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, Pongdee, Yu, Zigler

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

Assistant Professors: 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
Course Requirements [1]		
BIOL 133	Introductory Molecular Biology and Genetics	4
Select one of the following:		4
CHEM 119	Principles of Chemistry	
CHEM 120	General Chemistry (Lab)	
CHEM 150	Advanced General Chemistry (Lab)	
NEUR 101	Introduction to Neuroscience	4
NEUR 208	Neurobiology	4
NEUR 225	Cognitive Neuroscience	4
NEUR 254	Behavioral Neuroscience	4
Select one of the following statistics / methods courses:		4
BIOL 243	Molecular Methods (Lab)	
PSYC 251	Research Methods and Data Analysis	
Select one of the following laboratory courses:		4
NEUR 351	Experimental Neurobiology (Lab)	
NEUR 355	Advanced Cognitive Neuroscience (Lab)	
NEUR 359	Advanced Behavioral Neuroscience (Lab)	
PSYC 350	Drugs and Behavior (Lab)	
Select one of the following seminar courses:		4
BIOL 325	Biology of Aging	
NEUR 415	Ion Channels and Disease	
PSYC 419	Addiction	
PSYC 420	Consciousness and Unconsciousness: Explorations in Neurophilosophy	
Select one course from two of the following five groups: [2, 3]		8
Group A (attribute NGPA)		

BIOL 223	Genetics (Lab)
BIOL 224	Genetics
BIOL 233	Molecular Cell Biology
BIOL 243	Molecular Methods (Lab)
BIOL 270	Human Anatomy (Lab)
BIOL 280	Molecular Genetics (Lab)
BIOL 322	Genes and Behavior
BIOL 325	Biology of Aging
BIOL 388	Epigenetics
BIOL 389	Epigenetics (Lab)
CHEM 201	Organic Chemistry I (Lab)
CHEM 417	Advanced Biochemistry
Group B (attribute NGPB)	
CSCI 101	Introduction to Computer Science
CSCI 157	Introduction to Modeling and Programming
PHYS 101	General Physics I (Lab)
PHYS 103	Modern Mechanics (Lab)
PHYS 203	Intermediate Electricity and Magnetism I
STAT 204	Elementary Statistics
Group C (attribute NGPC)	
PSYC 202	Clinical Psychology
PSYC 208	Cognitive Psychology
PSYC 221	Adolescence
PSYC 222	Adult Development and Aging
PSYC 357	Child Development (Lab)
PSYC 358	Cognitive Psychology (Lab)
PSYC 385	Cognitive Science
PSYC 420	Consciousness and Unconsciousness: Explorations in Neurophilosophy
Group D (attribute NGPD)	
MUSC 228	Music and the Brain
NOND 130	Being Human in STEM
PHIL 190	Informal Logic and Critical Thinking
PHIL 220	The Self
PHIL 235	Bioethics
PHIL 312	Modern Logic
PSYC 228	Music and the Brain
Group E (attribute NGPE)	
NEUR 351	Experimental Neurobiology (Lab)
NEUR 355	Advanced Cognitive Neuroscience (Lab)
NEUR 359	Advanced Behavioral Neuroscience (Lab)
NEUR 415	Ion Channels and Disease
PSYC 349	Drugs and Behavior
PSYC 350	Drugs and Behavior (Lab)
PSYC 419	Addiction
Total Semester Hours	**44**

Code	Title	Semester Hours
Additional Requirements		
A comprehensive examination [4]		

1

In addition to the required statistics/methods and neuroscience laboratory courses, one additional laboratory science course is required. This course may be selected from the laboratory science courses designated above in Groups A-E or in the introductory Chemistry requirement.

2

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.

3

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

4

The comprehensive examination allows 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, and 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 [1]		
NEUR 101	Introduction to Neuroscience	4
Select four of the following:		16
BIOL 325	Biology of Aging	
NEUR 208	Neurobiology	
NEUR 225	Cognitive Neuroscience	
NEUR 254	Behavioral Neuroscience	
NEUR 351	Experimental Neurobiology (Lab)	
NEUR 359	Advanced Behavioral Neuroscience (Lab)	
NEUR 415	Ion Channels and Disease	
PSYC 349	Drugs and Behavior	
or PSYC 350	Drugs and Behavior (Lab)	
PSYC 419	Addiction	
Select one course from any of the following five groups: [2, 3]		**4**
Group A (attribute NGPA)		
BIOL 223	Genetics (Lab)	
BIOL 224	Genetics	
BIOL 233	Molecular Cell Biology	
BIOL 243	Molecular Methods (Lab)	
BIOL 270	Human Anatomy (Lab)	
BIOL 280	Molecular Genetics (Lab)	

BIOL 322	Genes and Behavior
BIOL 325	Biology of Aging
BIOL 388	Epigenetics
BIOL 389	Epigenetics (Lab)
CHEM 201	Organic Chemistry I (Lab)
CHEM 417	Advanced Biochemistry
Group B (attribute NGPB)	
CSCI 101	Introduction to Computer Science
CSCI 157	Introduction to Modeling and Programming
PHYS 101	General Physics I (Lab)
PHYS 103	Modern Mechanics (Lab)
PHYS 203	Intermediate Electricity and Magnetism I
STAT 204	Elementary Statistics
Group C (attribute NGPC)	
PSYC 202	Clinical Psychology
PSYC 208	Cognitive Psychology
PSYC 221	Adolescence
PSYC 222	Adult Development and Aging
PSYC 357	Child Development (Lab)
PSYC 358	Cognitive Psychology (Lab)
PSYC 385	Cognitive Science
PSYC 420	Consciousness and Unconsciousness: Explorations in Neurophilosophy
Group D (attribute NGPD)	
MUSC 228	Music and the Brain
NOND 130	Being Human in STEM
PHIL 190	Informal Logic and Critical Thinking
PHIL 220	The Self
PHIL 235	Bioethics
PHIL 312	Modern Logic
PSYC 228	Music and the Brain
Group E (attribute NGPE)	
NEUR 351	Experimental Neurobiology (Lab)
NEUR 355	Advanced Cognitive Neuroscience (Lab)
NEUR 359	Advanced Behavioral Neuroscience (Lab)
NEUR 415	Ion Channels and Disease
PSYC 349	Drugs and Behavior
PSYC 350	Drugs and Behavior (Lab)
PSYC 419	Addiction
Total Semester Hours	**24**

