

Neuroscience: Systems, Behavior & Plasticity

Vinay Parikh, Director
Weiss Hall
215-204-1572
vinay.parikh@temple.edu

Laura Dean, Administrator
654 Weiss Hall
215-204-2644
laura.dean@temple.edu

www.cla.temple.edu/neuroscience/

A major in Neuroscience enables students to pursue a curriculum in several departments, colleges, and schools at Temple University in one of the most dynamic areas of science. Neuroscience is an interdisciplinary field addressing neural and brain function at multiple levels. It encompasses a broad domain that ranges from molecular genetics and neural development, to brain processes involved in cognition and emotion, to mechanisms and consequences of neurodegenerative disease. The field of neuroscience also includes mathematical and physical principles involved in modeling neural systems and in brain imaging.

The undergraduate, interdisciplinary Neuroscience Major will culminate in a Bachelor of Science degree. Many high-level career options within and outside of the field of neuroscience are open to students with this major. This is a popular major with students aiming for professional careers in the health sciences such as in medicine, dentistry, pharmacy, physical and occupational therapy, and veterinary science.

Students interested in graduate school in biology, chemistry, communications science, neuroscience, or psychology are also likely to find the Neuroscience Major attractive.

Neuroscience Accelerated +1 Bachelor of Science / Master of Science Program

The accelerated +1 Bachelor of Science / Master of Science in Neuroscience: Systems, Behavior and Plasticity program offers outstanding Temple University Neuroscience majors the opportunity to earn both the BS and MS in Neuroscience in just 5 years. Admission to the program is highly selective. The program is designed to provide a research-intensive experience, advanced coursework, and professional development to students who intend to pursue doctoral studies in any of the academic Neuroscience disciplines.

The accelerated +1 program consists of a maximum of 113 semester hours of undergraduate coursework, a maximum of 10 semester hours of graduate coursework to count towards both the undergraduate and the graduate degrees, and an additional 20 semester hours of graduate coursework as a graduate student. Upon successful completion of the fourth year, students will receive a BS in Neuroscience, using 10 credits of graduate coursework, if they have met all other degree requirements. At the end of the contiguous fifth year, students will receive a MS in Neuroscience.

Students apply to the +1 program in the spring semester of the junior year after completing a minimum of 72 undergraduate credits. Additionally, students must have a faculty sponsor who has agreed to mentor the student's master's project research during the four-semester program.

More information can be found at CLA's Neuroscience Program site (<http://www.cla.temple.edu/neuroscience/undergraduate/#program-description>).

Programs

- Bachelor of Science in Neuroscience: Systems, Behavior & Plasticity (<http://bulletin.temple.edu/undergraduate/liberal-arts/neuroscience-systems-behavior-plasticity/bs-neuroscience-systems-behavior-plasticity>)
- Minor in Neuroscience Research (<http://bulletin.temple.edu/undergraduate/liberal-arts/neuroscience-systems-behavior-plasticity/minor-neuroscience-research>)

Courses

NSCI 0817. Brain Matters. 3 Credit Hours.

One of the last frontiers in science is the brain. We know a great deal about the structure and function of the brain and nervous system, but it is challenging to comprehend fully the complexity of a system made up of 100 billion components that are interacting with one another using tens of trillions of connections that can change and rewire during development and aging. Neuroscience is the multidisciplinary field in which brain research falls. Neuroscience is one of the fastest growing domains in all of science - and good bet for a future career path. Neuroscientists investigate brain function from the level of molecular genetics, to cellular dynamics, to brain anatomy and physiology, to relations between brain, behavior, and cognition, to brain development and aging, to diseases of the brain. In this course, we will touch on knowledge about the brain at all these levels, and more. We will also discuss case studies of brain impairment. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core. Students cannot receive credit for this course if they have successfully completed Psychology 0817.

Course Attributes: GS

Repeatability: This course may not be repeated for additional credits.

NSCI 1051. Fundamentals of Neuroscience. 3 Credit Hours.

One of the last frontiers in science is the brain. Neuroscience is one of the fastest growing domains in all of science - and a good bet for a future career path. Neuroscientists investigate brain function from the level of molecular genetics, to cellular dynamics, to brain anatomy and physiology, to relations between brain, behavior and cognition, to brain development and aging, to diseases of the brain. In this course, we will touch on knowledge about the brain at all of these levels. The major course goal is to introduce you to neuroscience and its multidisciplinary dimensions.

Repeatability: This course may not be repeated for additional credits.

