Interdisciplinary training in Computational Neuroscience for students, post-docs and faculty

A longstanding goal of neuroscience research is to understand how activity of individual neurons and within neural circuits gives rise to outputs ranging from movement to thought. Integrative and interdisciplinary training in neuroscience is necessary to help develop scientists who can work together to address this goal by using approaches from diverse fields including biology, psychology, computer science, electrical engineering, and physics.

Our training course is designed to introduce and strengthen the quantitative skills of researchers with biological and medical backgrounds and increase the knowledge of neuroscience concepts for those from quantitative backgrounds. No previous experience with modeling is expected.

All participant costs will be covered for expenses including travel, accommodation at University dorms, and meals.

June 4-15, 2018

Educational
The workshop will introduce neuroscience concepts from an advanced perspective using wet-lab and software (‘virtual’) experiments using a biology to model and back again approach.

Hands-On
Neuro-modeling via hands-on coding and development using the software package NEURON, and, in parallel provide exposure to electrophysiology from a mathematical and systems perspective.

Custom Projects
We will work individually with each attendee to develop a computational research project based on their own specific research interests.

Support
The faculty will provide follow-up support to participants for one year on all aspects of the short course, including their individual research project.

For further information contact Drs. Satish S. Nair (573-882-2964; nairs@missouri.edu) or David J. Schulz (573-882-4067; schulzd@missouri.edu)

Contact the Course Coordinator at: NairS@missouri.edu

http://engineering.missouri.edu/neuro/outreach/nih-neuroscience-course/

All Expenses covered by NIH grant funds

Application Deadline
March 1, 2018

Tentative Schedule on back side
**TENTATIVE SCHEDULE** (Monday, 4 June to Friday, 15 June, 2018)

Table 1. Seven color-coded parallel tracks of the short course; Track 1: Relevant Mathematics; Track 2: Neurons and Circuits; Track 3: Projects at cellular (#1) and network (#s 2&3) levels; Track 4: Write your own code using NEURON/Python; Track 5: Neuro-/electro-physiology from an engineering systems perspective; Track 6: Computational modeling research – case studies; Track 7: Development of individual computational research projects.

| Prior to arrival on campus – On-line boot-camp focusing on learning software (Python and NEURON), and ‘Basics of Neurobiology’ starts a month prior to Course. Participants are also provided access to a Canvas site that has all the course materials. |
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| **Morning** (9 am – 12 noon) | **Afternoon** (1 pm - 5 pm) | **Evening** (6:30-9 pm) |
| **Mon.** | Introductions; Knowledge & Instructional Surveys. Basics of neurobiology; Biology: Resting potential and GHK-equation from a systems viewpoint | What is Computational Neuroscience? *Software Expt. 1* Modeling a passive membrane; Derivatives, integration & ODEs; How does a software package solve ODEs? | 6:30-7:30 Participants introduce themselves (2 min max each). Sessions on Python + NEURON; Complete HWs. |
| **Tue.** | Biology: Voltage-gated channels and AP; Software Expt. 2 – Action potential | Mathematics of AP; Software Expt. 2 – contd.; Systems Neurophysiology | 6:30-7:30 Sessions on Python + NEURON; Complete HWs. |
| **Wed.** | Wet Lab 1 - Membrane Potential; Resting potential of leech neurons; Systems Neurophysiology | Wet Lab Expt. 2 – Membrane Conductances; Action potential in leech neurons; Systems Neurophysiology | Complete Wet Lab HWs; Instruction in RCR |
| **Thurs.** | Biology: Bursting; Software Expt. 3 – Bursting | Project 1 (match passive and in vitro firing properties of a FS interneuron); | Complete pending work; Begin work on independent comp research project |
| **Fri.** | Biology: Synaptic Transmission; *Soft. Expt. 4:* Modeling earthworm escape reflex using synapses and neurons | *Soft. Expt. 5:* Central pattern generator + short term memory, half-center oscillator, etc. | Complete HWs and submit Software Expts. 1,2 and 3, and Project 1 by Saturday morning + Project 2 (Two-cell half center oscillator) |
| **Sat.** | Project 2 (Two-cell half center oscillator)Work on independent comp research project | Discussion of Software Expts. 1-3; and of Project 1 | Complete Software Tutorials 4,5 and submit via Canvas site by Sunday |
| **Sun.** | BREAK | BREAK | Barbecue 5-8 pm MLK Shelter (on Katy trail) |
| **Mon.** | Discussion of Software Expts. 4,5 and Project 2; IF and other single cell models | Developing single cell models for IF cells; Writing NEURON/Python Code - 1 Detailed single cell models Faculty talk #1 | Comp Model Research Case 1, Writing NEURON/Python Code - 1 Work on independent comp research project. |
| **Tue.** | Comp Model Research Case 2; CG Collaboration Case Study – Schulz, Nair | Project 3 – Part I (modeling 40-cell network using NetPyNe, with IF and HH cell models); Faculty Talks 2 and 3 | Complete HWs + Work on independent comp research project. |
| **Wed.** | 1-2 pm Telecon with NIH Prog. Directors | 1-3 pm Writing NEURON/Python code, #2-4 3-4 Visit Labs? Complete pending work 4-5 Dr. Bergin - Science of teaching/learning; | Complete HWs + Project 3 – Part II Work on independent comp research project. |
| **Thurs.** | Comp Model Research Cases 4; Federal BRAIN initiative – what is it? Work on independent comp research project; | 1-3 pm Writing NEURON/Python code, #5-8 3-4 Faculty Research Talk 4-5 pm Visit other Labs? Complete work | Work on independent comp research project; Complete pending work |
| **Fri. morning** | Presentations of independent research projects – 5 minutes max each | Knowledge Survey. Course ends at 12:00 noon. Farewell Lunch; Dorm check-out |  |