

Neuroscience

INTERDISCIPLINARY

Faculty

Christopher M. Gillen
Assistant Professor of Biology

E. Raymond Heithaus
Jordan Professor of Environmental Science

Haruhiko Itagaki
*Associate Professor of Biology**

John K. Lutton
*Professor of Chemistry**

Hewlett G. McFarlane
Assistant Professor of Psychology

Andrew J. Niemiec
*Associate Professor of Psychology**

Susan Palmer
Director of the Five Colleges Program

Charles E. Rice
Professor Emeritus of Psychology

Joel F. Richeimer
Associate Professor of Philosophy

J. Kenneth Smail
Professor of Anthropology

Linda M. Smolak
Professor of Psychology

Jon L. Williams
*Director of the Neuroscience Program, Samuel B. Cummings Professor of Psychology**

* Members of the Neuroscience Committee

Neuroscience is the study of brain-behavior relationships in order to understand the roles they play in regulating both animal and human behavior. A thorough knowledge of the functions of the nervous system is essential to understanding the vicissitudes of psychological experience, general behavior, and clinical disorders. Therefore, the study of the nervous system and the brain anatomically, physiologically, and

biophysically, at both the microscopic and macroscopic levels, is central to the Neuroscience Program.

In recent years, neuroscience has become the most rapidly developing interdisciplinary area in the sciences. This field integrates the knowledge, research methods, and modern laboratory technology of biology, chemistry, psychology, and other scientific fields toward the common goal of understanding animal and human behavior. For this reason, the program's curriculum and list of instructors reflect a diversity of disciplines within a variety of departments.

The Neuroscience Program at Kenyon is interdisciplinary, differing from College departments in which faculty hold specific appointments. A primary objective of this program is to prepare students for entrance into graduate training or research occupations in neuroscience, neurochemistry, neurobiology, anatomy, physiology, physiological psychology, clinical psychology, behavioral science, and the health sciences (medicine and allied fields).

Students who are considering electing a concentration or a major in neuroscience should inquire about the program from any of the affiliated faculty members and should consult with Professor Williams, the program's director. Please note the ♦ symbol, which designates those

courses particularly appropriate for first-year students and upperclass students desiring to enter the neuroscience program.

First-Year and New Students

Introduction to Neuroscience

♦ NEUR 112 (1/2 unit)

Williams (coordinator), Itagaki, Lutton, Staff

This second-semester entry-level course begins by emphasizing that neuroscience is truly an interdisciplinary field. Consistent with this view, a number of faculty members from various departments give lectures and lead discussions throughout the semester. After covering brain evolution and the genetic basis of behavior, there is a review of the organization of the nervous system and the processes responsible for neural conduction and synaptic transmission. This knowledge is then applied to a comprehensive examination of the neurochemical, sensory, motor, developmental, motivational, cognitive, and emotional processes and structures that influence both normal and abnormal behavior. No prerequisites.

Neuroscience Concentration: Curriculum and Requirements

The neuroscience concentration is neither a major nor a minor, but an interdisciplinary program in which most of the course requirements are derived from the current course offerings in biology, chemistry, psychology, and anthropology. Specifically, this concentration involves three types of course requirements: required neuroscience courses, required basic science courses, and selected advance science courses. For a student to have a neuroscience concentration listed on his or her

transcript, a minimum of 4 units is required. Obviously, many of these courses could also count toward a major in biology, chemistry, psychology, or anthropology.

Required Neuroscience Courses: 1 unit

◆ NEUR 112 (1/2 unit) Introduction to Neuroscience
This course will serve in lieu of PSYC 101 for all advanced psychology courses that are listed in the neuroscience curriculum. This multidisciplinary, introductory course is offered during the second semester.

NEUR 471 (1/2 unit) Current Research Topics in Neuroscience
This culminating seminar for juniors and seniors is offered first semester for students who intend to fulfill the requirements for the concentration.