NSCI 1951. Honors Fundamentals of Neuroscience. 3 Credit Hours.

One of the last frontiers in science is the brain. Neuroscience is one of the fastest growing domains in all of science - and a good bet for a future career path. Neuroscientists investigate brain function from the level of molecular genetics, to cellular dynamics, to brain anatomy and physiology, to relations between brain, behavior and cognition, to brain development and aging, to diseases of the brain. In this course, we will touch on knowledge about the brain at all of these levels. The major course goal is to introduce you to neuroscience and its multidisciplinary dimensions. Note: Students who have received credit for NSCI 1051 will not receive additional credit for this course.

Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

Course Attributes: HO

Repeatability: This course may not be repeated for additional credits.

NSCI 2001. Functional Neuroanatomy. 3 Credit Hours.

This course provides a broad overview of the structures of the brain and their function. Gross anatomy of the central nervous system will be covered. The organization of the major neural systems underlying sensory, motor, and cognitive function will be emphasized.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently.

NSCI 2121. Development/Plasticity/Repair. 3 Credit Hours.

The major aim of this course is to present the neurobiology of development from conception to birth and neurological and behavioral development in infancy and childhood. The initial emphasis is on embryonic and fetal development of the central nervous system and emergent behavioral plasticity. Sensory and motor developments in the fetus are examined. Postnatal development of the cerebral cortex and behavioral outcomes are explored in the context of environmental effects that can amplify or inhibit adaptive capacity. Biological (e.g., genetic) and environmental (e.g., parenting) influences on brain development of emotion and cognition are addressed. The tremendous plasticity of the brain is emphasized. Plasticity is the ability of the nervous system to respond to change. Neural malleability is maximal in early development, but the capacity for change and repair in the nervous system is maintained throughout life.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently.

NSCI 2122. Cellular Neuroscience. 3 Credit Hours.

An exciting scientific frontier is the molecular genetics and cellular dynamics of brain function. This course addresses phenomena at a cellular and molecular level that underlie brain plasticity and function. The cellular basis of the nervous system, some genetic factors involved in neural cell division and proliferation, proteins enabling neural receptor function, and molecules that comprise neurotransmitters will be covered. The molecular cascade that is initiated by glutamate release and responses of AMPA and NMDA receptors that results in genetic changes and structural formation of synapses is one example of molecular mechanisms to be addressed in this course.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently.

NSCI 2222. The Neurobiology of Disease. 3 Credit Hours.

Advances in basic neuroscience research have the potential to lead to understanding, treatment, and even cures for major nervous system disease. This course will provide students with state-of-the-art knowledge about applied neuroscience - the causes and treatment of some major diseases of the central nervous system. There is an emphasis on neuropathologies at all points of the life span - from diseases in infancy such as Phenylketonuria and Tay Sachs disease, to diseases in adulthood such as Multiple Sclerosis, AIDS and forms of demyelination caused by the JC virus, to neurodegenerative diseases of old age such as Alzheimer's disease and Parkinson's disease.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently.

NSCI 3000. Current Topics in Neuroscience. 3 Credit Hours.

The goal of this class is to explore in depth a current topic in neuroscience. Potential topics include addiction, schizophrenia, Alzheimer's disease, memory reconsolidation, and more. Note: A semester's course will cover one topic in depth and not cover multiple topics. In addition, students will also read primary literature (research articles), lead a 10 minute discussion on an article, write a review on a related topic, and present slides with their view. These exercises are intended to promote scientific analysis and the development of public speaking and writing skills.

Repeatability: This course may be repeated for additional credit.

Pre-requisites:

(NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently)
AND (PSY 1003|Minimum Grade of C-|May not be taken concurrently)
AND (NSCI 2001|Minimum Grade of C-|May not be taken concurrently)

NSCI 3005. Affective Neuroscience. 3 Credit Hours.

The brain is not just a thinking machine; it is also a feeling machine. This course explores the neural substrates behind emotions such as love, trust, fear, and pleasure. We will also discuss the relationship between emotions and cognition, the effect of emotions on animal and human behavior, and the biological basis of affective disorders such as anxiety and depression.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(PSY 2501|Minimum Grade of C-|May not be taken concurrently
OR PSY 2502|Minimum Grade of C-|May not be taken concurrently
OR NSCI 2001|Minimum Grade of C-|May not be taken concurrently)
AND (PSY 1003|Minimum Grade of C-|May not be taken concurrently)

NSCI 3006. Stress and the Brain. 3 Credit Hours.

