NEUROSCIENCE (NEUR)

Neuroscience Undergraduate Courses

NEUR 1000 SUPERHEROES, ZOMBIES, CYBORGS AND DROIDS: COULD THEY LIVE AMONG US? (3 credits)
Neuroscience is constantly pushing the boundaries of what is possible, and concepts once relegated to the realm of science fiction are quickly becoming not only possible, but inevitable. In this course, we will use superheroes, zombies, cyborgs, and droids as vehicles into the wonderful and exciting world of neuroscience and how the brain and nervous system function. Mind control, enhanced strength, artificial brains...these may all seem like pure fantasy, but the reality may surprise you. This course fulfills the General Education: Natural and Physical Sciences requirement.
Prerequisite(s): High School Biology and High School Chemistry recommended. Not open to non-degree graduate students.
Distribution: Natural/Physical Sci General Education lecture

NEUR 1520 INTRODUCTION TO NEUROSCIENCE I (3 credits)
The nervous system is intricate, complex, and is the subject of one of the most exciting fields in the life sciences. This course is part 1 of a 2-semester sequence designed for neuroscience majors or students who are contemplating neuroscience as a major. This course will focus on understanding how the nervous system interacts at the cellular and molecular levels: anatomy and function of neurons, communication within and between neurons, and how neurons interact to perceive and process sensory information.
Prerequisite(s): High school biology and chemistry. Not open to non-degree graduate students.

NEUR 1540 INTRODUCTION TO NEUROSCIENCE II (3 credits)
The nervous system is intricate, complex, and is the subject of one of the most exciting fields in the life sciences. This course is part 2 of a 2-semester sequence designed for neuroscience majors or students who are contemplating neuroscience as a major. This course will focus on understanding how the nervous system interacts at the organismal, behavioral and cognitive levels: how the nervous system develops, how the motor system, hormones, and physiology influences behavior, and how cognition and systems neuroscience leads to understanding of the mind.
Prerequisite(s): NEUR 1520 or permission of instructor. Not open to non-degree graduate students.

NEUR 1560 NEUROSCIENCE PATHWAYS TO DISCOVERY (3 credits)
Experience the tools, strategies, challenges, and joy of discovery in neuroscience in a hands-on, active-learning environment. This laboratory/lecture course will introduce concepts of research exploration, guide students in developing topics for experimentation, and help students build ways to assemble the pieces needed to answer questions in neuroscience.
Prerequisite(s): Recommend concurrent with NEUR 1520 or NEUR 1540. Not open to non-degree graduate students.

NEUR 3500 BIOLOGICAL PRINCIPLES OF AGING (3 credits)
The Biological Bases of Aging Course provides a survey of the primary topics in the biology of aging field for undergraduate students. This a required course for the Gerontology major. By the end of the course, students will understand major theories, biological methods, and seminal research studies in the biology of aging field. Furthermore, students will learn how to critically analyze and interpret primary research about biological aging. This course provides preparation for students considering graduate school in gerontology or biology, geriatric nursing and social work, geriatric medicine, neuroscience, psychology, and exercise science. (Cross-listed with GERO 3500, BIOL 3500)
Prerequisite(s): Sophomore/Junior/Senior Standing. Not open to non-degree graduate students.

NEUR 3600 RESEARCH METHODS IN NEUROSCIENCE (3 credits)
In this course, students will get an introduction to how neuroscientists acquire, interpret, discuss, and share knowledge. Skills covered include study design, reading primary research articles, interpreting statistics, and writing scientific papers.
Prerequisite(s): PSYC 3130 or STAT 3000, and ENGL 1160 (or permission of Instructor) Not open to non-degree graduate students.
Distribution: Writing in the Discipline Single Course

NEUR 4000 SYSTEMS NEUROSCIENCE (3 credits)
This course is designed to provide a solid understanding of the peripheral and central connections that make the systems of the body function. Data and theories of brain-behavior relationships from current research in neuroscience will be discussed. (Cross-listed with NEUR 8006).
Prerequisite(s): NEUR 1520 and NEUR 1540 or permission. Not open to non-degree graduate students.

NEUR 4050 ADVANCED BIOLOGY OF AGING (3 credits)
This course covers biological aging topics at an advanced level, and is designed for undergraduate and graduate students who have some prior knowledge about biology or aging. The course will be interdisciplinary in nature and focus on topics relevant to gerontology, biology, psychology, and exercise science. Students will learn how to think critically about primary research in the biology of aging. Furthermore, they will apply their knowledge of the biology of aging field by creating a handbook of healthy aging for older adults. (Cross-listed with GERO 4050, GERO 8056).

