NEUROSCIENCE  NEU

Program in Neuroscience
College of Natural Science

215  Neuroscience and Society
Summer. 3(3-0) P: Completion of Tier I Writing Requirement Not open to students with credit in NEU 301 or ZOL 402. Critical examination of important societal issues related to neuroscience, including stress, addiction, and sex differences. Comparison of peer-reviewed neuroscientific research and popular press publications.

230  Basic Concepts in Neuroscience
Spring. 3(3-0) P: Completion of Tier I Writing Requirement RB: ((PSY 101) or some background coursework (at the university or high school level) in psychology) and (BS 161 or BS 181H or LB 145) Introduction to fundamental neuroscience concepts including neuroanatomy, neuronal signaling, and molecular mechanisms of learning and memory.

300  Neurobiology
Fall, Spring. 3(3-0) Interdepartmental with Integrative Biology. Administered by Neuroscience. P: (BS 162 or LB 144 or BS 182H) and (BS 161 or LB 145 or BS 181H) R: Not open to freshmen or sophomores and not open to students in the Program in Neuroscience and not open to students in the Lyman Briggs Neuroscience Major. SA: ZOL 402 Structure and function of nerve cells and nervous systems.

301  Introduction to Neuroscience I
Fall. 3(3-0) P: (BS 161 or BS 181H or LB 145) and (BS 162 or BS 182H or LB 144) RB: PSY 101 R: Open to undergraduate students in the Program in Neuroscience or in the Lyman Briggs Neuroscience Coordinate Major.
Survey of the field of neuroscience, including molecular, cellular, and autonomic, sensory and motor systems.

302  Introduction to Neuroscience II
Spring. 3(3-0) P: NEU 301 RB: PSY 101 R: Open to undergraduate students in the Lyman Briggs College or in the College of Natural Science or in the Program in Neuroscience. Survey of brain-based behavioral and cognitive systems and related human diseases.

304  Neuroanatomy
Summer. 3(3-0) Summer: Florence, Italy and England. P: Completion of Tier I Writing Requirement R: Not open to freshmen. Approval of department; application required. Structure and basic function of human nervous system, including the influence of art and cultural values on neuroanatomical knowledge throughout history.

306  History of Neuroscience
Summer. 3(3-0) Summer: Florence, Italy and England. P: Completion of Tier I Writing Requirement R: Not open to freshmen. Approval of department; application required. Specific topics in the history of neuroscience with an emphasis on the influence of cultural values on theories and discoveries.

307  Topics in History of Neuroscience (W)
Summer. 3(3-0) Summer: Florence, Italy and England. P: Completion of Tier I Writing Requirement R: Not open to freshmen. Approval of department; application required. Independent library research and group tutorial work aimed at critical analysis of the role that cultural values and historical events played in the specific topic investigated.

310  Psychology and Biology of Human Sexuality
Spring of even years. 3(3-0) Interdepartmental with Integrative Biology and Psychology. Administered by Neuroscience. P: (PSY 101 or concurrently) and (BS 161 or concurrently) or (BS 162 or concurrently) or (LB 144 or concurrently) or (LB 145 or concurrently) or (BS 181H or concurrently) or (BS 182H or concurrently)! Not open to students with credit in HDFS 446. Sexual behavior from biological, psychological and neuroscience perspectives. Sexual differentiation of the body. Role of hormones in development and reproduction in humans and other animals. Human sexual orientation. Fertility and contraception. Sexual disorders. Sexually transmitted diseases.

311L  Neuroscience Laboratory (W)
Fall, Spring. 2(1-3) P: ((NEU 301 or concurrently) and completion of Tier I writing requirement) and (STT 201 or STT 231 or STT 421) and (BS 171 or BS 191H or LB 145) RB: PSY 101 R: Open to undergraduate students in the Program in Neuroscience in the Lyman Briggs Neuroscience Coordinate Major.
Overview of neuroscience research methodology, including experimental design, data analysis, and presentation of results.

333  The Neurobiology of Food Intake and Overeating
Spring. 3(3-0) Interdepartmental with Psychology. Administered by Psychology. P: PSY 101 RB: PSY 209 Physiological and neurological mechanisms that drive food intake and overeating. Vulnerabilities to obesity.

