Department of Neurobiology and Behavior

2205 McGaugh Hall; (949) 824-8519
http://neurobiology.uci.edu/
Frank M. LaFerla, Department Chair
Raju Metherate, Department Vice Chair

Faculty
Matthew Blurton-Jones: Stem cells, Parkinson's disease, Alzheimer's disease, neurogenesis, differentiation, learning and memory, neurodegeneration, neurotrophins
Jorge Busciglio: Cellular and molecular mechanisms of neuronal degeneration in Down's syndrome and Alzheimer's disease
Lawrence F. Cahill: Brain mechanisms of emotion and memory
Thomas J. Carew: Cellular and molecular mechanisms of memory
Susana Cohen-Cory: Nervous system development; development of synaptic connectivity, neurotrophic factors, in vivo imaging
Carl Cotman: Brain aging, Alzheimer's, cell biology, biochemistry
Karina S. Cramer: Mechanisms of nervous system development; axonal target selection; development and plasticity of auditory brainstem pathways
Norbert Fortin: Fundamental neurobiological mechanisms underlying episodic memory
Ron D. Frostig: Functional organization of cortex
Sunil Gandhi: Plasticity in the neural circuits of the mammalian visual system
Kim Green: Alzheimer's disease, therapeutics, glucocorticoid, APP processing
Christine M. Gall: Regulation of neuronal gene expression
John F. Guzowski: Experience-dependent gene expression in the modification of neural circuits involved in long-term memory formation
Robert K. Josephson: Design of skeletal muscle
Claudia H. Kawas: Clinical neurology
Herbert P. Killackey: Developmental neuroanatomy
Frank LaFerla: Alzheimer's, neural apoptosis, transgenic animal modeling
Michael Leon: Brain development
John Marshall: Neuropharmacological approaches to behavioral analysis
James L. McGaugh: Neurobiology of learning and memory
Raju Metherate: Synaptic physiology and plasticity in sensory neuroprocesses
John C. Middlebrooks: Hearing research; neurophysiology; auditory prosthesis; computational neuroscience; auditory cortex
Ricardo Miledi: Molecular neurobiology and physiology of ion channels and receptors
Ian Parker: Intracellular calcium and cell signaling
Steven Small: Neurobiology of language, aphasia, functional neuroanatomy of hand motor function, long-term aspects of stroke recovery
Ivan Soltesz: Molecular and cellular neurobiology
George Sperling: Cognition, vision, and visual perception
Craig Stark: Memory, hippocampus, neuroimaging, amnesia, FMRI
Arnold Starr: Cognitive and sensory neuroprocesses
Oswald Steward: Mechanisms of synapse growth and plasticity
Georg Striedter: Neuroethology, behavioral neuroscience, evolutionary neurobiology
Katumi Sumikawa: Molecular neurobiology of synapses
Andrea J. Tenner: Molecular basis of the enrichment of human leukocyte function
Leslie M. Thompson: Molecular/biochemical analysis of skeletal dysplasias and Huntington's disease
Norman M. Weinberger: Neural bases of attention and learning
Marcelo Wood: Neurobiology and memory
Pauline Yahr: Behavioral neuroendocrinology

The Department of Neurobiology and Behavior Ph.D. program provides a broad foundation in neuroscience combined with a technical proficiency in a specific area of research. Faculty members in the Department address neuroscience at the molecular, cellular, systems, and behavioral levels. Research focuses on a range of topics including learning and memory, neurodegenerative disorders, addiction, sensory neurobiology, developmental neurobiology, and neural plasticity.

The Department of Neurobiology and Behavior also participates in the Interdepartmental Neuroscience Program, described in a previous section.

The Department of Neurobiology and Behavior offers the Ph.D. degree in Biological Sciences. Graduate students must complete a sequence of core courses (lectures and laboratories) during their first year, and maintain an overall GPA of 3.3 or better. They also must take a minimum of four advanced courses before graduation and participate in directed research each year and teaching during their first, second, third, and fourth years. Students will advance to candidacy for the Ph.D. at the end of their third year by means of a written critical review of the literature in the area in which they plan to do their dissertation, a research proposal, and an oral examination. Graduation depends on successful preparation and oral defense of a dissertation based on the student's research. The normative time for completion of the Ph.D. is five years, and the maximum time permitted is seven years.

Ideally, applicants for this program should have taken undergraduate courses in biology (one introductory year plus some advanced work), and/or psychology (experimental, physiological, and learning), chemistry
through biochemistry, introductory physics, calculus, and statistics. They also must submit GRE Aptitude test scores. Because graduate training emphasizes research, preference is given to applicants having laboratory research experience as undergraduates. Applicants with substantial outside commitments that would curtail laboratory research or prolong the time to degree are not accepted. The deadline for application is December 2.

