INTERDEPARTMENTAL PH.D. PROGRAMS

GENETICS PROGRAM

Director: Fred Sherman, Ph.D., Marie Curran Wilson and Joseph Chamberlain Wilson Professor and Chair of Biochemistry

The Ph.D. Program in Genetics provides students an opportunity to choose a program of study specializing in modern genetics through diverse laboratory experiences, training, coursework, and seminars. The interdepartmental nature of the program maximizes the students' exposure to the many facets of the discipline. Training is provided through the participation of the Departments of Biochemistry and Biophysics, and Microbiology and Immunology in the School of Medicine and Dentistry; the Division of Genetics, which includes members from the Departments of Medicine, Pediatrics, and Psychiatry in the Medical Center; and, the Department of Biology in the College, located at the adjacent River Campus. The program is administered by the Biochemistry Molecular Biology and Genetics (BMBG) Cluster.

Admission. An undergraduate degree in science as well as at least one undergraduate course in genetics is required. Students may apply for admission through the BMBG Cluster. During their first year of graduate study, students are expected to attend the faculty research presentations scheduled in each participating department. Based on these presentations, students choose three laboratories in which to complete rotations. At the end of the rotation period (usually in May of the first year) the student must choose an advisor and discuss the proposed research project. The student will be asked to submit a short outline of the proposed research project for review by the Cluster.

Ph.D. Program Requirements. In addition to core courses, students can choose from a variety of elective courses. Electives should be chosen based on recommendations of the student's advisor and advisory committee. Additional requirements include serving as a teaching assistant for one semester and presenting yearly seminars.

Qualifying Examination. At the end of the second year of study, the student is expected to submit a research proposal and pass a qualifying examination administered by the advisory committee. Upon successful completion of this examination, an M.S. degree in genetics is awarded.

COURSE REQUIREMENTS

IND 408. Biochemistry
Credit—four hours

This course provides instruction in biochemistry (as it relates to modern molecular biology) and cell biology and physiology.

IND 409. Cell Biology
Credit—four hours

This course provides instruction in basic pathways that regulate the biology of mammalian cells, and includes information on cell biology and intracellular signaling.

IND 410. Molecular Biology and Genetics
Credit—four hours

This course provides instruction in the utilization of genetic information for cellular functions. Topics include DNA replication, recombination, and repair; the synthesis and processing of RNA; and the genetic basis of human disease.

IND 501. Ethics in Research
Credit—one hour

A seminar course required for all graduate students and postdoctoral fellows engaged in research in the School of Medicine and Dentistry. Topics address issues related to professional standards of conduct in seminar format to encourage discussion among students, trainees, and faculty.

GEN 503, 504. Student Seminar
Credit—one hour

A seminar series offered each semester in which students present their work. Continuous registration is required.

GEN 507. Advanced Genetics
Credit—four hours

This course covers various model genetic systems of eukaryotes, emphasizing the features of each organism. The course includes lectures covering yeast, *tetrahymena, arabidopsis, C. elegans, drosophila,* zebra fish, and mice.

GEN 595. Ph.D. Research
Credit—to be arranged

Ph.D. research may be undertaken in any of the participating departments under the direction of a faculty advisor.

NEUROSCIENCE PROGRAM

Director, Howard J. Federoff, Professor of Neurology
Chair, Curriculum Committee, M. Kerry O'Banion, Associate Professor of Neurobiology and Anatomy
Chair, Admissions Committee, John Olschowka, Associate Professor of Neurobiology and Anatomy
Chair, Advisory Committee, Robert Gross, Associate Professor of Neurology and Pharmacology and Physiology.

Neuroscience is a highly interdisciplinary science. The graduate program in neuroscience at the University of Rochester is designed to provide the interdisciplinary training required to understand nervous system function at many levels of analysis. This unique program offers students the opportunity to study a wide range of modern neuroscience disciplines organized as specific programmatic themes, including learning; memory, and plasticity; cell signaling and communication; sensory, motor, and integrative neurobiology; development and aging; and neurobiology of disease. Program requirements are modified for graduate students pursuing the M.D./Ph.D. in neuroscience.

Faculty. Participating School of Medicine and Dentistry faculty come from several different departments, including the Departments of Neurobiology and Anatomy, Neurology, Pharmacology and Physiology, Microbiology and Immunology, Environmental Medicine, Ophthalmology, Pediatrics, and Otolaryngology. Participating faculty from the College on the River Campus have appointments in the Departments of Brain and Cognitive Sciences, Computer Science, and in the Center for Visual Science.

