires Matrix Remodeling

ABSTRACT: While neural progenitor cells (NPCs) embedded in 3D hydrogels hold significant therapeutic promise for the treatment of nervous system disorders, the material properties required to maintain NPC stemness and function have yet to be elucidated. In this talk, I will describe our use of an engineered protein hydrogel system to study cell-matrix interactions in which matrix stiffness and degradability are co-varied independently of other material properties. In this system, NPCs best maintain stemness in hydrogels with high degradability and low stiffness. This phenotypic response is not a result of classical mechanosensing, which was previously shown to modulate the behavior of NPCs cultured on 2D hydrogel substrates. Rather, in our 3D hydrogels, stemness maintenance depends primarily on hydrogel degradation. In a second, fully synthetic hydrogel system in which degradability and matrix stiffness are tuned independently, only degradability, and not stiffness, regulates NPC stemness. Our findings have identified matrix remodeling as a previously unknown requirement for maintaining NPC stemness and highlight degradability as an important parameter when designing materials for NPC transplantation. Furthermore, we have demonstrated that this requirement for degradation is independent of mechanotransduction pathways, in contrast to other stem cell types, emphasizing that different stem cell populations interact with materials in fundamentally different ways.

LECTURE 4:00 – 5:00 (PAA) A110
Happy Hour in Benson Hall Lobby Following

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BIOGRAPHY: Chris is a Bioengineering PhD candidate in Prof. Sarah Heilshorn's lab at Stanford University. His work focuses on using biomaterials systems to study cell-matrix interactions and on designing novel protein-engineered materials for cell culture and transplantation. Prior to beginning his PhD at Stanford, Chris graduated from Harvard University with a Bachelor's degree in Biomedical Engineering and Chemistry and a Master's degree in Bioengineering. At Harvard, Chris worked with Prof. David Mooney, designing hydrogel systems to control the delivery and differentiation of mesenchymal stem cells for bone regeneration therapies.