

School of Arts and Sciences

NEUROSCIENCE

www.neuroscience.pitt.edu/undergraduate

Neuroscience is the study of the biological bases and consequences of behavior, with a special focus on the structure and function of the nervous system and its role in behavioral processes. The University of Pittsburgh has been a trail-blazer in the relatively new field of neuroscience. Our undergraduate and graduate programs were some of the first of their kind, and they are now among the largest and most successful programs in this field in the United States.

The field has emerged during the past two decades as part of the explosive growth of research and interest in the neural sciences. The undergraduate neuroscience major is designed to provide a broad and challenging sequence of courses in biological sciences, chemistry, mathematics, and physics, in addition to introductory and advanced courses in neuroscience. Students also have the special opportunity to receive course credit for original research projects they conduct in collaboration with department faculty. In fact, the department's main goal is to promote outstanding programs of research and scholarship, with research being the engine that drives education. The small size of the upper-level courses and the opportunity to work closely with individual faculty members in research laboratories permit closer relationships between students and faculty than usually are found in the larger departments on campus.

The Bachelor of Science degree in neuroscience prepares students for a) advanced study in health-related fields, such as medicine, dentistry, pharmacy, public health, physical therapy, and exercise physiology; b) graduate training in neuroscience and related fields in the biological sciences, and a future career in a university, research institute, pharmaceutical company, or hospital; c) research assistant positions in pharmaceutical, hospital, and university settings; and d) public and private high school teaching following the completion of the teacher certification program in the School of Education.

Required Courses for the Major

The minimum number of credits required is 59, and must include the following courses:

1. *Neuroscience Core Courses (four courses—13–14 credits)*

NROSCI 1000 Introduction to Neuroscience (3 credits) or NROSCI 1003-UHC (4 credits)

This course examines the anatomy, physiology, and pharmacology of the central and peripheral divisions of the nervous system. Specific topics covered include neuronal function, synaptic transmission, sensory processing, movement, hunger, thirst, caloric and body fluid homeostasis, recovery of function after brain damage, and various neurological and psychiatric disorders.

NROSCI 1011 Functional Neuroanatomy (4 credits)

This course covers the basic structure of the central nervous system from spinal cord to cerebral cortex. The major sensory, motor, and integrative neural systems of the human brain are discussed. Based on an understanding of normal neural connections and brain function, the anatomical and physiological basis of various neurological disorders is explored.

NROSCI 1012 Neurophysiology (3 credits)

This course examines the functioning of neurons and synapses and the basic units responsible for fast communication within the nervous system. The course focuses on the electrical mechanisms used by the nervous system and on the quantitative approach to scientific investigation that is fundamental to neurophysiology. Some topics discussed include principles of electric current flow exploited by the nervous system, the basis of the resting potential of neurons, and the physiology of fast synaptic communication.



NROSCI 1017 Synaptic Transmission (3 credits)

This course examines the mechanisms by which neurotransmitters are synthesized and released and the biochemistry of synaptic responses. Basic physiological, biochemical, and morphological characteristics of neuronal transmission are discussed. An emphasis is placed on the experimental approaches used to examine these processes.

2. Two Neuroscience Advanced Electives (two courses—6 credits) from the following:

NROSCI 1020 Homeostasis (4 credits)

This course offers a detailed consideration of the complementary biological and behavioral processes that support body fluid regulation. Material is studied from multiple perspectives such as environmental demands, physiological systems, and the motivated behaviors of thirst, sodium appetite, and hunger. This course is research oriented.

NROSCI 1030 Psychiatric Disorders and Brain Function (3 credits)

This course examines the neurobiological basis of psychiatric disturbances including schizophrenia, depression, Parkinson's disease, and Huntington's disease.

NROSCI 1032 Functional Organization of the Human Nervous System (3 credits)

This course presents a detailed analysis of the functional organization of the human brain. Topics progress from simple problems of motor and sensory processing to complex functions such as memory, language, and cognition.

NROSCI 1034 Neural Basis of Cognition (3 credits)

This course is designed for students interested in learning about the neural basis of higher order cognitive functions, with an emphasis on cortical mechanisms.

NROSCI 1035 Control of Movement (3 credits)

This course will discuss the neural control of our actions in detail, including planning of movement in the cortex, relay of motor commands to the brain stem and spinal cord, coordination of movement by the cerebellum and basal ganglia, adjustment to movement via brain stem and spinal cord reflexes, execution of movement through contraction of muscle fibers, and feedback about movement as mediated by corollary discharge circuits.

NROSCI 1036 Neurobiology of Aging (3 credits)

This course examines age-related changes in the neurobiological systems, including motor, sensory, cognitive, and neuroendocrine.

