NEUROSCIENCE • biological chemistry • cancer biology • cell regulation • genetics and development • immunology • integrative biology • molecular biophysics • molecular microbiology

NEUROSCIENCE

CHAIR, GRADUATE PROGRAM

Ege T. Kavalali, Ph.D.

DEGREE OFFERED

Doctor of Philosophy

FACULTY AND RESEARCH INTERESTS

Leon Avery, Professor
Ph.D., Stanford University, 1983
Neurogenetics of *Caenorhabditis elegans*.

Ilya B. Bezprozvanny, Professor
Ph.D., Institute of Cytology, Russian Academy of Sciences, 1992
Structure, function and modulation of calcium channels.

James A. Bibb, Associate Professor
Ph.D., State University of New York at Stony Brook, 1994
Signal transduction in the nervous system, with emphasis on the biochemistry and neuropharmacology of protein phosphorylation/dephosphorylation.

Stephen C. Cannon, Professor
M.D., Ph.D., Johns Hopkins University, 1986
How ion channels regulate electrical excitability of cells and how defects in these channels lead to human disease.

Roberto Coppari, Assistant Professor
Ph.D., University of Marche, Italy, 2002
Cellular mechanisms and neuronal pathways controlling glucose and energy homeostasis.

Christopher Cowan, Assistant Professor
Ph.D., Baylor College of Medicine, 1998
Molecular biology of axon guidance.

Amelia Eisch, Assistant Professor
Ph.D., University of California, irvine, 1997
Function of adult neurogenesis in the brain.

Jeffrey Elliott, Professor
M.D., Washington University, St. Louis, 1988
Molecular and cellular basis for function of the ALS disease gene *SOD1*.

Joel Elmquist, Professor
D.V.M., Ph.D., Iowa State University, 1992, 1993
Functional neuroanatomy of the mammalian hypothalamus.

Matthew Goldberg, Assistant Professor
Ph.D., Yale University, 1998
Molecular biology of Parkinson's disease.

Carla Green, Professor
Ph.D., University of Kansas Medical Center, 1991
Molecular mechanisms of circadian rhythms and how they control metabolism.

Robert Greene, Professor
Ph.D., George Washington University, 1982;
M.D., University of Maryland, 1983
Control and function of sleep/wake states; system mechanisms of NMDA hypofunction-related cognitive defects.

Mark J. Henkemeyer, Associate Professor
Ph.D., University of Wisconsin, Madison, 1990
Molecular biology of axon guidance.

P. Robin Hiesinger, Assistant Professor
Ph.D., Albert-Ludwigs University, Freiburg, Germany, 2000
Neurogenetics; brain wiring/synaptic specification; synapse function/neurotransmitter-release membrane fusion; computational approaches to 4-D visualization and simulation.

Donald W. Hilgemann, Professor
Ph.D., University of Tübingen, Germany, 1980
Function and regulation of membrane transporters; electrophysiology; biophysics of ion pumps and channels.

Jenny Hsieh, Assistant Professor
Ph.D., Johns Hopkins University, 2000
Neural stem-cell biology; chromatin remodeling.

Kimberly M. Huber, Associate Professor
Ph.D., University of Texas Graduate School of Biomedical Sciences at Houston, 1995
Physiology and cellular mechanisms of synaptic plasticity.

Qui-Xing Jiang, Assistant Professor
Ph.D., Yale University, 2002
Elucidating the structural basis of the function of ion channels and other macromolecular complexes.

Jane E. Johnson, Professor
Ph.D., University of Washington, 1988
Molecular biology of mammalian neural development.

Rolf H. Joho, Associate Professor
Ph.D., University of Zürich, Switzerland, 1977
Molecular and cellular neurobiology; structure/function studies of ion channel proteins.

Ege T. Kavalali, Associate Professor
Ph.D., Rutgers University, 1995
Molecular physiology of neurotransmission in the central nervous system.

Helmut J. Krämer, Associate Professor
Ph.D., University of Cologne, Germany, 1989
Genetic dissection of endocytic trafficking in Drosophila.

Shuxin Li, Assistant Professor
M.D., Henan Medical University, 1986; Ph.D., University of Ottawa, 2000
Axonal regeneration in the central nervous system; cell death and neuronal survival; spinal cord injury.

Weichun Lin, Assistant Professor
Ph.D., State University of New York, 1996
Developmental neurobiology.

Qing Richard Lu, Assistant Professor
Ph.D., Rutgers University Robert Wood Johnson Medical School, 1997
Differentiation mechanisms in the mammalian central nervous system: gliogenesis as a model.

Colleen McClung, Assistant Professor
Ph.D., University of Virginia, 2001
Molecular mechanisms of mood disorders and drug addiction.

Lisa Monteggia, Assistant Professor
Ph.D., Chicago Medical School, 1998
Elucidating antidepressant efficacy; a functional molecular and behavioral approach to autism-spectrum disorders; cellular basis of psychiatric disorders.

