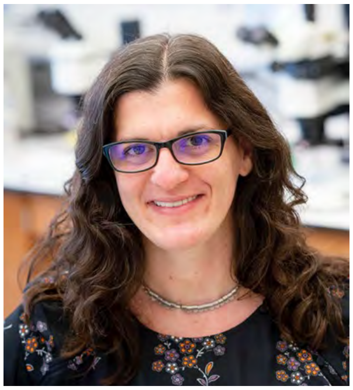
PennState College of Engineering | BIOMEDICAL ENGINEERING

Seminar Series

Mapping the material properties of the extracellular matrix during development

September 9 • 12:05–1:20 p.m.



Dr. Sarah Calve

Associate Professor of Mechanical Engineering

University of Colorado

Zoom link:
bit.ly/3wUiXYu

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294076

ABSTRACT

Despite decades of work, there has been little success in engineering scaffolds that can successfully restore functionality to damaged musculoskeletal tissues. What is rarely taken into consideration in scaffold design is that tissues undergo extensive extracellular matrix (ECM) remodeling during development, which is thought to play a significant role in directing cellular behavior in the formation of functional tissue. Researchers have been unable to capitalize on these instructive cues due to the limited knowledge regarding the material properties of developing musculoskeletal tissues. In this talk, Dr. Calve will describe how her laboratory has been addressing this gap by developing tools that can measure the composition, turnover, organization, and mechanical properties of the ECM in embryonic tissues. Dr. Calve's lab is combining mass spectrometry and bioorthogonal labeling strategies to identify newly synthesized ECM proteins in the developing mouse. To determine the organization of these components, the researchers are using confocal microscopy and novel decellularization and clearing protocols to visualize the 3D architecture of ECM networks in the developing limb. In addition, Dr. Calve and her team created new atomic force microscopy-based and uniaxial tensile testing methods to measure how these changes in composition and organization influence the mechanical properties of tissues and ECM networks at the mesoscale. Dr. Calve will conclude by describing how these techniques can resolve differences in material properties as a function of development and disease using a mouse model of Schwartz-Jampel syndrome in which knockdown of the ECM proteoglycan perlecan leads to musculoskeletal defects.

BIO

Dr. Calve received her bachelor of science in materials science and engineering from Cornell University, her master of science in molecular, cellular and developmental biology, and her doctorate in macromolecular science and engineering from the University of Michigan. Her doctoral research focused on the design and mechanical characterization of self-assembling constructs for musculoskeletal repair, under the guidance of Dr. Ellen Arruda. As a postdoctoral fellow at Northwestern University's Children's Memorial Hospital, Dr. Calve investigated the role of extracellular matrix remodeling during newt limb regeneration. Dr. Calve joined the Weldon School of Biomedical Engineering at Purdue University as an assistant professor in 2012. Her research group, the Musculoskeletal Extracellular Matrix Laboratory, is actively developing tools to quantify how the composition, turnover, organization, and mechanical properties of the musculoskeletal system change during scar-free tissue assembly. The goal is to use these tools to elucidate how different components integrate to form functional tissues during normal development and identify parameters that will guide the design of regenerative therapies. In 2017, she became the first Purdue professor to receive the NIH Director's New Innovator Award. Additional recognitions include the Rising Star Junior Faculty Award from the Biomedical Engineering Society's Cellular and Molecular Bioengineering Special Interest Group (2018), inclusion in the National Academy of Engineering, Japan–America Frontiers of Engineering Symposium (2018), selection as a Cellular and Molecular Bioengineering "Young Innovator" (2019) and being named the Leslie S. Geddes Assistant Professor of Biomedical Engineering at Purdue (2019). Dr. Calve joined the University of Colorado as an associate professor of mechanical engineering in January 2020.