Spring 2013 Principles of Neurophysiology (BION/BME/ECE 4910)
Lecture: 101 Kennedy Hall, Lab: 2070 Comstock Hall
Web Site: http://courses.cit.cornell.edu/bionb4910/index.html

Instructor: Dr. Bruce Johnson, Gil Mend, Shane Peace
Teaching Assistants: Josh Adjel, Kwaku Opare-Sea

"Never the less, all living things are about the same." C. Darwin.

4910 Course Objectives

1. Gain an intuitive understanding for important concepts in Cellular Neurobiology.
2. Gain experience and competence in electrophysiological techniques (Job Skills!)
3. Understand and appreciate the experimental paradigms of the field.
4. Polish your scientific thinking and writing.
5. Appreciate the personal excitement of a research physiologist interacting with a living system.

4910 Syllabus

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture (Mon-Weds), Lab (Mon-Tues)</th>
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<tbody>
<tr>
<td>1</td>
<td>Course Objectives, Extracellular Neuron Models, Recording Techniques</td>
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<tr>
<td>2</td>
<td>Membrane Electrical Properties, IntracellularVoltage Clamp Recording Techniques</td>
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<tr>
<td>3</td>
<td>Passive Membrane Properties, Experimental Animal Response Properties of Sensory Neurons</td>
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<td>4</td>
<td>Action Potential Conduction, Action Potential Generation and Transmission</td>
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<td>5</td>
<td>Fast Synaptic Transmission, Electrical Excitability in Plants, Neuronal Excitability in a Plant Cell</td>
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<td>6</td>
<td>Neuronal Excitability, Optical Imaging, Electrical Excitability in a Neuron, Excitable Properties of Small Brain Neurons</td>
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<tr>
<td>7</td>
<td>Neural Control of Behavior, Excitable Properties of Small Brain Neurons</td>
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Week | Lecture (Mon-Weds), Lab (Mon-Tues) | Required “Texts”:  
--- | --- | ---  
11 (April 1-3) | Ca Action Potential* |  
12 (April 8-10) | Hodgkin & Huxley II | Input/Output Properties of Neurons  
13 (April 15-17) | Hodgkin & Huxley II | Ionic Basis of Neuronal Excitability  
14 (April 22-24) | Hodgkin & Huxley II | Photo-Activation of Behavior and Synaptic Transmission  
15 (April 29-May 1) | Hodgkin & Huxley II | Required — Texts”:

A. 35% - Lab Reports  
B. 15% - Problem Sets and Other Assignments  
C. 20% - Midterm Paper  
D. 30% - Final Paper (25%) and Presentation (5%)  
Submit to BLACKBOARD!

4910 Grading  

A. 35% - Lab Reports  
B. 15% - Problem Sets and Other Assignments  
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Extra credit for helping lead lab exercises for other groups!
First Lab: Model Neuron
Membrane resistance

First Lab: Model Neuron
Membrane capacitance and resistance
Simple RC circuit

First Lab: Model Neuron
RC Circuit
RC circuit-consecutive inputs - What happens?

First Lab Model Neuron
Exercise 1
Cellular basis of thinking
RC circuit
Synaptic Integration
First Lab: Biological Signals

Define the fish’s waveform
Characterize its activity

Biological function generator

Figure 16. Electric fish data. One male electric fish was placed in a tank for a 2 minute period at which point a female was inserted. The female has a distinctly higher main frequency component signal compared to the male and the distinction readily appears in the analysis window. While other parameters (such as amplitude) may make a relatively unclear clustering, the rate behavior of the only the female discharges may be readily illustrated.

No formal write-up; Answer questions posed in the lab exercise
Show example figures of your results (resistor ladder graphs, RC circuit responses, electric fish EODs and frequency analysis).
Hypothesize the identity of your e-fish- electric fish pdf on web site

http://crawdad.cornell.edu/gprime/apps/eod1/eod1.html
http://crawdad.cornell.edu/gprime/apps/eod2/eod2.html