Course Description

Instructors: John Rinzel & Eero Simoncelli

Time/Location: Wednesdays, 9:30-11:20 AM / Warren Weaver rm. 1314 (subject to change)

Prerequisites: Working familiarity with linear systems, probability and statistics (e.g., from Mathematical Tools for Neural Science) and differential equations. Working knowledge of the MATLAB programming environment. Seek advice of instructor if in doubt.

Brief Description: This course will survey various approaches to modeling of neuronal systems, from components of individual cells to populations of interacting neurons, and from models of physiological mechanisms to more abstract models of information encoding and decoding. A central theme will be the role of theory in neuroscience, in generating testable hypotheses, providing conceptual and methodological frameworks for the analysis and interpretation of experimental data and developing of new experimental methods. Questions to be addressed include: how do we characterize the observed responses or identify the computations of particular neurons or neuronal circuits; how do the responses/computations evolve dynamically; how are they implemented in neural ware; and how are they manifested in human/animal behaviors?

Format: The course consists of one 2-hour lecture each week. Roughly half of these will be done by the two primary instructors, and the remainder will be guest lectures by members of several NYU working groups. Examples will be drawn from various neural contexts, including visual and auditory systems, decision-making, motor control, and learning and memory.

Grading: Students enrolled for credit must complete homework assignments roughly every two weeks in the early portion of the semester. These will be primarily in the form of MATLAB computer exercises, examining the lecture topics in terms of concrete and realistic problems. Students will also implement a course project that either explores properties of a particular model, or compares responses of a model to neural data.

Course materials: There is no required textbook for the course, but “Theoretical Neuroscience” by Dayan and Abbott (MIT Press, 2001) provides a good reference for much of the material. Supplementary reading materials will be handed out in class, and all materials will be available as Acrobat (pdf) files from the course web site: http://www.cns.nyu.edu/doctoral/courses/2005-2006/fall/compNeuro05/