NEUROSCI 613: Neurophysiology and Computational Neuroscience
November 7 – December 12, 2017
M, T, Th 1-3pm
USB 4130

Coordinators:
Victoria Booth, Associate Professor of Mathematics and Anesthesiology
Anatoli Lopatin, Associate Professor of Molecular & Integrative Physiology
Geoffrey Murphy, Associate Professor of Molecular & Integrative Physiology

Description: This module focuses on neurophysiology and provides an introduction to computational modeling of neurons and neural networks. Lectures will cover the biophysics of neural membranes, electrophysiology of dendrites and axons, generation of action potentials and their axonal propagation, synaptic transmission and plasticity at synapses. Computational modeling labs will cover the following topics:

1) Single neuron models (Hodgkin-Huxley and integrate-and-fire models); current clamp simulations, frequency-current curves
2) Diversity of ionic current kinetics and its effects on action potential generation and neuron responses
3) Synaptic currents
4) Synchrony and rhythm generation in neural networks

Computer labs will be implemented in Matlab. Please have Matlab installed on your laptop and bring it on the scheduled computer lab days. Information for installing Matlab under the UM university-wide license is available at
http://caenfaq.engin.umich.edu/software-for-students/matlab-for-students
Experience in programming and Matlab is helpful but not required.

In lieu of an exam, the final assignment will be a critique of a journal paper implementing computational modeling to investigate neural or synaptic neurophysiology. Students may work in teams of 2. Teams will choose a paper from a provided list of candidate papers and the written critique must address specific questions/points that will provided.

Grades: Problem set and computer labs 70%, team paper critique 25%, class participation 5%

Contact Info:
Victoria Booth, East Hall 3858, vbooth@umich.edu. Office Hours: TW 4-5pm, Th 11am-12pm
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Geoffrey Murphy, murphyg@umich.edu

Date	Topic
Tues 11/7	Neural membrane potential and cable properties ***Anatoli Lopatin***
Thurs 11/9	Action potentials and propagation (including NERVE web-based simulator of action potential generation and propagation)

	Anatoli Lopatin
Mon 11/13	No class – Society for Neurosciences meeting
Tues 11/14	No class – Society for Neurosciences meeting
Thurs 11/16	Computer lab 1: Hodgkin-Huxley neuron model, simplified neuron models (Matlab coding and simulation) ***Victoria Booth***
Mon 11/20	Ion channels and channel diversity ***Anatoli Lopatin***
Tues 11/21	Computer lab 2: Hodgkin-Huxley models for diverse neurons ***Victoria Booth***
Wed 11/22	Problem Set 1 due
Thurs 11/23	No class – Thanksgiving break
Mon 11/27	Synapses ***Geoffrey Murphy*** Computer Lab 1 due
Tues 11/28	Synapses and synaptic plasticity ***Geoffrey Murphy***
Thurs 11/30	Computer lab 3: Modeling synaptic currents in neural networks ***Victoria Booth***
Fri 12/1	Computer Lab 2 due
Mon 12/4	Computer lab 3: Modeling synaptic currents in neural networks ***Victoria Booth***
Tues 12/5	*Guest faculty lecture*
Thurs 12/7	Computer lab 4: Synchrony and rhythms in neural networks ***Victoria Booth***
Mon 12/11	Computer lab 4: Synchrony and rhythms in neural networks ***Victoria Booth*** Computer Lab 3 due
Tues 12/12	Neuroscience Preliminary Exam preparation ***Geoffrey Murphy***
Mon 12/18	Computer Lab 4 due
Thurs 12/21	Team journal paper critique due