

Laboratory Techniques for the Educator



Crawdad Invertebrate Neurophysiology Course

January 10-13, 2014

Cornell University, Ithaca, NY

Course Overview:

ADInstruments and the Department of Neurobiology and Behavior at Cornell University will co-host a hands-on workshop for higher education life science instructors seeking to expand their curriculum reach in the neurosciences. The training event will be based on topics explored in the “Crawdad Project,” a three-year (1996-8) program funded by the National Science Foundation to promote the use of invertebrates in undergraduate physiology and neuroscience lab courses. The goals of this hosted workshop are to provide teachers hands-on experience with invertebrate preparations that demonstrate basic principles of nervous system physiology, and can easily be incorporated into laboratory courses back home.

The laboratory exercises use simple invertebrate preparations to illustrate fundamental processes of all nervous systems. The use of commercially cultured invertebrates (crayfish and snails) reduces cost and administrative overhead as well as potential ethical and environmental objections on the part of students. These exercises have been developed and refined at Cornell and elsewhere over many years. Attendees will take home time-tested experiments crafted by seasoned neurobiology faculty.

The laboratory exercises are based primarily on crayfish superficial flexor muscle and its motor innervation, crayfish stretch receptor, and snail brain recordings.

Targeted training will help you unlock the full potential of your equipment and instruction. Join the neuroscience educator’s community and develop new laboratory skills alongside like-minded peers in a comfortable and supportive environment.

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Topics to be covered:

- Motor innervation
- Neuroanatomy
- Sensory systems
- Ionic bases of resting and action potentials
- Synaptic transmission
- Synaptic plasticity
- Central pattern generation for rhythmic motor activity

Exercises to be covered:

- Passive Membrane Properties - Introduction to membrane properties and equipment use
- Crayfish Motor Nerve Recording - Extracellular recording of spontaneous and reflex motor activity
- Ionic Basis of Resting Potential - Intracellular recording of crayfish muscle
- Ionic basis of action potential - Intracellular recording from snail brain neurons
- Plant Action Potential - Intracellular recording of a large alga cell that fires an AP
- Synaptic Connectivity - Simultaneous Extracellular and Intracellular recording from nerve and muscle; matching PSP's with AP's
- Synaptic Plasticity - Stimulating a nerve, recording muscle synaptic potentials; facilitation and PTP
- Stretch Receptor - Extracellular recording of crayfish stretch receptor
- Conduction velocity measurements from multiple motor neurons simultaneously; rhythmic motor pattern generation

Skills to be covered:

- Neuromuscular Intro - Preparations used in Crayfish Motor Nerve, Resting Potential, Axonal conduction velocity; Rhythmic Motor Activity and Synaptic labs
- Dissecting Tips - General advice on successful dissection
- Recording Tips - Background and troubleshooting for extra- and intracellular computer based data acquisition
- Data Analysis - including spike sorting, matching presynaptic action potentials with postsynaptic potentials; measuring AP conduction velocity; calculating time constants for sensory receptor adaptation

If you aren't familiar with Cornell's *Crawdad* CD produced by Sinauer, please check it out at:
<http://www.sinauer.com/crawdad-a-cd-rom-lab-manual-for-neurophysiology.html>

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Event Schedule:

If there is a specific topic you would like to cover outside of this schedule, one-on-one coaching sessions will be available. The agenda below is representative of the standard schedule but subject matter and times may change.

Day One

Morning Session

- ADInstruments Introduction
- Model Axon
- Begin Nerve 3 Recording

Lunch

Afternoon Session

- Nerve 3 recording
- Conduction Velocity

Day Two

Morning Session

- Muscle recording - Introduction to intracellular recording; ionic basis of resting potentials

Lunch

Afternoon Session

- Excitability of snail brain neurons

Day Three

Morning Session

- Continue excitability of snail brain neurons

Lunch

Afternoon Session

- Synaptic connectivity and plasticity

Day Four

Morning Session

- Stretch receptor and wrap-up