

Neuroscience

Neuroscience is an interdisciplinary field that seeks to understand the functions and diseases of the nervous system. It draws on knowledge from neurobiology as well as elements of psychology and cognitive science, and mathematical and physical principles involved in modeling neural systems. Through the Neuroscience concentration, students develop foundational knowledge through courses in biology, chemistry, and mathematics as well as three core courses in neuroscience. They are also required to develop facility with research methodologies (through courses in statistics and laboratory methods) before moving into specific topics in the field (e.g., visual physiology, neurochemistry and behavior, and synaptic transmission and plasticity). Members of the Neuroscience faculty are affiliated with the Carney Institute for Brain Science, a multidisciplinary program that promotes collaborative research about the brain. Prospective concentrators should contact neurowundergrad@brown.edu in order to have a faculty advisor assigned to them.

The concentration combines a general science background with a number of specific courses devoted to the cellular, molecular, and integrative functions of the nervous system. The concentration allows considerable flexibility for students to tailor a program to their individual interests. Elective courses focus on a variety of areas including molecular mechanisms, cellular function, sensory and motor systems, neuropharmacology, learning and memory, animal behavior, cognitive function, bioengineering, theoretical neuroscience and computer modeling.

You may find this following form useful for mapping out your courses, be sure to use it before meeting with your concentration advisor for the first time: [link to course plan worksheet PDF (https://neuroscience.brown.edu/sites/default/files/NeuroCoursePlanWorksheet_Fillable.pdf)]

Standard program for the Sc.B. degree

The concentration in neuroscience leads to an Sc.B. degree. The following courses, or their equivalent, are required for the degree. Keep in mind that there are multiple ways to fulfil the various requirements and your concentration advisor can help you go through your options and optimize your course of study:

Background Courses:

MATH 0090	Single Variable Calculus, Part I ((only needed as a prerequisite for MATH 10))	1
MATH 0100	Single Variable Calculus, Part II ((or equivalent))	1
PHYS 0030	Basic Physics A (Mechanics *see NOTE)	1
PHYS 0040	Basic Physics B (Electromagnetism)	1
BIOL 0200	The Foundation of Living Systems ((or placement test))	1
CHEM 0330	Equilibrium, Rate, and Structure	1
CHEM 0350	Organic Chemistry I	1

Note: ENGN 0030 may be used instead of PHYS 0030, but ENGN 0040 is NOT equivalent to PHYS 0040.

Core Concentration Courses:

NEUR 0010	The Brain: An Introduction to Neuroscience	1
NEUR 1020	Principles of Neurobiology	1
NEUR 1030	Neural Systems	1

One critical reading course 1

NEUR 1440	Mechanisms and Meaning of Neural Dynamics	
NEUR 1510	Neurotechnology: Molecular Tools and Methods for Neurobiology	
NEUR 1530	Communication In the Brain: What We Know and How We Know It	
NEUR 1560	Developmental Neurobiology	

NEUR 1660	Neural Computation in Learning and Decision-Making	
NEUR 1970	Independent Study (*Two Semesters)	
BIOL 1100	Cell Physiology and Biophysics	
BIOL 1180	Comparative Animal Physiology	
BIOL 1190	Synaptic Transmission and Plasticity	
CPSY 1400	The Neural Bases of Cognition	
CPSY 1760	The Moral Brain	
PHP 1890	The Craving Mind	
1930/40	Topics in Neuroscience	

NOTE: Critical reading courses are small discussion based courses, with around 20 students, with a focus on primary literature around a neuroscience related topic. Other courses not listed here could also fulfil this requirement, please check with your concentration advisor.

One statistics course 1

PHP 1501	Essentials of Data Analysis	
PHP 1510	Principles of Biostatistics and Data Analysis	
PHP 2510	Principles of Biostatistics and Data Analysis	
APMA 0650	Introduction to Probability and Statistics	
APMA 1650	Introduction to Probability and Statistics with Calculus	
CPSY 0900	Statistical Methods	
SOC 1100	Introductory Statistics for Social Research	
BIOL 0495	Statistical Analysis of Biological Data	
EDUC 1230	Applied Statistics for Ed Research and Policy Analysis	

One lab methods course 1

NEUR 0680	Introduction to Computational Neuroscience	
NEUR 1440	Mechanisms and Meaning of Neural Dynamics	
NEUR 1600	Experimental Neurobiology	
NEUR 1630	Big Data Neuroscience Ideas Lab	
NEUR 1640	Behavioral Neurogenetics Laboratory	
NEUR 1650	Structure of the Nervous System	
NEUR 1660	Neural Computation in Learning and Decision-Making	
NEUR 1670	Neuropharmacology and Synaptic Transmission	
NEUR 1680	Computational Neuroscience	
NEUR 1970	Independent Study	

*Two Semesters of NEUR1970 can be used to fulfill one critical reading, lab, or elective requirement

CPSY 1190	Techniques in Physiological Psychology	
CPSY 1194	Sleep and Chronobiology Research	
CPSY 1490	Functional Magnetic Resonance Imaging: Theory and Practice	
CPSY 1491	Neural Modeling Laboratory	
CPSY 1492	Computational Cognitive Neuroscience	
BIOL 0800	Principles of Physiology	
BIOL 1880	Comparative Biology of the Vertebrates	

