

NEUROSCIENCE: REQUIREMENTS

Neuroscience studies 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 faculty reflect a diversity of subdisciplines within a variety of departments. 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).

First-Year and New Students

Students who are considering a concentration or a major in neuroscience should inquire about the program from any of the affiliated faculty members and should also consult with the program's director.

NEUR 212 Neuroscience

This second-semester course is the entryway into the neuroscience curriculum. It 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.

Prerequisites: BIOL 115 or 116 or CHEM 121 or 122 or a score of 5 on AP BIOL or CHEM.

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, clinical neuropsychology).

With the 2013-14 academic year, the following requirements for the neuroscience major and minor apply to the class of 2017 and those following. Students in the classes of 2014, 2015, and 2016 may choose these new requirements or the old requirements (next section) to fulfill their requirements for the major or the minor.

Neuroscience Major Requirements (7.0 to 7.25 units)

Required Core Courses (4.75-5.25 units)

Neuroscience Required (1.0 credit)

NEUR 212 - Neuroscience

NEUR 471 - Topics in Neuroscience

Neuroscience/Psychology Required (1.0 credit)

NEUR 305- Physiological Psychology **or** NEUR 307 - Sensation and Perception **and**

One of the following laboratory courses:

NEUR 401 - Research Methods in Biopsychology;

NEUR 405 - Research Methods in Physiological Psychology;

NEUR 406 - Research Methods in Sensation and Perception;

PSYC 402 - Research Methods in Cognition;

PSYC 403 - Research Methods in Learning and Motivation;

or 2 semesters (0.5 units) of NEUR 385 - Research in Neuroscience.

Biology Required (2.25 credits)

BIOL 109 - Introduction to Experimental Biology (Lab)

BIOL 110 - Introduction to Experimental Biology (Lab)

BIOL 115 - Energy in Living Systems (or Biology AP score of 5)

BIOL 116 - Information in Living Systems

BIOL 358 - Neurobiology

BIOL 359 - Experimental Neurobiology (Lab)

Chemistry Required (0.5-1.0 credit)

CHEM 121 & 124 - Introductory Chemistry I & II **or** CHEM 122 - Chemical Principles

Electives: 2.25 units beyond the required core curriculum and selected from the elective list below. Overall the electives must span at least three departments, with at least 1.0 unit being from a single department and a minimum of 0.5 units from the other two departments (this will aid both your breadth and depth of understanding).

Biology Electives:

BIOL 243 - Comparative Animal Physiology
BIOL 261 - Animal Behavior
BIOL 263 - Molecular Biology & Genomics
BIOL 266 - Cell Biology
BIOL 321 - Developmental Biology

Chemistry Electives:

CHEM 231, 232 - Organic Chemistry
CHEM 233, 234 - Organic Chemistry Laboratory
CHEM 256 - Biochemistry
CHEM 335 - Thermodynamics & Kinetics
CHEM 341 - Instrumental Analysis
CHEM 370 - Computational Chemistry
CHEM 371 - Biochemistry Laboratory
CHEM 401 - Chemistry and Biochemistry Seminar (Permission of NEUR Chair required)

Neuroscience Electives:

NEUR 302 - Comparative Psychology
NEUR 304 - Human Neuropsychology
NEUR 305 - Physiological Psychology (if not taken as core course)
NEUR 307 - Sensation & Perception (if not taken as core course)
NEUR 347 - Psychopharmacology

Psychology Electives:

PSYC 301 - Cognitive Psychology
PSYC 303 - Learning & Motivation
PSYC 306 - Psychology of Language

Other Electives:

ANTH 111 - Intro to Biological Anthropology
ANTH 321 - Evolution and Human Evolution
ANTH 323 - Bioarcheology of Sub-Saharan Africa
ANTH 421 - Neanderthals
MATH 106 - Statistics
MATH 108 - Models of Life
PHIL 245 - Philosophy of Natural Science
PHIL 260 - Philosophy of Mind
PHIL 262 - Philosophy of Perception
PHYS 210 - Biological Physics
SCMP 118 - Intro to Programming

Requirements for the Neuroscience Minor (4.0 units)

Neuroscience Required (1.0 units)

NEUR 212 - Introduction to Neuroscience

NEUR 471 - Topics in Neuroscience

Basic Science Required (2.0 units)

NEUR 305 - Physiological Psychology or NEUR 307 - Sensation and Perception

BIOL 115 - Energy in Living Systems

BIOL 116 - Information in Living Systems

NEUR/CHEM 109 - Neurochemistry or CHEM 121 - Introductory Chemistry I or CHEM 122 - Chemical Principles and Labs

Electives

1.0 unit from the elective list above for the major

Old Requirements: These requirements may be used by the classes of 2014, 2015, and 2016 to fulfill their neuroscience major and minor requirements.

