FIU Engineering & Computing
Biomedical Engineering

Wallace H. Coulter Foundation
Biomedical Engineering Seminar Series

MICHAEL SACKS, PHD is a world authority on cardiovascular modeling and simulation, particularly on developing patient-specific, simulation-based approaches for the understanding and treatment of heart and heart valve diseases. His research is based on multi-scale modeling, quantification, and simulation of the biophysical behavior of the constituent cells and tissues and translation to the organ level in health, disease, and treatment. For example, he has developed novel non-invasive methods to quantify pre- and post-surgical state of the mitral valve from pre-surgical clinical images.

He has determined the how local stress environments of heart valve interstitial cells alter their biosynthetic responses in the context of altered heart and valvular organ-level responses. His research also includes developing novel cardiac models to simulate growth and remodeling of the myocardium in pulmonary hypertension, the first full 3D approach for left ventricular myocardium mechanical behavior. Dr. Sacks is also active in modeling replacement heart valve materials and in understanding the in-vivo remodeling processes.

DR. MICHAEL SACKS

Professor of Biomedical Engineering
The University of Texas at Austin

THE MITRAL VALVE FROM CELLULAR BIOPHYSICS TO SURGICAL REPAIR

ABSTRACT: Heart valves regulate the unidirectional blood flow and normal functioning of the heart. Currently, repair and replacement of the mitral valve is the most common heart valve treatment in the United States. While successful in the short term, there remains major issues with long-term treatment outcomes, largely due to the limitations in our understanding of mitral valve disease and means to develop improved treatment modalities. High-fidelity computer simulations provide a means to connect the cellular function with the organ-level valve via tissue mechanical responses, and to help the design of optimal repair strategies and novel biomaterials. As in many physiological systems, one can approach heart valve biomechanics from using multiscale modeling (MSM) methodologies, since mechanical stimuli occur and have biological impact at the organ, tissue, and cellular levels. Yet, MSM approaches of heart valves are scarce, largely due to the major difficulties in adapting conventional methods. Moreover, existing physiologically realistic computational models of heart valve function make many assumptions, such as a simplified micro-structural and anatomical representation of the valves, and thorough validations with in-vitro or in-vivo data are still limited. Finally, few attempts have been made to connect the underlying cellular function with changes in tissue and organ level stresses, which are paramount to improving our understanding of the effects of mitral valve repair on the underlying tissue degenerative processes. Details of what we know about mitral heart valve function and how these are being integrated into left-ventricle models can guide such approaches will be presented.

FRIDAY, FEBRUARY 12 / 9:00 AM / VIA ZOOM

▸ Zoom Registration https://bme.fiu.edu/seminars

Wallace H. Coulter Foundation

Through the generous support of the Wallace H. Coulter Foundation the Department of Biomedical Engineering facilitates weekly lectures each year during academic terms. Experts in all areas of Biomedical Engineering are invited to campus to provide a research seminar and to meet with faculty and students and to tour our academic and research facilities.

Friday, February 12, 2021
9:00 AM-10:00 AM | https://bme.fiu.edu/seminars