NROSCI 1040 Biological Basis of Learning and Memory (3 credits)

This course presents an overview of the neural bases of memory and learning in humans and monkeys, as well as of simple learned behaviors like classical conditioning in nonprimate animals.

NROSCI 1041 Developmental Neuroscience (3 credits)

This course provides an overview of the principles that govern the developmental assembly of a complex nervous system. The topics are discussed in the context of experimental results obtained by anatomical, biochemical, and electrophysiological techniques using vertebrate and invertebrate animals.

NROSCI 1042 Neurochemical Basis of Behavior (3 credits)

This course provides an overview of molecular, cellular, and systemwide mechanisms that regulate the expression of goal-directed and emotional behaviors.

NROSCI 1046 Foundations of Clinical Neurophysiology (3 credits)

This course covers the fundamental and basic principles used in the practice of Clinical Neurophysiology with the goal of providing an overview of both basic science and clinical topics relevant to performing intraoperative neurophysiological monitoring in a surgical setting.

3. Department Writing Requirement (one course—1 credit)

NROSCI 1800/1801 Neuroscience Writing Practicum (1 credit)

This practicum is a special writing course for the Neuroscience major. Students must be registered in a co-requisite class. In collaboration with their Neuroscience professor, students pick a topic and a specific focus from which to research and write a scientific literature review paper. Instruction is provided in the style, format, structure and organization of scientific literature reviews. Emphasis is placed on the process of writing and the use of plain standard written English to achieve clarity and concision.

NROSCI 1962 Thesis Research/Writing Practicum (1 credit)

This course involves writing a thesis based on independent neuroscience research. A two-person thesis committee must be formed before registering for this course and must include at least one faculty member from the Department of Neuroscience. The student needs to be concurrently enrolled in NROSCI 1961 or should have earned at least three credits of NROSCI 1961 in a previous term where the student conducted independent neuroscience research. The thesis is submitted to both readers, should be at least twelve pages in length, and has to go through a series of revisions before a final grade is assigned. A thesis writing form, which can be obtained from the Undergraduate Advising Office (A206 Langley), is completed by the student and faculty readers. The form is then submitted to either Dr. Rinaman or Dr. Meriney for approval (signature). Once the form is completed and signed, it should be submitted to the Undergraduate Neuroscience Advising Office, A206 Langley Hall

4. **Additional Offerings**

NROSCI 0080 Brain and Behavior

NROSCI 0081 Drugs and Behavior

NROSCI 1047 Topics in Neuroscience (2 credits)

NROSCI 1097 Undergraduate Teaching Experience (2 credits)

NROSCI 1901 Independent Study (1-6 credits)

NROSCI 1961 Thesis Research (1-6 credits)

NROSCI 1111 UHC Functional Neuroanatomy Honors Practicum (2 credits)

5. **Co-requisite Courses (UHC equivalents accepted; 40–44 credits)**

BIOSC 0050 Foundations of Biology Lab 1 1 cr.

BIOSC 0060 Foundations of Biology Lab 2 1 cr.

BIOSC 0150 Foundations of Biology 1 3 cr.

BIOSC 0160 Foundations of Biology 2 3 cr.

BIOSC 1000 Biochemistry 3 cr.

CHEM 0110 General Chemistry 4 cr

CHEM 0120 General Chemistry 2 4 cr.

CHEM 0130 Organic Chemistry 1 3 cr.

CHEM 0320 Organic Chemistry 2 3 cr.

CHEM 0330 Organic Chemistry Lab 1 1 cr.

CHEM 0340 Organic Chemistry Lab 2 1 cr.

MATH 0220 Analytical Geometry and Calculus 1 4 cr.

NROSCI 1250 Human Physiology 3 cr.

or NROSCI 1070 UHC Human Physiology 4 cr

PHYS 0110 Introduction to Physics 1 3 cr.

PHYS 0111 Introduction to Physics 2 3 cr.

or PHYS 0174/0175 Basic Physical Science & Engineering

4 cr. each

6. **General Education Requirements and Electives**

The neuroscience major includes approximately 60 credits of general education/elective credits.