Requirements for Admission. Entering students with either a B.A. or B.S. degree are expected to have completed courses in biology, biochemistry, cell biology, physics, chemistry, and calculus. Students lacking an adequate background are offered remedial courses in the fall of their first year. Students are not expected to need more than one or two remedial courses.

Doctoral Degree Program Requirements. All neuroscience students take the following courses: Cellular Neuroscience, Integrative and Systems Neuroscience, Statistics, and Ethics in Research. Other requirements include laboratory rotations, 10 hours of upper-level electives, and participation in the Neuroscience Journal Club. Students also serve as a teaching assistant for one semester.

Electives. Students are required to complete at least six credit hours in upper-level neuroscience courses and four credit hours in any other upper-level disciplines suited to their particular area of interest. A minimum of 10 credit hours is required.

Laboratory Rotations. Students must complete a minimum of two lab rotations by the end of the summer, first year. The purpose of the lab rotation is to learn a technique, to gain an appreciation of different scientific approaches to a problem, and to gain exposure to an area of research that eventually may lead to a focused area of investigation. The experience should broaden one's research skills and, therefore, successive rotations should not be taken with related faculty or in labs where essentially the same techniques are used. However, coordinating the rotations to employ different techniques aimed at investigations into one particular area of neuroscience research is appropriate. Students are expected to consult with the advisory committee to plan their rotations. At the end of each rotation, students orally present their work or research area.

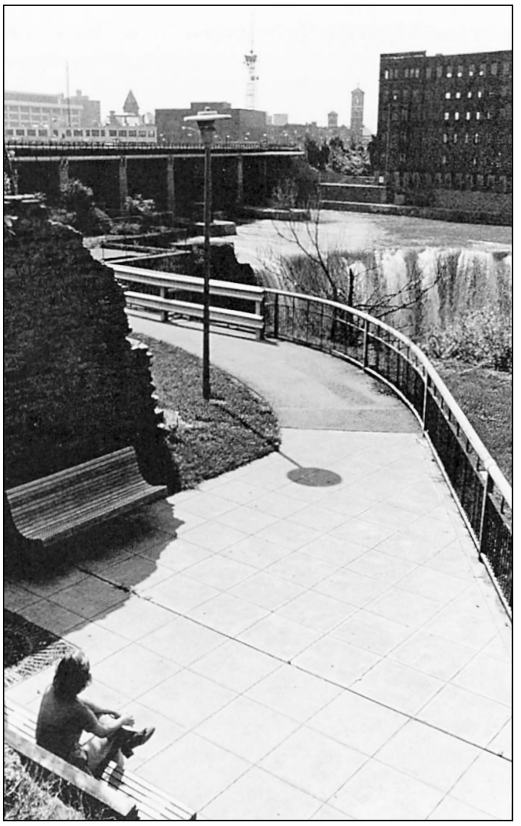
Teaching. All students serve as a teaching assistant for at least one semester in either NSC 201, NSC 203, or Mind, Brain, and Behavior I (Medical Neurosciences). This experience must include responsibility for a weekly conference, discussion group, or laboratory.

Presentations. After the second year, students participate in a neuroscience program seminar series and are expected to present at least one seminar related to their thesis research each year.

Thesis Committee. Each student will choose a faculty member as thesis advisor. The student, along with the thesis advisor, will select the other committee members (a total of four members, including advisor). This committee will be chosen during the student's spring semester of the second year and will be responsible for administering the Part II examination.

Qualifying Exam and Thesis Proposal. The qualifying examination consists of two parts. Part I must be taken no later than the end of the fall semester, second year. For Part I of the Qualifying Examination, the student, in consultation with an Examination Committee, chooses a topic that may be related—but not identical to—his or her intended research focus. The student is asked to critically evaluate the literature related to the topic and consider directions for future research, over a period of three or four weeks, reporting his or her evaluation to the committee in a written document. A public seminar followed by an oral examination with the Examination Committee completes the process. Part II of the Qualifying Exam, the thesis proposal, should be prepared by the end of the third year. It requires a written research proposal in the format of an NIH grant application, no longer than 10 pages. The proposal defense consists of a public seminar followed by a closed examination with the student's thesis committee.

Ph.D. Thesis Preparation and Final Exam. The committee includes the members of the proposal committee. Upon completion of the thesis, the student will present the thesis work in the form of an open lecture and then defend the work to a thesis committee.



COURSES OFFERED BY THE NEUROSCIENCE PROGRAM

483. Seminar in Neural-Immune Interactions

Credit—two hours

Associate Professor Moynihan

This is a seminar series devoted to topics in neural-immune interaction. Weekly seminars, presented by graduate students and faculty, will cover a range of topics such as: hormones as immunoregulators; cytokines as regulators of the nervous system; the peripheral nervous system and immune responses; stress-induced immunomodulation in animals and humans; the role of the nervous system in autoimmune disease and in the aging immune system; and behaviorally conditioned immunomodulation. Fall.