Luis F. Parada, Professor
Ph.D., Massachusetts Institute of Technology, 1985
The role of proto-oncogenes in vertebrate development; trk receptors and neurotropins.

Juan M. Pascual, Assistant Professor
M.D., Universidad de Granada, Spain, 1990; Ph.D., Baylor College of Medicine, 1995
Animal and cellular models of neurogenetic disorders; synaptic transmission in experimental epilepsies; disorders of brain energy metabolism.

Andrew Pieper, Assistant Professor
M.D., Ph.D., Johns Hopkins University, 2001
Molecular mechanisms of neuropsychiatric disease.

Craig Powell, Assistant Professor
M.D., Ph.D., Baylor College of Medicine, 1994
Molecular and cellular mechanisms of cognition with an emphasis on learning and memory.

Janine Prange-Kiel, Assistant Professor
Ph.D., University of Tuebingen, Germany, 1998
Regulation of hippocampal aromatase expression and its impact on synaptic plasticity; the role of aromatase in Alzheimer's disease.

José Rizo-Rey, Professor
Ph.D., University of Barcelona, Spain, 1988
Structural analysis by NMR of proteins involved in calcium-triggered synaptic vesicle exocytosis.

Adrian Rothenfluh, Assistant Professor
Ph.D., Rockefeller University, 1999
Genetics and neurobiology of behavioral responses to drugs of abuse in the fruit fly.

David W. Self, Associate Professor
Ph.D., University of California, Irvine, 1992
Neurobiology of motivational systems and drug addiction.

Dean P. Smith, Associate Professor
M.D., University of Utah, 1986; Ph.D., University of California, San Diego, 1992
Molecular biology of sensory transduction in Drosophila.

Joe Takahashi, Professor
Ph.D., University of Oregon, 1981
Molecular and genetic analysis of the mammalian circadian clock system.

Carol A. Tamminga, Professor
M.D., Vanderbilt University Medical School, 1971
Role of the NMDA-sensitive glutamate system in the pathophysiology of schizophrenia, especially in the hippocampus.

Jonathan Terman, Assistant Professor
Ph.D., Ohio State University, 1997
Axonal growth and guidance; neuronal connectivity; axonal regeneration.

Jiang Wu, Assistant Professor
Ph.D., University of Texas at Austin, 2001
Chromatin regulation of neural development; neural stem-cell differentiation; activity-dependent gene expression.

Masashi Yanagisawa, Professor
M.D., Ph.D., University of Tsukuba, Japan, 1985, 1988
Identification and characterization of new neuropeptides that regulate vital functions such as sleep, appetite and blood pressure.

Gang Yu, Associate Professor
Ph.D., University of Calgary, Canada, 1996
Molecular mechanisms of Alzheimer's disease and neuronal signaling.

Objectives

The Neuroscience Graduate Program focuses on cellular and molecular neurobiology. Topics of particular interest include synaptic physiology and synaptic plasticity; membrane biophysics, especially receptors and ion channels; neuronal organelle traffic, particularly the biogenesis and exo- and endocytosis of synaptic vesicles; neurogenetics of invertebrates and vertebrates; development of neural systems; and molecular and cellular basis of complex behavior.

Special Requirements for Admission

Students wishing to join the Neuroscience Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Usually students seek enrollment in the program toward the end of their first year of study following completion of the set of research rotations and selection of a mentor. Prospective students should note that the diverse research topics in the field make neurobiology an appropriate doctoral subject for those with undergraduate degrees in physics, chemistry, engineering, mathematics and psychology, as well as in biological disciplines.

Curriculum

Neurobiology is a field defined not by a specific intellectual approach or experimental technique but by its subject matter: the cells of the nervous, sensory and muscular systems. Because of the variety of methods that must be brought to bear in studies of these systems, the optimal training for a career in neurobiological research includes an in-depth exposure to the principles of biochemistry, biophysics, cell and molecular biology, developmental biology, genetics, immunology, pharmacology, and physiology, as well as behavioral neuroscience.

Core Course

By providing a solid background in the above areas, the first-year Core Course offers appropriate training for first-year students who elect to join the Neuroscience Graduate Program. The first-year course also provides 15 hours of course credit toward the minimum 24 hours required for graduation.

Laboratory Rotations

First-year students participate in three laboratory rotations. Insofar as possible, students with an interest in neurobiology should seek rotations that expose them to a wide variety of technical approaches, including anatomy, behavior, biochemistry, biophysics, cell biology, genetics, molecular biology and physiology. At the end of the first year of study, students choose a mentor for dissertation research.

Advanced Topics in Neuroscience

Each student in the Neuroscience Graduate Program is required to accrue at least nine hours of credit from the advanced courses offered within the Division of Basic Science. Three of these credit hours come from Fundamentals of Neuroscience, and at least three more come from the advanced courses given by the Neursocience Graduate Program. (See list below.) Although the third and subsequent years will be devoted largely to research on a dissertation topic, students may take additional graduate seminar courses.

