

NEUROSCIENCE (NEUR)

NEUR 1024 (a) Mind the Gap: Bridging Scientific and Creative Writing in the Neurosciences.

Michael Fine.

Non-Standard Rotation. Fall 2024. Enrollment limit: 16.

Mind the Gap serves as an introduction to the world of neuroscience and science communication through an exploration of creative works of fiction, sci-fi, non-fiction, and scientific reports. The class will explore works from Antonio Damasio, Sam Kean, Daniel Keyes, Oliver Sacks, and more as well as shorter scientific reports and research articles. Regardless of background, students in this class will learn to compare the different writing styles necessary for scientific communication with an understanding of how different audiences drive how we shift from scientific to creative and persuasive writing. Students will learn general concepts in Neuroscience by discussing both creative literature and associated scientific papers. Through practice, students will gain insights into proper citation management and concise scientific writing skills. (Same as: BIOL 1024)

NEUR 1099 (a, INS) Brains in Motion: Exploring the Interface between Mind and Body

Manuel Diaz-Rios.

Every Fall. Fall 2024. Enrollment limit: 24.

This course is an introductory exploration of the nervous system as it relates to bodily functions. It explores neurons as the basic building blocks of brain and behavior. Through lectures and classroom experiments, students would learn how electrochemical nerve signals control body movement, cardiovascular function, reflexes, and brain activity. Further, students explore how the nervous system can interact with machine interfaces, including prosthetics. (Same as: BIOL 1099)

Previous terms offered: Fall 2023, Fall 2022, Fall 2021, Spring 2021, Fall 2020.

NEUR 2050 (a) Biological Psychology

Thomas Small.

Every Other Year. Spring 2025. Enrollment limit: 35.

An introductory survey of biological influences on behavior. The primary emphasis is on the neurobiological regulation of behavior in humans and other vertebrate animals, focusing on genetic, developmental, hormonal, and neuronal mechanisms. Additionally, the evolution of these regulatory systems is considered. This course explores the structural and functional properties of the central nervous system to understand how behavior occurs—and how it is disrupted—at the molecular, cellular, and systems level. Topics discussed may include cellular processes/communication, sensation/perception, cognition, sleep, eating, sex, and aggression. Emphasis will be placed on how biological mechanisms contribute to psychological [dys]function. (Same as: PSYC 2050)

Prerequisites: PSYC 1101 or BIOL 1102 or BIOL 1109 or Placement in above PSYC 1101 or Placement in BIOL 2000 level.

Previous terms offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021.

NEUR 2060 (a) Cognitive Neuroscience

Every Other Year. Enrollment limit: 35.

An introduction to the neuroscientific study of cognition. Topics surveyed in the course include the neural bases of perception, attention, memory, language, executive function, and decision making. In covering these topics, the course will draw on evidence from brain imaging (fMRI, EEG, MEG), transcranial magnetic stimulation, electrophysiology, and neuropsychology. Also considers how knowledge about the brain constrains our understanding of the mind. (Same as: PSYC 2060)

Prerequisites: PSYC 1101 or BIOL 1102 or BIOL 1109 or Placement in above PSYC 1101 or Placement in BIOL 2000 level.

Previous terms offered: Fall 2023, Fall 2022, Fall 2020.

NEUR 2099 (a) Brain, Behavior, and Evolution

Non-Standard Rotation. Enrollment limit: 35.

A comparative and evolutionary approach to animal behavioral neuroscience. The primary focus is on the evolution of the brain and behavior in vertebrate systems, including humans, but invertebrates are also discussed. Topics include the evolution and diversity of sensory systems, reproductive behaviors, parental care, learning and memory, social behaviors, intelligence, and cognition. (Same as: PSYC 2099)

Prerequisites: PSYC 1101 or BIOL 1102 or BIOL 1109 or Placement in above PSYC 1101 or Placement in BIOL 2000 level.

Previous terms offered: Fall 2021, Fall 2020.

NEUR 2135 (a, INS, MCSR) Neurobiology

Stephen Hauptman; Hadley Horch.

