

Neuroscience

Department Website: <http://neuroscience.uchicago.edu/undergraduate>

Program of Study

Neuroscience is the study of neurons and neural systems and their outputs: sensation, perception, homeostasis, and behavior. Neural function is investigated at the levels of molecules, cells, circuits, organisms, and species, making neuroscience inherently multidisciplinary. In addition to established neuroscience career paths in academia, medicine, and the pharmaceutical industry, new careers for students of neuroscience are emerging in economics, software development, and other fields requiring "big data" analysis or a mechanistic understanding of how humans think. The course of study in the undergraduate major in neuroscience provides students with the background and skills appropriate for these diverse careers.

The University of Chicago offers a bachelor of arts (BA) degree and a bachelor of science (BS) degree in Neuroscience. The Neuroscience major is designed to accommodate students with the range of scientific variety that one finds at the professional level of neuroscience, including physics, chemistry, computer science, engineering, mathematics, biology, psychology, and medicine. Neuroscience faculty at the University of Chicago have expertise in all of these areas and are distributed across the Biological Sciences, Social Sciences, and Physical Sciences Divisions. Majoring students have the opportunity to take a broad range of courses or to specialize in a particular area.

Declaring the Major

Students who wish to major in Neuroscience should declare the major in their second year.

(Because the Neuroscience major was introduced in the 2016–17 academic year, the Class of 2020 and subsequent classes can design a plan of study in Neuroscience from their first year. Students in the Class of 2019 may also be able to major in Neuroscience, depending on the courses they have already taken, although there is no way to guarantee this.)

General Education

Students majoring in Neuroscience typically begin their general education requirement in the biological sciences with BIOS 20186 Fundamentals of Cell and Molecular Biology. Attaining a proper grounding in cell biology is essential before delving into neuroscience as a discipline. To complete the requirement, students may choose to take one of the following: BIOS 20153 Fundamentals of Ecology and Ev OR BIOS 20150 How Can We Understand the Biosphere?, BIOS 20151 Introduction to Quantitative Modeling in Biology (Basic), BIOS 20152 Introduction to Quantitative Modeling in Biology (Advanced), BIOS 20187 Fundamentals of Genetics, BIOS 20188 Fundamentals of Physiology, or BIOS 20191 Integrative Physiology. *(Note: The general education requirement for the Neuroscience major can be fulfilled by courses in the Biology Fundamentals Sequences [BIOS 20186 to 20190] without the Biological Sciences prerequisites [BIOS 20153-20151/20152] unless a student pursues a double major in Biological Sciences. Students who choose this path will be expected to possess the competency in mathematical modeling of biological phenomena covered in BIOS 20151 or BIOS 20152.)*

Two alternative paths to fulfilling the general education requirement in the biological sciences exist. (1) Neuroscience majors may petition to take the Pre-Med Sequence for Non-Biology majors. In this case, BIOS 20170 Microbial and Human Cell Biology and BIOS 20171 Human Genetics and Developmental Biology will satisfy the general education requirement in the biological sciences. (Note that BIOS 20171 must be taken concurrently with BIOS 20172 Mathematical Modeling for Pre-Med Students.) (2) A score of 4 or 5 on the AP Biology exam allows students to enter the Advanced Biology sequence in the Autumn Quarter of their first year. This three-quarter, lab-intensive sequence is for students with a strong background in research. Upon completion of the sequence students are awarded two credits, which satisfy the general education requirement in the biological sciences.

The Major

The basic degree in Neuroscience is the BA. A BS is awarded to students who complete an additional three quarters of Neuroscience electives, which must include one to three quarters of faculty-supervised research (scholarly or experimental) resulting in a written thesis (see Requirements for the Bachelor of Science Degree in Neuroscience below).

The major curriculum includes nine required Neuroscience courses, which provide a comprehensive overview of the field. Students must also take another 700 units of elective courses, offering broad exposure to the many aspects of neuroscience or tailored for depth in a particular area, such as cognitive neuroscience or machine learning.

