Cardiac Anesthesia Research Lab

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Research Projects

Cardiac Conduction

We have engineered tissue to create an electrical conduit in the heart for use in patients with complete heart block. Ultimately, our laboratory hopes to provide a realistic, alternative to cardiac pacemaker therapy.

Adult Stem Cells

We are developing methods to expand and differentiate adult stem cells to determine their potential to treat several serious cardiac disorders. These studies are designed to provide new therapies for heart disease.

Myocardial Infarction

This project is intended to provide a new treatment for people that have survived a heart attack. We are injecting cellular components into the heart to limit damage from ischemia and to preserve cardiac function.

Collaborators

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Funding

We are currently funded by the National Institutes of Health, David Pullman at the Pullman Group, the Ryan Family Endowment and from generous donations to the Cardiac Conduction Fund.

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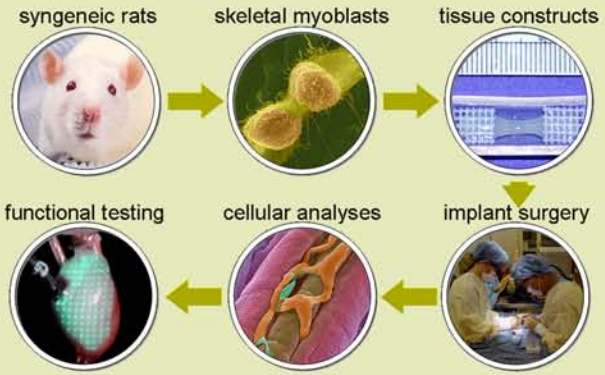
Cardiac Conduction

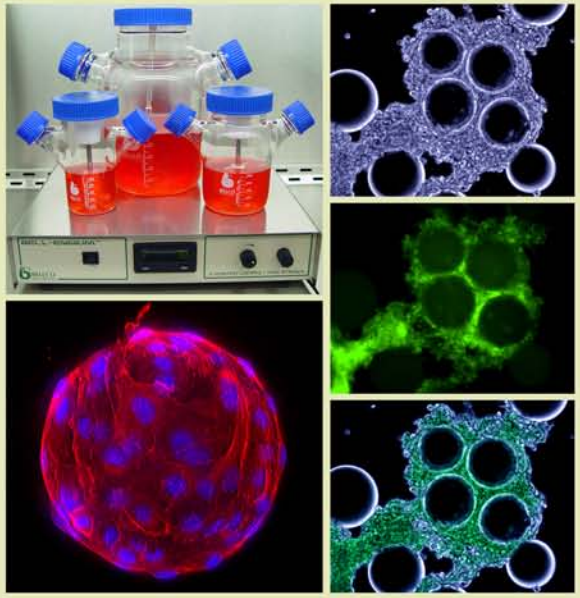
For this project, our goal is to provide an alternative or adjunct treatment to pacemaker device implantation in patients with complete heart block. So far, we have developed engineered tissues that electrically connect the upper and lower chambers of the heart in laboratory rats using the following experimental strategy:



We are now improving this technology by screening for cells that replicate the electrical properties of human hearts. We have also begun to perform studies in a large animal model of pediatric complete heart block to simulate the clinical situation in affected children. Eventually, we anticipate that these constructs will be made from the patient's own cells and will allow for permanent and sequential spread of electrical impulses through the heart.

Adult Stem Cells

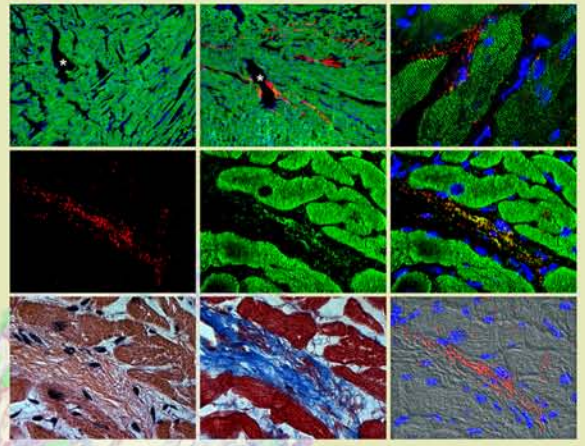
Identification of reliable cell culture methods to grow and differentiate adult stem cells remains an important obstacle in developing regenerative therapies for human diseases.
The goal of this project is to develop reproducible techniques to expand and control the fate of adult stem cells to better determine their regenerative potential for treating several serious cardiac disorders and diseases.



We have designed a 3-D bioreactor to grow stem cells from several tissues. Our studies are currently focused on controlling their differentiation.

Myocardial Infarction

In collaboration with researchers at Beth Israel Deaconess Medical Center, we have pioneered the use of cellular components called mitochondria to salvage cardiac muscle in patients that have suffered a heart attack.



By injecting hearts with these organelles after re-establishing blood flow to the infarct, we can minimize injury and improve cardiac function. The images above demonstrate that injected autologous mitochondria (fluorescently stained red) spread through the wall of the heart (stained green) and remain viable outside of the cardiac cells for several hours. This innovative new therapy may significantly improve the clinical outcome for millions of Americans.