# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**

Karis R. Tang-Quan

**Project Number**

**S1011**

**Project Title**

## Bioartificial Engineered Heart Tissue: in vitro Construction of Contractile Cardiomyocytes for Tissue Replacement Therap

**Abstract**

**Objectives/Goals**

Engineered heart tissue (EHT) is needed in tissue replacement therapy for infarcts, which form in the heart and do not contract with the rest of the organ. The objective was to tissue engineer spontaneously beating heart tissue from neonatal rat cardiomyocytes. This study aimed to refine the technique and shorten the process of creating contractile constructs from 14 days to 7 days. EHT was created to be biologically and functionally similar to heart tissue. Immunohistochemistry, gene expression, and protein production were studied to verify that the constructs were biologically similar to heart tissue. The spontaneous contractions were an indicator as to whether the tissue functioned like heart tissue.

**Methods/Materials**

Gel rings were made from neonatal rat cardiomyocytes cultured in a reconstitution mixture. Rings were taken off the molds and observed to determine if they would spontaneously contract. Rings were studied by means of (1) immunohistochemistry, (2) Agarose gel electrophoresis for gene expression, and (3) Western blot for protein production.

**Results**

Six rings were successfully created, beating spontaneously with the familiar "lub-dub" contractions of a functioning heart. A video of the beating engineered heart tissue constructed in vitro was recorded. Contractile-related genes and proteins were found in the beating rings; immunohistochemistry showed presence of nuclei and actin filaments. Early trials produced rings with contractile properties, but no beating action, requiring a refining of the engineering process.

**Conclusions/Discussion**

This study on heart tissue engineering provides a foundation for generating working heart muscle in a lab. Short culture times are feasible for developing EHT that is biologically and functionally similar to the heart. Cardiomyocyte-specific RNA and protein were confirmed to have been produced in the cardiomyocyte constructs. The spontaneously beating rings showed that the constructs could perform heart tissue functions. EHT can be used for in vivo implantations as a tissue replacement therapy.

**Summary Statement**

Contractile heart tissue was engineered in vitro using neonatal rat cardiomyocytes, providing a basis for organ tissue implantation in the future.

**Help Received**

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