Katelyn E. Swift-Spong
Sophomore
Franklin W. Olin College of Engineering
Major: Electrical and Computer Engineering

Faculty Advisor: Burt Tilley

Program: Research Alliance in Math & Science

Email: swiftspongke@ornl.gov
Home: Katelyn.Swift-Spong@students.olin.edu

Research Area: Computational Sciences and Engineering

Balloon angioplasty is one of the standard treatments for coronary artery disease, but it can often trigger a process called intimal hyperplasia. This process produces changes in the state of the artery that eventually lead to stenosis (narrowing) of the artery. This stenosis results from migration by chemotaxis of vascular smooth muscle cells (SMCs) from the middle (media) layer of the arterial wall into the inner (intimal) layer. Matrix metalloproteinases (MMPs), released as a natural response to injury of the artery, cause the breakdown of collagen and other structural components of the extra cellular matrix, which facilitates the SMC migration to the intima. By starting with a continuous model of SMC migration in reduced dimensionality, we will incorporate enzyme kinetics models for MMP2 breakdown of collagen, and examine the effects of pathway kinetics on the cellular migration process. The project will use extensible markup languages (XML) for data and model description within two simulation environments: Systems Biology Workbench (SBW) and JSim, a simulation program developed by the University of Washington. These models will provide code that can be imported into our previously developed hybrid modeling environment for the intimal hyperplasia process. The ultimate goal is to develop a unified approach to multiscale biomodeling, taking advantage of the capabilities of these simulation tools (SBW and JSim) and standardized model descriptions provided by XML, as an interface to our hybrid simulation modeling environment.

Research Mentor:

Richard C. Ward, Ph.D. (865) 574-5449
Computational Sciences and Engineering Division wardrc1@ornl.gov
Oak Ridge National Laboratory