

DEPARTMENT OF BIOMEDICAL ENGINEERING
COLLEGE OF ENGINEERING AND APPLIED SCIENCES

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: April 29, 2024

PROJECT TITLE: Examine the Role of Surface Mechanics and Smooth Muscle Cell Activation in Vascular Calcification

Physical Requirement : Sit and Stand for extended periods

Project's Technical Skills Requirement : No required skills

Project's Available Positions : Fall Semester Co-Op

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Project Description

The vascular smooth muscle cells (VSMCs) that comprise the medial layer of arteries exhibit two distinct phenotypes: contractile and synthetic. Contractile VSMCs regulate blood pressure in the artery but can dedifferentiate into the synthetic phenotype in response to injury. We are hypothesizing a potential third phenotype of VSMCs caused by mechanical strain. We propose that this third phenotype happens through the Wnt signaling pathway as VSMCs become osteoblast-like cells and deposit mineral into the arterial extra cellular matrix. Our research would provide new knowledge by confirming the continued plasticity of VSMCs caused by mechanical strain activating the canonical Wnt signaling pathway. The mechanical changes leading to this potential third phenotype are caused by hypertension, known as the silent killer. By understanding the signaling pathway associated with this phenotypic modulation of VSMCs, we could work to develop targeted therapeutics to treat vascular calcification at the cellular and molecular level.

Experimental Plan:

- 1) Examine the secretome profile of synthetic smooth muscle cells on surfaces of varying stiffness
- 2) Examine the activation of Wnt signaling and phenotypic modulation of synthetic smooth muscle cells on surfaces of varying stiffness

Training provided:

- Polymer synthesis
- Materials characterization
- Aseptic technique
- Cell culture
- Potential for research publications and presentations at local and national conferences