Department of Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON

Spring 2022 Seminar Series

Scale Wars: Leveraging Multiscale Blood Flow Modeling for Cardiovascular Disease Therapy

Venkat Keshav Chivukula, PhD
Assistant Professor, Department of Biomedical Engineering
Florida Institute of Technology

Corrine Bahr Memorial Lecture

Increasing prevalence of cardiovascular disease worldwide has led to growing dependence on medical device therapies such as ventricular assist devices, mechanical heart valves and other blood-contacting devices. However, the success of a medical device can be severely hindered by complications such as emboli formation/thrombosis leading to device failure and other devastating events such as stroke and myocardial infarction. Thrombus formation results from both response to foreign materials, as well as non-physiological blood flow introduced by these devices. Elucidating the complex interplay between hemodynamic stimuli and biological response is essential for mitigating these issues and for improving biocompatibility of medical device therapy. Blood as a fluid is truly unique, comprising of red blood cells, white blood cells and platelets suspended in plasma. Thus, the diverse and complex behavior of blood as a particle-laden fluid operating under various spatio-temporal interdependencies presents a fascinating and challenging problem to analyze. In this seminar, I will describe some of the approaches that we utilize at various scales (micro, meso and macro) to investigate the hemodynamics of surgical optimization and designing patient management strategies for cardiovascular disease therapy. Specifically, I will focus on clinically-relevant applications such as thrombosis and heart failure therapies (ventricular assist devices). I will describe the ongoing projects in my lab to incorporate virtual surgery, hemodynamic optimization and multi-scale approaches into predictive hemodynamic modeling to understand, detect, diagnose and treat cardiovascular disease.

ABOUT the SPEAKER

I am an Assistant Professor in BME and the PI of the Multiscale Cardiovascular Fluids Laboratory at Florida Institute of Technology. The human body, and the cardiovascular system specifically, is fascinating, and forms the focal point of my research. I have a background in mechanical engineering, with a PhD in biomedical engineering. I obtained my BE in Mechanical Engineering from the University of Mumbai, India, MS in Mechanical Engineering from the University of Arizona and PhD in Biomedical Engineering from the University of Iowa. I was a post-doctoral researcher at the Oregon Health and Science University and the University of Washington, where I was awarded an American Heart Association (AHA) postdoctoral fellowship and the Young Investigator Fellowship by the American Society of Artificial Internal Organs (ASAIO) for my research on heart failure. Following that, I was a Lecturer in Biomedical Engineering at the University of North Texas near Dallas for a year, where I was awarded the Outstanding Teaching Faculty Award in 2020. I was recently awarded the AHA Career Development Award in March 2022 to pursue new avenues in improving heart failure therapy. I love to teach and enjoy empowering students in the fantastically intriguing (and of course, complex!) realm of engineering. Additionally, I enjoy doing K-12 outreach by spreading the power of knowledge (especially in STEM fields) to the youth of today.

Monday, April 25 at noon
1003 Engineering Centers (Tong Auditorium)