Neuroscience Core Courses: 4.5 units

NEUR 112 (.5 unit) Introduction to Neuroscience

NEUR 471 (.5 unit) Current Research Topics in Neuroscience

BIOL 115 and BIOL 116 (1 unit) Energy in Living Systems, and Information in Living Systems

BIOL 358 (.5 unit) Neurobiology

CHEM 121, 124/125 (or CHEM 122, 124/125) (1 unit) Introductory Chemistry I, II (or Honors Introductory Chemistry I, II)

PSYC 305 (.5 unit) Physiological Psychology

PSYC 401 (.5 unit) Research Methods in Biopsychology, or PSYC 403 (.5 unit) Research

Methods in Learning and Motivation, or PSYC 406 (.5 unit) Research Methods in Sensation and Perception

Biochemical Track: 2.75 units

One selected biology course from the concentration list (see section on neuroscience concentration, below) (.5 unit)

BIOL 359 (.25 unit) Experimental Neurobiology, or CHEM 371 (.25 unit) Biochemistry Laboratory

CHEM 231, 232 (1 unit) Organic Chemistry I, II

Recommended courses:

CHEM 123 and 126
CHEM 233, 234
CHEM 256

One selected psychology course from the concentration list (below) (.5 unit)
MATH 111 (.5 unit) Calculus

Biopsychological Track: 2.75 to 3 units

One selected biology course from the concentration list (below) (.5 unit)
BIOL 359 (.25 unit) Experimental Neurobiology, or PSYC 405 (.5 unit) Research Methods in
Physiological Psychology
CHEM 123 and 126 (.5 unit)
Introductory Chemistry Laboratory I, II
PSYC 200 (.5 unit) Statistical Analysis in Psychology
Two selected psychology courses from the concentration list (below) (1 unit)

Senior Exercise

The Senior Exercise consists of an original research proposal, written in a format appropriate for a scientific grant. The exercise is completed in the fall of the student's senior year. This Senior Exercise is evaluated by two faculty members: the Senior Exercise advisor and another member of the Neuroscience Program.

In preparation for the Senior Exercise, students can gain research experience by participating in Individual Study (NEUR 493) under the supervision of a faculty advisor. Although independent study courses are not required for the major, conducting research is a valuable educational experience, particularly for students planning to pursue graduate or medical training.

Honors

Seniors participating in the Honors Program (NEUR 497Y-498Y) must complete an honors project and pass an oral exam. Assessment of the honors candidates is conducted 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.

Neuroscience Concentration: Curriculum and Requirements

Required neuroscience courses: 1 unit

NEUR 112 (or 212) (.5 unit) Introduction to Neuroscience

This course also serves 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 first semester.

NEUR 471 (.5 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 115 Energy in Living Systems and BIOL 116 Information in Living Systems
CHEM 109 Neurochemistry (or CHEM 121 and 124/125 or CHEM 122 and 124/125)
PSYC 305 Physiological Psychology

Selected advanced science courses: 1 unit selected from the following:

Biology courses

BIOL 243 Comparative Animal Physiology
BIOL 261 Animal Behavior
BIOL 263 Molecular Biology and Genomics
BIOL 321 Developmental Biology
BIOL 358 Neurobiology
BIOL 366 Cell Physiology

Chemistry courses

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

Neuroscience courses

NEUR 302 Comparative Psychology
NEUR 304 Neuropsychology
NEUR 307 Sensation and Perception
NEUR 347 Psychopharmacology

Psychology courses

PSYC 301 Cognitive Psychology
PSYC 303 Psychology of Learning and Motivation

Anthropology courses

ANTH 111 Introduction to Biological Anthropology
ANTH 321 Evolution and Human Evolution

NEUR COURSES AND DIVERSIFICATION REQUIREMENTS

The following courses may be paired to satisfy the natural sciences requirement:

- NEUR 105 and NEUR 112
- NEUR 105 and BIOL 103
- NEUR 105 and BIOL 105

Please note: Beginning 2013-14, BIOL 103 and BIOL 105 can no longer be paired with NEUR 105 to satisfy the natural sciences requirement.

