

# Neuroscience - CLA (NSCI)

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Course information contained within the Bulletin is accurate at the time of publication in July 2024 but is subject to change. For the most up-to-date course information, please refer to the Course Catalog.

## **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 1002. Careers in Neuroscience. 1 Credit Hour.**

This course will cover the wide range career options available in Neuroscience, focusing on what is possible with an undergraduate and graduate degree. Traditional career paths will be discussed, such as medicine and research, as well as "non-traditional" paths in clinical/science administration. We will then focus on professional development. Topics covered will include inviting guest speakers that can provide information about where to find research/volunteering/job opportunities, workshops on resumes and personal statements, and practice with public speaking in various science-specific formats (science presentations and job/school interviews). By the end of this course, you will be well versed in what a degree in Neuroscience can provide you, and you will have the professional skills and application materials to prepare for this career. Because there is significant overlap in course content, students will receive credit for only one of these courses: CLA 1002, CJ 1002, ENG 1801, HIST 1012, NSCI 1002, POLS 1002, PSY 1002, SOC 1002.

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951)

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951) and (NSCI 2122, BIOL 1012, or BIOL 1112)

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951) and (NSCI 2001, BIOL 1012, or BIOL 1112)

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951) and NSCI 2001.

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951), PSY 1003, and NSCI 2001.

**NSCI 3002. Neurobiology of Pain and the Opioid Epidemic. 3 Credit Hours.**

This course will investigate the neural and psychological perspectives on pain and the opioid epidemic. We will begin with an evolutionary and historical view of why pain exists and how it was treated before the advent of modern medicine. Next, we will discuss the neurological underpinnings of both acute and chronic pain, focusing on pain pathways at the peripheral level and the role of the limbic system in pain at the central level. Next, we will address the pharmacology of pain treatments and the disorders they treat, with heavy focus on opioids and the current epidemic. This discussion will be facilitated using the book "Dreamland" that details the origins and impact of the opioid epidemic. Our reading and discussions of "Dreamland" will help provide historical context for the opioid epidemic, and allow us to explore the societal implications of addiction. Furthermore, the book will allow us to critically look at the major institutions and groups that played a role in the epidemic, from the dealers to pharmaceutical companies to physicians. By the end of the course, you will have an in-depth knowledge of the basic science of pain processing, pathways involved in addiction, and the broader origins of opioid addiction in the United States.

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

**Pre-requisites:** Minimum grade of C- in NSCI 2001.

**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:** Minimum grade of C- in (PSY 2501, PSY 2502, or NSCI 2001) and PSY 1003.

**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:** Minimum grade of C- in (PSY 2501, PSY 2502, or NSCI 2001) and PSY 1003.

**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:** Minimum grade of C- in (PSY 2501, PSY 2502, or NSCI 2001) and PSY 1003.

**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:** Minimum grade of C- in PSY 1003 and (PSY 2104, PSY 2501, PSY 2502, or NSCI 2001)

**NSCI 3013. Behavioral Epigenetics. 3 Credit Hours.**

In the broadest sense, the term epigenetics refers to the study of environmental influences on gene expression. These processes encompass a multitude of mechanisms by which DNA is regulated, all of which are independent of DNA mutation. Epigenetic modifications are highly dynamic and respond quickly to environmental changes, such as diet or stress. Epigenetic marks represent concrete mechanisms for the long-held idea that biology and behavior are shaped by complex interactions between genetic and environmental factors. Some of these epigenetic marks are passed on to future generations via the germline and influence neuroprogramming in the next generation offspring. In the brain, where most neurons are post-mitotic, epigenetic processes play a critical role in regulating gene expression and synaptic plasticity, which are pivotal events for the regulation of behavior.

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

**Pre-requisites:** Minimum grade of C- in NSCI 1051.

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951) and NSCI 2122.

**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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951), PSY 1003, and (NSCI 2001 or NSCI 2122)

**NSCI 3602. Clinical Neuropsychology. 3 Credit Hours.**

This course will provide background on basic functional anatomy of the central nervous system and neuropsychological theories and methods. The primary focus of the course will be the clinical assessment and treatment of neuropsychological disorders, such as aphasia, agnosia, dementia, and others. NOTE: This course is cross-listed with PSY 3602; students will receive credit for only one of these two courses.

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

**Pre-requisites:** Minimum grade of C- in (PSY 1003, PSY 2168, STAT 2102, or STAT 2103), (PSY 1004, PSY 1167, SOC 1167, MATH 1013, or STAT 2101), and any 2000-level PSY course.

**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:** Minimum grade of C- in PSY 1003 and (PSY 2601, HRPR 2103, or NSCI 2001)

**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](http://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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951)

**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:** Minimum grade of C- in NSCI 3087 and NSCI 3096.

**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](http://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:** Minimum grade of C- in (NSCI 1051 or NSCI 1951)

**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.