415  Neuroinformatics and Quantitative Reasoning
Fall. 3(3-0) P: ((NEU 301 and (NEU 302 or concurrently)) and completion of Tier I writing requirement) and (MTH 124 or MTH 132 or MTH 152H or LB 118) and (STT 201 or STT 231 or STT 421 or PSY 295) R: Open to undergraduate students in the Neuroscience Major or in the Lyman Briggs Neuroscience Coordinate Major.
Quantitative reasoning and statistical methods for querying internet databases and understanding basic neuroscience models

416  Development of the Nervous System Through the Lifespan
Fall. 3(3-0) Interdepartmental with Integrative Biology. Administered by Neuroscience. P: NEU 302 or IBIO 300 or PSY 209 RB: IBIO 341 R: Open to undergraduate students in the Program in Neuroscience or in the Department of Integrative Biology or in the Department of Psychology or in the Lyman Briggs Neuroscience Major or in the Lyman Briggs Zoology Coordinate Major.
Development of neurons and their connections, roles of both genetics and behavioral experience in shaping the mammalian nervous system.

417  Instrumental Methods of Analysis in Neuroscience
Spring. 3(3-0) Interdepartmental with Chemistry. Administered by Neuroscience. P: (((CEN 251 and CEM 252) or (CEN 351 and CEM 352)) and (PHY 231 and PHY 232)) or (PHY 183 and PHY 184) or (PHY 193H and PHY 294H) or (LB 273 and LB 274) R: NEU 301 or CEM 262.
Design, operational principles and practical application of modern instrumental methods used for the separation, identification and quantification of neurochemical species in neuroscience. Application of methods of chemical analysis to study neurosensory, chemical composition in single secretory cells, chemical structure of cells and tissues.

420  Neurobiology of Disease
Spring. 3(3-0) P: NEU 301 and NEU 302 R: Open to undergraduate students in the Program in Neuroscience or in the Lyman Briggs Neuroscience Coordinate Major.
Genetic, molecular, cellular, systems, and behavioral abnormalities that contribute to the manifestation of neurologic and psychiatric diseases and disorders that affect the nervous system.

422  Fundamentals of Neuropharmacology
Spring. 2(2-0) Interdepartmental with Pharmacology and Toxicology. Administered by Pharmacology and Toxicology. P: NEU 301 or PSL 250 or PSL 310 or PSL 431 R: Open to juniors or seniors or approval of department.
Mechanisms and uses of action of drugs on neurons and neuron-controlled activities.

425  Computational Modeling in Neuroscience
Spring. 3(3-0) P: NEU 302 RB: (MTH 124 and MTH 126) or (MTH 132 and MTH 133) R: Open to undergraduate students in the Neuroscience Major or in the Lyman Briggs Neuroscience Major.
Introduction to theory and network modeling techniques in neuroscience, using brain activity data to validate theoretical models. Review of successful network models.

430  Genomics of Brain Development, Learning, and Behavior
Summer. 3(3-0) P: (IBIO 341) and (NEU 302 or concurrently) RB: PSY 209 Role of genes in brain development and function. Issues in behavioral and psychiatric genetics.

431  Pharmacology of Drug Addiction
Fall. 3(3-0) Interdepartmental with Pharmacology and Toxicology. Administered by Pharmacology and Toxicology. RB: Zoology or Human Biology or Psychology or Biochemistry or Physiology.
Introduction to pharmacology and neuropharmacology. Understanding of the biological basis for drug abuse and addiction.
Students work under the direction of a faculty member. Research involves use of neuroimaging techniques such as functional Magnetic Resonance Imaging (fMRI) and optical imaging. Other methods include magnetoencephalography (MEG), functional Magnetic Resonance Imaging (fMRI), and positron emission tomography (PET). Research topics include association between brain activity and behavior. Data types include electrophysiological data, imaging data, and behavioral data. Students learn about hypothesis testing, dimension reduction, and correlation with behavior. Data analysis techniques include psychometric techniques, regression analysis, and statistical modeling.