NEUROSCIENCE ELECTIVES (no fewer than five)

NSCI 20500	Neuroanatomy	100
NSCI 20510	Evolution and the Nervous System	100
NSCI 21000	Social Neuroscience	100
NSCI 21100	Photons to Consciousness: Cellular and Integrative Brain Functions	100
NSCI 21500	Epigenetics in Brain and Behavior	100
NSCI 21600	Attention and Working Memory in the Mind and Brain	100
NSCI 21700	Cell and Molecular Biology of the Neuron	100
NSCI 21800	Perspectives in Drug Abuse	100

NSCI 21900	Neuropharmacology	100
NSCI 22000	Gazing into the Black Box: Neocortex	100
NSCI 22100	Molecular Neuroscience	100
NSCI 22300	Molecular Principles of Nervous System Development	100
NSCI 22400	Neuroscience of Seeing	100
NSCI 23800	Neurons and Glia: Advanced Cellular and Molecular Topics	100
NSCI 24000	Modeling and Signal Analysis for Neuroscientists	100
NSCI 29100	Neuroscience Thesis Research	100
NSCI 29101	Neuroscience Thesis Research	100
NSCI 29102	Neuroscience Thesis Research	100
NSCI 29200	Neuroscience Honors Thesis Research	100
NSCI 29201	Neuroscience Honors Thesis Research	100
NSCI 29202	Neuroscience Honors Thesis Research	100
NSCI 29700	Reading and Research in Neuroscience	100
BIOS 24208	Survey of Systems Neuroscience	100
BIOS 24217	Conquest of Pain	100
BIOS 24231	Methods in Computational Neuroscience	100
BIOS 24232	Computational Approaches to Cognitive Neuroscience	100
BIOS 27721	Observing Proteins in Action: How to Design and Build Your Own Instruments	100
LING 27010	Psycholinguistics	100
NURB 32400	Synaptic Physiology	100
PSYC 20300	Biological Psychology	100
PSYC 20400	Cognitive Psychology	100
PSYC 23800	Introduction to Learning and Memory	100
PSYC 25560	Body and Mind: How Our Bodies Reveal and Change Emotion and Thought (not offered 2018-19)	100
PSYC 25750	The Psychology and Neurobiology of Stress	100
PSYC 26660	Genes and Behavior (not offered 2018-19)	100
CMSC 25025	Machine Learning and Large-Scale Data Analysis	100
CMSC 25400	Machine Learning	100

RELATED ELECTIVES (no more than two)

No more than two of the following BIOS courses:		300
BIOS 20172	Mathematical Modeling for Pre-Med Students	
BIOS 20173	Perspectives of Human Physiology	
BIOS 20175	Biochemistry and Metabolism	
BIOS 20187	Fundamentals of Genetics	
BIOS 20188	Fundamentals of Physiology	
or BIOS 20191	Integrative Physiology	
BIOS 20189	Fundamentals of Developmental Biology	
or BIOS 20190	Principles of Developmental Biology	
BIOS 20234	Molecular Biology of the Cell	
BIOS 20235	Biological Systems	
BIOS 20236	Biological Dynamics	
BIOS 20242	Principles of Physiology	
CMSC 12100-12200	Computer Science with Applications I-II	200
CMSC 15100-15200	Introduction to Computer Science I-II	200
CMSC 16100-16200	Honors Introduction to Computer Science I-II	200
BIOS 20200	Introduction to Biochemistry	100
BIOS 26210	Mathematical Methods for Biological Sciences I	100
BIOS 26211	Mathematical Methods for Biological Sciences II	100
CMSC 15400	Introduction to Computer Systems	100
PHYS 12300	General Physics III	100
or PHYS 13300	Waves, Optics, and Heat	

Requirements for the Bachelor of Science Degree in Neuroscience

Students can earn a BS in Neuroscience by completing three quarters of Neuroscience elective courses over and above the BA requirements, which must include one to three quarters of faculty-supervised research that results in a written thesis (NSCI 29100 Neuroscience Thesis Research, NSCI 29101 Neuroscience Thesis Research, NSCI 29102 Neuroscience Thesis Research). The additional courses and the thesis work require approval by the office of the director of undergraduate studies and the thesis advisor. The thesis may be either research-based or literature-based.

Grading

All courses used to satisfy prerequisites and requirements must be taken for quality grades. Students must pass all courses in the Fundamental Neuroscience Sequence (NSCI 20100-20140) with an average GPA of 2.0 or higher. Students are also required to pass general education courses with an average GPA of 2.0 or higher to continue in the program.