Required Basic Science Courses: 2 units minimum

BIOL 113 (From Cell to Organism) and BIOL 114 (Genetics and Development of Organisms)
CHEM 109 Neurochemistry (CHEM 111, 112 or 115, 116 can serve as a replacement)
PSYC 305 Physiological Psychology

Selected Advanced Science Courses: 1 unit selected from the following:

Biology Courses

BIOL 261 Animal Behavior
BIOL 321 Developmental Biology
BIOL 341 Comparative Animal Physiology
BIOL 358 Neurobiology
BIOL 363 Molecular Biology and Genomics
BIOL 366 Cell Biology

Chemistry Courses

CHEM 231, 232 Organic Chemistry
CHEM 341 Instrumental Analysis
CHEM 256 Biochemistry

Psychology Courses

PSYC 301 Cognitive Psychology
PSYC 302 Comparative Psychology
PSYC 303 Psychology of Learning and Motivation

PSYC 304 Neuropsychology
PSYC 307 Sensation and Perception
PSYC 347 Psychopharmacology

Anthropology Courses

ANTH 110 Human Origins
ANTH 321 Evolution and Human Evolution

Neuroscience Major: Curriculum and Requirements

The neuroscience major is intended primarily for students who are planning to attend graduate school in the many specialized fields of neuroscience, such as medical neuroscience, developmental neuroscience, cognitive neuroscience, or behavioral neuroscience. It is also an excellent major for students who are seriously interested in pursuing research careers or becoming clinical practitioners concerned with the biochemical or the biopsychological aspects of the nervous system or behavior (e.g. psychopharmacology, psychiatry, neuroclinical psychology).

One of the primary reasons for the development of this relatively recent major is the increasing number of students who have graduated with self-designed "neuroscience" synoptic majors. Although synoptic majors allow individualistic and descriptive titles, the "neuroscience major" is now reserved for students who want to take a more uniform set of designated courses that is consistent with the expectations of the top medical and graduate schools.

Despite the need for uniform curriculum requirements for the neuroscience major, two tracks are available to fulfill the major: (a) a biochemical track and (b) a biopsychological track. Both tracks require 5 units of neuroscience core courses, plus 2 1/2 units of courses in one of the two tracks, for a total of 7 1/2 units for the major. **(Note: One additional advanced laboratory course will also be required of all neuroscience majors. This additional requirement is expected to take effect for majors starting with those graduating in 2004. See below for**

details.) The core courses, as well as the required courses for each of the tracks, are as follows:

Neuroscience Core Courses: 5 units

◆ NEUR 112 (1/2 unit) Introduction to Neuroscience
NEUR 471 (1/2 unit) Current Research Topics in Neuroscience
NEUR 493 or NEUR 494 (1/2 unit) Individual Study
or
NEUR 497-498 (1/2 unit) Senior Honors
or
BIOL 385 (1/4 unit) and BIOL 386 (1/4 unit) Research in Biology
BIOL 113 and BIOL 114 (1 unit) From Cell to Organism, and Genetics and Development of Organisms
BIOL 358 (1/2 unit) Neurobiology
CHEM 111, 112 (or CHEM 115, 116) (1 unit) Introductory Chemistry I, II (or Honors Introductory Chemistry I, II)
PSYC 401 (1/2 unit) Research Methods in Biopsychology
PSYC 305 (1/2 unit) Physiological Psychology

Biochemical Track: 2 1/2 units

One selected biology course from the concentration list above (1/2 unit)
CHEM 231, 232 (1 unit) Organic Chemistry
Recommended courses:
CHEM 113, 114 or CHEM 117, 118
CHEM 233, 234
CHEM 256
One selected psychology course from the concentration list (1/2 unit)
MATH 111 (1/2 unit) Calculus

Biopsychological Track: 2 1/2 units

One selected biology course from the concentration list above (1/2 unit)
CHEM 113, 114 (or CHEM 117, 118) (1/2 unit) Introductory Chemistry Laboratory I and II (or Honors Introductory Chemistry Laboratory I and II)
PSYC 200 (1/2 unit) Statistical Analysis in Psychology

Two selected psychology courses from the concentration list above
(1 unit)

All neuroscience majors, starting with those who graduate in 2004, will also be required to take an additional advanced laboratory course. Majors in the Biochemical Track are to take either BIOL 359 (1/4 unit) Experimental Neurobiology or CHEM 371 (1/4 unit) Biochemistry Laboratory, for a total of 7 3/4 units for the major. Majors in the Biopsychology Track are to take either BIOL 359 (1/4 unit) Experimental Neurobiology or PSYC 405 (1/2 unit) Research Methods in Physiological Psychology, for a total of 7 3/4 or 8 units for the major.