Every Fall. Fall 2024. Enrollment limit: 35.

Examines fundamental concepts in neurobiology from the molecular to the systems level. Topics include neuronal communication, gene regulation, morphology, neuronal development, axon guidance, mechanisms of neuronal plasticity, sensory systems, and the molecular basis of behavior and disease. Weekly lab sessions introduce a wide range of methods used to examine neurons and neuronal systems. (Same as: BIOL 2135)

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

Previous terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2020.

NEUR 2504 (a) Cellular Signaling

Michael Fine.

Every Spring. Spring 2025. Enrollment limit: 35.

All cells signal through a variety of mechanisms. Cells take advantage of these signaling pathways to communicate intrinsically, through their local environment, and across entire systems throughout the body. This course will focus on broad types of signaling pathways that have been observed and defined across many fields of biology and introduce students to concepts such as lipid signaling, the immune synapse, and signaling pathways in cancer and other pathologies. Topics of exploration include bioactive lipid signaling, autocrine, cell-cell signaling, and paracrine signaling. We will expand into systemic endocrine signaling and the hypothalamic-pituitary-adrenal axis (HPA) and discuss more complicated signaling systems such as what happens during oncogenesis and the communication between the gut microbiome and the brain. (Same as: BIOL 2504, BIOC 2504)

Prerequisites: Three of: either BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level and CHEM 1092 or either CHEM 1102 or CHEM 1109 or Placement in CHEM 2000/1109 or Placement in CHEM 2000 level and BIOL 2000 - 2499.

NEUR 2510 (a, INS) Neuropharmacology

Manuel Diaz-Rios; Tina Rioux.

Every Spring. Spring 2025. Enrollment limit: 24.

This course will discuss drug-induced changes in the functioning of the nervous system. The specific focus will be to provide a description of the cellular and molecular actions of drugs (natural or artificial) on the communication between neurons (known as synaptic transmission) and on the production of behaviors such as walking, breathing, heart function, and learning/memory, among others. This course will also refer to specific diseases of the nervous system and their treatment, in addition to giving an overview of the techniques used for the study of neuropharmacology. The lab portion of this course would involve the dissection and handling of mouse tissue. If you are not comfortable with the idea of dissecting mice you should not take this course. (Same as: BIOL 2510)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and either BIOL 2135 (same as NEUR 2135) or BIOL 2214 (same as NEUR 2214) or PSYC 2050 (same as NEUR 2050).

Previous terms offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021.

NEUR 2553 (a, INS) Neurophysiology

Tina Rioux; Daniel Powell.

Every Fall. Fall 2024. Enrollment limit: 20.

A comparative study of the function of the nervous system in invertebrate and vertebrate animals. Topics include the mechanism that underlie both action potentials and patterns of spontaneous activity in individual nerve cells, interactions between neurons, and the organization of neurons into larger functional units. Lectures and four hours of laboratory work per week. (Same as: BIOL 2553)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and either BIOL 2135 or BIOL 2214 or PSYC 2050.

Previous terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2020.

NEUR 2566 (a, INS) Molecular Neurobiology

Hadley Horch; Anja Forche.

Every Spring. Spring 2025. Enrollment limit: 24.

Examination of the molecular control of neuronal structure and function. After understanding classic cloning techniques and experiments, students will learn more modern variations of techniques related to nucleic acid sequencing, protein visualization, and genetic manipulation. Additional topics such as intracellular signaling, neurotrophins and cell death, growth cone guidance, and the molecular basis of learning and memory are covered. The final portion of the course revolves around pathological disorders, such as Alzheimer's disease and spinal cord injuries, culminating in an independent investigation of the molecular basis of a neurological disorder of each student's choosing. Students will gain experience reading and interpreting primary research articles, working collaboratively in small groups, and communicating scientifically. Weekly laboratory sessions are devoted to exploring the molecular basis of compensatory plasticity in the cricket auditory system. (Same as: BIOL 2566)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level and either BIOL 2112 or BIOL 2124 (same as BIOC 2124) or BIOL 2135 (same as NEUR 2135) or BIOL 2553 (same as NEUR 2553) or PSYC 2050 (same as NEUR 2050).

