

Graduate Course, Fall 2007: Thursday, 9:30-11:20am, WWH Rm 1314.

Computational Modeling of Neuronal Systems G80.3042.004, Identical to G63.2855.001  
Prerequisites: familiarity with linear algebra, applied differential equations, statistics and probability.

John Rinzel.

3 points.

Lecture/seminar course on computational modeling of neuronal systems, from cellular to system level, from models of physiological mechanisms to more abstract models of information encoding and decoding. We will address the characterization of neuronal responses or identification of neuronal computations; how they evolve dynamically; how they are implemented in neural ware; and how they are manifested in human/animal behaviors. Modeling will involve deterministic and stochastic differential equations, information theory, and Bayesian estimation and decision theory. Lecturers from NYU working groups will present foundational material as well as current research. Examples taken from various neural contexts, including visual and auditory systems, decision-making, motor control, and learning and memory. Students will undertake a course project to simulate a neural system, or to compare a model to neural data.

## COMPUTATIONAL MODELING OF NEURONAL SYSTEMS.

Fall, 2007. Thursday, 9:30-11:20am, Courant (Warren Weaver Hall) Rm 1314.

Instructor: John Rinzel

Grad-level course. Mixed audience of math and neuroscience grad students and postdocs.

Course web site:

<http://www.cns.nyu.edu/~rinzel/CMNSF07/>

### Schedule:

Introduction to mechanistic and descriptive modeling, encoding concepts.

- |          |  |
|----------|--|
| Sept 6   | Rinzel: "Nonlinear neuronal dynamics I: mechanisms of cellular excitability and oscillations"                |
| Sept 13  | Rinzel: "Nonlinear neuronal dynamics II: networks; Case study: episodic activity in developing spinal cord." |
| Sept 20* | Simoncelli: "Descriptive models of neural encoding I: LNP cascade"   |
| Sept 27* | Paninski: "Neural Encoding II: Fitting LIF models to noisy spiking data"                                     |

Decision-making.

- |        |   |
|--------|---|
| Oct 4  | Shea-Brown/Rinzel: "Network models for decision making" |
| Oct 11 | Glimcher: "Neurobiology of decision making."            |
| Oct 18 | Daw: "Reinforcement learning"                           |

Vision.

- |        |  |
|--------|--|
| Oct 25 | Movshon: "Cortical processing of visual motion signals"  |
| Nov 1  | Rubin/Rinzel: "Dynamics of perceptual bistability"   |
| Nov 8* | Cai/Rangan: "Large-scale model of cortical area V1."   |
| Nov 15 | Tranchina: "Synaptic depression: from stochastic to rate model; application to a model of cortical suppression." |

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|--------|-------------------------|
| Nov 22 | no class (Thanksgiving) |
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Synchronization/correlation.

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|--------|--|
| Nov 29 | Pesaran: "Correlation between different brain areas" |
| Dec 6  | Reyes: "Feedforward propagation in layered networks" |

\* JR away.

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