Department of
Biomedical Engineering
UNIVERSITY OF WISCONSIN-MADISON

Spring 2018 Seminar Series

Cardiovascular Soft Tissues in Time & Space

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Cardiovascular soft tissues serve critical mechanical functions within the body, but pathologic changes to these tissues alter their material properties causing disruption or reduction in function. This loss can be sudden, such as the rupture of a myocardial infarct or aortic aneurysm; or it can be gradual, such as ventricular hypertrophy and heart failure or aneurysm dilation. Computational models have been employed to aid in the design of cardiovascular devices, but--until recently--they have lacked predictive capacity. Predictions of long-term respones to interventions could only be assessed through expensive chronic animal and clinical trials and predictions of sudden failure events could only be achieved when a failure initiation region was pre-defined.

In this talk, I will share strategies for predicting the temporal and spatial characteristics of cardiovascular soft tissues. First, I will discuss my work on computational models to predict ventricular hypertrophy under overload conditions such as mitral regurgitation, aortic stenosis, and myocardial infarction. The result were fast, clinically applicable models of ventricular thickening and dilation. Second, I will discuss experimental testing and analysis techniques for determining the heterogeneous properties of soft tissues. I developed computational tools to identify regions with locally similar behavior within an intact whole tissue specimen as well as an inverse method that determines each region's anisotropic, nonlinear material properties. Finally, I will share how I plan to use these techniques and models to make patient specific predictions for those with congenital heart disease and aortic disease.

ABOUT the SPEAKER

Dr. Colleen Witzenburg is currently a postdoctoral research fellow in Prof. Jeffrey Holmes' group in the Biomedical Engineering Department at the University of Virginia.

She received her M.S. and Ph.D. in Mechanical Engineering at the University of Minnesota in 2011 and 2014, respectively, carrying out her thesis work with Prof. Victor Barocas. She earned her B.S. in Mechanical Engineering from Iowa State University in 2009.

Dr. Witzenburg has received postdoctoral fellowships from both the American Heart Association and the Hartwell Foundation.

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