Courses

**NEURBIO 200A. Research in Neurobiology and Behavior. 2-12 Units.** Individual research with Neurobiology and Behavior faculty.

Repeatability: Unlimited as topics vary.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 200B. Research in Neurobiology and Behavior. 2-12 Units.** Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 200A.

Repeatability: Unlimited as topics vary.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 200C. Research in Neurobiology and Behavior. 2-12 Units.** Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 200B.

Repeatability: Unlimited as topics vary.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 201A. Research in Neurobiology and Behavior. 2-12 Units.** Individual research with Neurobiology and Behavior faculty.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 201B. Research in Neurobiology and Behavior. 2-12 Units.** Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 201A.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 201C. Research in Neurobiology and Behavior. 2-12 Units.** Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 201B.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 202A. Foundations of Neuroscience. 2 Units.** Intended to expose students to critical reading and analysis of the primary neuroscience literature. Instructors from departments associated with the Interdepartmental Neuroscience Program participate and discuss topics of current interest.

Grading Option: Satisfactory/unsatisfactory only.

**NEURBIO 202B. Foundations of Neuroscience. 2 Units.** Intended to expose students to critical reading and analysis of the primary neuroscience literature. Instructors from departments associated with the Interdepartmental Neuroscience Program participate and discuss topics of current interest.

Prerequisite: NEURBIO 202A.

Grading Option: Satisfactory/unsatisfactory only.

**NEURBIO 202C. Foundations of Neuroscience. 2 Units.** Intended to expose students to critical reading and analysis of the primary neuroscience literature. Instructors from departments associated with the Interdepartmental Neuroscience Program participate and discuss topics of current interest.

Prerequisite: NEURBIO 202B.

Grading Option: Satisfactory/unsatisfactory only.

**NEURBIO 206. Molecular Neuroscience. 5 Units.** Surveys molecular and cellular mechanisms involved in neuronal function, including control of gene expression, post-transcriptional and post-translational processing, RNA and protein targeting, cell death mechanisms, and molecular genetic basis of neurological disorders. Overview of the molecular aspects of developmental neurobiology.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 207. Cellular Neuroscience. 5 Units.** Neurophysiological and neurochemical mechanisms of electrical and chemical signaling in neurons. Topics include generation of resting-and action-potentials, voltage- and ligand-gated ion channels, second messenger systems, and synaptic transmission and integration.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 207L. Cellular Neuroscience Laboratory. 2 Units.** Intensive hands-on laboratory experience of contemporary techniques for studying ion channels and synaptic function. Experiments include microelectrode recording, patch clamp, quantal analysis of synaptic transmission, heterologous expression of genes for channels and receptors, brain slice, and fluorescence calcium imaging.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Neurobiology and Behavior graduate students only.

**NEURBIO 208A. Systems Neuroscience. 5 Units.** Study of the mammalian nervous system at the systems level. Anatomy and physiology of sensory, motor, and integrative functions.

Same as ANATOMY 210A.

Restriction: Neurobiology and Behavior graduate students only.
NEURBIO 208B. Systems Neuroscience. 5 Units.
Study of the mammalian nervous system at the systems level. Anatomy and physiology of sensory, motor, and integrative functions.
Prerequisite: NEURBIO 208A.
Repeatability: May be taken for credit 2 times.
Same as ANATOMY 210B.
Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 209. Behavioral Neuroscience. 5 Units.
Overview of fundamental conceptual and experimental issues in the neurobiology of learning and memory. The approach is a cross-level integration of research in molecular-genetic, cellular, circuit, systems, and behavioral analyses.
Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 230. Chromatin Structure and Function. 4 Units.
Focuses on the role of chromatin/nuclear structure organization in eukaryotic genome regulation. The effects of histone and DNA modification, chromatin remodeling, higher order chromatin structure and nuclear organization on gene regulation, DNA replication, and repair are discussed.
Prerequisite: MOL BIO 203 or MOL BIO 204 or NEUROBIO 206.
Same as BIOCHEM 225.
Restriction: Graduate students only.

NEURBIO 232. Regenerative Neurobiology. 4 Units.
Surveys the latest research on regenerative neurobiology. Both basic stem cell discoveries and their potential clinical application to brain disorders will be examined.

NEURBIO 235. Balancing Research and Teaching. 1 Unit.
The goal of this course is to offer graduate students who have commitments outside of their research program (such as teaching) an opportunity to learn to balance these commitments.

NEURBIO 236. Cortex: Structure, Function, and Plasticity. 4 Units.
Structured to include lectures and presentation of papers about cortex with emphasis on sensory-motor cortex. Both historical and current perspectives on cortical structure-function relationship will be critically evaluated.

