NJIT

Department of Biomedical Engineering

Graduate Seminar

February 25th (Friday)
11:30 am-1:00 pm
WebEx (Click here)

Dr. Valerie Tutwiler, PhD.
Assistant Professor
Department of Biomedical Engineering
Rutgers – The State University of New Jersey.

Biomechanics of Blood Clots

Abstract

The dysregulation of blood clotting results in the leading causes of death in those under the age of 45 (bleeding following injury) and in the world (thrombotic conditions such as heart attacks and strokes). Fibrin is an extracellular matrix protein and a major component of blood clots that form at the sites of injury to stop bleeding (hemostasis) and of pathological thrombi that form inside vessels and block the blood flow (thrombosis). We characterize how the biochemical, mechanical, and structural components of blood clotting mechanistically underly the dysregulation of coagulation with the long-term goal of informing novel treatment and diagnostics. Fibrin's mechanical properties underlie blood clot behavior in the highly dynamic intra- and extravascular environment. It is critically important that the fibrin network is mechanically tough and resistant to rupture, as it must be able to prevent bleeding while withstanding forces of blood flow, dynamic pressure of extravascular muscle contractions, pulsations of blood vessel walls, and tensile forces generated by the contracting platelets. We take a multidisciplinary approach, combining experiments and mathematical modeling, to examine how the structure of the fibrin network influences both the viscoelastic and fracture mechanics of fibrin blood clots with respect to bleeding following traumatic injury or breaking apart of a thrombus. Mechanical testing is coupled with studies to characterize clot structure, clot formation, and enzymatic degradation. Gaining a deeper understanding of fibrin structural and mechanical integrity is fundamentally important to understanding the pathogenesis of bleeding and thrombosis.

About the Speaker

Valerie Tutwiler is an Assistant Professor in the Department of Biomedical Engineering at Rutgers University, where her lab students the structure and mechanics of blood clots. Dr. Tutwiler received her B.S. and M.S. in Biomedical Engineering from Drexel University in 2013. She conducted her M.S. research on developing a microfluidic model of heparin induced thrombocytopenia at the Children's Hospital of Philadelphia. Dr. Tutwiler conducted her Ph.D research between Drexel University and the University of Pennsylvania on the kinetics and mechanics of contracting blood clots. After completing her Ph.D in 2017 she completed her postdoctoral work in Cell and Developmental Biology at the University of Pennsylvania where she studied the structure and mechanics of blood clots as a NIH NHLBI K99/R00 Postdoctoral Fellow. Her work has been funded by the National Institutes of Health, American Heart Association, and American Society of Hematology.