PLAN OF STUDY*

FRESHMAN YEAR

Fall Term

BIOSC 0150 Foundations of Biology 1

BIOSC 0050 Foundations of Biology Lab 1

CHEM 0110 General Chemistry I

Spring Term

BIOSC 0060 Foundations of Biology 2 Lab

BIOSC 0160 Foundations of Biology 2

CHEM 0120 General Chemistry 2

MATH 0220 Analytical Geometry and Calculus 1

SOPHOMORE YEAR

Fall Term

CHEM 0310 Organic Chemistry 1

CHEM 0330 Organic Chemistry 1 Lab

NROSCI 1250 Human Physiology

Spring Term

CHEM 0320 Organic Chemistry 2

CHEM 0340 Organic Chemistry 2 Lab

NROSCI 1000 Introduction to Neuroscience

JUNIOR YEAR

Fall Term

NROSCI 1011 Functional Neuroanatomy

PHYS 0110 or 0174 Introduction to Physics 1

NROSCI 1901 Independent Study Research

Spring Term

NROSCI 1017 Synaptic Transmission

PHYS 0111 or 0175 Introduction to Physics 2

PHYS 0212 Physics Lab (optional)

NROSCI 1901 Independent Research Study

SENIOR YEAR

Fall Term

NROSCI Advanced Elective

BIOSC 1000 Biochemistry

NROSCI 1961 Thesis Research

Spring Term

NROSCI 1012 Neurophysiology

NROSCI Advanced Elective

NROSCI 1961 Thesis Research

NROSCI 1800 or 1962 Writing Practicum

**This is one example of a plan of study. It is best to meet with the neuroscience advisor to develop a plan specific to your background and career goals.*

Earning Departmental Honors

To qualify for departmental honors, students need to maintain a minimum overall GPA of 3.25 as well as a GPA of 3.25 in the neuroscience major. In addition, students must complete a substantial amount of experimental research on an approved research project that is relevant to neuroscience and give a public presentation of the work. The full faculty of the department approves departmental honors after consideration of all eligible students.

Special Programs

Undergraduate Research

The Department of Neuroscience encourages interested undergraduate majors to gain research experience within an active neuroscience laboratory. Our department is a world-class research department; we are committed to doing high-quality research and sharing the excitement of scientific exploration with our trainees. We urge our majors to take advantage of the opportunity to do meaningful and exciting neuroscience research while still an undergraduate. It is not unusual for our majors to report their research at scientific meetings and to be published. While the research experience itself has strong benefits, it is also useful for interacting more closely with professors, and enhancing preparation for graduate or medical school. Most undergraduates who enroll in research for credit are interested in completing an independent project that results in an undergraduate thesis.

Volunteer Opportunities

There are many volunteer opportunities available to students through healthcare facilities such as University of Pittsburgh Medical Center (UPMC), the University of Pittsburgh Cancer Institute (www.upci.upmc.edu), and Children's Hospital of Pittsburgh of UPMC (www.chp.edu), as well as Student Volunteer Outreach (www.svo.pitt.edu) and organizations such as the Western Pennsylvania School for Blind Children, the Pittsburgh Children's Institute, and the Central Blood Bank of Pittsburgh.

Internships

Neuroscience majors pursue internships to explore a specific interest or career path while earning academic credit. Consult the Office of Experiential Learning (OEL) (www.pitt.edu/~oel) for assistance. In the past, students have interned at the School of Medicine's Department of Pathology, the Allegheny County coroner's office, and with pharmaceutical companies as research assistants, scientific writers and summer sales representatives.

Study Abroad

Studying abroad is an exciting way to add an international perspective to your undergraduate education and strengthen your credentials as a graduate. The University of Pittsburgh encourages you to take advantage of this opportunity (almost 5 percent of Pitt students study abroad compared with 1.3 percent, nationally). Study abroad will not only distinguish you when you enter the job market or pursue graduate study, but also help broaden your experience of the world beyond your own country's borders, giving you an appreciation of other cultures and peoples while allowing you to earn credits toward your degree. Scholarships are available, and financial aid is applicable.

Fellowships

Various fellowship opportunities exist to support undergraduate research, undergraduate teaching, and study abroad programs at Pitt. Neuroscience majors who have earned fellowships for work in the Summer Undergraduate Research Program (<http://www.as.pitt.edu/undergraduate/experience/pdf/SURP.pdf>), Brackenridge Summer Research Program (<http://www.honorscollege.pitt.edu/opportunities/brackenridge.html>), Center for Neuroscience at the University of Pittsburgh (<http://cnp.neurobio.pitt.edu/training/summer/index.aspx>), Chancellor's Undergraduate Research Program (<http://www.honorscollege.pitt.edu/opportunities/urf.html>), Howard Hughes Medical Institute (www.hhmi.org), musculoskeletal research (www.pitt.edu/~msrc/summer), as well as other research and teaching awards from the University Honors College and OEL small grants. Other opportunities are listed at www.as.pitt.edu/undergraduate/experience/research-ops.html.

For neuroscience program information, contact:

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412-624-5156
E-mail: plr5@pitt.edu
www.neuroscience.pitt.edu/undergraduate

For information on other majors, contact:

University of Pittsburgh
Office of Admissions and Financial Aid
Alumni Hall, 4227 Fifth Avenue
Pittsburgh, PA 15260-6601
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