Previous terms offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021.

NEUR 2750 (a, INS) Behavioral Neuroscience Laboratory: Affective Neuroscience

Thomas Small; Anja Forche.

Every Year. Fall 2024. Enrollment limit: 20.

A laboratory course that exposes students to modern techniques in neuroscience that can be applied to the study of affective behavior, broadly. Underlying concepts associated with various behavioral, molecular, neuroanatomical, pharmacological, and translational methods will be discussed in a lecture format. Students will apply these concepts and techniques in discussions and laboratory preparations demonstrating how affective processes are organized within the central nervous system of vertebrates. This course will explore using experimental examples how the brain influences behavior, thereby illuminating our understanding of human neuropsychological functioning. (Same as: PSYC 2750)

Prerequisites: Three of: either PSYC 2050 (same as NEUR 2050) or BIOL 2135 (same as NEUR 2135) or PSYC 2060 (same as NEUR 2060) and PSYC 2510 or either BIOL 1102 or BIOL 1109 and PSYC 2520 or either MATH 1300 or MATH 1400.

Previous terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2020.

NEUR 2775 (a, INS, MCSR) Laboratory in Cognitive Neuroscience

Erika Nyhus; Anja Forche.

Every Year. Spring 2025. Enrollment limit: 20.

A laboratory course in cognitive neuroscience that studies the timing and organization of human cognition through electroencephalography (EEG), a direct measure of brain activity from scalp electrodes with millisecond precision. Students will learn the conceptual and practical foundations of experimental design, data analysis and interpretation, and be introduced to applications of EEG in medicine and technology. (Same as: PSYC 2775)

Prerequisites: Three of: PSYC 2040 or either PSYC 2050 (same as NEUR 2050) or PSYC 2055 (same as NEUR 2055) or PSYC 2060 (same as NEUR 2060) or BIOL 2135 (same as NEUR 2135) or PSYC 2055 (same as NEUR 2055) and PSYC 2510 or either BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level and PSYC 2520 or either MATH 1300 or MATH 1400.

Previous terms offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021.

NEUR 3050 (a) Hormones and Behavior

Thomas Small.

Every Fall. Spring 2025. Enrollment limit: 16.

An advanced discussion of concepts in behavioral neuroendocrinology. Topics include descriptions of the major classes of hormones, their roles in the regulation of development and adult behavioral expression, and the cellular and molecular mechanisms responsible for their behavioral effects. Hormonal influences on reproductive, aggressive, and parental behaviors, as well as on cognitive processes are considered. (Same as: PSYC 3050)

Prerequisites: Three of: either PSYC 2050 (same as NEUR 2050) or BIOL 2135 (same as NEUR 2135) or PSYC 2060 (same as NEUR 2060) and PSYC 2510 or either BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level and PSYC 2520 or either MATH 1300 or MATH 1400.

Previous terms offered: Spring 2024, Spring 2022, Fall 2020.

NEUR 3054 (a) Sex and the Brain: Translational Animal Models of Neuropsychopathology

Jennifer Honeycutt.

Every Other Spring. Spring 2025. Enrollment limit: 14.

This seminar explores the role of sex as a biological variable on neural and behavioral outcomes, focusing on translational animal models of neuropsychopathology. Students engage with empirical research, historical perspectives, and debates on how sex- difference research in neuroscience is funded, conducted, and interpreted. Through analysis of primary literature, discussions, and presentations, students explore how sex differences— or their absence— shape our understanding and treatment of psychiatric disorders and influence research methods. The course covers several animal models, emphasizing how their neural and behavioral findings offer translational insights into human disease. By examining sex-specific neural and behavioral findings in pathological model systems, students gain a deeper understanding of the relationship between sex and typical or atypical outcomes. This course fosters critical thinking about the implications of studying sex differences in behavioral neuroscience and their impact on scientific research and public health. (Same as: PSYC 3054)

Prerequisites: Three of: either PSYC 2050 (same as NEUR 2050) or BIOL 2135 (same as NEUR 2135) or PSYC 2060 (same as NEUR 2060) and PSYC 2510 or either BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level and PSYC 2520 or either MATH 1300 or MATH 1400 or MATH 1756.

