Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"Physicochemical Properties of Extracellular Matrix: Key to function, Clue to mechanism "

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Shyni Varghese, Ph.D., is a Professor of Biomedical Engineering, Mechanical Engineering & Materials Science, and Orthopaedics Surgery at Duke University. She is also the inaugural MEDx investigator at Duke University. Prior to moving to Duke, she was a Professor of Bioengineering at University of California, San Diego. Dr. Varghese's research lies at the interface of biologically inspired materials and stem cells. Dr. Varghese has co-authored over 100 peer-reviewed research articles, covering a wide range of interdisciplinary topics in stem cells, smart biomaterials, biologically-inspired systems, organ-on-chip platforms, and regenerative medicine. Her research activities have also resulted in over 12 patent disclosures. She serves on various scientific bodies, is on the editorial board of a number of journals, and is a consultant to various biotech companies. She is currently serving as an associate editor of Biomaterials Science (an RSC journal).

ABSTRACT

Reciprocal interactions of cells with their microenvironment are fundamental to multiple cellular processes necessary for tissue development, homeostasis, and regeneration. It is becoming increasingly apparent that while the extracellular environment normally maintains tissue homeostasis, but when negatively perturbed, it may also contribute to disease progression and age-dependent pathologies. In this talk, I will discuss our efforts to delineate the role of the ECM on various cellular responses relevant to tissue regeneration and disease progression. First, I will briefly talk about our efforts to create synthetic analogs of the ECM to direct stem cell commitment in vitro and in vivo and employ such engineered matrices as a platform to understand the molecular mechanism underlying stem cell differentiation (Shih et al., PNAS 111: 990, 2014; 114: 5419 2017; Kang H et al., Biomacromolecules 16: 1050, 2015). I will next talk about our recent efforts in understanding the role of extracellular matrix on cancer metastasis and fibrosis. Our findings show that the cells transition from a proteolytic-independent mode of invasion to a proteolytic-dependent mode upon an increase in the mechanical resistance from the extracellular environment (Aung A et al., Biophys. J 107:2528, 2014). By employing a cutaneous fibrosis model, we unraveled the role of elastic fibers and their components, which lie at the interface of tissue stiffness and inflammation, on fibrosis progression (Nakasaki M et al., Nature Communications 6: 8574, 2015). Surprisingly, interfering with the ECM organization to alter the elastin content and tissue stiffness to levels comparable to normal skin diminished the inflammatory response and abrogated the fibrotic phenotype. I will end by briefly introducing our efforts to develop vascularized tissue and healthy and disease tissue models in vitro as technological platforms to study basic concepts and screen and small molecules.

Friday, August 21st
12:00 Noon

Seminar will be presented virtually via Zoom:
https://go.unc.edu/f3QHx