Committee on Neurobiology

Chair
- Ruth Anne Eatock
  Professor
- Francisco Bezanilla, Biochemistry and Molecular Biology
- Jean Decety, Psychology
- Harriet de Wit, Psychiatry and Behavioral Neuroscience
- Glyn Dawson, Pediatrics
- Ruth Anne Eatock, Neurobiology
- Aaron P. Fox, Neurobiology, Pharmacology and Physiology
- Elliot S. Gershon, Psychiatry and Behavioral Neuroscience
- Jay M. Goldberg, Neurobiology, Pharmacology and Physiology
- Christopher Gomez, Neurology
- William Green, Neurobiology
- Elizabeth Grove, Neurobiology
- Melina Hale, Organismal Biology and Anatomy
- Dorothy Hanck, Medicine
- Christian Hansel, Neurobiology
- Nicholas Hatsopoulos, Organismal Biology and Anatomy
- Richard P. Kraig, Neurology
- Andrea King, Psychiatry and Behavioral Neuroscience
- Anning Lin, Ben May Department of Cancer Research
- Daniel Margoliash, Organismal Biology and Anatomy
- Peggy Mason, Neurobiology
- John Maunsell, Neurobiology
- Martha McClintock, Psychology
- Deborah Nelson, Neurobiology, Pharmacology and Physiology
- Eduardo Perozo, Biochemistry and Molecular Biology
- Brian Popko, Neurology
- Nanduri Prabhakar, Medicine
- Brian Prendergast, Psychology
- Victoria Prince, Organismal Biology and Anatomy
- Anthony T. Reder, Neurology
- Raymond P. Roos, Neurology
- Marsha Rosner, Ben May Department of Cancer Research
- Steven Roth, Anesthesia and Critical Care
- Eric A. Schwartz, Neurobiology, Pharmacology and Physiology
- S. Murray Sherman, Neurobiology
Committee on Neurobiology

- Sangram Sisodia, Neurobiology
- Betty Soliven, Neurology
- Sara Szuchet, Neurology
- Wei-Jen Tang, Ben May Department of Cancer Research
- Gopal Thinakaran, Neurobiology
- V. Leo Towle, Neurology
- Paul Vezina, Psychiatry and Behavioral Neuroscience
- Ming Xu, Anesthesia and Critical Care

Associate Professor
- James Brorson, Neurology
- Stephanie Dulawa, Psychiatry and Behavioral Neuroscience
- David Freedman, Neurobiology
- Leslie Kay, Psychology
- Philip E. Lloyd, Neurobiology, Pharmacology and Physiology
- Jeremy Marks, Pediatrics
- Dario Maestripieri, Comparative Human Development
- James A. Mastrianni, Neurology
- Daniel McGehee, Anesthesia and Critical Care
- Abraham Palmer, Human Genetics
- Clifton Ragsdale, Neurobiology
- Xiaoxi Zhuang, Neurobiology

Assistant Professor
- Sliman Bensmaia, Organismal Biology and Anatomy
- David Biron, Physics
- Sarah London, Psychology
- Jason MacLean, Neurobiology
- Leslie Osborne, Neurobiology
- Wei Wei, Neurobiology

Emeritus Faculty
- Robert L. Perlman, Pediatrics

The Committee on Neurobiology is an interdepartmental committee designed to provide training and instruction for students interested in the biology of the nervous system, and to encourage communication and the exchange of ideas between faculty members and students interested in neurobiology. Recent technical and conceptual developments in neuroscience have produced remarkable growth in this field. The committee reflects this growth in its structure, having members from different departments whose research interests include a broad spectrum of approaches from the biochemical and molecular to the behavioral and comparative. The committee aims to provide broad training in technical and theoretical aspects of the neurosciences.
THE DEGREE OF DOCTOR OF PHILOSOPHY

Students initially are admitted to the Division of the Biological Sciences and must meet divisional requirements. The progress of each student will be supervised during the first one or two years by the chair of the Committee on Neurobiology until the student chooses a thesis advisor. Upon choosing a thesis advisor, an advisory committee chaired by a faculty member who is not the student’s thesis advisor is formed. The advisory committee consists of at least four faculty members with a majority being members of the Committee on Neurobiology. As a student’s focus changes, the composition of the advisory committee may be modified.

Each student is required to take four core courses, two graded laboratory rotations and three-related electives. Usually these courses will be taken during the first year and part of the second year. Required courses include a series of courses on cellular, developmental, molecular and systems neurobiology. Elective courses focus on topics such as neuropharmacology, systems neurophysiology, development, physiology of ion channels and statistics.

During the first year, in addition to taking courses, students rotate through different laboratories. During the second year, the student writes a thesis proposal in NRSA format and defends this before the advisory committee. For the purposes of the divisional requirements, this is the examination testing the candidate’s qualifications for candidacy.