COURSES:

NEUR 105 Topics in Neuroscience

Credit: 0.5

This introductory course will explore a range of topics and issues in the study of neuroscience. Specifically, the course will focus on the relationship between neuroscience, the arts and humanities. The course will treat the humanities and sciences as partners working together on the same problems. Usually, three topics are covered per semester. Examples of topics covered include: the neuroscience of emotions, play behavior, film, visual and artistic perspective, space, time. Other topics may be covered. Assignments will include weekly quizzes, class discussion, and a thesis paper. Prerequisite: None. NEUR 105 is a non-majors introductory course geared towards first and second year students, although others may take it. Anyone who plans to major or concentrate in Neuroscience will need to take Introduction to Neuroscience (NEUR 112). NEUR 105 can be paired with NEUR 112 (Introduction to Neuroscience), BIOL 103 (Biology in Science Fiction) or BIOL 105 (Biology of Exercise) in order to satisfy the Natural Science distribution requirement. This course is repeatable for credit. However, this course taken twice or with a NEUR special topic does not satisfy the natural sciences diversification.

Instructors: McFarlane, Richeimer

NEUR 112 Introduction to Neuroscience

Credit: 0.5

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 course examines the development and organization of the human nervous system 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 the PSYC 101 prerequisite for all advanced-level psychology courses listed for the neuroscience concentration. However, this course does not count towards Natural Sciences diversification. No prerequisites.

Instructor: Niemiec, Staff

NEUR 385 Research in Neuroscience

Credit: 0.25

This combined discussion and laboratory course aims to develop abilities for asking sound research questions, designing reasonable scientific approaches to answer such questions, and performing experiments to test both the design and the question. We consider how to assess difficulties and limitations in experimental strategies due to design, equipment, system selected, and so on. The course provides a detailed understanding of selected modern research equipment. Students select their own research problems in consultation with one or more neuroscience faculty members. This course is designed both for those who plan to undertake honors research in their senior year and for those who are not doing honors but who want some practical research experience. A student can begin the research in either semester. If a year of credit is earned, it may be applied toward the Research Methods course requirement for the major in neuroscience. Prerequisites: BIOL 109Y-110Y and NEUR 212, and permission of instructor.

NEUR 471 Topics in Neuroscience

Credit: 0.5

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 and major. 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 the 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.

NEUR 493 Individual Study

Credit: 0.25-0.5

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.

NEUR 497Y Senior Honors

Credit: 0.5

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 3.33 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.

NEUR 498Y Senior Honors

Credit: 0.5

See course description for NEUR 497Y.

Instructor: Staff

Additional courses that meet the requirements for this major/concentration

ANTH 111: Introduction to Biological Anthropology

ANTH 321: Evolution and Human Evolution

BIOL 115: Energy in Living Systems

BIOL 116: Information in Living Systems

BIOL 243: Animal Physiology

BIOL 261: Animal Behavior

BIOL 263: Molecular Biology and Genomics

BIOL 266: Cell Biology

BIOL 321: Developmental Biology

BIOL 358: Neurobiology

BIOL 359: Experimental Neurobiology

CHEM 109: Neurochemistry

CHEM 121: Introductory Chemistry

CHEM 122: Chemical Principles

CHEM 123: Introductory Chemistry Lab I

CHEM 124: Introductory Chemistry II

CHEM 126: Introductory Chemistry Lab II

CHEM 231: Organic Chemistry I

CHEM 232: Organic Chemistry II

CHEM 233: Organic Chemistry Lab I

CHEM 234: Organic Chemistry Lab II

CHEM 256: Biochemistry

CHEM 335: Chemical Kinetics and Thermodynamics

CHEM 341: Instrumental Analysis

CHEM 371: Advanced Lab: Biochemistry

MATH 111: Calculus I

PSYC 200: Statistical Analysis in Psychology

PSYC 301: Cognitive Psychology

PSYC 302: Comparative Psychology

PSYC 303: Learning and Motivation

PSYC 304: Neuropsychology

PSYC 305: Physiological Psychology

PSYC 307: Sensation and Perception

PSYC 347: Psychopharmacology

PSYC 401: Research Methods: Biopsychology

PSYC 403: Research Methods in Learning and Motivation
PSYC 406: Research Methods in Sensation and Perception