Neurobiology Engineering Laboratory

Department of Electrical and Computer Engineering

Mission

The Neurobiology Engineering Laboratory investigates the principles and mechanisms of information processing and knowledge representation in biological neurons and neuronal networks. The laboratory utilizes the theory and practice of electrical engineering, computer engineering, and computer science coupled with mathematics in its work.

Capabilities

Located in room A-211 of the WMU College of Engineering and Applied Sciences, the laboratory features a cell culture facility and equipment and supplies for implementation of electronic instrumentation for electrophysiology experiments. The expertise of associated faculty and students as listed on the next page includes neurobiology, electronic instrumentation, nonlinear systems, simulation and modeling, and signal processing.

Research

- Application of optimal control methods to neuron electrophysiology to find reduced energy stimulus to illicit a desired response
- Exploring use of microelectrode arrays (MEAs) in neural research. MEAs enable long term measurement and stimulation of neuron cell culture electrical activity via an array of electrodes. These arrays have been used by researchers in a variety of applications, including studies of neuron cell culture learning and the effects of pharmacological agents.
- Support of research in the Department of Biological Sciences to study effects of electrical stimulation on protein production by skeletal muscle cells.

Support

WMU College of Engineering and Applied Sciences
WMU College of Arts and Sciences Interdisciplinary Research Initiative Award
NASA Michigan Space Grant Consortium
WMU Faculty Research and Creative Activities Support Fund
WMU Graduate Student Research Fund
WMU Seibert Undergraduate Research and Creative Activities Award

Example Publications

1. M. E. Koelling, D. A. Miller, M. E. Ellinger, F. L. Severance, and J. Stahl, "Current stimuli that provide membrane voltage tracking in a six dimensional neuron model," *Journal of Dynamic Systems, Measurement, and Control*, vol. 135, July 2013.
2. M. Ellinger, M. E. Koelling, D. A. Miller, F. L. Severance, and J. Stahl, "Exploring optimal current stimuli that provide membrane voltage tracking in a neuron model," *Biological Cybernetics*, vol. 104, pp. 185-195, March 2011.

Founding Faculty

Dr. Damon Miller, Director
damon.miller@wmich.edu
Electrical and Computer Engineering
nonlinear circuits and systems, neural systems, artificial neural networks, electronic instrumentation

Dr. Frank Severance, Co-Director Emeritus
frank.severance@wmich.edu
Electrical and Computer Engineering
nonlinear systems, modeling and simulation, biological neural networks, bioinformatics

Doctoral Students

Jason Anyalebechi
Research Associate
Electrical and Computer Engineering

Michael Ellinger
Senior Research Associate
Electrical and Computer Engineering

John Stahl
Research Associate
Electrical and Computer Engineering

Master Students

Benjamin VanDyken
Mechanical Engineering

Undergraduate Students

Alexandra Ferguson
Electrical and Computer Engineering

Affiliated Faculty

Dr. Bradley Bazuin
brad.bazuin@wmich.edu
Electrical and Computer Engineering
wireless communication, temporal and spatial signal processing, printed electronics, radio frequency identification, radio frequency circuit design

Dr. John Gesink
john.gesink@wmich.edu
Electrical and Computer Engineering
rehabilitation engineering, sensors, instrumentation

Dr. John Jellies
john.jellies@wmich.edu
Biological Sciences
integrative developmental and behavioral biology, neurobiology, developmental biology, biophysics, comparative biology

Dr. Melinda Koelling
melinda.koelling@wmich.edu
Mathematics
application of mathematics to neuroscience, optimal control, computational neuroscience models

Dr. Cindy Linn
cindy.linn@wmich.edu
Biological Sciences
neurophysiology, excitotoxicity, glaucoma, retina

Dr. John Spitsbergen
john.spitsbergen@wmich.edu
Biological Sciences
neurobiology, physiology

Affiliated Students

Sr. John-Mary Vianney
Biological Sciences Doctoral Student
(Spitsbergen Lab)