Four electives related to neuroscience 4

Four courses that will enhance your understanding of the field of neuroscience. While electives need not be from the neuroscience department, the following list are common courses taught by Neuroscience and other departments that are often used as electives. We encourage students to explore the broader course catalog and consult with their concentration advisor to explore the full range of electives, rather than limiting themselves to this list:

NEUR 0680	Introduction to Computational Neuroscience
NEUR 1040	Introduction to Neurogenetics
NEUR 1065	Biology of Hearing
NEUR 1440	Mechanisms and Meaning of Neural Dynamics
NEUR 1510	Neurotechnology: Molecular Tools and Methods for Neurobiology
NEUR 1530	Communication In the Brain: What We Know and How We Know It
NEUR 1540	Neurobiology of Learning and Memory
NEUR 1560	Developmental Neurobiology
NEUR 1600	Experimental Neurobiology
NEUR 1630	Big Data Neuroscience Ideas Lab
NEUR 1650	Structure of the Nervous System
NEUR 1660	Neural Computation in Learning and Decision-Making
NEUR 1670	Neuropharmacology and Synaptic Transmission
NEUR 1740	The Diseased Brain: Mechanisms of Neurological and Psychiatric Disorders
NEUR 1970	Independent Study

*Two Semesters of NEUR1970 can be used to fulfill one critical reading, lab, or elective requirement

NEUR 2110	Statistical Neuroscience
All NEUR 1930/1940 Seminar Course	
CPSY 0120	Introduction to Sleep
CPSY 0400	Cognitive Neuroscience
CPSY 1150	Memory and the Brain
CPSY 1180B	Animal Languages
CPSY 1193	Laboratory in Genes and Behavior
CPSY 1291	Computational Methods for Mind, Brain and Behavior
CPSY 1400	The Neural Bases of Cognition
CPSY 1420	Cognitive Neuropsychology
CPSY 1478	Translational Models of Neuropsychiatric Disorder
CPSY 1480C	Cognitive Control Functions of the Prefrontal Cortex
CPSY 1480H	Disorders of Memory
CPSY 1490	Functional Magnetic Resonance Imaging: Theory and Practice
CPSY 1492	Computational Cognitive Neuroscience
CPSY 1495	Affective Neuroscience
CPSY 1560	Visually-Guided Action and Cognitive Processes
CPSY 1561	The Nature of Attention
CPSY 1570	Perceptual Learning
CPSY 1580E	Perception, Attention, and Consciousness
CPSY 1620	Developmental Cognitive Neuroscience
CPSY 1760	The Moral Brain
CPSY 1820	Language and the Brain
CPSY 1950	Deep Learning in Brains, Minds and Machines

BIOL 1100	Cell Physiology and Biophysics
BIOL 1110	Topics in Signal Transduction
BIOL 1155	Hormones and Behavior
BIOL 1260	Physiological Pharmacology
BIOL 1545	Human Genetics and Genomics
ENGN 1220	Neuroengineering
PHP 1890	The Craving Mind
COST 1020	Cognitive Neuroscience of Meditation

List 2: Selected common non-neuro courses (no more than 2) - student must be able to justify why it enhances their understanding of Neuro

BIOL 0470	Genetics
BIOL 0800	Principles of Physiology
BIOL 1050	Biology of the Eukaryotic Cell
BIOL 1540	Molecular Genetics
BIOL 1810	21st Century Applications in Cell and Molecular Biology
CPSY 0950	Introduction to programming
CPSY 1195	Life Under Water in the Anthropocene
CPSY 1500	Perception and Action
CSCI 0111	Computing Foundations: Data
ENGL 1900Z	Neuroaesthetics and Reading
PHIL 1770	Philosophy of Mind
PHP 1540	Alcohol Use and Misuse
STS 1700P	Neuroethics
TAPS 1281Z	Arts and Health: Practice

Completing the Concentration Research Requirement As with other ScB concentrations, neuroscience concentrators are required (beginning with the class of 2023) to do the equivalent of one semester of independent study, research or design. This is a chance for the student to explore and apply the concepts that they have learned in their concentration courses. The following are ways in which this research requirement can be met. After consulting with your concentration advisor, be sure to include how you will fulfill your research requirement in the appropriate box within ASK: 1. Enrolling in independent study courses (NEUR 1970, CLPS 1970/80 or BIO 1950/60) for work in a lab. Keep in mind to count this towards your concentration two semesters or one semester and a summer are required. 2. Enrolling in independent study (NEUR 1970) to work with a faculty member to explore an integrative topic related to neuroscience. See our section on independent study for more information. 3. Enrolling in a course-based research experience, also known as a CURE course. Current related CURE courses are NEUR 1630, CLPS 1195, CLPS 1591, but there might be new ones coming down the pipeline. 4. Participating in a structured summer research program (eg. an UTRA or an REU) that is equivalent in scope and scale as would be pursued during a semester of independent research. 5. Participating in a research-focused Fall or Spring UTRA. 6. Pursue a design or independent research project related to neuroscience that could be associated with a different course. 7. Anyone writing an honors thesis automatically fulfils the research requirement, in order to document your research requirement, please describe your plan in your Course Plan Worksheet and in ASK, be sure to discuss it with your concentration advisor to make sure it is appropriate. Honors: Honors in Neuroscience requires a thesis and presentation based on a research project, and quality grades in the concentration. Guidelines and information on faculty research as well as details about declaring Honors are available in the Undergraduate Neuroscience Page [<https://www.brown.edu/academics/neuroscience/undergraduate-concentration>].

Total Credits

17

¹ Independent study and honors research projects are encouraged.