

## **Math 490N/Biol 595N: Topics for Mid-term Test**

Thursday, March 11, 12:30–1:20; extra time 1:20-2:20 in REC 122.

### **Biology for all**

There will be essay questions about some of the topics below.

- Basics of cells, neurons, nervous system
- Chemical and electrical basis for the membrane potential in ‘resting’ neuron and for action potentials
- Synapses, their structure and function
- Ion channels, their structure and function
- Basic biology behind the models we have studied
  - The Morris-Lecar model for the membrane potential oscillations in the Barnacle Giant Muscle Fiber
  - Calcium Stores in the ER: Calcium concentration oscillations in the bullfrog sympathetic ganglion neuron
  - Calcium Stores in the ER: Calcium concentration oscillations in the pituitary gonadotrophs

### **Math for all**

There will be a question or questions about interpretation or construction of graphs concerning the topics below.

- Differential equations, systems of differential equations, initial value problems, solutions
- Graphical representations of solutions: graphs of solution functions vs time, phase portraits
- Nullclines, fixed points
- Stability of fixed points
- Bifurcation diagram

### **Biology for biological scientists (Biol 595N)**

- Paper of Morris and Lecar; more on the biology of the barnacle giant muscle fiber
- Papers of Kuba and Nishi and Friel and Tsien; more on the biology of the bullfrog sympathetic ganglion neuron
- The control of the production of LH and FSH
- Papers of Tse, Tse, Almers, and Hille and Tse and Tse; more on the biology of the pituitary gonadotroph

### **Math for mathematical scientists (Math 490N/Math 598)**

- Linearization of a non-linear system of ordinary differential equations at a fixed point
- Solution of linear, constant coefficient systems
- Calculations to find fixed points and classify their stability
- Construction of a bifurcation diagram