Senior Exercise

The Senior Exercise consists of an original research proposal, written in a format appropriate for a scientific grant. The exercise can be completed at one of two times at the option of the student. It is due sometime within the first two months of either the first or second semester of the student's senior year. This exercise is evaluated by two members of the advisor's department and one member of the Neuroscience Program from another department. Students gain research experience by participating in Independent Study (NEUR 493 and/or 494) or Senior Honors (NEUR 497-498), or Research Strategies in Biology (BIOL 385-386), under the supervision of a faculty advisor.

Seniors participating in the Honors Program must complete an honors project and pass an oral exam. Assessment of the honors candidates is accomplished by two members of the advisor's department, one member of the Neuroscience Program from another department, and an outside examiner brought in by the advisor's department.

Year Courses

Senior Honors

NEUR 497-498 (1 unit)
Staff

This program for senior honors students culminates in the completion of a senior honors research project. The research is expected to be on a topic of particular relevance to the student's postgraduate plans. Students must select a research advisor from the faculty members in the Neuroscience Program. They are expected to have done a thorough bibliographic search of the literature, written a short review paper, and formulated some tentative hypotheses during the spring semester of their junior year. Prerequisites: The student must have a 3.3 overall GPA, a 3.5 GPA in the neuroscience core courses, and have completed at least 5 units toward the major. Permission must be granted by the director of the Neuroscience Program.

First-Semester Courses

Current Research Topics in Neuroscience

NEUR 471 (1/2 unit)
Williams (coordinator), Palmer

This capstone seminar is required of all students who plan to graduate with a neuroscience concentration or major. The seminar is intended to bring together the knowledge acquired from courses required for, or relevant to, the concentration. During the course of the semester, each student will submit a critique of a published article and write a research proposal with the assistance of an instructor. Oral presentations are given in conjunction with each of these exercises. This seminar is limited to juniors or seniors who have taken NEUR 112 and completed two of the three required basic science courses for the concentration.

Individual Study

NEUR 493 (1/2 unit)
Staff

Students conduct independent research under the supervision of one

of the faculty members affiliated with the Neuroscience Program. This course is restricted to juniors or seniors who are neuroscience majors or have taken (or are concurrently enrolled in) courses required for the neuroscience concentration. Prerequisites: permission of instructor and neuroscience director, along with demonstrated special interest.

Second-Semester Courses

Introduction to Neuroscience

◆ NEUR 112 (1/2 unit)
Williams (coordinator), Itagaki, Lutton, staff

This course begins with a definition of neuroscience as an interdisciplinary field, in the context of the philosophy of science. Consistent with this view, a number of faculty members from various departments are responsible for giving lectures and leading discussions throughout the semester. After covering the basics of cellular neurophysiology, the development and organization of the human nervous system are examined in terms of sensory, motor, motivational, emotional, and cognitive processes. The neurological and biochemical bases of various brain and behavioral disorders are also examined. This course can be used as a substitute for PSYC 101 as a prerequisite for all advanced-level psychology courses listed for the Neuroscience Concentration. No prerequisites.

Individual Study

NEUR 494 (1/2 unit)
Staff

Students conduct independent research under the supervision of one of the faculty members affiliated with the Neuroscience Program. This course is restricted to juniors or seniors who are neuroscience majors or have taken (or are concurrently enrolled in) courses required for the neuroscience concentration. Prerequisites: permission of instructor and neuroscience director, along with demonstrated special interest.