The Neuroscience Graduate Program offers the neuroscience core course, Fundamentals of Neuroscience, and a series of advanced graduate seminar courses. Advanced courses are intended not only to offer knowledge about a given topic but also to confer a detailed understanding of experimental procedures and to promote clear presentation of ideas and arguments. The advanced courses given each year by the Neuroscience Graduate Program are meant to offer students a balanced perspective on molecular, cellular, developmental and integrative neurobiology. New topics are selected yearly to reflect the evolution of research in the field.

NEUROSCIENCE COURSES

Course descriptions are listed in the Division of Basic Science chapter of the catalog.

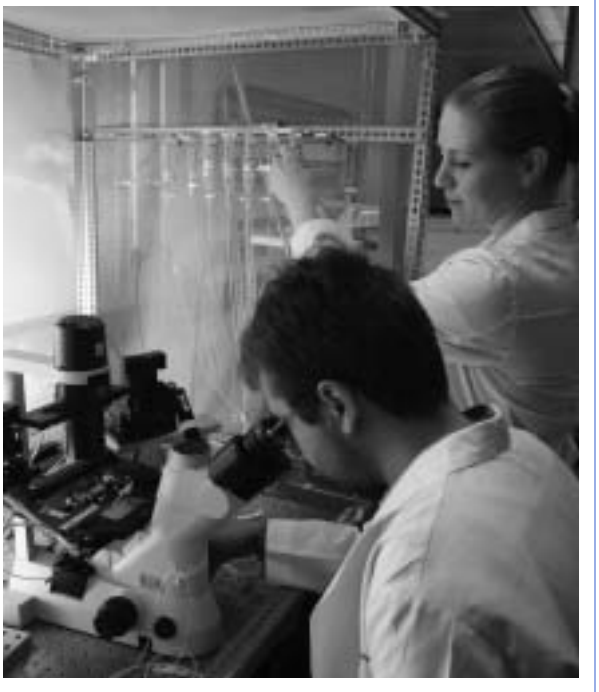
Chemical Neurotransmission
Developmental Neurogenetics
Fundamentals of Neuroscience
Heritable Neurological Diseases of Mice and Men
Hyopothalamic Control of Homeostasis
Heritable Neurological Diseases of Mice and Men
Neurobiology of Drug Addiction
Neurobiology of Mental Illness
Neuropharmacology
Structure and Function of Ion Channels

NEUROSCIENCE JOURNAL CLUB

The Neuroscience Journal Club offers students an opportunity to keep abreast of recent research results, to sharpen critical acumen and to develop speaking skills. Every student in the graduate program is expected to attend a journal club and to participate actively. In addition, each student is required to make at least one journal club presentation per year.

NEUROSCIENCE SEMINAR

Weekly neuroscience seminars hosted by tthe departments of Psychiatry, Neurology and Neuroscience are held to present current advances in all areas of modern neurobiology. One or two seminars are organized by the students of the Neuroscience Graduate Program. Furthermore, numerous scientific presentations of interest to neurobiologists occur each year in seminar series offered by the departments of Cell Biology, Molecular Biology, Pharmacology and Physiology, among others. The University Lecture Series often deals with the nervous system and related topics.



WORK IN PROGRESS

Students, postdoctoral fellows, faculty and other interested individuals meet on a biweekly basis to discuss current research carried out by students of the Neuroscience Graduate Program. The student presentations are made in a setting that fosters spontaneity and exchange of ideas.

ANNUAL NEUROSCIENCE RETREAT

Once a year, students, postdoctoral fellows and faculty gather for an all-day meeting to present current work and exchange research ideas. This meeting is held off campus in a setting where participants have the opportunity to present their research in a manner similar to the annual meeting of the Society for Neuroscience. All students in the Neuroscience Graduate Program are expected to attend, and advanced students are

required to present their research in a formal setting.

Qualifying Examination

The qualifying examination comprises a written and an oral component, each of which must be passed as part of the qualifications for admission to Ph.D. candidacy. Unless a prior extension is granted by the Steering Committee, each student must complete the qualifying examination by the end of June of his or her second year of graduate enrollment. Those students in the Medical Scientist Training Program who initially take two years of medical training must complete the qualifying examination by the end of June of their third year of enrollment.

The written component is a research proposal dealing with a group of related scientific problems in an area of study different from that in which the student expects to conduct his or her dissertation. The oral examination ordinarily is given in a single closed session lasting from one to two hours. The student is expected to answer questions relating to material in courses that he or she has taken, to the subject matter in the written proposal and to general information in the field of neurobiology.

Dissertation Defense

A complete copy of the dissertation must be approved by the dissertation committee before a public dissertation defense can be schduled. The defense is composed of a public lecture describing the main observations of the research, followed by an oral examination by the dissertation committee. Attendance during the oral examination is restricted to faculty of the graduate school, and participation is restricted to the examination committee.