The original observations included in the final Ph.D. dissertation should be judged suitable for publication. The final oral examination for the Ph.D. degree consists of a public seminar and a private defense conducted by the advisory committee and by other such members of the University faculties as may be deemed suitable.

NEUROBIOLOGY, COMMITTEE ON COURSES

NURB 30107. Behavioral Neuroscience. 100 Units.
This course is concerned with the structure and function of systems of neurons, and how these are related to behavior. Common patterns of organization are described from the anatomical, physiological, and behavioral perspectives of analysis. The comparative approach is emphasized throughout. Laboratories include exposure to instrumentation and electronics, and involve work with live animals. A central goal of the laboratory is to expose students to in vivo extracellular electrophysiology in vertebrate preparations. Laboratories will be attended only on one day a week but may run well beyond the canonical period.
Instructor(s): D. Margoliash
Terms Offered: Winter
Equivalent Course(s): PSYC 40107,CPNS 30107
NURB 30500. Medical Neurobiology. 100 Units.
This intensive course starts by introducing the student to neuroanatomy and neurophysiology. With the vocabulary afforded by that introduction in hand, students will then learn the general principles of perception, followed by focused treatment of vision, hearing and verbal communication, pain, and equilibrium. Students will then learn the key components of voluntary motor control including the motor unit, reflexes, gait, posture, praxis, cerebellar and basal ganglia function, and gaze control. The course wraps up with a consideration of neural contributions to homeostasis and a consideration of how the brain informs the practice of medicine.
The course consists of daily lectures, 9 laboratory exercises, 6 review sessions, a midterm and a final. In addition, the ophthalmology and neurology exams will be taught in collaboration with Clinical Skills.
At the conclusion of this course, students will be prepared for the boards, the neurological part of CPPT, and most importantly for understanding the neural contributions to disorders of all organ systems.
Instructor(s): P. Mason Terms Offered: Autumn
Equivalent Course(s): NEUR 30500

NURB 31349. Protein Structure and Functions in Medicine. 100 Units.
This course explores how molecular machinery works in the context of medicine (vision, fight or flight, cancer, and action of drugs). We first explore the physical and biochemical properties of proteins in the context of cellular signaling. We then examine how proteins and other cellular components make up the signal transduction pathway of humans and conduct their biological functions. The course engages students to strengthen their scientific communication and teaching skills via the in-class podcast, oral examinations, computer-aided structural presentations, student lectures, and discussions.
Instructor(s): W-J. Tang Terms Offered: Winter
Prerequisite(s): Completion of a Biological Sciences Fundamentals sequence.
Biochemistry strongly recommended.
Equivalent Course(s): BIOS 21349

NURB 31600. Survey of Systems Neuroscience. 100 Units.
This lab-centered course teaches students the fundamental principles of vertebrate nervous system organization. Students learn the major structures and the basic circuitry of the brain, spinal cord and peripheral nervous system. Somatic, visual, auditory, vestibular and olfactory sensory systems are presented in particular depth. A highlight of this course is that students become practiced at recognizing the nuclear organization and cellular architecture of many regions of brain in rodents, cats and primates.
Instructor(s): L. Osborne Terms Offered: Autumn
Prerequisite(s): undergraduates with consent of instructor
Equivalent Course(s): ORGB 32500
**NURB 31800. Cellular Neurobiology. 100 Units.**
This course is concerned with the structure and function of the nervous system at the cellular level. The cellular and subcellular components of neurons and their basic membrane and electrophysiological properties will be described. Cellular and molecular aspects of interactions between neurons will be studied. This will lead to functional analyses of the mechanisms involved in the generation and modulation of behavior in selected model systems.
Instructor(s): P. Lloyd, C. Hansel Terms Offered: Autumn
Prerequisite(s): Undergraduates With Consent Of Instructor.

**NURB 31900. Molecular Mechanisms of Cell Signaling. 100 Units.**
Cells in the body communicate with each other by a variety of extracellular signals (e.g., hormones, neurotransmitters) and processes such as vision and olfaction, as well as diseases such as cancer, all involve aspects of such signaling processes. The subject matter of this course considers molecular mechanism of the wide variety of intracellular mechanisms that, when activated, change cell behavior. Both general and specific aspects of intracellular signaling are covered, with an emphasis on the structural basis of cell signaling.
Instructor(s): W.-J. Tang Terms Offered: Spring
Prerequisite(s): "BIOS 20181-20183 or 20191-20193, and 20200"
Equivalent Course(s): BIOS 26317, CPHY 31900

**NURB 32100. Cell and Molecular Biology of the Neuron. 100 Units.**
Cell and molecular biology of the neuron will discuss the fundamental knowledge the students need to understand the inner workings of the neuron. This course will explore core concepts in cell and molecular biology in considerable depth using examples from neurobiology. A wide range of topics will be covered including: from gene to proteins, regulation of gene expression, mammalian cell architecture, neuronal compartmentalization, membrane trafficking, neuronal dysfunction, and genetic models.
Instructor(s): G. Thinakaran Terms Offered: Winter