Summary of Requirements for the Major in Neuroscience

GENERAL EDUCATION

One of the following BIOS sequences:*		200
BIOS 20186	Fundamentals of Cell and Molecular Biology	
Plus one of the following		
BIOS 20153	Fundamentals of Ecology and Ev	
or BIOS 20150	How Can We Understand the Biosphere?	
BIOS 20151	Introduction to Quantitative Modeling in Biology (Basic)	
BIOS 20152	Introduction to Quantitative Modeling in Biology (Advanced)	
BIOS 20187	Fundamentals of Genetics	
BIOS 20188	Fundamentals of Physiology	
BIOS 20191	Integrative Physiology	
OR		
BIOS 20170 & BIOS 20171	Microbial and Human Cell Biology and Human Genetics and Developmental Biology #	
One of the following two-course MATH sequences:		200
MATH 13100-13200	Elementary Functions and Calculus I-II	
MATH 15100-15200	Calculus I-II *	
MATH 16100-16200	Honors Calculus I-II	
One of the following two-course CHEM sequences:		200
CHEM 10100 & CHEM 10200	Introductory General Chemistry I and Introductory General Chemistry II	
CHEM 11100-11200	Comprehensive General Chemistry I-II *	
CHEM 12100 & CHEM 12200	Honors General Chemistry I and Honors General Chemistry II	
Total Units		600

MAJOR: BACHELOR OF ARTS

CHEM 11300	Comprehensive General Chemistry III *	100
or CHEM 12300	Honors General Chemistry III	
PHYS 12100-12200	General Physics I-II (or higher) *	200
STAT 22000	Statistical Methods and Applications *	100
NSCI 20100	Neuroscience Laboratory	100
NSCI 20110	Fundamental Neuroscience	100
NSCI 20120	Cellular Neuroscience	100
NSCI 20130	Systems Neuroscience	100
NSCI 20140	Sensation and Perception	100
At least five Neuroscience electives ***		500
No more than two related electives ^		200
Total Units		1600

MAJOR: BACHELOR OF SCIENCE

CHEM 11300	Comprehensive General Chemistry III *	100
or CHEM 12300	Honors General Chemistry III	
PHYS 12100-12200	General Physics I-II (or higher) *	200

STAT 22000	Statistical Methods and Applications *	100
NSCI 20100	Neuroscience Laboratory	100
NSCI 20110	Fundamental Neuroscience	100
NSCI 20120	Cellular Neuroscience	100
NSCI 20130	Systems Neuroscience	100
NSCI 20140	Sensation and Perception	100
At least five Neuroscience electives ***		500
No more than two related electives ^		200
Three additional electives **		300
Total Units		1900

* Credit may be granted by examination.

BIOS 20171 must be taken concurrently with BIOS 20172.

** Must include one to three courses of NSCI 29100, 29101, 29102 Neuroscience Thesis Research or NSCI 29200, 29201, 29202 Neuroscience Honors Thesis Research

^ May also include additional Neuroscience electives

*** While they may register for multiple quarters of NSCI 29700 Reading and Research in Neuroscience, only one may be counted toward major requirements

Honors

To obtain honors in Neuroscience, students must have a minimum GPA of 3.5 in the major and a cumulative GPA of 3.25 at the point of entering the honors track, no later than the end of the third year. Only students who receive a BS will be eligible for honors. Entry into the honors track must be approved by the director of undergraduate studies. Students must do full-time paid experimental research over the summer between their third and fourth years (students accepted into the honors program will receive funding from the department). Students continue with part-time research effort for three quarters throughout their fourth year (NSCI 29200 Neuroscience Honors Thesis Research, NSCI 29201 Neuroscience Honors Thesis Research, NSCI 29202 Neuroscience Honors Thesis Research). As part of the research course work, honors students participate in regular group meetings in which they share their research with each other and supervising faculty, and receive guidance on formulating testable hypotheses, experimental design, report writing, and oral presentations. They also receive training in the responsible conduct of research. Experimental research may not be credited toward honors in more than one major.

