Title of Program:  Translational Studies in Heart Failure Gene Therapy

Dept/Center/Lab:  Department of Thoracic and Cardiovascular Surgery, Sanger Heart and Vascular Institute, Cannon Research Center, Molecular Cardiac Surgery Research Lab, Carolinas Medical Center

Principal Mentor:  Charles R. Bridges, MD, ScD  
Chairman, Department of Thoracic and Cardiovascular Surgery, Carolinas Medical Center

Other Faculty:  Michael G. Katz, MD, PhD  
Senior Research Scientist  
Cannon Research Center, Carolinas Medical Center

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Research Scientist  
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Research Associate

Summary Description:  
Our laboratory specializes in a novel technology of gene delivery that utilizes cardiopulmonary bypass with complete cardiac isolation in vivo. This procedure allows for the optimization of myocyte gene transfer efficiency while minimizing the probability of collateral organ gene expression. Our research project includes (1) surgical creation of myocardial infarction in ovine and rodent models that closely mimics human ischemic heart failure; (2) assessment of cardiac mechanics and myocardial energetics using magnetic resonance imaging, echocardiography, and invasive hemodynamic procedures; and (3) gene delivery during open heart surgery with cardioplegic arrest as well as gene delivery through thoracotomy rats using different delivery techniques, different vectors, and different therapeutic genes. The goal of our study is to create genetic strategies to reverse developing heart failure.

Expectations and Role of Student:  
Students interested in cardiac surgery, cardiology, and gene therapy are preferred. The student is expected to learn the surgical anatomy of the heart including coronary artery anatomy and surrounding structures; pathophysiology of heart failure development after creation of different experimental myocardial infarctions; principles of cardiopulmonary bypass; the use of echocardiography and MRI in the assessment of heart function after infarct and gene therapy; and the basics of gene therapy in animals and humans. In addition, we try to teach students basic surgical skills such as instrument handling, suture techniques, surgical approaches to the heart, etc. The student will also spend time with the Principal Mentor in the clinical department to understand the main methods of surgical treatment of patients with cardiovascular diseases. The student is expected to become a contributing member of the research team while investigating molecular changes in myocytes post gene transfection. The student will present oral and written summaries of research and will be required to prepare and present an abstract and paper summarizing findings.