NEURAL SCIENCE (NEURL-UA)

NEURL-UA 100 Introduction to Neural Science (4 Credits)
Typically offered Spring
Introductory lecture course covering the fundamental principles of neuroscience. Topics include principles of brain organization, structure and ultrastructure of neurons, neurophysiology and biophysics of excitable cells, synaptic transmission, neurotransmitter systems and neurochemistry, neuropharmacology, neuroendocrine relations, molecular biology of neurons, development and plasticity of the brain, aging and diseases of the nervous system, organization of sensory and motor systems, structure and function of the cerebral cortex, and modeling of neural systems.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: BIOL-UA 11 OR BIOL-SHU 21 Corequisite: BIOL-UA 12 or BIOL-SHU 22.

NEURL-UA 210 Cellular & Molecular Neurobiology (4 Credits)
Typically offered Fall
A lecture course that provides students with broad exposure to current questions and experimental approaches in cellular neuroscience. Lectures are organized into three areas: cell structure and organization of the vertebrate central nervous system, mechanisms underlying neural signaling and plasticity, and control of cell form and its developmental determinants.
Grading: CAS Graded
Repeatable for additional credit: No
Corequisites: BIOL-UA 21) OR (NEUR-SHU 201).

NEURL-UA 211 Cellular & Molecular Neurobiology Lab (4 Credits)
Typically offered Fall
A laboratory course that provides students with broad exposure to experimental approaches in cellular neuroscience. Laboratories are organized into two areas: cell structure and organization of the vertebrate central nervous system, and mechanisms underlying neural signaling and plasticity. Laboratory instruction is given in anatomical, physiological, and biochemical methods for investigating the biology of nerve cells.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 100; Corequisite: BIOL-UA 21.

NEURL-UA 220 Behavioral and Integrative Neuroscience (4 Credits)
Typically offered Spring
Lecture and laboratory course that focuses on how the brain uses both sensory and stored information to generate behavior. Lectures and laboratories cover four main areas: sensory process, learning and memory, motivational and attentional mechanisms, and the motor system. Laboratories employ a range of electrophysiological techniques, lesions and pharmacological manipulations, and various behavioral techniques to examine the integrative processes by which the brain governs behavior. Note: Neural science majors on the Honors track must register for both the lecture and the laboratory (6 points), but the two need not be taken synchronously; nonmajors and non-Honors track NS majors may register for the lab, but a grade of B or better in V80.0100 and permission of the instructor are required for entrance.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 100 OR NEUR-SHU 201.

NEURL-UA 221 Behavioral & Integrative Neuroscience Lab (2 Credits)
Typically offered Spring
A laboratory course that address the physiological and anatomical bases of behavior. Laboratory experiments will emphasize mammalian sensory, motor, regulatory, and motivational mechanisms involved in the control of behavior, and higher mental processes such as those involved in language and memory.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 100.

NEURL-UA 301 Honors Seminar (2 Credits)
Typically offered Fall
Intended for honors-track seniors currently conducting research towards their honors thesis. Covers both practical and theoretical aspects of succeeding in science with topics such as scientific writing, authorship and publication practices, navigating mentorship relationships, and oral presentation skills. Structured as a weekly seminar class with active participation, including student presentation of journal articles and varying length presentations of students' own research projects.
Grading: CAS Graded
Repeatable for additional credit: No

NEURL-UA 302 Special Topics in Neural Science (4 Credits)
Typically offered Fall and Spring
Seminar providing in-depth treatment of an area of current interest in neuroscience. Lectures present background material and address current problems in the area. Students read and discuss review articles and current literature on the topic. Course content is determined on a semester-by-semester basis.
Grading: CAS Graded
Repeatable for additional credit: Yes
Prerequisites: NEURL-UA 220 or NEUR-SHU 251 or BIOL-UH 3101.