Minor in Neuroscience

The minor in Neuroscience is intended to provide neuroscientific literacy for students whose primary interest lies in other fields. Students must meet the general education requirements for the biological and physical sciences before entering the program. Two BIOS courses at the 10000-level or above plus MATH 13100-13200 Elementary Functions and Calculus I-II are the minimum general education requirements for the minor. Students interested in completing the minor are encouraged to take BIOS 20186 Fundamentals of Cell and Molecular Biology and BIOS 20188 Fundamentals of Physiology to complete their general education requirement in the biological sciences. (Note that students in these courses will be expected to be familiar with the concepts introduced in BIOS 20151 Introduction to Quantitative Modeling in Biology (Basic) or BIOS 20152 Introduction to Quantitative Modeling in Biology (Advanced).)

Summary of Requirements for the Minor in Neuroscience

NSCI 20110	Fundamental Neuroscience	100
NSCI 20120	Cellular Neuroscience	100
NSCI 20130	Systems Neuroscience	100
Four electives		400
Total Units		700

Students are strongly encouraged to take STAT 22000 Statistical Methods and Applications (or higher) and NSCI 20140 Sensation and Perception for two of the four electives, if these courses have not already been taken to fulfill major requirements. Each student's elective courses will need to be approved by the director of undergraduate studies. No course in the minor can be double counted with the student's major(s) or with other minors, nor can it be counted toward general education requirements.

NSCI 20500	Neuroanatomy	100
NSCI 20510	Evolution and the Nervous System	100
NSCI 21100	Photons to Consciousness: Cellular and Integrative Brain Functions	100
NSCI 22000	Gazing into the Black Box: Neocortex	100
NSCI 22100	Molecular Neuroscience	100
NSCI 22300	Molecular Principles of Nervous System Development	100

NSCI 22400	Neuroscience of Seeing	100
NSCI 24000	Modeling and Signal Analysis for Neuroscientists	100
BIOS 24208	Survey of Systems Neuroscience	100
BIOS 24217	Conquest of Pain	100
BIOS 24231	Methods in Computational Neuroscience	100
BIOS 24232	Computational Approaches to Cognitive Neuroscience	100
BIOS 27721	Observing Proteins in Action: How to Design and Build Your Own Instruments	100
CMSC 25025	Machine Learning and Large-Scale Data Analysis	100
CMSC 25050	Computer Vision	100
LING 27010	Psycholinguistics	100
NURB 32400	Synaptic Physiology	100
PSYC 20300	Biological Psychology	100
PSYC 20400	Cognitive Psychology	100
PSYC 20700	Sensation and Perception	100
PSYC 23800	Introduction to Learning and Memory	100
PSYC 25560	Body and Mind: How Our Bodies Reveal and Change Emotion and Thought	100
PSYC 25750	The Psychology and Neurobiology of Stress	100
PSYC 26660	Genes and Behavior	100
STAT 22000	Statistical Methods and Applications	100

Neuroscience Courses

NSCI 00292. Neuroscience Honors Thesis Research. 000 Units.

Research Thesis and Seminar

Instructor(s): Elizabeth Grove Terms Offered: Summer

Prerequisite(s): Acceptance into the Neuroscience Honors Program

NSCI 20100. Neuroscience Laboratory. 100 Units.

This course has three components in series, representing (1) molecular neuroscience, (2) cellular electrophysiology, and (3) computation and psychophysics. The course meets one afternoon each week for four hours of laboratory time, including a didactic introduction. Students will be graded on their laboratory reports.

Instructor(s): J. Maunsell; E. Heckscher; C. Hansel; M. McNulty Terms Offered: Winter

Prerequisite(s): NSCI 20110. Must be a Neuroscience Major

NSCI 20110. Fundamental Neuroscience. 100 Units.

This course is a rigorous introduction to the study of neurons, nervous systems and brains. The systems anatomy and physiology of the vertebrate brain will be covered in depth. Common features of neural circuits, such as those subserving the stretch reflex, will be examined. The biology of brain evolution and development will be introduced. A highlight of this course will be student dissections of sheep brains and the laboratory presentation of human brain dissections by the instructors.

Instructor(s): C. Ragsdale, P. Mason Terms Offered: Autumn

Prerequisite(s): At least two quarters of Biological Sciences instruction (including courses taken concurrently) or consent of instructor

Equivalent Course(s): BIOS 24110

NSCI 20120. Cellular Neuroscience. 100 Units.

This course describes the cellular and subcellular properties of neurons, including passive and active electrophysiological properties, and their synaptic interactions. Readings are assigned from a general neuroscience textbook.

