

# 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 Brown Institute for Brain Science, a multidisciplinary program that promotes collaborative research about the brain. Prospective concentrators should contact Elyse\_Netto@brown.edu in order to have a faculty advisor assigned to them.

## Standard program for the Sc.B. degree

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 advising contract PDF]

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	Introductory Calculus, Part I ((only needed as a prerequisite for MATH 10))	1
MATH 0100	Introductory 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	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	1
NEUR 1530	Communication In the Brain: What We Know and How We Know It	
NEUR 1560	Developmental Neurobiology	
NEUR 1970	Independent Study (*Two Semesters)	
CLPS 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	Essential Statistics	
APMA 1650	Statistical Inference I	
CLPS 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 1600	Experimental Neurobiology	
NEUR 1630	Big Data Neuroscience Lab	
NEUR 1650	Structure of the Nervous System	
NEUR 1660	Neural Computation in Learning and Decision-Making	
NEUR 1680	Computational Neuroscience	
NEUR 1970	Independent Study	

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

CLPS 1194	Sleep and Chronobiology Research	
CLPS 1490	Functional Magnetic Resonance Imaging: Theory and Practice	
CLPS 1491	Neural Modeling Laboratory	
CLPS 1492	Computational Cognitive Neuroscience	
BIOL 0800	Principles of Physiology	

### Four electives related to neuroscience 1 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 0650	Biology of Hearing	
NEUR 0680	Introduction to Computational Neuroscience	
NEUR 1040	Introduction to Neurogenetics	
NEUR 1440	Mechanisms and Meaning of Neural Dynamics	
NEUR 1540	Neurobiology of Learning and Memory	
NEUR 1560	Developmental Neurobiology	
NEUR 1600	Experimental Neurobiology	
NEUR 1630	Big Data Neuroscience Lab	
NEUR 1600	Experimental Neurobiology	
NEUR 1650	Structure of the Nervous System	
NEUR 1660	Neural Computation in Learning and Decision-Making	
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
CLPS 0120	Introduction to Sleep
CLPS 1150	Memory and the Brain
CLPS 1193	Laboratory in Genes and Behavior
CLPS 1180B	Animal Languages
CLPS 1400	The Neural Bases of Cognition
CLPS 1478	Translational Models of Neuropsychiatric Disorder
CLPS 1480C	Cognitive Control Functions of the Prefrontal Cortex
CLPS 1490	Functional Magnetic Resonance Imaging: Theory and Practice
CLPS 1492	Computational Cognitive Neuroscience
CLPS 1495	Affective Neuroscience
CLPS 1561	The Nature of Attention
CLPS 1580E	Perception, Attention, and Consciousness
CLPS 1620	Developmental Cognitive Neuroscience
CLPS 1760	The Moral Brain
BIOL 1100	Cell Physiology and Biophysics
BIOL 1110	Topics in Signal Transduction
BIOL 1260	Physiological Pharmacology
ENGN 1220	Neuroengineering
PHP 1890	The Craving Mind
BIOL 1545	Human Genetics and Genomics
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
CLPS 0950	Introduction to programming
CLPS 1195	Life Under Water in the Anthropocene
CLPS 1500	Perception and Action

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. Pursue a design or independent research project related to neuroscience that could be associated with a different course. 6. Anyone writing an honors thesis automatically fulfills the research requirement, in order to document your research requirement, please describe your plan in your Concentration Agreement 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

<sup>1</sup> Independent study and honors research projects are encouraged.