NEURBIO 237. Neurobiology of Brain Aging. 4 Units.
Outlines some of the significant changes that occur in the aging brain, with a special emphasis on risk factors and protective strategies that promote successful brain aging. Topics include changes in synaptic plasticity, neurotrophic factors, and molecular mechanisms in aging.
Prerequisite: NEURBIO 209.

NEURBIO 238. Neurobiology of Memory as a Multidisciplinary Science. 4 Units.
The study of memory is a highly multidisciplinary science ranging from molecular and cellular studies in reduced studies in reduced preparations to functional imaging studies in humans. The focus is to integrate across approaches and levels of analysis to better understand how the hippocampus, and its constituent elements, subserves memory. Emphasis on the challenges of this multidisciplinary field.
Restriction: Majors only

NEURBIO 239. Functional Imaging of the Nervous System. 4 Units.
Overview of technical and applied aspects of imaging techniques available for studying the nervous system. The areas emphasized are cellular and subcellular imaging of neural function, systems-level imaging of brain function, and imaging of the human brain.
Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 240. Advanced Analysis of Learning and Memory. 4 Units.
Advanced analysis of contemporary research concerning the nature and neurobiological bases of learning and memory. Special emphasis is given to time-dependent processes involved in memory storage.
Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 244. Cognitive Neuroscience of Human Memory. 4 Units.
In-depth treatment of current topics of interest in the cognitive neuroscience of human long-term memory. Topics include methods of investigation of human memory, functional architecture of memory, implicit vs. explicit distinction, and control processes in memory, among others.
Prerequisite: NEURBIO 209.

NEURBIO 248. Topics in Neurobiology and Behavior. 4 Units.
Studies in selected areas of Neurobiology and Behavior. Topics addressed vary each quarter.
Repeatability: May be taken for credit 3 times.

NEURBIO 249. Electronics for Biologists. 4 Units.
Basic principles of electricity; properties and use of discrete components and integrated circuits; circuit analysis and design. Intended for advanced students in the life sciences.
Same as PHYSIO 205.

NEURBIO 250. Basal Ganglia and Movement Disorders. 4 Units.
Principles underlying the organization and functions of the basal ganglia and amygdala are considered. The circuitry, neurotransmitters, and influences on cortex and brainstem motor regions are discussed. Clinical disorders of the basal ganglia, including parkinsonism and ballism, are included.
Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 254. Molecular Neurobiology. 4 Units.
The application of genetic and recombinant DNA technology to neurobiology. Topics include the study of neuronal proteins which play important roles in the formation of synapses and synaptic transmission.
Restriction: Neurobiology and Behavior graduate students only.
NEURBIO 255. **History of Neuroscience. 4 Units.**
An overview of the conceptual and technical foundations of contemporary neuroscience from ancient times to the present. The subjects include synapses, neurons, brain organization, sensory, motor and regulatory systems, learning and memory, human brain function and dysfunction.

Repeatability: May be taken for credit 2 times.
Restriction: Neurobiology and Behavior graduate students only.

Concurrent with BIO SCI N119.

NEURBIO 257. **Statistics for Neurobiologists. 4 Units.**
Introduction to common methods for statistical analysis used in neurobiology. Topics covered include t-tests, ANOVAs, correlations and regressions, general linear model, power analysis, and non-parametric tests.

Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 260. **Auditory Neuroscience. 4 Units.**
Multidisciplinary overview of brain mechanisms of hearing. Emphasizes breath of auditory function and research: single neurons to psychoacoustics, the cochlea to the cortex, and basic science to clinic.

NEURBIO 261. **Advanced Topics in Neurodegeneration. 4 Units.**
Neurodegenerative disorders represent one of the most devastating illnesses to afflict humans, and usually occur in an age-dependent fashion. Course reviews the basic mechanisms that underlie cognitive and motor dysfunction in the major disorders of the brain.

Prerequisite: NEUROBIO 206.

NEURBIO 265. **Developmental Neurobiology—Wiring the Brain. 4 Units.**
The development of the nervous system is discussed with particular emphasis on the processes that underlie the appearance of complex and highly ordered neural circuits. Topics include neuronal migration, axon guidance, and formation and maintenance of synaptic connections.

NEURBIO 290. **Colloquium in Neurobiology and Behavior. 1.3 Unit.**
Presentation of contemporary research problems in neurobiology and behavior and related areas by invited speakers.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 292. **Scientific Communication. 4 Units.**
Students learn how to effectively communicate scientific ideas and results. Activities include learning how to effectively write a scientific manuscript, how to perform a coherent slide presentation, and how to run-through a poster presentation.

Restriction: Neurobiology and Behavior graduate students only.

NEURBIO 299. **University Teaching. 1-4 Units.**
Limited to Teaching Assistants.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.