NEUR 3055 (a) Cognitive Neuroscience of Memory

Every Spring. Enrollment limit: 16.

An advanced discussion of recent empirical and theoretical approaches to understanding the cognitive neuroscience of memory. Readings and discussions address empirical studies using neuroimaging methods. Topics include hippocampal and cortical contributions to memory encoding and retrieval and the effect of genetic variability, drugs, emotions, and sleep on memory. (Same as: PSYC 3055)

Prerequisites: Three of: either PSYC 2040 or PSYC 2050 (same as NEUR 2050) or PSYC 2055 (same as NEUR 2055) or PSYC 2060 (same as NEUR 2060) or BIOL 2135 (same as NEUR 2135) and Placement in BIOL 2000 level or PSYC 2510 or either BIOL 1102 or BIOL 1109 and PSYC 2520 or either MATH 1300 or MATH 1400.

Previous terms offered: Fall 2023, Fall 2020.

NEUR 3311 (a) Motor Systems Neurobiology

Manuel Diaz-Rios.

Non-Standard Rotation. Fall 2024. Enrollment limit: 16.

In this course you will learn about the main animal models used in the study of how the nervous system controls motor behavior as animals, including humans, interact with the environment. The course will cover the principal motor systems (including those for walking, flying, swimming, breathing, and others), focusing in particular on bridging the gap between molecular/cellular neuroscience and higher-level perception and behavior. Topics to be covered include neuroanatomy, neurophysiology and functions of the most studied animal behaviors, and the groups of interconnected neurons (termed neural circuits) that control them. Students will read, interpret, analyze, and discuss seminal (classical) and recent scientific papers from influential motor systems neurobiology laboratories. The course will also discuss the relevance of these neuronal motor systems to human diseases. (Same as: BIOL 3311)

Prerequisites: BIOL 2112 or BIOL 2124 (same as BIOC 2124) or BIOL 2135 (same as NEUR 2135) or BIOL 2175 or BIOL 2553 (same as NEUR 2553) or BIOL 2566 (same as NEUR 2566) or PSYC 2750 (same as NEUR 2750) or PSYC 2751.

Previous terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2020.

NEUR 3325 (a, INS) Topics in Neuroscience

Daniel Powell; Michael Fine.

Non-Standard Rotation. Fall 2024; Spring 2025. Enrollment limit: 15.

An advanced seminar focusing on one or more aspects of neuroscience, such as neuronal regeneration and development, modulation of neuronal activity, or the neural basis of behavior. Students read and discuss original papers from the literature. (Same as: BIOL 3325)

Prerequisites: BIOL 2135 (same as NEUR 2135) or BIOL 2553 (same as NEUR 2553) or BIOL 2566 (same as NEUR 2566) or BIOL 2588 (same as NEUR 2588) or PSYC 2750 (same as NEUR 2750)- 2751 or PSYC 2775 (same as NEUR 2775).

Previous terms offered: Spring 2024, Fall 2023, Spring 2023, Spring 2022, Spring 2021.

NEUR 3329 (a, INS) Neuronal Regeneration

Every Fall. Enrollment limit: 15.

The consequences of neuronal damage in humans, especially in the brain and spinal cord, are frequently devastating and permanent. Invertebrates, on the other hand, are often capable of complete functional regeneration. Examines the varied responses to neuronal injury in a range of species. Topics include neuronal regeneration in planaria, insects, amphibians, and mammals. Students read and discuss original papers from the literature in an attempt to understand the basis of the radically different regenerative responses mounted by a variety of neuronal systems. (Same as: BIOL 3329)

Prerequisites: BIOL 2112 or BIOL 2124 or BIOL 2135 or BIOL 2175 or BIOL 2553 or BIOL 2566 or PSYC 2750 or PSYC 2751.

Previous terms offered: Fall 2021.