1

In addition to the required statistics/methods and neuroscience laboratory courses, one additional laboratory science course is required. This course may be selected from the laboratory science courses designated above in Groups A-E or in the introductory Chemistry requirement.

2

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.

3

Students participating in the Sewanee-at-Yale semester program should contact the Neuroscience Chair to discuss relevant course offerings.

Courses

NEUR 101 Introduction to Neuroscience (4)
This course provides an introduction to the structure and function of the central and peripheral nervous systems. Fundamental concepts and topics in neuroscience will be discussed using molecular/cellular, behavioral and/or cognitive frameworks; clinically relevant conditions (e.g., neurodegenerative diseases, psychiatric disorders) will also be explored. Methods and techniques used by neuroscientists in research laboratories and clinical settings will be used to understand how neuroscience knowledge is constructed.

NEUR 195 Introduction to Research (2 or 4)
An introduction to research methods and hypothesis-driven laboratory research in the context of a faculty member's research program. Activities may include literature reviews, training in laboratory techniques, and/or analyzing data. This course may be repeated for credit at the discretion of the instructor. *Prerequisite: Instructor prerequisite override required.*

NEUR 208 Neurobiology (4)
A comprehensive study of the biology of the nervous system covering its overall organization and development, electrical and chemical signaling, synaptic plasticity, and mechanisms of sensory perception and motor function. Non-laboratory course. *Prerequisite: (CHEM 119 or CHEM 120 or CHEM 150) and (NEUR 101 or BIOL 133).*

NEUR 225 Cognitive Neuroscience (4)
This course provides a systems-level approach to the study of the mammalian nervous system. Content focuses on various aspects of cognitive processing, such as perception, attention, memory, learning, emotion, executive control and decision making. *Prerequisite: NEUR 101.*

NEUR 254 Behavioral Neuroscience (4)
This course introduces major topics and techniques used by behavioral neuroscientists to study the relationship between the brain and behavior. Content may explore motivated behaviors, stress, learning and memory, control of movement, sleep and circadian rhythms, and preclinical models of psychiatric and neurodegenerative disorders. *Prerequisite: NEUR 101.*

NEUR 295 Mentored Research (2 or 4)
Intermediate-level laboratory research in the context of a faculty member's research program. Activities may include designing and/or conducting experiments, analyzing data, and written/oral presentation of findings. This course may be repeated for credit at the discretion of the instructor. *Prerequisite: NEUR 195 and instructor prerequisite override required.*

NEUR 351 Experimental Neurobiology (Lab) (4)
This lecture and laboratory course utilizes electrical recordings from a variety of invertebrates 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 Advanced Cognitive Neuroscience (Lab) (4)
This laboratory course provides an experimental approach to the study of cognitive processing, building on topics introduced in NEUR 225. Laboratory exercises may cover processes such as perception, attention, memory, learning and decision making. The course includes a focus on scientific methodology, including hypothesis testing, study design, data collection and analysis, and communication of results. *Prerequisite: NEUR 225.*

NEUR 359 Advanced Behavioral Neuroscience (Lab) (4)
This inquiry-based laboratory course explores the relationship between the brain and behavior. Class research projects will focus on select topics in behavioral neuroscience. Students will engage with the scientific process by designing and conducting experiments to test hypotheses, collecting and analyzing data, and communicating results. *Prerequisite: PSYC 254.*

NEUR 395 Advanced Research (2 or 4)
Advanced laboratory research for students who have a strong background in neuroscience research. Students will work with a faculty research mentor to design and conduct experiments aimed to address a novel scientific question. This course may be repeated for credit at the discretion of the instructor. *Prerequisite: NEUR 295 and instructor prerequisite override required.*

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) and (BIOL 243 or BIOL 233 or PSYC 251).*

NEUR 416 Neuroscience of Preference and Choice (4)
This seminar course examines topics related to the neuroeconomics of choice. Topics may include cognitive effort, temporal discounting, overconfidence, risk sensitivity, anchoring, and prospect theory. A significant portion of the course consists of student-led discussion of readings examining these topics. Readings focus on scholarly works featuring psychological and neurobiological perspectives. *Prerequisite: NEUR 225 or PSYC 208.*

NEUR 444 Independent Study (2 or 4)
Students will complete directed readings and writing on a topic in neuroscience. Must be approved by the program chair. This course may be repeated for credit when the topic differs. *Prerequisite: Instructor prerequisite override required.*

NEUR 495 Topics in Neuroscience (2 or 4)
Selected topics in neuroscience. Content will vary from semester to semester. This course may be repeated for credit when the topic differs. This course is only available through the Sewanee-at-Yale Directed Research Program. *Prerequisite: Only open to students admitted to the Sewanee-at-Yale program.*

NEUR 499 Directed Research (4 or 8)
Students conduct research under the direction of a faculty member on a topic of mutual interest. Typically culminates in a written research report. This course is only available through the Yale Directed Research Program. *Prerequisite: Only open to students admitted to the Sewanee-at-Yale program.*