CARDIOVASCULAR AND CARDIOLOGY RESEARCH

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Heart disease is the leading cause of death in the United States with about 600,000 related deaths every year. Many of the research labs at the Georgia Institute of Technology are conducting experiments specifically dealing with the heart and blood vessels of the human body, as well as understanding the mechanisms of blood circulation. The opportunity to untangle the puzzles of cardiology inspires many at Georgia Tech, including the labs of Dr. Robert Taylor and Dr. Don Giddens.

Dr. Robert Taylor is a professor in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University as well as a cardiologist. His research focuses on vascular inflammation in the pathogenesis of vascular diseases, specifically hypertension, diabetes, and atherosclerosis. The research involves strong collaborative efforts with other members of the Coulter Department who have a focus on applying nanotechnology and imaging approaches to the general area of atherosclerosis. His work employs novel animal models of human vascular disease to study the role of various mechanical and humoral factors in the development of hypertension and atherosclerosis. He has a particular interest in the renin angiotensin system, advanced glycation endproducts, biomechanical forces, and oxidative stress. His research also examines the interaction between vascular inflammation and bone marrow-derived endothelial progenitor cells. This research employs many areas of engineering and science including imagining technology, regenerative therapy, cell biology, etc.

Dr. Don Giddens, Dean Emeritus of the Coulter Department, is also involved in cardiovascular research. His lab's objective is to develop techniques to quantify the fluid mechanical environment to better understand the development and progression of numerous cardiovascular pathologies, as well as develop optimal treatment strategies. The research team actively collaborates with vascular biologists, vascular surgeons, and interventional cardiology in order to better understand the limitations in their current diagnostic, prognostic, and treatment strategies as well as how engineering principles can be applied to improve patient care. The research team focuses on discovering the mechanical environment in systems ranging from the single cell up to human coronary vasculature. Possible applications for this research include the development of robust methods that can be implemented clinically to better understand and treat atherosclerosis as well as other cardiovascular diseases. This research is useful to understand how the blood flow environment can predispose a region of the vascular system for atherosclerosis development or lead to failure of medical devices. For example, in collaboration with interventional cardiologist at Emory University, the researchers investigated the rapid progression of coronary artery disease. Clinically, this is important as patients can be asymptomatic but, due to rapid disease progression, have a potentially fatal heart attack without warning. The research team utilizes various clinical imaging techniques to reconstruct a patient's coronary vascular system and employ advanced computational methods to model their hemodynamic environment. The clinical studies follow patients over periods of six months and one year, which allows quantification in coronary artery disease progression and relate it to blood flow induced mechanical forces. The research lab is also involved in research projects on modeling the transport of nanoparticles to treat atherosclerosis, microfluidics in microelectromechanical systems (MEMS), and vascular disease development in heart transplant patients.

For BME students interested in such research topics, possible applicable courses are all (bio)mechanics courses offered in the BME department. The most applicable include BMED 3300 (Biotransport) and BMED 4757 (Biofluid Mechanics). Courses covering human physiology and anatomy, such as BMED 3100 (Systems Physiology) are also advantageous.

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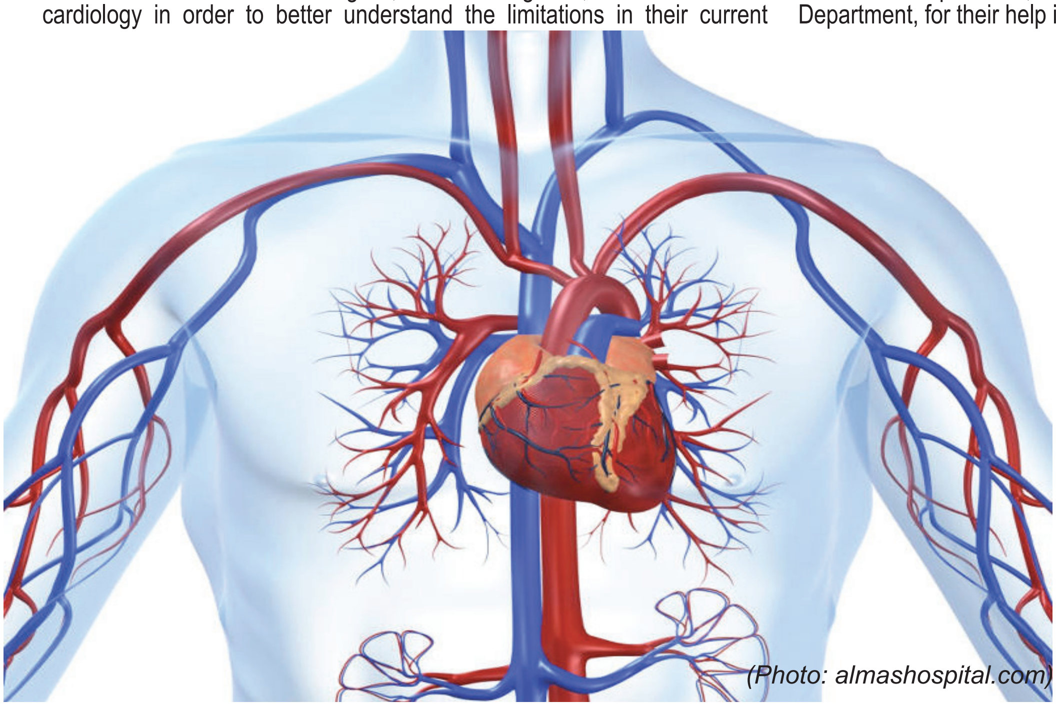

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