NEURL-UA 305 Development and Dysfunction of the Nervous System (4 Credits)
Typically offered Spring
The development of the nervous system is a unique field of study because it requires us to synthesize information from most areas of biology. These include everything from genetics through animal behavior. The course begins by considering the maturation of behavioral milestones that we seek to explain at the level of neural mechanism. The nervous system emerges from a stem cell population which ultimately creates an enormous diversity of neuron and glial cell types. In mammals, approximately 1011 neurons come to be precisely connected to one another as growing neuronal process are guided to their correct targets by a series of molecular cues. Even after these specific connections are attained, there occurs a dramatic change in their function and connectivity. During this period of developmental plasticity, the nervous system is influenced by environmental experiences, and this process can shape adult behavioral abilities. Finally, we will consider how normal developmental mechanisms can be disrupted, leading to severe neurological disorders that last a lifetime.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 210 OR NEUR-SHU 210.

NEURL-UA 306 Special Topics in Neural Science Lab (2 Credits)
This course combines lectures, discussions, and experimental work. Topics vary, but may include neurogenetics and computational neuroscience. Projects vary but may include designing and conducting experiments, analyzing data, and writing and presenting results.
Grading: CAS Graded
Repeatable for additional credit: Yes

NEURL-UA 310 How to Build a Brain: From Channels to Networks (4 Credits)
Typically offered Spring
Brain function is determined by ion channels that generate neuronal firing and by the synapses that allow information transfer between neurons in a network. To facilitate analyses of this complex process, neuroscientists use computer simulations to make predictions and design experiments. Students will build a network from the ground up. Using simulations, students will examine how biophysical properties affect the firing of neurons, how groups of neurons interact, and how information flows through neural networks. 'Skeleton' MATLAB programs will be provided, which the student can easily modify to explore the various processes that affect function.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 210 or NEURL-UA 220 or NEUR-SHU 210 or NEUR-SHU 251.

NEURL-UA 311 Neurogenetics and Behavior (4 Credits)
Typically offered Fall
Understanding the relationship between genes and behavior will be the primary goal of this course. Students will learn both classic and contemporary genetic tools that are utilized by researchers to study behaviors such as courtship, addiction, memory, sleep, and aggressive behavior. The course will focus on learning about animal model systems (fruit flies, nematodes, zebrafish, and mice) amenable to genetic manipulation. The course will also discuss the relationship among genetics, development, and neural circuitry. Through analyzing and presenting primary scientific articles, students will communicate their understanding of neurogenetics. Students will examine research topics that are at the forefront in the field of neurogenetics and behavior.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 100 AND BIOL-UA 21.

NEURL-UA 312 Neuroeconomics (4 Credits)
Typically offered Spring term of odd numbered years
Neuroeconomics covers the neuroscientific, economic and psychological foundations of human and animal decision-making. Aimed mostly at juniors and seniors in Neural Science and Psychology, the course is also appropriate for Economics and Stern students. Topics covered include: Subjective Value Theory and its Representation in the Brain, Intertemporal Choice, Neural Foundations of Game Theory, Consumer Decision-Making, Neural Foundations of Prospect Theory, and Efficient Coding as an Explanation for Choice Inconsistency. Class periods begin with a one hour lecture by the Professor; this is followed by student presentations of relevant original research articles and open discussion of those articles.
Grading: CAS Graded
Repeatable for additional credit: No
Prerequisites: NEURL-UA 220 or NEUR-SHU 251.

NEURL-UA 313 Neurobiology of Brain Disorders (4 Credits)
Understanding the neurobiological basis of neurodevelopmental and neurodegenerative disorders is the primary goal of this course. Students will learn the clinical manifestation of these disorders and how researchers utilize genetic, molecular, and cellular tools to study aberrant brain function and behavior in disease models. The course will largely be focused on mouse models of brain disorders, but other model systems will also be discussed, such as fruit flies, zebrafish, rats, and human stem cell-derived models, including brain organoids.
Grading: CAS Graded
Repeatable for additional credit: No
Corequisites: NEURL-UA 210.

NEURL-UA 998 Independent Study (1-4 Credits)
Typically offered Fall and Spring
Independent study with a Center for Neural Science faculty member. Open to advanced neural science majors with permission of the director of undergraduate studies.
Grading: CAS Graded
Repeatable for additional credit: Yes