

Neuroscience

Overview

Website: Neuroscience (<https://new.sewanee.edu/programs-of-study/neuroscience/>)

Multiple models of Neuroscience programs exist. While some focus on animal behavior, others operate in conjunction with the cognitive sciences or prioritize clinical behaviors. The Neuroscience program at Sewanee provides students with the depth of core Neuroscience knowledge, but also breadth of training outside of Neuroscience in the natural sciences, psychology, mathematics, and philosophy resulting in multidisciplinary discourse.

Faculty

Professors: Bachman, Berner, Miles, Peterman, Yu, Zigler

Associate Professors: Bateman (Chair), Kikis, Pongdee, Seballos, Shibata, A. Summers

Assistant Professors: Cammack, Reppert, Shelley

Major

The curriculum for the Neuroscience major includes courses at the introductory level, intermediate level, and the advanced level (advanced laboratory courses and seminars) and elective courses. Introductory courses provide students with basic terminology and knowledge and familiarize them with various modes of inquiry in neuroscience and related fields. Intermediate courses offer a deeper involvement in the content of neuroscience, while advanced courses provide laboratory experience, familiarization with primary literature, and courses more focused on narrow topics within the field of neuroscience.

Requirements for the Major in Neuroscience

The major requires successful completion of the following:

Code	Title	Semester Hours
Three introductory courses: ¹		
NEUR 101	Introduction to Neuroscience	4
BIOL 133	Introductory Molecular Biology and Genetics	4
CHEM 120 or CHEM 150	General Chemistry (Lab) Advanced General Chemistry (Lab)	4
Three intermediate courses:		
NEUR 208	Neurobiology	4
NEUR 225	Cognitive Neuroscience	4
NEUR 254	Behavioral Neuroscience	4
Select one statistics/methods course from the following:		
BIOL 243	Molecular Methods (Lab)	4
PSYC 251	Research Methods and Data Analysis	4
Select one lab course from the following:		
NEUR 351	Experimental Neurobiology (Lab)	4
NEUR 355	Affective Neuroscience (Lab)	4
NEUR 359	Advanced Behavioral Neuroscience (Lab)	4
PSYC 350	Drugs and Behavior (Lab)	4
Select one seminar course from the following:		
NEUR 414	The Social Brain	4
NEUR 415	Ion Channels and Disease	4
NEUR 417	History of Neuroscience: Brain and Society	4
PSYC 419	Addiction	4
PSYC 421	Sex, Brain, and Behavior	4
Select three elective courses from at least two of the lists that follow:		
List A		

BIOL 233	Molecular Cell Biology
BIOL 270	Human Anatomy (Lab)
BIOL 275	Histology and Microanatomy
BIOL/CHEM 307	Mechanistic Biochemistry (Lab)
BIOL 312	General and Human Physiology
or BIOL 314	General and Human Physiology (Lab)
BIOL/CHEM 316	Biochemistry of Metabolism and Molecular Biology (Lab)
or BIOL 317	Biochemistry of Metabolism and Molecular Biology
BIOL 318	Molecular Revolutions in Medicine
BIOL 325	Biology of Aging
BIOL 331	Immunology
BIOL 333	Developmental Biology (Lab)
or BIOL 334	Developmental Biology
BIOL 388	Epigenetics
or BIOL 389	Epigenetics (Lab)
CHEM 201	Organic Chemistry I (Lab)
CHEM 202	Organic Chemistry II (Lab)
CHEM 417	Advanced Biochemistry
List B	
CSCI 101	Introduction to Computer Science
CSCI 157	Introduction to Modeling and Programming
CSCI 257	Data Structures
CSCI 290	Data Mining
PHIL 235	Bioethics
PHIL 306	Epistemology
PHIL 308	Metaphysics
STAT 204	Elementary Statistics
STAT 214	Statistical Modeling
List C	
ECON 320	Behavioral Economics
PSYC 208	Cognitive Psychology
or PSYC 358	Cognitive Psychology (Lab)
PSYC 221	Adolescence
PSYC 348	Motivation and Cognitive Control
PSYC 349	Drugs and Behavior
PSYC 357	Child Development (Lab)
List D	
PHYS 101	General Physics I (Lab)
PHYS 102	General Physics II (Lab)
PHYS 103	Modern Mechanics (Lab)
PHYS 104	Electric and Magnetic Interactions (Lab)
PHYS 203	Intermediate Electricity and Magnetism I
PHYS 305	Advanced Laboratory
List E	
NEUR 351	Experimental Neurobiology (Lab)
NEUR 355	Affective Neuroscience (Lab)
NEUR 359	Advanced Behavioral Neuroscience (Lab)
NEUR 360	Affective Neuroscience
NEUR 414	The Social Brain
NEUR 415	Ion Channels and Disease
NEUR 417	History of Neuroscience: Brain and Society
PSYC 350	Drugs and Behavior (Lab)