Instructor(s): M. Sheffield, W. Wei Terms Offered: Winter

Prerequisite(s): NSCI 20110, along with completion of MATH 13100, or MATH 15100, or MATH 16100, or consent of instructor

Equivalent Course(s): BIOS 24120

NSCI 20130. Systems Neuroscience. 100 Units.

This course covers vertebrate and invertebrate systems neuroscience with a focus on the anatomy, physiology, and development of sensory and motor control systems. The neural bases of form and motion perception, locomotion, memory, and other forms of neural plasticity are examined in detail. We also discuss clinical aspects of neurological disorders.

Instructor(s): D. Freedman Terms Offered: Spring

Prerequisite(s): NSCI 20110, NSCI 20120 or consent of instructors

Equivalent Course(s): BIOS 24130

NSCI 20140. Sensation and Perception. 100 Units.

What we see and hear depends on energy that enters the eyes and ears, but what we actually experience-perception-follows from human neural responses. This course focuses on visual and auditory phenomena, including basic percepts (for example, acuity, brightness, color, loudness, pitch) and also more complex percepts such as movement and object recognition. Biological underpinnings of perception are an integral part of the course.

Instructor(s): S. Shevell Terms Offered: Winter

Equivalent Course(s): PSYC 20700

NSCI 20500. Neuroanatomy. 100 Units.

This course is part of the Study Abroad Neuroscience program in Paris, France. In this course, we will use an understanding of development in order to understand the neuroanatomy of the adult vertebrate nervous system. This understanding will be solidified by dissections of mammalian, fish and bird brains as well as a trip to see myriad brains at the Muséum national d'histoire naturelle. In the second half of the course, neuroanatomical adaptations specific to particular animals will be examined in the context of critical environmental and ecological factors. Examples include postural control in sloths, vision in marine animals and raptors, and the control of muscles of facial expression across mammalian species.

Instructor(s): P. Mason Terms Offered: TBD. Paris Study Abroad Neuroscience Program

Prerequisite(s): Enrollment into the Paris Study Abroad Program

NSCI 20510. Evolution and the Nervous System. 100 Units.

Evolutionary neuroscience has traditionally focused on the neural bases of animal behavior (neuroethology) and employed the methods of comparative anatomy, cellular neurophysiology and behavioral neuropsychology. This course will approach neuroethology from a modern evolutionary perspective, one that integrates findings from genomics, molecular developmental biology and paleontology with insights from neuroethology. Our exploration will include the controversies over the evolutionary origin of neurons and centralized brains, the independent solutions across taxa to processing ecologically important sensory information, and recent insights into the evolution of the neocortex.

Instructor(s): C. Ragsdale Terms Offered: TBD. Paris Study Abroad Neuroscience Program

Prerequisite(s): Enrollment into the Paris Study Abroad Program

NSCI 21000. Social Neuroscience. 100 Units.

Social species, by definition, create emergent organizations beyond the individual - structures ranging from dyads and families to groups and cultures. Social neuroscience is the interdisciplinary field devoted to the study of neural, hormonal, cellular, and genetic mechanisms, and to the study of the associations and influences between social and biological levels of organization. The course provides a valuable interdisciplinary framework for students in psychology, neuroscience, behavioral economics, and comparative human development. Many aspects of social cognition will be examined, including but not limited to attachment, attraction, altruism, contagion, cooperation, competition, dominance, empathy, isolation, morality, and social decision-making.

Instructor(s): J. Decety Terms Offered: Spring

Equivalent Course(s): BIOS 24137, ECON 21830, PSYC 22350, CHDV 22350

NSCI 21100. Photons to Consciousness: Cellular and Integrative Brain Functions. 100 Units.

This course uses the visual system as a model to explore how the brain works. We begin by considering the physical properties of light. We then proceed to consider the mechanism of sensory transduction, cellular mechanisms of neuron to neuron communication, the operation of small neural networks, strategies of signal detection in neuron networks, and the hierarchical organization of cortical function. We conclude with visually guided behavior and consciousness.

Instructor(s): E. Schwartz Terms Offered: Winter

Prerequisite(s): NSCI 20110

Equivalent Course(s): BIOS 24136

NSCI 21500. Epigenetics in Brain and Behavior. 100 Units.

