USC University of Southern California

Department of Biomedical Engineering
Systems Cellular-Molecular Bioengineering Distinguished Speaker Series

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Friday, November 18, 2016 2:00 – 3:00 pm

UPC – Denney Research Center (DRB), Room 146
Light refreshments will be served after the seminar

"Feeling Pericellular Mechanical Heterogeneities"

While there is strong evidence for roles of bulk stromal stiffness in cell regulation, roles for the pericellular mechanical microenvironment are less clear, in large part due to the difficulty of measurement. My group implements automated Active Microrheology (aAMR), an optical tweezers technology, to probe extracellular stiffness and map it in the volume surrounding cells. Our aAMR applies sinusoidal optical forces onto microbeads embedded within natural extracellular matrices (ECMs), including those comprised of fibrin and type 1 collagen. As in the case of passive microrheology, aAMR reports the complex material response function of the ECM just surrounding each microbead. Different from passive methods, aAMR is valid for systems not in thermal equilibrium, as is typical for regions of the ECM near to contractile cells. Our aAMR microscope can probe many beads surrounding each cell to map the mechanical landscape, allowing us to seek correlations between local stiffness distributions and cell properties such as contractility, signaling, and differentiation. I will present specific examples for which the distribution of pericellular stiffness correlates with cell phenotype including MT1-MMP deficient primary mesenchymal stem cells and endothelial cell branching morphogenesis. Lastly, I will touch on the implications of the remarkably steep local gradients in stiffness, particularly how it relates to the challenges of testing mechanical hypothesis in 3D hydrogel systems.

Hosted By: Megan McCain