Seminar Talk

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3:00 p.m. KH 224

Title: Development of an elastic-stochastic computational model of extracellular matrix assembly and fibrosis.

Abstract:
In this seminar, I will discuss our recent efforts to develop a computational model to understand how cells assemble extracellular matrix (ECM), in particular during a disease state known as fibrosis. The ECM is a mesh of proteins and molecules that surround cells and provide structural support in tissue. Excessive and aberrant assembly of the ECM is a potentially lethal condition known as fibrosis. Fibrosis is seen in nearly all organs and is responsible for organ failure in heart, liver, lung, and kidney disease, and also plays an important role in malignant tumor growth and implanted biomaterial failure. Our model focuses on the assembly of fibronectin, a critical protein that comprises a large component of the ECM. Fibronectin assembly during fibrosis is especially complex, involving the interaction between cell-traction forces stretching individual fibronectin domains, which are highly elastic, and the stochastic binding of pro-fibrotic growth factors to the protein and cell surface. I will present our preliminary simulation results, efforts for experimental validation, and future modeling directions.

Bio:
Dr. Weinberg received the B.S.E. degree in biomedical engineering from Duke University in 2006, and the Ph.D. degree in biomedical engineering from the Johns Hopkins University in 2012. From 2012-2014, he was a postdoctoral research associate for the Biomathematics Initiative at the College of William & Mary, and is currently a Research Assistant Professor at the Virginia, Modeling, Analysis and Simulation Center (VMASC) at ODU. His research is focused on modeling extracellular matrix-cell interactions, cardiac and neural electrophysiology, and calcium signaling.