Epigenetic mechanisms alter the function of the genome without altering the base sequence of genomic DNA (the As, Cs, Ts, and Gs we are familiar with), thus can be flexibly modified in response to the environment. Once considered a domain of cancer, we now recognize that epigenetic processes affect neurodevelopment, cognitive processes, mental disorders, and behavior. Through a combination of introductory lectures and student-led discussion of primary literature, we will explore a variety of epigenetic modifications, consider how they encode personal and transgenerational experiences, and examine how they influence brain function and behavior.

Instructor(s): S. London Terms Offered: Winter

Prerequisite(s): At least one course in cell, molecular, or systems biology is highly encouraged.

Equivalent Course(s): CHDV 26665, BIOS 24134, PSYC 26665

NSCI 21600. Attention and Working Memory in the Mind and Brain. 100 Units.

This course will provide a broad overview of current work in psychology and neuroscience related to attention and working memory. We will discuss evidence for sharp capacity limits in an individual's ability to actively monitor and maintain information in an "online" mental state. Readings will be primarily based on original source articles from peer-reviewed journals, with a focus on behavioral and neural approaches for measuring and understanding these basic cognitive processes.

Instructor(s): E. Awh, E. Vogel Terms Offered: Winter

Prerequisite(s): PQ: NSCI 20110 (Fundamental Neuroscience) is required for Neuroscience majors only.

Equivalent Course(s): PSYC 23820

NSCI 21700. Cell and Molecular Biology of the Neuron. 100 Units.

Cell and molecular biology of the neuron will discuss the fundamental knowledge the students need to understand the inner workings of the neuron. This course will explore core concepts in cell and molecular biology in considerable depth using examples from neurobiology. A wide range of topics will be covered including: from gene to proteins, regulation of gene expression, mammalian cell architecture, neuronal compartmentalization, membrane trafficking, neuronal dysfunction, and genetic models.

Instructor(s): G. Thinakaran Terms Offered: Winter

Prerequisite(s): For undergraduates in the Neuro major: NSCI 20110 and NSCI 20120.

Equivalent Course(s): NURB 32100

NSCI 21800. Perspectives in Drug Abuse. 100 Units.

It is a broad overview course about drug abuse, that is appropriate for graduate students as well as undergraduates. It includes lectures on epidemiology, genetics, neurobiology, experimental methods, policy and treatment, as well as lectures on several specific drug classes. Lectures are by Dr. de Wit and by other invited faculty members, and students are required to present and discuss recent published papers during classes.

Equivalent Course(s): NURB 32900, BIOS 24135

NSCI 21900. Neuropharmacology. 100 Units.

This is a one quarter course that will explore neuronal pharmacology. Both the autonomic and central nervous system will be examined. The course has a clinical orientation. The course starts with an overview of the nervous system. In this section, we will explore the cellular aspects of neurons and their basic membrane and electrophysiological properties as well cellular and molecular aspects of synaptic transmission. The majority of the course will explore different neurotransmitter systems and drugs that interact with these systems.

Instructor(s): A. Fox Terms Offered: Spring

Prerequisite(s): NSCI 20110, NSCI 20120

NSCI 22000. Gazing into the Black Box: Neocortex. 100 Units.

The neocortex is the multilayered outermost structure of the mammalian brain. It is the site of higher brain functions including reasoning and creativity. However, the complexity of the neocortex-it is comprised of ~20 billion neurons which have 0.15 quadrillion connections between them-seems to preclude any hope of achieving a fundamental understanding of the system. Recent technological innovations have opened novel avenues of investigation making realization of the neocortex an increasingly tractable problem. This course will place particular emphasis on how to critically read scientific papers as we evaluate and discuss current experimental approaches to the neocortex. Integral to this evaluation will be the detailed discussion of the latest technological approaches.

Instructor(s): J. MacLean Terms Offered: Autumn

Prerequisite(s): NSCI 20110, 20120, 20130 or consent of instructor. For Biology majors: Three quarters of a Biological Sciences Fundamentals sequence.

Equivalent Course(s): CPNS 34200, BIOS 24226

NSCI 22100. Molecular Neuroscience. 100 Units.

This lecture/seminar course explores the application of modern cellular and molecular techniques to clarify basic questions in neurobiology. Topics include mechanisms of synaptic transmission, protein trafficking, exo- and endo-cytosis, and development and mechanisms of neurological diseases.

