

**UNIVERSITY OF SOUTH FLORIDA**  
**DEPARTMENT OF PHYSICS**  
Spring 2006 Research Colloquium

Friday, March 24, 2006

in

PHY 130 at 4:00 PM

**New Tools for Studying Neural Dynamics in Vitro**

**Steve M. Potter**

Coulter Department of Biomedical Engineering  
Georgia Institute of Technology and Emory University Medical School

**ABSTRACT**

Tremendous progress in understanding brain function is being made at the molecular level, with so much effort being poured into genomics and proteomics. Connecting the dots between molecules and behavior requires a better understanding of living neuronal networks, whose basic operating principles are still very poorly understood. We have developed and improved a number of research tools for the study of neuronal dynamics in networks of cultured neurons and glia. The accessibility of in vitro networks allows them to be probed and manipulated in great detail, both optically and electrically. We use multi-electrode array culture dishes to create long-term two-way interfaces between cultured nets and computers. We developed hardware and software that allows real-time closed-loop electrical and chemical feedback to the networks to look at their functional dynamics.

We apply multiphoton fluorescence microscopy to observe morphological dynamics. By applying optical and electrical network-level tools, we hope to uncover new principles of brain networks that might be applied to the treatment of brain disorders such as epilepsy, and eventually to the creation of more brain-like artificial intelligence.