Stress, in some form or other, is part of our everyday lives. How we respond to stress can either ensure our immediate survival or threaten long-term physical and mental well-being. This course will survey the clinical and preclinical research to understand how the brain initiates stress responses, and how stress, in turn, impacts the brain to alter behavior. The role that stress plays in the development of disorders, such as depression and post-traumatic stress disorder, will also be explored.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(PSY 2501|Minimum Grade of C-|May not be taken concurrently)
 OR PSY 2502|Minimum Grade of C-|May not be taken concurrently
 OR NSCI 2001|Minimum Grade of C-|May not be taken concurrently)
 AND (PSY 1003|Minimum Grade of C-|May not be taken concurrently)

NSCI 3007. Neuropharmacology of Drugs of Abuse. 3 Credit Hours.

This course will explore how drugs of abuse act within the brain. We will discuss the acute and longterm effects of selected drugs of abuse on behavior, mood, cognition and neuronal function and material from studies with humans is integrated with basic studies on the neurobiological basis of drug action and drug abuse -- including detailed coverage of synaptic transmission and the distribution, regulation and integration of brain neurotransmitter systems. The focus is on addictive or illicit drugs, and all the major classes are discussed, including: opiates (heroin, morphine, opium), sedative - hypnotics (alcohol, barbiturates, chloral hydrate), anxiolytics (benzodiazepines), psychomotor stimulants (amphetamine, cocaine), marijuana, hallucinogens (LSD, mescaline), hallucinogenic-stimulants (MDA, MDMA), and dissociative anesthetics (PCP).

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(PSY 2501|Minimum Grade of C-|May not be taken concurrently)
 OR PSY 2502|Minimum Grade of C-|May not be taken concurrently
 OR NSCI 2001|Minimum Grade of C-|May not be taken concurrently)
 AND (PSY 1003|Minimum Grade of C-|May not be taken concurrently)

NSCI 3008. Decision Neuroscience. 3 Credit Hours.

How do we make decisions in social and economic contexts? What factors influence our decisions? How can neuroscience be used to better understand our decisions? To answer these questions, this course focuses on how new research in neuroscience, psychology, and behavioral economics shapes our broader understanding of decision making. The topics covered in the course include functional organization of key brain systems, approaches to measuring and interpreting neuroscience data, methods for measuring decision-making behavior, economic and cognitive modeling, and impact of neuroscience on real-world decision-making. Emerging topics will include applications in policy, marketing, and finance.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(PSY 1003|Minimum Grade of C-|May not be taken concurrently)
 AND (PSY 1004|Minimum Grade of C-|May not be taken concurrently)
 AND (PSY 2104|Minimum Grade of C-|May not be taken concurrently)
 OR PSY 2501|Minimum Grade of C-|May not be taken concurrently
 OR PSY 2502|Minimum Grade of C-|May not be taken concurrently
 OR NSCI 2001|Minimum Grade of C-|May not be taken concurrently)

NSCI 3087. Techniques in Neuroscience. 3 Credit Hours.

A major reason that neuroscience is such a dynamic and rapidly advancing field is that it relies on cutting edge technology. Throughout the history of neuroscience, advances have come with the development of new techniques. In this course, students will learn about a variety of traditional techniques in basic and clinical neuroscience as well as newly developed techniques driving the field to new insights. Methods to be discussed will be selected from among: genetic assays, genotyping, histology, immunohistochemistry, stereotaxic surgery, electrophysiology (patch clamping, single and multiple unit recording, EEG), behavioral assessment of animals, neuropsychological assessment in humans, human electrophysiology, transcranial magnetic stimulation, MRI and fMRI. From among identified neuroscience techniques, students will select one and prepare a demonstration or video.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(NSCI 1051|Minimum Grade of C-|May not be taken concurrently)
 OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently)
 AND (NSCI 2121|Minimum Grade of C-|May not be taken concurrently)
 AND (NSCI 2122|Minimum Grade of C-|May not be taken concurrently)
 AND (NSCI 2222|Minimum Grade of C-|May not be taken concurrently)

NSCI 3096. Conducting Neuroscience Research. 3 Credit Hours.

The objective of this writing intensive course is to develop critical thinking and analytical skills necessary for applying the scientific method in neuroscience. In the course, students will complete readings of primary sources, discuss literature, and participate in activities to strengthen research abilities. This experience will reinforce key methodological and statistical concepts that were taught earlier in the curriculum, while stimulating growth in understanding neuroscience and research processes in general. Students will present reports in writing and in class presentations.