PSYC 419	Addiction	
PSYC 421	Sex, Brain, and Behavior	
Total Semester Hours		48

¹ Students participating in the Sewanee-at-Yale semester program should contact the neuroscience chair to discuss relevant course offerings.

In developing the major, the Neuroscience Steering Committee has created cross-disciplinary and field-expanding opportunities and has included courses expected to offer a fruitful integration with Neuroscience. The elective lists include courses with subject matter that is implicitly related to the study of behavior or cognition, or tangential to Neuroscience as a discipline but with theoretical relevance. Such courses must be completed by students wishing to pursue graduate work in neuroscience (or biology or psychology) or students interested in the health professions, as they are typically required before admission to those programs.

Additional Requirements

A **comprehensive examination** that will allow the Neuroscience Steering Committee to assess students' ability to:

- Identify important questions related to their field of interest
- Exhibit knowledge of experimental design
- Think critically about experimental methodology and analysis
- Integrate and synthesize information from other courses and sub-disciplines

Minor

A minor in neuroscience allows students to consider how brain-function relates to behavior, and to explore one of the most compelling scientific frontiers in understanding ourselves and our actions. The minor examines the nervous system and its contribution to our experiences through a truly interdisciplinary approach. Students are required to take courses in both psychology and biology, and are highly encouraged to explore related courses within chemistry, computer science, and philosophy.

The goal of the neuroscience minor is to encourage students to critically evaluate how the brain functions from the molecular and cellular level, and how these processes affect behavior. The neuroscience minor is ideal for students with an interest in any neuroscience-related field. The minor prepares students for graduate study in neuroscience or related fields, and is also a good preparation for those planning to pursue a career in medicine and related disciplines.

Requirements for the Minor in Neuroscience

The minor requires successful completion of the following:

Code	Title	Semester Hours
Course Requirements		
NEUR 101	Introduction to Neuroscience	4
Select five of the following:		20
NEUR 208	Neurobiology	
NEUR 225	Cognitive Neuroscience	
NEUR 254	Behavioral Neuroscience	
NEUR 351	Experimental Neurobiology (Lab)	
NEUR 355 or NEUR 360	Affective Neuroscience (Lab) Affective Neuroscience	
NEUR 359	Advanced Behavioral Neuroscience (Lab)	
NEUR 414	The Social Brain	
NEUR 415	Ion Channels and Disease	
NEUR 417	History of Neuroscience: Brain and Society	
PSYC 348	Motivation and Cognitive Control	
PSYC 349 or PSYC 350	Drugs and Behavior Drugs and Behavior (Lab)	
PSYC 419	Addiction	
PSYC 421	Sex, Brain, and Behavior	
Total Semester Hours		24

Courses

NEUR 101 Introduction to Neuroscience (4)

This course provides an introduction to the mammalian nervous system. Content focuses on the structure and function of the brain, and explores methods used by neuroscientists. Sensory systems, control of movement, learning and memory, and diseases of the brain may be discussed.

NEUR 208 Neurobiology (4)

A comprehensive study of the vertebrate nervous system covering its overall organization and development, function, control of homeostatic systems, and mechanisms of sensory perception. Non-laboratory course. *Prerequisite: (CHEM 120 or CHEM 150) and (NEUR 101 or BIOL 133).*

NEUR 225 Cognitive Neuroscience (4)

An introductory course on the neural bases of higher cognitive processes including perception, action, attention, memory, language, socio-emotional functions, executive functions and consciousness. Also discussed are the mind-body problem and other current theories and conceptual approaches. *Prerequisite: NEUR 101.*

NEUR 254 Behavioral Neuroscience (4)

