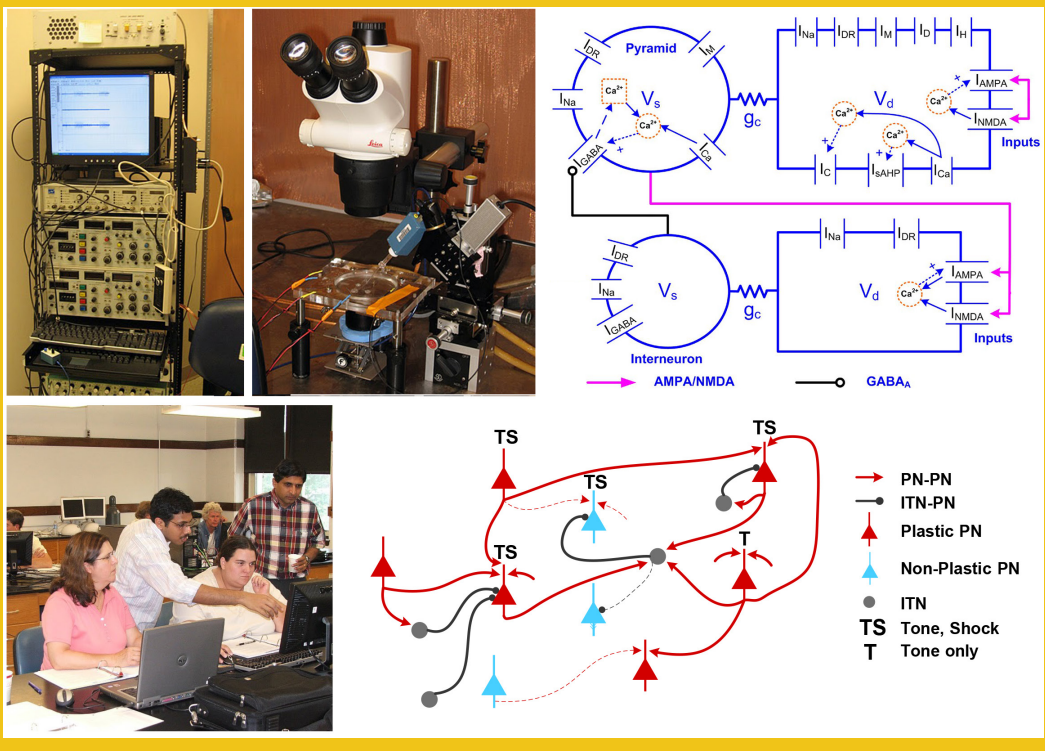
Computational Neuroscience:

Models and Neurobiology

A new NIH BRAIN Initiative Summer Course at the University of Missouri June 19-30, 2017



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.

All Expenses

covered by NIH grant funds

Application Deadline

February 1, 2017

June 19-30, 2017

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

Contact the Course Coordinator at : NairS@missouri.edu

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)

Tentative Schedule on back side

TENTATIVE SCHEDULE (Monday, 19 June to Friday, 30 June, 2017)

Table 1. Seven color-coded parallel tracks of the short course; Track 1: Relevant Mathematics; Track 2: Neurons and Circuits; Track 3: Group projects at 1- and 2-cell levels using canned programs; Track 4: Model development individually from basics using the package NEURON; Track 5: Neuro-/electro-physiology from an engineering systems perspective; Track 6: Computational Model Research Case Studies; Track 7: Development of individual computational research projects.

Prior to arrival on campus - A primer we developed 'Basics of Neurobiology' is sent to participants a month prior to Course**.** Participants are also provided access to the Blackboard site that has all the course materials.		
Morning (9 am – 12 noon)	Afternoon (1 pm - 5 pm)	Evening (6:30-9 pm)
Mon. Introductions; Basics of neurobiology; Biology: Resting potential and GHK-equation What is computational neuroscience?	*Software Expt.* 1 How to model a passive membrane; Derivatives, integration, and differential equations; How does a software package solve a differential equation?	6:30-7:30 Participants introduce themselves (5 min max each). Pick one of "Neurobiology" or "Math/Software" sessions to attend. Complete HWs
Tue. Biology: Voltage-gated channels and AP; Software Expt. 2 – Action potential;	*Wet Lab Expt.* 1 – Membrane Potential; Resting Potentials in Muscle Cells; Instruction in RCR	6:30-7:30 Participants introduce themselves (5 min max each). Complete HWs;
Wed. Mathematics of AP; Software Expt. 2 – contd.; Begin ideas of independent comp research project	*Wet Lab Expt.* 2 – Membrane Conductances; Action potential in leech neurons; Instruction in RCR	Complete HWs + Continue cell model + Project 1 (match passive and in vitro firing properties of a FS interneuron);
Thurs. Biology: Bursting, Synaptic transmission; Software Expt. 3 – Bursting	*Wet Lab Expt.* 3 – Synaptic conductances; Synaptic integration in earthworm escape;	Complete HWs + Project 1 (match passive and in vitro firing properties of a neuron)
Fri. *Soft. Expt.* 4: Modeling earthworm escape reflex using synapses and neurons Comp Model Research Case Study 1	1-2 pm Telecon with NIH Program Officers *Soft. Expt.* 5: Central pattern generator *Soft. Expt.* 6: Modeling networks - short term memory, half-center oscillator, etc.	Complete HWs + Project 2 (Two-cell half center oscillator)
Sat. Comp Model Research Case Study 2; Work on independent comp research project	1-2 pm Discussion of Tutorials/Projects 3 pm Writing NEURON code to model spike frequency adaptation and bursting	Complete HWs + Project 2 (Two-cell half center oscillator)
Sun. BREAK	BREAK	BREAK
Mon. Comp Model Research Case Study 3 Crab cardiac ganglion - Nair and Schulz;	1:00 pm Discussion of Tutorials/Projects 2-5 pm Writing your own code - Modeling synaptic plasticity	Complete HWs + Project 3 (100-cell model of a neural network)
Tue Independent comp research project – 5 minute presentations;	1-4 pm Systems Neurophysiology I 4-5 pm Faculty Research Talk	Complete HWs + Project 3 (100-cell model of a neural network)
Wed Work on independent comp research project; Comp Model Research Case Study 4.	1-4 pm Systems Neurophysiology I 4-5 pm Discussion related to writing code	Dr. Bergin - Science of teaching/learning; Complete HWs + Project 3 (100-cell model of a neural network)
Thurs Federal BRAIN initiative – what is it? Work on independent comp research project;	1-4 pm Discussion of all projects 4-5 pm Faculty Research Talk	Participant discussion of topics of interest; Complete pending work
Fri Presentations of independent research projects	Course ends at 12:00 noon. Lunch and check-out from dorms.	