NEUR 4160 NEUROPHARMACOLOGY (3 credits)
Neuropharmacology will introduce students to ligand-receptor interactions and their effects on behavior, cognition, and development. This course will characterize the molecular structure of ligands and how these small molecules or biologics affect central nervous system receptors and transporters. Students will learn about structure-activity relationships and principles of pharmacology: distribution, metabolism, pharmacokinetics, and elimination) and explore the historical milestones in drug development. We'll also discuss the dynamic actions of drugs of abused drugs and the mechanisms of action. For undergraduate Neuroscience Majors, the course counts as a Neuroscience Block 1. (Cross-listed with NEUR 8166, PSYC 4160, PSYC 8166).
Prerequisite(s): Need at least one: NEUR 1520 or NEUR 1540 or PSYC 1020 or BIOL 1450. And need NEUR 3600 or PSYC 3140. PSYC 4230 recommended for students who have not taken NEUR 1520 or BIOL 1450.

NEUR 4200 ADVANCED NEUROSCIENCE LABORATORY (3 credits)
This course is designed as a capstone laboratory course for Neuroscience majors. The course will provide students with hands-on experience in collecting data in diverse areas of neuroscience, analyzing these data, interpreting the data, and preparing written and verbal presentations of the data.
Prerequisite(s): NEUR 1520, NEUR 1540, and PSYC 3140 or NEUR 3600. Junior or Senior status or permission of Instructor. Not open to non-degree graduate students.

NEUR 4230 BEHAVIORAL NEUROSCIENCE (3 credits)
A comprehensive study of the relationship of the nervous and other organ systems to behavior. Research on both human and other animal species is considered. (Cross-listed with PSYC 4230).
Prerequisite(s): BIOL 1450 OR PSYC 1010

NEUR 4290 NEUROETHOLOGY (3 credits)
In the field of Neuroethology a major goal is to understand the neural bases of animal behaviors in a natural context. In this course students will investigate how behaviors are generated and modulated by the nervous system in organisms ranging from insects to mammals. We will explore the neural mechanisms underlying a variety of animal behaviors as they interact with their natural environment ranging from sensory perception of the world (e.g. echolocation, electrolocation), to locomotor movements (e.g. flying, swimming), to more complex behaviors (e.g. learning, memory). (Cross-listed with NEUR 8296, BIOL 4290, BIOL 8296, PSYC 8296).
Prerequisite(s): NEUR 1520, NEUR 1540 and BIOL 1750; or by permission of instructor. Not open to non-degree graduate students.

NEUR 4330 SOCIAL NEUROSCIENCE (3 credits)
This course will evaluate the biological substrates of sociality and social behavior, and examine how brain events bias social behavior and cognition, as well as how social behavior and cognition influence brain functioning. We will explore the neural mechanisms that inform social behavior and explain our ability to recognize, understand and interact with others. Cutting edge questions on concepts such as love, trust, empathy and prejudice will also be explored. (Cross-listed with NEUR 8336, PSYC 8336).
Prerequisite(s): NEUR 1520 and NEUR 1540 or permission of Instructor. Not open to non-degree graduate students.

NEUR 4340 ADVANCED BEHAVIORAL NEUROSCIENCE (3 credits)
Building on content from Introductory Neuroscience courses, this course will deeply explore the fundamental link between behavior and biological processes. Prepare to unravel the mysteries of behavior, cognition, emotions, sensory systems, and disorders by exploring cutting-edge neuroscience methods to reveal the specific cells and neurobiological processes that give rise to human and animal behavior. PSYC 4230 should not be taken after the completion of this course. (Cross-listed with NEUR 8346, PSYC 4340).
Prerequisite(s): NEUR 1520 and NEUR 1540, or PSYC 4230

NEUR 4480 NEUROIMMUNOLOGY (3 credits)
The course explores the bi-directional mechanisms by which the brain and the immune system communicate with each other in health and during injury or infection. This course also introduces human immunology as a basis for understanding the advanced content in neuroimmunology. Topics include innate immunity in the central nervous system (CNS), inflammation in neurodegenerative diseases, CNS infections and autoimmune diseases. Reading and evaluating neuroimmunology primary literature, presentation and scientific writing will be emphasized. Counts as a Neuroscience Block 1 course requirement. (Cross-listed with NEUR 8486).
Prerequisite(s): NEUR 1520 and NEUR 1540, or permission of Instructor.

NEUR 4640 NEURAL MECHANISMS OF SUBSTANCE USE DISORDERS (3 credits)
This course details how the brain changes during and after the administration of illicit substances. Illicit drugs 'hijack' the natural reward pathways and brain circuits. Material highlights brain regions, neural circuits, and structural alterations that accompany illicit drug use. Modern neuroscience research techniques that measure and manipulate brain function reveal opportunities for therapeutic interventions. The course will explore how therapeutic interventions repair the brain. (Cross-listed with NEUR 8646).
Prerequisite(s): NEUR 1520 and NEUR 1540 and either NEUR 3600 or PSYC 3140.

