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 neuroundergrad@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 (http://bulletin.brown.edu/the-college/concentrations/neur/neuroStudentAdviceContract_Fillable.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 fulfill 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**

- **NEUR 1440** Mechanisms and Meaning of Neural Dynamics 1
- **NEUR 1530** Communication In the Brain: What We Know and How We Know It 1
- **NEUR 1560** Developmental Neurobiology 1
- **NEUR 1970** Independent Study (Two Semesters) 1
- **BIOL 1100** Cell Physiology and Biophysics 1
- **BIOL 1190** Synaptic Transmission and Plasticity 1

**One statistics course**

- **PHP 1510** Essentials of Data Analysis 1
- **PHP 1510** Principles of Biostatistics and Data Analysis 1
- **PHP 2510** Principles of Biostatistics and Data Analysis 1
- **APMA 0650** Essential Statistics 1
- **APMA 1650** Statistical Inference I 1
- **CLPS 0900** Statistical Methods 1
- **SOC 1100** Introductory Statistics for Social Research 1
- **BIOL 0495** Statistical Analysis of Biological Data 1
- **EDUC 1230** Applied Statistics for Ed Research and Policy Analysis 1

**One lab methods course**

- **NEUR 0680** Introduction to Computational Neuroscience 1
- **NEUR 1440** Mechanisms and Meaning of Neural Dynamics 1
- **NEUR 1600** Experimental Neurobiology 1
- **NEUR 1630** Big Data Neuroscience Ideas Lab 1
- **NEUR 1650** Structure of the Nervous System 1
- **NEUR 1660** Neural Computation in Learning and Decision-Making 1
- **NEUR 1670** Neuropharmacology and Synaptic Transmission 1
- **NEUR 1680** Computational Neuroscience 1
- **NEUR 1970** Independent Study 1

*Two Semesters of NEUR 1970 can be used to fulfill one critical reading, lab, or elective requirement

**Four electives related to neuroscience**

- **CLPS 1190** Techniques in Physiological Psychology 1
- **CLPS 1194** Sleep and Chronobiology Research 1
- **CLPS 1490** Functional Magnetic Resonance Imaging: Theory and Practice 1
- **CLPS 1491** Neural Modeling Laboratory 1
- **CLPS 1492** Computational Cognitive Neuroscience 1
- **BIOL 0800** Principles of Physiology 1
- **BIOL 1880** Comparative Biology of the Vertebrates 1

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 1
- **NEUR 1040** Introduction to Neurogenetics 1
- **NEUR 1440** Mechanisms and Meaning of Neural Dynamics 1
- **NEUR 1540** Neurobiology of Learning and Memory 1
- **NEUR 1560** Developmental Neurobiology 1
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>NEUR 1600</td>
<td>Experimental Neurobiology</td>
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<tr>
<td>NEUR 1740</td>
<td>The Diseased Brain: Mechanisms of Neurological and Psychiatric Disorders</td>
</tr>
<tr>
<td>NEUR 1970</td>
<td>Independent Study</td>
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*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

1 Independent study and honors research projects are encouraged.