JOHNS HOPKINS
BIOMEDICAL ENGINEERING

BME Seminar Series

Michael Mak, PhD

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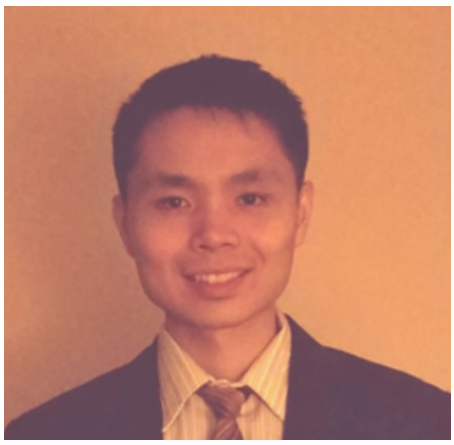
Monday, November 7, 2022
1:00 p.m.
Traylor 709

Faculty host: Scot Kuo



Title: Emergent Mechanobiological States in Cells and Tissues

Abstract: Physical interactions between cells and the extracellular matrix (ECM) are important in tissue homeostasis and in diseases such as cancer and fibrosis. These interactions are governed by cytoskeletal dynamics, ECM mechanical properties, and mechano-signaling and feedback. While there are many well-established patterns and mechanisms associated cell-ECM interactions, including stiffness and topography sensing, our understanding remains incomplete due to the complexity of ECM mechanics and cell biophysics. Notably, the ECM exhibits non-elastic mechanical properties, resulting from the unbinding or reorganization of molecular bonds under applied forces. Cells are dynamic actuators that are programmable by microenvironmental signals. This combination results in complex interactions that extend beyond classically studied elastic substrate deformation and matrix deposition and degradation. In this talk, we will discuss the mechanisms and functional consequences of these interactions in the spatiotemporal evolution of cells and tissues.

Bio: My lab aims to uncover the fundamental mechanics and biophysics underlying emergent mechanobiological phenomena. To achieve this, my lab develops complementary experimental and computational approaches that can probe into the multiscale mechanobiology of cell and cytoskeletal dynamics, cell-matrix interactions, and collective cell behaviors in 3D microenvironments. We develop in vitro and in silico models, devices, and biomaterials. We further perform high resolution imaging experiments and develop automated image analysis tools for quantitative analyses of cell behaviors across multiple scales. We take an integrative, systems level approach investigating both biochemical and biomechanical signaling and feedback that regulate the spatial and temporal evolution of cell, tissue, and microenvironmental states.