

# **Stony Brook University The Graduate School**

Doctoral Defense Announcement

## **Abstract**

Development of a Novel Bioassay Chamber to Optimize Autologous Endothelial Cell Viability and Density on Topological and Topographical Substrates

By

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Tissue engineering is an interdisciplinary field which focuses on scaffold design to aid in tissue replacement. One major difficulty involves the lack of vasculature within these scaffolds. This leads to replacement failure. Our lab uses the microvascular tissue engineering approach to fabricate a scaffold that directs endothelial cell (EC) migration to eventually form planar capillary networks. *In vivo*, a combination of topological, mechanical and chemical cues plays a role in EC migration. Here, scaffold composition, surface chemistry and shear stress were used to direct endothelial cell growth.

Cell culture experiments were designed to optimize fabrication of an electrospun cellulose acetate scaffold for ECs. Results indicated that ECs prefer to grow along fibers with a diameter in the range of 1-5 $\mu$ m. The addition of chitosan to electrospun fibers enhanced viability. Fibronectin addition increased EC density. Carbon nano-tubes and vascular endothelial growth factor were unsuitable additives.

A novel bioassay chamber was designed to optimize EC culture from an autologous tissue donor source. Murine aortas were dissected using an institutionally endorsed tissue sharing protocol. They were cannulated and perfused at low flow rates in my bioassay chamber. ECs preferred large diameter fibers enhanced with chitosan. Cell density was unrelated to perfusate flow rate in the bioassay chamber, but viability was enhanced with higher flow. Long term culture increased cell viability but did not affect density.

The directed growth of ECs was investigated on hydrophilic and hydrophobic glass substrates microstamped with extracellular matrix (ECM) proteins. ECM proteins playing key roles in cell migration and adhesion were investigated. Cell density on these proteins was significantly higher vs. the paired hydrophilic or hydrophobic substrates. Cell viability was significantly higher on stamped proteins vs. on hydrophobic glass.

In the bioassay chamber with low pulsatile flow ECs displayed a significantly higher density on microstamped ECM proteins vs. on both hydrophilic and hydrophobic glass. They grew with a significantly higher viability on ECM vs. hydrophobic glass substrates. This novel bioassay chamber can thus be used to test multiple factors promoting angiogenesis in a controlled system.

**Date:** May 9, 2007

**Time:** 9:30 AM

**Place:** Psychology A, 3<sup>rd</sup> Floor, Conference Room

**Program:** Biomedical Engineering

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