Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"Mechanical Behavior of Biomedical and Biological Materials: From Breast Cancer Detection to Vascular Embolization"

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Dr. Jingjie Hu is an assistant professor in the department of mechanical and aerospace engineering at NC State. She is also an affiliated faculty in biomedical engineering. Her research focuses on biomaterials and mechanics for translational applications. Hu received her Ph.D. from Princeton University in 2018 and her B.S.E. from the University of Michigan in 2013, both in mechanical engineering. Prior to joining NC State, she completed her postdoctoral training in translational bioengineering at Mayo Clinic. Her work has been recognized by awards including Rising Star in Mechanical Engineering by UC Berkeley and a 3M Adhesion Society Scholarship. Hu has served as the chair for the Gordon Research Seminar (GRS) in Science of Adhesion (2019), and a committee member of Math and Science for Sub-Saharan Africa Program (MS4SSA, an initiative of the World Bank) to promote STEM education in Sub-Saharan region.

ABSTRACT

Biomedical and biological materials are usually complex structures consisting of multiple components. The mechanical interactions between the different components in these structures govern their critical behaviors and performance. However, the underlying mechanics controlling these processes are not fully understood. My research contributes to this understanding by integrating mechanical and materials engineering principles in the design, fabrication and characterization of biomedical related structures for healthcare applications, including cancer detection and vascular embolization. The first part of the talk will present a combined experimental and theoretical study of 1) nanoparticle targeting, and 2) the use of cell mechanics in breast cancer detection. First, the key role of adhesion is presented to provide new insights for the development of targeted nanoparticles for detection of cancer. Combined thermodynamics and kinetics concepts are used to predict nanoparticle entry process. Next, the use of cell mechanics is explored in the development of mechanical biomarkers for the detection of breast cancer outside the body. This involves the shear deformation of single normal/tumor cells that is subjected to the laminar flow in a fluidic chamber, and the use of digital image correlation (DIC) to determine the strain variations within the cells. The second part of the talk will introduce the biohybrid design of a tissue-derived nanocomposite for vascular embolization. A decellularized extracellular matrix-based nanocomposite is developed to provide outstanding mechanical stability, transcatheter injectability, antibacterial properties, and biological activity to prevent recanalization, shown in a porcine survival model of embolization. The implications of these work are then discussed for the design of multifunctional biomedical related materials and devices.

Friday, January 14th
12:00 Noon

Presented Virtually via Webex: https://go.unc.edu/Pq73X