

Cardiovascular and Soft Tissue Multiscale Biomechanics and Diagnosis

By Danial Shahmirzadi

Ultrasound & Elasticity Imaging Lab
Department of Biomedical Engineering
Columbia University, NY

ABSTRACT

Cardiovascular disease and cancer are among the leading causes of morbidity and mortality in the United States and worldwide. Underlying mechanisms of disease onset and progression have been shown to involve intimately-linked phenomena spanning across organ, tissue, cellular, and molecular scales. Accurate descriptions of mechanical and structural transformations in tissues under pathological conditions can only be obtained by developing comprehensive, multiscale models of soft tissue biomechanics. Such multiscale biomechanical models would highly benefit bioengineers and clinicians in enhancing the performance of synthetic tissue-mimicking substitutes and the reliability of early diagnosis and therapeutic methods. A critical gap in our understanding of the bridge between the biomechanics at micro- and macro-scales persists and warrants further interdisciplinary works. Drawing upon a wide range of studies including multiscale simulations of aortic calcification and aneurysm, histology-based characterization of aortic microscale deformation, microscale AFM and macroscale tensile mechanical testing of healthy and diseased aortas, ultrasound imaging of aneurysm experimental phantoms, healthy and diseased animal models *in vivo* and *in vitro*, and patient data, as well as preliminary results on examining liver and pancreas tissue mechanical properties for cancer diagnosis and treatment, this talk aims to present aspects of cardiovascular and soft tissue biomechanics that could be used to quantify the disease progress and to identify reliable diagnosis biomarkers. Furthermore, future directions to establish data-driven, non-invasive, multifaceted platforms for enriched models of disease development that could be readily used by physicians will be laid out.

BIOGRAPHY

Dr. Shahmirzadi obtained his Mechanical Engineering degrees from the University of Tehran (BSc, 2002), Texas A&M University (MSc, 2005), and the University of Maryland, College Park (PhD, 2010). He was a visiting researcher at the University of California--Berkeley, 2008--2010, before joining Columbia University to hold his current appointment as a postdoctoral research scientist. His research interests are broadly multiscale characterization of cardiovascular and soft tissue biomechanics; soft tissue engineering; predictive modeling of pathological conditions; and image-guided, real-time and noninvasive diagnosis and intervention. Dr. Shahmirzadi is the author/co-author of more than 15 peer-reviewed journal articles, two review articles, one book chapter, and 35 conference proceedings and abstracts, as well as the recipient of several awards including the AG Wylie dissertation fellowship and the Future Faculty fellowship from the University of Maryland.

EVENT DETAILS

DATE:

Wednesday, April 17, 2013

TIME:

1:00 PM

LOCATION:

Carnegie, Room 315
Stevens Institute of Technology

ATTENDANCE:

This event is open to Stevens'
Faculty, Students, Staff, and
Invited Guests