445 Analysis of Neural Activity Data (W)
Fall. 3(3-0) P: ((NEU 301 and (NEU 302 or concurrently)) and completion of Tier I writing requirement) and (MTH 124 or MTH 132 or MTH 152W or LB 118) and (STT 201 or STT 231 or STT 421 or PSY 295)
Conceptual and methodological approaches to analyzing large functional datasets. Emphasis on statistical issues, including preprocessing, estimation methods, hypothesis testing, dimension reduction, and correlation with behavior. Data types include electrophysiological recording, electroencephalography (EEG), magnetoencephalography (MEG), functional Magnetic Resonance Imaging (fMRI) and optical imaging.

492 Synaptic Transmission
Spring of even years. 3(3-0) P: NEU 301 R: Open to undergraduate students in the Neuroscience Major or in the Lyman Briggs Neuroscience Major.
Chemical and electrical aspects of nerve impulse transmission at synaptic and neuromodulator junctions. Influence of drugs.

493 Molecular, Cellular and Developmental Neurobiology
Fall. 3(3-0) Interdepartmental with Integrative Biology. Administered by Neuroscience. P: (NEU 302 and NEU 311L) or IBIO 402 RB: (PHM 350 or PSL 431) and IBIO 341 R: Open to undergraduate students in the Neuroscience Major or in the Bachelor of Science in Zoology or in the Lyman Briggs Neuroscience Major or in the Lyman Briggs Zoology Coordinate Major.
Introduction to ion channels and their critical role in normal physiological functioning, sensory and neuro-muscular diseases and disorders, as well as targets of toxins and poisons.

801 Molecular, Cellular and Developmental Neuroscience I
Fall. 3(3-0) R: B.S., B.A. or M.S. degree in the biological or psychological sciences. R: Open to graduate students in the Program in Neuroscience or in the Neuroscience-Environmental Toxicology Major. Approval of department.
Genetics, molecular and cellular biology of the developing and the adult nervous system.

802 Systems and Behavioral Neuroscience I
Fall. 3(3-0) R: B.S., B.A. or M.S. in the biological or psychological sciences. R: Open to graduate students in the Program in Neuroscience. Approval of department.
Anatomy and physiology of multicellular neural systems controlling learning and memory, motivated behaviors, pain, biological rhythms and psychopathologies.

803 Molecular, Cellular and Developmental Neuroscience II
Spring. 3(3-0) Interdepartmental with Physiology. Administered by Neuroscience. R: B.S., B.A. or M.S. degree in the biological or psychological sciences. R: Open to graduate students in the Program in Neuroscience. Approval of department.
Electrical and intra- and extracellular signaling mechanisms of neurons and glia in health and disease in the developing and mature nervous system.

804 Molecular and Developmental Neurobiology
Fall. 3(3-0) Interdepartmental with Integrative Biology and Pathology and Diagnostic Investigation and Pharmacology and Toxicology and Psychology. Administered by Neuroscience. R: Bachelor’s degree in a Biological Science or Psychology. R: Open to graduate students in Neuroscience major.
Nervous system specific gene transcription and translation. Maturation, degeneration, plasticity, and repair in the nervous system.

805 Systems and Behavioral Neuroscience II
Spring. 3(3-0) R: B.S., B.A. or M.S. in the biological or psychological sciences. R: Open to graduate students in the Program in Neuroscience or in the Neuroscience-Environmental Toxicology Major. Approval of department.
Anatomy and physiology of multicellular olfactory, visual, auditory, motor, somatosensory and autonomic nervous systems.

807 Strategies in Neuroscience Research
Fall. 2(2-0) RB: PHM 827 R: Open to graduate students in the Neuroscience Major. Methods and underlying principles of neuroscience research.

811 Advanced Behavioral Neuroscience
Spring. 3(3-0) Interdepartmental with Psychology. Administered by Psychology. R: (PSY 411) or approval of department. R: Open only to graduate students in the Psychology major or Neuroscience major.
Biological mechanisms involved in learning and memory, motivated behaviors, biological rhythms, and psychopathologies.

815 Neuroinformatics and Quantitative Reasoning
Fall. 3(3-0) R: Open to graduate students in the Medical Neuroscience Graduate Certificate or in the Neuroscience Major or in the Neuroscience-Environmental Toxicology Major. Approval of department.
Quantitative reasoning and statistical methods for querying internet databases and understanding basic neuroscience models for graduate students.