508. Neural Plasticity in Learning and Development

Credit—three hours

Professor E. Nordeen

An examination of neural plasticity in development, as well as in adult learning and memory. Topics covered are approached from the joint perspectives of behavior, computational modeling, and neural mechanisms. Readings are drawn from review and primary research articles. There are two essay-style exams and students are required to write a critical overview of a research topic germane to the course. This is a course designed for graduate students and undergraduate students who have a background in the neurosciences. Spring.

510. History of Neuroscience

Credit—one hour

Professors Joynt and Satran

This series of lectures and discussions covers various aspects of the historical development of our knowledge about the nervous system and the evolution of modern neural science. Some of the topics covered from this standpoint are the brain as mind, cortical localization, neuron doctrine, development of clinical neurology, development of electrophysiology, connection theory of higher function, memory and dementia, frontal lobe function, corpus callosum function, and others. This course is open to graduate students, medical students, residents, and interested members of the faculty. The class meets once a week for 11 weeks with a lecture and discussion. Fall, odd years.

512. Cellular Neuroscience

Credit—five hours

Professor Shrager

Cellular and molecular mechanisms in the nervous system are discussed in detail. Among the topics covered are overview of cellular components and molecular approaches, voltage and transmitter gated ionic channels, second messenger modulation of ionic channels, biochemistry of synaptic transmission, inhibitory and excitatory amino acids, neuronal and glial cell lineage and growth factors, axonal pathfinding, and experience-dependent plasticity. Sessions include lectures, discussions, and presentations of papers from the literature. Fall.

525. Biology of Neurological Diseases

Credit—three hours

Professor Joynt and Research Associate Professor Loy

This three-hour course is designed to focus on the etiopathogenesis and pathobiology of human neurologic diseases. The introduction to each session provides a brief review of relevant clinical issues. The major discussion concentrates on what is known regarding the basic neurobiological and cell biological processes which go awry and result in human disease. Therapy is discussed in terms of mechanisms of action and how drug therapy permits understanding disease mechanisms. This is not a course in the clinical approach to neurological disease, differential diagnosis, or clinical (pharmacological) management. Reading assignments and references are distributed two weeks prior to each session. Spring, even years.

530. Neural Basis of Learning, Memory, and Higher Function
Credit—three hours
Associate Professor Ringo

A part lecture part discussion course covering the physiologic bases of learning and memory. Topics include types of memory, evidence of memory in single-unit responses, computational approaches, habituation, conditioned reflexes, electrophysiologic indices, neuroanatomy of amnesia, interhemispheric relations, and clinical amnesia. Meets twice a week for one and one half hours. Fall, odd years.

531. Integrative and Systems Neuroscience
Credit—six hours
Prerequisites: NSC 201 or equivalent. Undergraduates and graduate students who are not in either the neuroscience or neurobiology and anatomy programs need instructor approval.
Professor Pasternak and Associate Professor O'Neill

The course provides a critical overview of current approaches to the study of systems neuroscience. Topics include the discussion of connectivity, neurophysiology, and the behavioral measures of sensory and motor systems, memory, and attention. The class meets for two hours three times a week and consists of a lecture and a discussion of assigned papers. Spring.

540. Principles of Behavior Analysis
Credit—three hours
Professor Cory-Slechta

This course covers the fundamental principles of the experimental analysis of behavior, including both operant and respondent conditioning. From there it progresses to include stimulus control and stimulus generalization and response generalization and how these processes work in the formation of behavioral chains. It then discusses the formation of more complex operant behaviors, including psychophysics, learning and memory, and language acquisition. The final part of the course relates these principles to applied areas of the human environment, including behavior modification and entities such as the legal and religious systems.

581. Teaching Tutorial in Neuroscience
Credit—three hours
Associate Professor O'Neill and Professor K. Nordeen

This experience provides an opportunity for students to acquire and develop skills in teaching and course management in neuroscience. Students assist in teaching NSC 201 or NSC 203 and are expected to attend staff meetings, provide instruction in the laboratory, bear responsibility for small-group teaching, assist in the preparation and grading of examinations and papers, and participate in staff-evaluation sessions. In addition, students devote time to the preparation of teaching aids such as videotapes and slides. Fall and Spring.

592. Neuroscience Journal Club
Credit—one hour
Assistant Professor Calkins

A seminar course on current topics in neuroscience research. The objective is to gain experience discussing and critically evaluating primary research articles covering a broad range of topics in neuroscience. Each class begins with a presentation and discussion of a specialized technique used in the primary article.