An introduction to the field of behavioral neuroscience. The course begins with an overview of the basics of brain anatomy, brain organization, and neuronal signaling. The remainder of the course focuses on specific topics that are commonly studied by neuroscientists. Such topics include the brain basis of memory, emotion, aging, and sleep. *Prerequisite: NEUR 101.*

NEUR 351 Experimental Neurobiology (Lab) (4)

This lecture and laboratory course utilizes electrical recordings from a variety of invertebrates and vertebrates to build upon topics discussed in NEUR 208, illustrating the principles of nervous system communication in sensory and motor systems. The course will also include the roles of hypothesis testing, models, data analysis, and the scientific method in understanding how experimental data can lead to knowledge of nervous system function. *Prerequisite: NEUR 208.*

NEUR 355 Affective Neuroscience (Lab) (4)

This course covers the systems-level neural and behavioral bases of human and animal emotion. Students discuss readings paramount to understanding how we perceive motivationally significant information and stimuli and experience, express, and regulate our emotions. The course explores basic theories of emotion, automatic processes, emotion regulation, rewards, social relationships, decision-making, learning and memory, stress, and psychopathology (e.g., depression, anxiety, and personality disorders). Students design and conduct experiments using cognitive neuroscience methodology related to affective processing or emotion regulation, analyze the data, and write detailed laboratory reports. *Prerequisite: PSYC 251 and (NEUR 225 or NEUR 254 or NEUR 208 or PSYC 225 or PSYC 254).*

NEUR 359 Advanced Behavioral Neuroscience (Lab) (4)

An examination of how brain function affects behavior. The course is an extension of NEUR 254 and includes an advanced examination of brain organization, neuronal signaling, and specific topics that are studied by neuroscientists. Such topics include the brain bases of fear, pain, eating, sexuality, and stress. This class also examines methods used to study behavioral neuroscience in humans and animals. The course includes a laboratory with a brain dissection and focus on designing and conducting studies to answer empirical questions about behavioral neuroscience. *Prerequisite: PSYC 251 and (NEUR 254 or PSYC 254 or PSYC 225 or NEUR 208 or NEUR 225).*

NEUR 360 Affective Neuroscience (4)

This course covers the systems-level neural and behavioral bases of human and animal emotion. Students discuss readings paramount to understanding how we perceive motivationally significant information and stimuli and experience, express, and regulate our emotions. The course explores basic theories of emotion, automatic processes, emotion regulation, rewards, social relationships, decision-making, learning and memory, stress, and psychopathology (e.g., depression, anxiety, and personality disorders). This course cannot be taken for credit if the student has already received credit for NEUR 355. *Prerequisite: PSYC 251 and (NEUR 225 or NEUR 254 or PSYC 225 or PSYC 254 or NEUR 208).*

NEUR 414 The Social Brain (4)

A seminar focusing on the interdisciplinary field of social neuroscience. Course content examines social and emotional behavior through a variety of levels and contexts, and identifies the neural systems that support these behaviors. The course explores a number of core social psychological domains (e.g., culture, motivation, emotion, person perception, empathy, decision making, interpersonal relationships, morality, and self-identity). *Prerequisite: (PSYC 251 or BIOL 243) and (NEUR 225 or NEUR 254 or PSYC 225 or NEUR 208 or PSYC 254).*

NEUR 415 Ion Channels and Disease (4)

This upper level course examines the structure and function of ion channels at the molecular level, including the biophysics of ion permeability, voltage-sensing, and activation by neurotransmitters. Approximately half of the course is student-led discussions on research papers that detail ion channel dysfunction that lead to disease. *Prerequisite: (NEUR 208 or NEUR 225 or NEUR 254 or PSYC 225 or PSYC 254) and (BIOL 243 or BIOL 233 or PSYC 251).*

NEUR 417 History of Neuroscience: Brain and Society (4)

A historical survey of neuroscience, from the end of the 18th century to the present. Students discuss the theoretical and technological advances related to our current understanding of the brain. *Prerequisite: (PSYC 251 or BIOL 243) and (NEUR 208 or NEUR 225 or NEUR 254 or PSYC 225 or PSYC 254).*

NEUR 444 Independent Study (2 or 4)

Students in this course will design and execute an experimental research project terminating in a written report or will complete readings in an area of neuroscience. Must be approved by the program chair. This course may be repeated for credit when the topic differs. *Prerequisite: Instructor prerequisite override required.*