Instructor(s): S. Sisodia Terms Offered: Spring

Prerequisite(s): NSCI 20110, NSCI 20120 and BIOS 20200, or consent of instructor

Equivalent Course(s): BIOS 24131

NSCI 22300. Molecular Principles of Nervous System Development. 100 Units.

This elective course provides an overview of the fundamental questions in developmental neurobiology. It is based on primary research papers and highlights key discoveries in vertebrate and invertebrate animals that advanced our understanding of nervous system development. Topics covered, among others, will include neural stem cells, neuronal specification and terminal differentiation, and circuit assembly. Dogmas and current debates in developmental neurobiology will be discussed, aiming to promote critical thinking about the field. This advanced-level course is open to upper level undergraduate and graduate students and combines lectures, student presentations, and discussion sections.

Instructor(s): E. Grove, P. Kratsios Terms Offered: Winter

Prerequisite(s): For Neuroscience Majors: NSCI 20110, NSCI 20120, NSCI 20130, BIOS 20187 or consent of instructor

Equivalent Course(s): NURB 32300, DVBI 32300, CPNS 32300

NSCI 22400. Neuroscience of Seeing. 100 Units.

This course focuses on the neural basis of vision, in the context of the following two questions: 1. How does the brain transform visual stimuli into neuronal responses? 2. How does the brain use visual information to guide behavior? The course covers signal transformation throughout the visual pathway, from retina to thalamus to cortex, and includes biophysical, anatomical, and computational studies of the visual system, psychophysics, and quantitative models of visual processing. This course is designed as an advanced neuroscience course for undergraduate and graduate students. The students are expected to have a general background in neurophysiology and neuroanatomy.

Instructor(s): W. Wei, J. Maunsell, M. Sherman, S. Shevell Terms Offered: Winter

Prerequisite(s): NSCI 20110 or BIOS 24110 or consent of instructor

Equivalent Course(s): BIOS 24133, PSYC 24133

NSCI 23400. Synaptic Physiology. 100 Units.

This course covers the basic principles of synaptic transmission and plasticity using a combination of lecture and discussion of primary literature. Lecture topics cover membrane electrical phenomena that lead to release of neurotransmitter presynaptically, as well as the physiological consequences of postsynaptic receptor activation. Paper discussions, which make up ~ 2/3 of the course, are centered on two major topics: 1) The molecular machinery controlling synaptic vesicle exocytosis and recycling, and 2) Synaptic plasticity covering LTP, LTD, Metaplasticity, Spike-timing dependent plasticity and Homeostatic plasticity. There is significant emphasis on the connections between the various forms of synaptic modification and behavior.

Instructor(s): D. McGehee and A. Fox Terms Offered: Spring

Prerequisite(s): Undergrads by consent of instructor

Equivalent Course(s): NURB 32400

NSCI 23500. Survey of Systems Neuroscience. 100 Units.

This lab-centered course teaches students the fundamental principles of vertebrate nervous system organization. Students learn the major structures and the basic circuitry of the brain, spinal cord and peripheral nervous system. Somatic, visual, auditory, vestibular and olfactory sensory systems are presented in particular depth. A highlight of this course is that students become practiced at recognizing the nuclear organization and cellular architecture of many regions of brain in rodents, cats and primates.

Instructor(s): S. Bensmaia Terms Offered: Autumn

Prerequisite(s): NSCI 20130. For Biological Sciences majors: Three quarters of a Biological Sciences fundamentals sequence

Equivalent Course(s): NURB 31600, BIOS 24208, CPNS 30116, ORGB 32500

NSCI 23600. Computational Approaches to Cognitive Neuroscience. 100 Units.

This course is concerned with the relationship of the nervous system to higher order behaviors (e.g., perception, object recognition, action, attention, learning, memory, and decision making). Psychophysical, functional imaging, and electrophysiological methods are introduced. Mathematical and statistical methods (e.g. neural networks and algorithms for studying neural encoding in individual neurons and decoding in populations of neurons) are discussed. Weekly lab sections allow students to program cognitive neuroscientific experiments and simulations.

Instructor(s): N. Hatsopoulos Terms Offered: Winter

Prerequisite(s): For Neuroscience Majors: NSCI 20130, BIOS 26210, and knowledge using Matlab, or consent of instructor.