Course Attributes: WI

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently)
AND (PSY 1003|Minimum Grade of C-|May not be taken concurrently)

NSCI 3604. Food on the Brain. 3 Credit Hours.

This course is about food and eating from a variety of perspectives including from a neuroscience, developmental, and an individual differences perspective. We will review the neurobiology of tasting and consuming food; examine lifespan and gender differences. We will examine eating in healthy individuals but also will cover health and clinical psychology topics such as eating and weight disorders. We will review the current understanding of food as an addictive substance and consider food and eating occurs within a social and environmental context.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(PSY 1003|Minimum Grade of C-|May not be taken concurrently)
AND (PSY 2601|Minimum Grade of C-|May not be taken concurrently
OR HRPR 2103|Minimum Grade of C-|May not be taken concurrently
OR NSCI 2001|Minimum Grade of C-|May not be taken concurrently)

NSCI 3900. Honors Special Topics. 3 Credit Hours.

The goal of this Honors class is to explore in depth a current topic in neuroscience. Potential topics include addiction, schizophrenia, Alzheimer's disease, memory reconsolidation, and more. Note: A semester's course will cover one topic in depth and not cover multiple topics.

Cohort Restrictions: Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

Course Attributes: HO

Repeatability: This course may be repeated for additional credit.

NSCI 4182. Independent Study in Neuroscience 1. 1 to 4 Credit Hour.

Neuroscience majors are encouraged to gain first-hand experience with research as provided by Independent Study. This course is available in the laboratories of neuroscience faculty members at Temple University listed on the Neuroscience web site: www.temple.edu/cla/neuroscience. Students will carry out supervised neuroscience research by observing and participating in ongoing research in the laboratory. This course requires the student to spend 3-4 hours per credit per week of a 14-week semester in the lab.

Field of Study Restrictions: Must be enrolled in one of the following Fields of study: Neuroscience.

Repeatability: This course may be repeated for additional credit.

Pre-requisites:

NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently.

NSCI 4191. Collaborative Research I. 1 to 4 Credit Hour.

Faculty advisor needed for research in a particular area. For projects outside Temple University, approval must be obtained through a faculty member who will handle the liaison with the outside institution and ensure uniformity of requirements.

Repeatability: This course may be repeated for additional credit.

NSCI 4197. Capstone in Neuroscience. 4 Credit Hours.

The focus of this capstone is a topic important to many domains in neuroscience. Different topics will be covered in different semesters. This course has two major components: (1) instruction and practice on scientific writing of research papers and proposals, and instruction and practice on oral presentations; (2) Integration of content in basic and clinical neuroscience. The course will allow students to follow issues in neuroscience from cellular and molecular levels to translation and application in human life. The emphasis is on synthesis and application of material learned in the neuroscience major. NOTE: This course is limited to neuroscience majors in their senior year.

Field of Study Restrictions: Must be enrolled in one of the following Fields of study: Neuroscience.

Course Attributes: WI

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

NSCI 3087|Minimum Grade of C-|May not be taken concurrently.

NSCI 4282. Independent Study in Neuroscience 2. 1 to 4 Credit Hour.

Neuroscience majors are encouraged to gain first-hand experience with research as provided by Independent Study and may take up to 8 independent study credits. Independent Study in Neuroscience 2 follows Neuroscience 4182, Independent Study in Neuroscience 1, and can be taken in the same laboratory or in another lab of a neuroscience faculty member at Temple University. Faculty members sponsoring this course are listed on the Neuroscience web site: www.temple.edu/cla/neuroscience. Students will carry out supervised neuroscience research by observing and participating in ongoing research. This course requires the student to spend 3-4 hours per credit per week of a 14-week semester in the lab.

Field of Study Restrictions: Must be enrolled in one of the following Fields of study: Neuroscience.

Repeatability: This course may be repeated for additional credit.

Pre-requisites:

NSCI 1051|Minimum Grade of C-|May not be taken concurrently
OR NSCI 1951|Minimum Grade of C-|May not be taken concurrently.

NSCI 4291. Collaborative Research II. 1 to 4 Credit Hour.

Faculty advisor needed for research in a particular area. For projects outside Temple University, approval must be obtained through a faculty member who will handle the liaison with the outside institution and ensure uniformity of requirements.

Repeatability: This course may be repeated for additional credit.