



DREXEL UNIVERSITY

Materials Science
and Engineering
College of Engineering

Spring Seminar Series

3D Printing Multifunctional Materials with Spatially Organized Properties

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PISB 104

Biological tissues can be viewed as complex composite materials where the spatial arrangement of multiple extracellular matrix (ECM) components is intimately linked to the tissue's function in the body. Disrupting this organization affects normal tissue function and properties, even if the overall composition remains the same. For example, the osteochondral interface between bone and cartilage contains biochemical, structural, and mechanical gradients that are critical for load transfer and joint movement. Current techniques to repair this tissue typically result in poorly organized tissues that fail to restore normal biomechanical function. Inspired by native tissues, the Chow Lab focuses on developing strategies to combine and organize multiple bioactive components within a continuous biomaterial. Our overarching goal is to fabricate scaffolds that guide heterogeneous tissue formation and organization, leading to engineered constructs with properties that more closely match their native counterparts. To achieve this, we developed a versatile platform where end-functionalized polymer conjugates are 3D printed into user-defined patterns. The conjugate's functional groups (i.e., peptides, bioorthogonal chemistries) become displayed on the surface during fabrication to generate functionalized scaffolds in a single step. Multiple chemistries can therefore be spatially organized within a continuous material by using different conjugates and multiple printer heads. In parallel, scaffold architecture can be independently and simultaneously controlled by changing the print pattern. This seminar will describe our platform and discuss how we are using this modular strategy to fabricate multifunctional materials to regenerate the osteochondral interface.

Dr. Lesley Chow is an Assistant Professor jointly appointed in the Departments of Materials Science and Engineering and Bioengineering at Lehigh University and was recently appointed to the Harold Chambers Junior Professorship in 2019. Lesley joined Lehigh following her postdoctoral training with Dr. Molly Stevens at Imperial College London in the Departments of Materials and Bioengineering. She received her B.S. in Materials Science and Engineering from the University of Florida and her Ph.D. in Materials Science and Engineering from Northwestern University in the laboratory of Dr. Samuel Stupp. Her research interests center around creating biomaterials for tissue engineering and regenerative medicine applications. At Lehigh, Dr. Chow leads the Modular Biomaterials Laboratory, which focuses on the design and synthesis of functional building blocks to fabricate biomaterials with spatially organized biochemical and physical properties to resemble native tissues. These materials serve as platforms to deepen understanding about how tissue organization affects cell and tissue function across scales and to improve clinical translation of biomaterials. Her laboratory is currently focused on musculoskeletal tissue engineering and is supported by the Foundation for Orthopedic Trauma, PA Department of Health, PA Department of Community and Economic Development, and a gift donation through St. Luke's University Health Network.