**NURB 32200. Molecular Neurobiology. 100 Units.**
This course is devoted to the examination of current research in the molecular biology of the nervous system. We will explore the structure and function of macromolecules that control, propagate, and elicit neural signaling. Topics covered include 1) structural elements of neurons and glia; 2) structure and function of the synapse; 3) aspects of the molecular basis of neural signaling; and 4) gene expression in neural systems. Lectures draw on current journal literature to present a state-of-the-art background of the topic, the current questions being explored, as well as problems and aspects.
Instructor(s): W. Green Terms Offered: Alternate Springs
NURB 32400. Synaptic Physiology. 100 Units.
This course covers the basic principles of synaptic transmission and plasticity using a combination of lecture and discussion of primary literature. Lecture topics cover membrane electrical phenomena that lead to release of neurotransmitter presynaptically, as well as the physiological consequences of postsynaptic receptor activation. Paper discussions, which make up ~ 2/3 of the course, are centered on two major topics: 1) The molecular machinery controlling synaptic vesicle exocytosis and recycling, and 2) Synaptic plasticity covering LTP, LTD, Metaplasticity, Spike-timing dependent plasticity and Homeostatic plasticity. There is significant emphasis on the connections between the various forms of synaptic modification and behavior.
Instructor(s): D. McGehee and A. Fox Terms Offered: Spring

NURB 32800. Neuropsychopharmacology. 100 Units.
Effects of drugs on behavior; emphasis on the functional contribution of brain neurotransmitter systems.
Instructor(s): P. Vezina Terms Offered: Winter

NURB 32900. Perspectives in Drug Abuse. 100 Units.
It is a broad overview course about drug abuse, that is appropriate for graduate students as well as undergraduates. It includes lectures on epidemiology, genetics, neurobiology, experimental methods, policy and treatment, as well as lectures on several specific drug classes. Lectures are by Dr. de Wit and by other invited faculty members, and students are required to present and discuss recent published papers during classes.
Instructor(s): H. de Wit Terms Offered: Spring

NURB 33400. Genetic Approaches in Neurobiology. 100 Units.
This course is more technique oriented. The goal is to give a good coverage of different genetic approaches as well as different aspects of neurobiology. Topics are organized by genetic approaches as the following: 1) Transgenic. 2) Gene targeting. 3) Gene replacement. 4) Conditional knockout. 5) Genetic and optical control of neural activity. 6) Transgenic facilitated imaging. 7) Forward genetics and genetic screening. The selection of a variety of papers throughout the course aims to cover different neural pathways, neurotransmitters, receptor/channel types, signaling pathways, and functional implications (learning, memory, addiction, development etc). Specific emphasis will be on the integration of molecular, cellular and systems level approaches in understanding behavior. Lecture time will be devoted to the genetic approaches. Students will present and discuss papers. We will have 2-3 papers each lecture.ches as well as different elements of neuro
Instructor(s): X. Zhuang Terms Offered: Winter
Equivalent Course(s): NEUR 33400
NURB 33800. Animal Models of Neuropsychiatric Disorders. 100 Units.
This course will cover the development, validation, and use of animal models of neuropsychiatric disorders. A wide range of animal models will be covered including behavioral, pharmacological, and genetic models, with an emphasis on mouse models. The disorders covered will range from those with unknown etiology to those with known single-gene causes. Disorders covered will include schizophrenia, mood disorders, obsessive-compulsive disorder, and autism spectrum disorders.
Instructor(s): S. Dulawa Terms Offered: Spring
Equivalent Course(s): BIOS 25129

NURB 34600. Neurobiology of Disease I. 100 Units.
This seminar course is devoted to understanding pathogenic mechanisms of neuronal death, neurodegenerative disease, and neuronal repair. Weekly seminars are given by experts in the basic and clinical aspects of neurodegenerative diseases. For each lecture, students are provided with a brief description of clinical and pathological features of a given set or mechanistic category of neurodegenerative diseases that is followed by a more detailed description of the current status of knowledge of several of the prototypical pathogenic mechanisms.
Instructor(s): C. Gomez Terms Offered: Winter

NURB 34700. Neurobiology of Disease II. 100 Units.
This seminar course is devoted to understanding pathogenic mechanisms of neuronal death, neurodegenerative disease, and neuronal repair. Weekly seminars are given by experts in the basic and clinical aspects of neurodegenerative diseases. For each lecture, students are provided with a brief description of clinical and pathological features of a given set or mechanistic category of neurodegenerative diseases that is followed by a more detailed description of the current status of knowledge of several of the prototypical pathogenic mechanisms.
Instructor(s): C. Gomez, Staff Terms Offered: Spring
Prerequisite(s): BIOS 24246
Equivalent Course(s): BIOS 24247, CPNS 34700