Equivalent Course(s): ORGB 34650, BIOS 24232, CPNS 33200, PSYC 34410

NSCI 23800. Neurons and Glia: Advanced Cellular and Molecular Topics. 100 Units.

This is not a survey course and will provide in-depth analysis of topics in the areas of molecular and cell biology of the nervous system selected by the faculty. The topics to be covered this year are: 1) structure and function of neuronal proteins 2) cell biology of neurons and synapses, 3) neurochemistry and metabolism of neurons, and 4) cell biology of glia. Each topic will be covered as a unit that will start with the main techniques used in that area of research followed by central concepts. Each week will usually consist of two faculty lectures where key papers on that specific topic are assigned and analyzed. In the third session, there will be assigned papers on specific topics from the faculty lectures that will be presented and discussions led by the students.

Instructor(s): W. Green; R. Carrillo Terms Offered: Spring

Prerequisite(s): Required: NSCI 20110, NSCI 20120, NSCI 20130 or consent of Instructor Recommended: BIOS 20200

Equivalent Course(s): NURB 34800

NSCI 24000. Modeling and Signal Analysis for Neuroscientists. 100 Units.

The course provides an introduction into signal analysis and modeling for neuroscientists. We cover linear and nonlinear techniques and model both single neurons and neuronal networks. The goal is to provide students with the mathematical background to understand the literature in this field, the principles of analysis and simulation software, and allow them to construct their own tools. Several of the 90-minute lectures include demonstrations and/or exercises in Matlab.

Instructor(s): W. van Drongelen Terms Offered: Spring, L.

Prerequisite(s): Undergraduates: Biology Major - BIOS 26210 and 26211, or consent of instructor. Neuroscience Major - NSCI 20130, BIOS 26210 and 26211, or consent of instructor.

Equivalent Course(s): CPNS 32111, BIOS 24408

NSCI 29100. Neuroscience Thesis Research. 100 Units.

Scholar or Research Thesis.

Instructor(s): Staff Terms Offered: Autumn, Spring, Summer, Winter

Prerequisite(s): By consent of instructor and approval of major director.

NSCI 29101. Neuroscience Thesis Research. 100 Units.

Scholar or Research Thesis.

Instructor(s): Staff Terms Offered: Autumn, Spring, Summer, Winter

Prerequisite(s): NSCI 29100, and consent of instructor, and approval of major director.

NSCI 29102. Neuroscience Thesis Research. 100 Units.

Scholar or Research Thesis.

Instructor(s): Staff Terms Offered: Autumn, Spring, Summer, Winter

Prerequisite(s): NSCI 29100, and consent of instructor, and approval of major director.

NSCI 29200. Neuroscience Honors Thesis Research. 100 Units.

Scholar or Research Thesis.

Instructor(s): Staff Terms Offered: Autumn, Spring, Summer, Winter

Prerequisite(s): By consent of instructor and approval of major director. Open to Neuroscience majors who are candidates for honors in Neuroscience.

NSCI 29201. Neuroscience Honors Thesis Research. 100 Units.

NSCI 29200, and consent of instructor, and approval of major director. Open to Neuroscience majors who are candidates for honors in Neuroscience.

Instructor(s): Staff Terms Offered: Autumn, Spring, Summer, Winter

Prerequisite(s): NSCI 29200, and consent of instructor, and approval of major director. Open to Neuroscience majors who are candidates for honors in Neuroscience.

NSCI 29202. Neuroscience Honors Thesis Research. 100 Units.

Research Thesis and Seminar.

Instructor(s): Staff Terms Offered: Autumn, Spring, Summer, Winter

Prerequisite(s): NSCI 29201, and consent of instructor, and approval of major director. Open to Neuroscience majors who are candidates for honors in Neuroscience.

NSCI 29700. Reading and Research in Neuroscience. 100 Units.

Students can do reading and research in an area of neuroscience under the guidance of a faculty member. A written report is required at the end of the quarter.

Instructor(s): Staff Terms Offered: Autumn Spring Summer Winter

Prerequisite(s): By consent of instructor and approval of NSCI Undergraduate Director.

Note(s): Students are required to submit the College Reading & Research form



Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Times was used instead of Trajan.

Times was used instead of Palatino.

The editor may contact Leepfrog for a draft with the correct fonts in place.