CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
S1015

Project Title
Bioartificial Heart Tissue: An Electroactive Polymer for Cardiac Patches

Abstract

Objectives/Goals
Tissue engineering seeks to replace heart infarcts with functional engineered heart tissue. The project aimed to study the effects of mechanical and electrical stimulation for engineering cardiac patches. The project investigated further the effectiveness of a polymer and scaffold for cardiac tissue engineering.

Methods/Materials
Electrospinning of polyurethane (PU) created an elastic scaffold. An electroactive polymer was developed to provide stimulation. Eleven trials of 30 samples of human foreskin fibroblasts (HFF) and neonatal rat cardiomyocytes were cultured. Immunofluorescence and scanning electron microscopy (SEM) were used to collect images.

Results
The design of the polymer is novel but unstable. Morphology and directional orientation of the layers of cells indicate proper cell signaling. The properties of PU are unique to the needs of cardiomyocytes because the fibers participate in contraction with the cells, instead of inhibiting it.

Conclusions/Discussion
The effects of electrical and mechanical stimulation on cardiomyocytes using an electroactive polymer could not be studied. However, a greater discovery was made in the second part of the project objective - the application of PU as a scaffold. Electrospinning brought out novel advantages to using PU in engineering cardiac patches.

Summary Statement
An electroactive polymer and electrospun polyurethane scaffold were developed to engineer cardiac patches using neonatal rat cardiomyocytes.

Help Received
Used the lab facilities at the University of California, Los Angeles, under the mentorship of Dr. Ben Wu