FIU Biomedical Engineering
FLORIDA INTERNATIONAL UNIVERSITY

Dr. Joshua Hutcheson

About Dr. Hutcheson

Dr. Hutcheson is excited to join the Department of Biomedical Engineering at Florida International University! He most recently worked as a research fellow at Brigham and Women's Hospital and Harvard Medical School within the Center for Interdisciplinary Cardiovascular Sciences. In this position, Dr. Hutcheson developed molecular imaging techniques and materials-based analyses to visualize the earliest events involved in the formation of vascular calcification—a leading cause of heart attacks. This work received recognition from the American Heart Association and was recently published in *Nature Materials* and the *Journal of Clinical Investigation*. Dr. Hutcheson received his Ph.D. in Biomedical Engineering from Vanderbilt University, where he studied molecular and biomechanical mechanisms of aortic valve disease. This work was published in *Arteriosclerosis, Thrombosis, and Vascular Biology* and the *Journal of Molecular and Cellular Cardiology*, and Dr. Hutcheson was invited to provide an expert review on the mechanisms of aortic valve disease in *Nature Reviews Cardiology*. Prior to his graduate and postdoctoral research in cardiovascular disease mechanisms, Dr. Hutcheson received his B.S. and M.S. in Chemical and Biomolecular Engineering from the Georgia Institute of Technology. Dr. Hutcheson is passionate about teaching and researching the mechanisms of cardiovascular tissue maintenance and remodeling.

About Research in the Hutcheson Lab

Our work will focus on the mechanisms through which tissues are built and maintained and the pathological changes that lead to disease. The work will primarily focus on cardiovascular diseases—the leading cause of death in Western societies. Our research will combine advanced imaging, materials science, biomechanics, and molecular biology to connect cellular processes to tissue function. By understanding the ways that cells sense and respond to each other and to changes in the extracellular environment, we can develop new ways to detect initiators of disease and interventions that restore tissue to a normal state. Accomplishing these goals requires an interdisciplinary effort, and researchers in the Hutcheson Lab will work at the interface between bioengineering and molecular biology. Researchers will also regularly interact with the Heart Valve Translational Research Program at Brigham and Women's Hospital and Harvard Medical School. To find out more about Dr. Hutcheson, work in the Hutcheson Lab, and previous publications, please visit http://joshdhutch.wix.com/hutchesonlab.

Specific Research Areas of Interest

Inflammation resolution and cardiovascular remodeling: Inflammation-driven fibrosis and calcification in cardiovascular tissues is a leading cause of death. Anti-inflammatory treatments have proven ineffective at preventing this remodeling. We will explore natural inflammation resolution therapies that promote homeostasis and tissue regeneration. This could lead to a clinical treatment for this currently untreatable condition. The research will involve development of co-culture platforms to study interactions between inflammatory cells and resident cardiovascular cells that maintain tissue structure. We will study the mechanisms by which these cells communicate and the resultant changes in cellular phenotypes. We will also use animal models of cardiovascular calcification to explore the clinical benefit of inflammation resolution.

Exploring biomineralization in the bone-vascular axis: Biomineralization is an important part of bone physiology but is detrimental to the function of cardiovascular tissues. Any viable therapy for cardiovascular calcification or osteoporosis must affect one tissue without off-target effects in the other. We will use advanced imaging and material-based analyses to identify overlapping and divergent mechanisms in these processes. This work will involve cell culture models of bone and cardiovascular mineralization, optical and electron microscopy, Raman spectroscopy, and mass spectrometry.

Unraveling cellular contributions to aortic valve disease: The aortic valve has poorly defined cell populations. The cellular complexity arises from different embryonic origins. We will study the interactions between the different cell populations in the aortic valve to discover new therapies for aortic valve disease and to design tissue engineered valve replacements. To do this, we will design new *in vitro* models to study the interactions between different valve cell populations. A large portion of this study will be completed with collaborators at the Biomolecular Sciences Institute to study the role of a specific population of cells—neural crest-derived melanocytes—in the maintenance of aortic valve tissue and the development of valve disease in mice.

Cytoskeletal alterations and extracellular matrix remodeling: Extracellular matrix components that compose tissues are released from cells in a controlled manner that involves trafficking of small vesicles. The local mechanical environment of the cell influences the cell cytoskeleton and the release of extracellular matrix. We will study how cytoskeletal changes alter trafficking of intracellular vesicles and release of extracellular matrix components. This study will involve advanced optical imaging and molecular biology techniques to assay changes in intracellular trafficking. Outcomes of this study could lead to treatments for fibrotic remodeling of soft tissues and more rational designs for engineered tissue replacements.