

Title: Modeling Membrane Dynamics In Excitable Tissue

Director: Brett A. Sims, Department of Mathematics
Grambling State University

Dates of Program: June 2 – July 11, 2008

Research Students:

Heather Smith

Major: Computer Science

Tariq Scott

Major: Engineering Tech and Computer Science

Brandon Bradley

Major: Mathematics

Johnte Bass

Major: Physics

Summary: This summer research program at Grambling State University (GSU) will give four undergraduate students the opportunity to study and perform interdisciplinary research in modeling practices for building deterministic models for membrane dynamics in excitable tissue (neural and heart tissue). Students will continue the 2007 research focus on developing a new model for ion flux. A global focus in the study of excitable tissue is action potential propagation. However, action potential propagation depends significantly on cell membrane dynamics. The four student research participants will work in teams of two- one focusing on wave propagation modeling and the other focusing on modeling membrane dynamics (ionic channel dynamics). Action potential models containing linear and nonlinear source terms will also be considered.

Investigative studies will include a theoretical analysis of solutions, eigenvalues, and eigenvectors for various wave propagation models of the form $\tau \frac{\partial V}{\partial t} = \lambda^2 \frac{\partial^2 V}{\partial x^2} - f(V)$.

The study of membrane dynamics will focus on the influence of ion channel protein conformation on ionic membrane current. Theoretical analysis will involve the existence

of solutions for an ion flux model of the form $J = D(\beta c \nabla V + \nabla C + \frac{\gamma}{4\pi\epsilon} \sum_{n=1}^b \frac{M \cdot \vec{p}_n}{R_n^2})$.