NEUR 4650 NEUROMECHANICS OF HUMAN MOVEMENT (3 credits)
A study of basic principles of neural process as they relate to human voluntary movement. Applications of neural and mechanical principles through observations and assessment of movement, from learning to performance, as well as development. (Cross-listed with BMCH 4650).
Prerequisite(s): NEUR 1540 or permission of instructor

NEUR 4810 BEHAVIORAL GENETICS (4 credits)
This lecture and laboratory course will explore the interaction between behavior and genetics. Topics addressed will include research systems used in behavioral genetics research, ways of studying animal behavior, gene function, gene expression, genetic manipulation, genome sequencing, and bioinformatics. Research techniques will include behavioral observations, cognition assays, and traditional and cutting edge genetics research techniques and analyses (DNA/RNA isolation, PCR, gel electrophoresis, transgene generation, quantitative PCR, next generation sequencing). Students will design, conduct, analyze, and present semi-independent research projects over the course of the semester. (Cross-listed with BIOL 4810).
Prerequisite(s): BIOL 2140

NEUR 4840 GLIA IN HEALTH AND DISEASE (3 credits)
While neurons are often highlighted as the primary drivers of brain function, evidence is rapidly growing that a lesser-known class of cells, glia, are intimately involved in virtually all aspects of central nervous system function. This course is designed for students looking for an in-depth discussion on the various glial cells of the central system, with an emphasis on cutting-edge research and the techniques used to study them. Counts as a Block 1 Neuroscience requirement. (Cross-listed with NEUR 8846).
Prerequisite(s): NEUR 1520 or NEUR 1540, or permission of Instructor.

NEUR 4850 NEUROBIOLOGY OF LEARNING AND MEMORY (3 credits)
This course will evaluate the neurobiology of learning and memory. In this course students will explore how learning and memory processes are encoded and stored at the cellular and molecular neurobiology levels. We will examine both classic and cutting edge studies to see how changes in molecular activity, genetics, and cellular physiology can influence learning and memory processes. Counts as a Block 1 course for Neuroscience Majors. (Cross-listed with NEUR 8856).
Prerequisite(s): NEUR 1520 & NEUR 1540 or Instructor Permission. Not open to non-degree graduate students.

NEUR 4870 MOLECULAR AND CELLULAR NEUROBIOLOGY (3 credits)
This course presents foundational topics in molecular and cellular neurobiology in the context of how the nervous system is functionally organized. Topics include: nervous system cell types and their subcellular organization; electrical properties of neurons and glia; energy metabolism and biochemistry of the brain; intra- and intercellular neuronal signaling; the regulation of gene expression in neuronal cells; synaptic plasticity; and how these are altered in disease. (Cross-listed with BIOL 4870, BIOL 8876, NEUR 8876).
Prerequisite(s): NEUR 1500, or both NEUR 1520 and NEUR 1540, or BIOL 3020, or permission of instructor.

NEUR 4890 GENES, BRAIN, AND BEHAVIOR (3 credits)
This course will evaluate the complex interaction between an organism's genome and neural activity pattern in the nervous system as related to behavior. In this course students will explore how changes in gene expression (allelic variants, epigenetics, differential regulation) and gene networks within neural tissue can reciprocally influence behaviors such as communication, foraging, reproduction, and cognition. (Cross-listed with NEUR 8896, BIOL 4890, BIOL 8896, PSYC 8896).
Prerequisite(s): NEUR 1520, NEUR 1540, and BIOL 2140. Or by permission of instructor. Not open to non-degree graduate students.

NEUR 4910 SPECIAL TOPICS IN NEUROSCIENCE - BLOCK 1 (3 credits)
Fulfills Neuroscience BLOCK 1 or Neuroscience Elective requirement. A study of designated special topic in neuroscience. Students may repeat this class as long as the specific topic is not duplicated.
Prerequisite(s): NEUR 1520, junior-senior status (sophomore status by permission), or instructor permission. Not open to non-degree graduate students.

NEUR 4920 SPECIAL TOPICS IN NEUROSCIENCE - BLOCK 2 (3 credits)
This course fulfills Neuroscience BLOCK 2 or Neuroscience Elective requirements. A study of designated special topic in neuroscience. Students may repeat this class as long as the specific topic is not duplicated.
Prerequisite(s): NEUR 1520 or NEUR 1540, junior-senior status (sophomore status by permission), or instructor permission. Not open to non-degree graduate students.

NEUR 4930 SPECIAL TOPICS IN NEUROSCIENCE - NEURO ELECTIVE BLOCK (3 credits)
This course will provide for an in-depth study of a designated topic in neuroscience that is different than the focus of an existing course in the neuroscience curriculum. Students may repeat this class as long as the specific topic is not duplicated. Fulfills a Neuroscience Elective requirement.
Prerequisite(s): NEUR 1520 or NEUR 1540, or Instructor permission.

NEUR 4960 EXPERIENTIAL STUDY IN NEUROSCIENCE (1-6 credits)
Focused research projects, data analysis, and/or directed readings with faculty supervision. Oral and written reports based on empirical research are expected outcomes.
Prerequisite(s): NEUR 1520; PSYC 3130. PSYC 3140 recommended. Instructor permission required.