Neuroscience Course Descriptions

Advanced Topics Courses, 221-249, are offered once every two or three years, depending on the course. Please see Advanced Courses for the 2007-2009 schedule and additional information.

**NS 201A: Basic Concepts in Cellular and Molecular Neuroscience.**
D. Ron
An interdisciplinary introduction to fundamental aspects of nervous system function. The course emphasizes the ionic and molecular basis of excitability, synaptic transmission and signal transduction.
Offered every Fall.

**NS 201B: Basic Concepts in Systems Neuroscience.**
M. Brainard
Introduction to fundamental aspects of nervous system development, including neural determination, axon guidance, and neuron-target interactions, and overview of basics of integrative neural function, including sensory, motor and limbic systems, and computational neuroscience.
Offered every Winter.

**NS 201C: Genetics, Development, and Cell Biology of the Nervous System.**
H. Baier
N201C introduces the students to genetic and cell biological approaches to the assembly and function of the nervous system. The first set of lectures will cover overarching principles of cellular neurobiology in the context of the developing nervous system, including signaling, cell adhesion, and cytoskeletal dynamics. Topics will include neurogenesis, axon guidance, dendrite formation, and synaptogenesis. The second set of lectures will cover forward and reverse genetic analyses of complex neurobiological processes, including brain patterning, neuroendocrine signaling, circadian rhythms, sensory processing, and behavior. Tutorials and review sessions will deepen the students' perspective of material presented in the lectures. Emphasis will be placed on an understanding of basic concepts, as well as an appreciation of the major questions that drive current research in these areas.
Offered every Spring.

**NS 214: Ethics and the Responsible Conduct of Research.**
S. Baraban
This course will cover topics related to the responsible conduct of research such as conflicts of interest, responsible authorship, policies regarding the use of human and animal subjects, handling misconduct, proper data management, research funding rules and procedures. Students will review and present case studies for class discussion.

**NS 215: Laboratory Rotation.**
Staff
A laboratory rotation course to familiarize new departmental graduate students with various approaches to neurobiological research. Offered every Fall, Winter and Spring.

**NS 220: Neuroscience Journal Club.**
L. Reichardt
Pertinent papers from the recent neuroscience literature are read and discussed. Each student must participate regularly. Each third and fourth year student must present once during the academic year.
Offered every Fall, Winter and Spring.

**NS 221: Current Topics in Neuroscience.**
L. Noble, A. Bonci
Students will read and discuss papers related to the current week's formal Neuroscience Seminar series, attend the seminar, and meet with the speaker.
Offered every year.

**NS 222: Signaling in Neurobiology.**
M. Von Zastrow
This course will discuss receptor-mediated signal transduction and its regulation at the cellular level. The first part of the course will be largely didactic, reviewing basic principles of information theory and molecular pharmacology that are relevant to all signaling systems. The second part of the course will focus on selected receptors and regulatory mechanisms that function in neurons. Faculty experts in each area will present a lecture and assign relevant research paper(s) for student discussion. Topics include G protein-coupled receptors and regulation, regulation of ion channel signaling, receptor tyrosine kinases, Wnt signaling, TGF-beta signaling, polarity and chemotaxis.
Offered every three years.

**NS 223: Developmental Neurobiology.**
S. Pleasure
This course will cover important areas of vertebrate and invertebrate nervous system development. It will integrate findings from anatomical, cellular, molecular and genetic approaches. Topics may include: neural induction, regionalization of the neural plate and neural tube, cell-type specification, proliferation, apoptosis, morphogenesis, neurogenesis, gliogenesis, migration, differentiation, axon pathfinding, dendritogenesis, synaptogenesis.

Offered every three years.

**NS 225: Neurobiology of Disease.**
S. Finkbeiner
Lectures and student-led discussions on physiological and molecular bases of diseases such as Alzheimer’s, Parkinson’s, multiple sclerosis, epilepsy, autism, addiction, triple repeat and prion diseases.
Offered every two years.

**NS 230: Topics in Membrane Biophysics and Synaptic Physiology.**
E. Ullian
Topics addressed in this course will include ligand- and voltage-sensitive calcium permeation, ion transport, exocytosis/endocytosis, calcium domains and buffering in the nerve terminal, transmitter release statistics, neuromodulation of ion channels, co-transmission, short-term and long-term synaptic plasticity, dendritic backpropagation, lateral inhibition, and integration.
Offered every three years.

**NS 235: Sensory Transduction and Perception.**
J. Korenbrot
Topics in genetic, molecular, cellular and systems approaches to sensory transduction relevant to our understanding of coding of environmental stimuli by sensory neurons will be covered. Offered every three years.

**NS 240: Neurobiology of Vision.**
J. Horton
Visual information processing by the retina and central nervous system. Molecular, electrophysiological, pharmacological, anatomical, and psychophysical approaches will be discussed. Topics may include synaptic interactions, diseases specific to the visual system, color vision, form perception, motion detection, and visual development.
Offered every three years.

**NS 245: Behavioral Neuroscience.**
P. Janak
Lectures and discussion of primary research concerning the neural basis of behavior. Topics will include basic concepts of learning and neuroethology with examples from vertebrate and invertebrate systems. A comparative approach will be taken to understanding psychological constructs such as drive, motivation and emotion. Emphasis will be placed on neural circuit analysis of behaviors such as sound localization, drug self-administration, and fear conditioning.
Offered every three years.

**NS 246: Cognitive Neuroscience.**
A. Gazzaley
This advanced course will explore the foundations of Systems Neuroscience via an in-depth study of selected model systems such as sound localization, echolocation, voluntary eye movements, and goal directed reaching. The primary goal of the course is to teach a set of physiological, behavioral and computational principles and techniques that are broadly applicable in Systems Neuroscience, including techniques for identifying neural circuits and relating neural populations to perception and action.
Offered every three years.

**NS 247: Computational Neuroscience.**
Course Director to be announced
Lecture and critical discussion course on theoretical and computational approaches to Neuroscience. Topics may include: models of neurons and neural circuits; activity-dependent processes of neural development; applications of "neural networks" and learning theory in Neuroscience; analysis of neural coding. Relevant mathematics will be taught through lectures and problem sets. Mathematical topics may include basics of linear algebra and dynamical systems, probability theory, information theory, optimization.

**NS 248: Analysis of Neural and Behavioral Data.**
L. Frank
Lectures, critical discussions, and problem solving using Matlab. Topics will include: probability, descriptive statistics, binomial and poisson processes, analysis of spike trains, and analysis of dynamic neural and behavioral data. Previous Matlab experience strongly suggested.
Offered every two years.

**NS 249: Neural Circuits, Perception & Action.**
P. Sabes
This advanced course will explore the foundations of Systems Neuroscience via an in-depth study of selected model systems such as sound localization, echolocation, voluntary eye movements, and goal directed reaching. The primary goal of the course is to teach a set of physiological, behavioral and computational principles and techniques that are broadly applicable in Systems Neuroscience, including techniques for identifying neural circuits and relating neural populations to perception and action.
Offered every three years.

**NS 250: Dissertation Research.**
Staff.
Offered every Fall, Winter and Spring.