827 Physiology and Pharmacology of Excitable Cells
Fall. 4(4-0) Interdepartmental with Integrative Biology and Pharmacology and Toxicology and Psychology. Administered by Pharmacology and Toxicology and Psychology. R: Open to graduate students in the College of Natural Science or in the Department of Pharmacology and Toxicology or approval of department.
Function of neurons and muscle at the cellular level: membrane biophysics and potentials, synaptic transmission, sensory nervous system function.

832 Evolution of Nervous Systems
Spring of odd years. 3(3-0) Interdepartmental with Integrative Biology. Administered by Integrative Biology. R: Background in neuroscience or evolutionary biology recommended. R: Open to graduate students in the Department of Computer Science and Engineering or in the Department of Integrative Biology or in the Program in Neuroscience or in the Department of Psychology or approval of department. SA: ZOL 832
Evolutionary origins, mechanisms, and consequences of evolutionary change in nervous systems.

839 Systems Neuroscience
Spring. 4(4-0) Interdepartmental with Human Anatomy and Integrative Biology and Pharmacology and Toxicology and Psychology. Administered by Neuroscience. R: Open to graduate students or human medicine students or osteopathic medicine students in the College of Natural Science or in the College of Agriculture and Natural Resources or in the College of Human Medicine or in the College of Osteopathic Medicine or in the College of Social Science or in the College of Veterinary Medicine. SA: ANT 839
Anatomy, pharmacology, and physiology of multicellular nervous systems. Sensory, motor, autonomic, and chemo-regulatory systems in vertebrate brains.

840 Social, Cognitive, and Affective Neuroscience
Fall. 3(3-0) Not open to students with credit in NEU 839 or NEU 841.
Introduction to nervous system structure and function aimed at students and professionals with limited biological science background.

841 Medical Neuroscience
Fall. 3(3-0) R: Undergraduate degree in the biological sciences Not open to students with credit in NEU 839.
Detailed survey of nervous system structure and function with an emphasis on medical applications.

842 Neuroethics
Summer. 3(3-0) R: (NEU 840 or concurrently) or (NEU 841 or concurrently)
Introduction to the field of neuroethics and the responsible application of advances in neuroscience research.
843 Methods for Assessing the Nervous System
Spring. 3(3-0) RB: (NEU 840 or concurrently) or (NEU 841 or concurrently)
Introduction to the various techniques and methods used to study brain structure and function.

844 The Science and Ethics of Brain Interventions
Summer. 2(2-0) RB: (NEU 840 or concurrently) or (NEU 841 or concurrently)
Introduction to cognitive enhancement to improve intellect and cognition, and legal and ethical implications of this.

845 Neuroscience of Drug Use and Human Disorders
Spring. 3(3-0) RB: NEU 840 or concurrently
Introduction to the neurochemical basis of human disorders and how drugs are used to treat these disorders.

846 Neurobiology of Nervous System Disorders
Spring. 3(3-0) RB: NEU 841 or concurrently
Overview of abnormalities that contribute to central nervous system, peripheral nervous system, and psychological diseases and disorders examined at genetic, cellular, and behavioral levels.

847 Development of the Nervous System
Fall. 3(3-0) RB: NEU 841 or concurrently
Introduction to processes involved in the development of the nervous systems and their clinical application.

848 Foundations of Law and Legal Research
Fall, Spring, Summer. 2(2-0) R: Open to graduate students in the Program in Neuroscience. Approval of department. Not open to students with credit in LAW 807A.
Introduction to the American legal system with focus on legal research and communication needs of non-lawyers

890 Independent Study in Neuroscience
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: Bachelor’s degree in neuroscience, biology, psychology, or related area.
Supervised student research on a specialized research topic in basic or clinical neuroscience.

892 Special Topics in Neuroscience and the Law
Fall. 1 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. RB: NEU 840 or concurrently
Topics in which the field of neuroscience and the legal system intersect

899 Master’s Thesis Research
Fall, Spring, Summer. 1 to 36 credits. A student may earn a maximum of 99 credits in all enrollments for this course. Master’s thesis research.

992 Advanced Topics in Neuroscience
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. RB: (NEU 804 and NEU 811 and NEU 827) and Bachelor’s degree in neuroscience, biology, psychology or related area.
Readings, presentations and discussion of specialized topics in neuroscience.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course.
Doctoral dissertation research.