Neuroscience

Department Website: http://neuroscience.uchicago.edu/undergraduate

Program of Study

Neuroscience is the study of neurons and neural systems and their outputs: sensation, perception, homeostasis, and behavior. Neural function is investigated at the levels of molecules, cells, circuits, organisms, and species, making neuroscience inherently multidisciplinary. In addition to established neuroscience career paths in academia, medicine, and the pharmaceutical industry, new careers for students of neuroscience are emerging in economics, software development, and other fields requiring "big data" analysis or a mechanistic understanding of how humans think. The course of study in the undergraduate major in neuroscience provides students with the background and skills appropriate for these diverse careers.

The University of Chicago offers a bachelor of arts (BA) degree and a bachelor of science (BS) degree in Neuroscience. The Neuroscience major is designed to accommodate students with the range of scientific variety that one finds at the professional level of neuroscience, including physics, chemistry, computer science, engineering, mathematics, biology, psychology, and medicine. Neuroscience faculty at the University of Chicago have expertise in all of these areas and are distributed across the Biological Sciences, Social Sciences, and Physical Sciences Divisions. Majoring students have the opportunity to take a broad range of courses or to specialize in a particular area.

Declaring the Major

Students who wish to major in Neuroscience should declare the major in their second year. (Because the Neuroscience major was introduced in the 2016–17 academic year, the Class of 2020 and subsequent classes can design a plan of study in Neuroscience from their first year. Students in the Classes of 2018 and 2019 may also be able to major in Neuroscience, depending on the courses they have already taken, although there is no way to guarantee this. Students in these classes should consult with their College advisers to see if majoring in Neuroscience is feasible.)

General Education

Students majoring in Neuroscience typically begin their general education requirement in the Biological Sciences with BIOS 20186 Fundamentals of Cell and Molecular Biology. Attaining a proper grounding in cell biology is essential before delving into neuroscience as a discipline. To complete the requirement, students may choose to take one of the following: BIOS 20150 How Can We Understand the Biosphere?, BIOS 20151 Introduction to Quantitative Modeling in Biology (Basic), BIOS 20152 Introduction to Quantitative Modeling in Biology (Advanced), BIOS 20187 Fundamentals of Genetics, BIOS 20188 Fundamentals of Physiology, or BIOS 20191 Integrative Physiology. (Note: The general education requirement for the NSCI major can be fulfilled by courses in the Biology Fundamentals Sequences [20186-20190] without the Biological Sciences prerequisites [BIOS 20150-20151/20152] unless a student pursues a double major in Biological Sciences. Students who choose this path will be expected to possess the competency in mathematical modeling of biological phenomena covered in BIOS 20151 or BIOS 20152.)

Two alternative paths to fulfilling the General Education requirements exist. 1) Neuroscience majors may petition to take the Pre-Med Sequence for Non-Biology majors. In this case, BIOS 20170 Microbial and Human Cell Biology and BIOS 20171 Human Genetics and Developmental Biology will satisfy the core. (Note that BIOS 20171 must be taken concurrently with BIOS 20172 Mathematical Modeling for Pre-Med Students.) 2) A score of 4 or 5 on the AP Biology exam allows students to enter the Advanced Biology sequence in the Autumn of their first year. This three-quarter, lab-intensive sequence is for students with a strong background in research. Upon completion of the sequence students are awarded two credits, which satisfy the general education requirement in Biological Sciences.

The Major

The basic degree in Neuroscience is the BA, for which requirements are described below. A BS is awarded to students who complete an additional three quarters of Neuroscience electives, which must include one to three quarters of faculty-supervised research (scholarly or experimental) resulting in a written thesis (see Requirements for the Bachelor of Science Degree in Neuroscience below).

The major curriculum includes nine required Neuroscience courses, which provide a comprehensive overview of the field. The BA requires another 700 units of elective courses, which must be selected from the list below. Electives can be chosen for a broad exposure or tailored for depth in a particular area, such as cellular/molecular, systems, cognitive, and computational neuroscience and machine learning.

Students must have their program of elective courses approved by the office of the director of undergraduate studies. The Student Elective Approval Form (http://neuroscience.uchicago.edu/wp-content/uploads/2017/01/Student-Approval-Form.-pdf) should be filled out by the end of the third year and submitted to the Neuroscience major director of undergraduate studies for approval at neuromajor@uchicago.edu.

ELECTIVES

No more than three of the following BIOS courses: 300

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 20172</td>
<td>Mathematical Modeling for Pre-Med Students</td>
</tr>
<tr>
<td>BIOS 20173</td>
<td>Perspectives of Human Physiology</td>
</tr>
</tbody>
</table>
No more than one of the following two-course CMSC sequences:  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMSC 12100-12200</td>
<td>Computer Science with Applications I-II</td>
</tr>
<tr>
<td>CMSC 15100-15200</td>
<td>Introduction to Computer Science I-II</td>
</tr>
<tr>
<td>CMSC 16100-16200</td>
<td>Honors Introduction to Computer Science I-II</td>
</tr>
<tr>
<td>BIOS 20200</td>
<td>Introduction to Biochemistry</td>
</tr>
<tr>
<td>BIOS 24206</td>
<td>Peering Inside the Black Box: Neocortex</td>
</tr>
<tr>
<td>BIOS 24208</td>
<td>Survey of Systems Neuroscience</td>
</tr>
<tr>
<td>BIOS 24217</td>
<td>Conquest of Pain</td>
</tr>
<tr>
<td>BIOS 24231</td>
<td>Methods in Computational Neuroscience</td>
</tr>
<tr>
<td>BIOS 24232</td>
<td>Computational Approaches to Cognitive Neuroscience</td>
</tr>
<tr>
<td>BIOS 24408</td>
<td>Modeling and Signal Analysis for Neuroscientists</td>
</tr>
<tr>
<td>BIOS 26210</td>
<td>Mathematical Methods for Biological Sciences I</td>
</tr>
<tr>
<td>BIOS 26211</td>
<td>Mathematical Methods for Biological Sciences II</td>
</tr>
<tr>
<td>BIOS 27721</td>
<td>Observing Proteins in Action: How to Design and Build Your Own</td>
</tr>
<tr>
<td>LING 27010</td>
<td>Psycholinguistics</td>
</tr>
<tr>
<td>NURB 32400</td>
<td>Synaptic Physiology</td>
</tr>
<tr>
<td>PSYC 20300</td>
<td>Biological Psychology</td>
</tr>
<tr>
<td>PSYC 23800</td>
<td>Introduction to Learning and Memory</td>
</tr>
<tr>
<td>PSYC 25560</td>
<td>Body &amp; Mind: How our bodies reveal &amp; change emotion &amp; thought</td>
</tr>
<tr>
<td>PSYC 25750</td>
<td>The Psychology and Neurobiology of Stress</td>
</tr>
<tr>
<td>CMSC 15400</td>
<td>Introduction to Computer Systems</td>
</tr>
<tr>
<td>CMSC 25020</td>
<td>Computational Linguistics</td>
</tr>
<tr>
<td>CMSC 25025</td>
<td>Machine Learning and Large-Scale Data Analysis</td>
</tr>
<tr>
<td>CMSC 25050</td>
<td>Computer Vision</td>
</tr>
<tr>
<td>CMSC 25400</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>PHYS 12300</td>
<td>General Physics III</td>
</tr>
<tr>
<td>or PHYS 13300</td>
<td>Waves, Optics, and Heat</td>
</tr>
<tr>
<td>NSCI 29100</td>
<td>Neuroscience Thesis Research</td>
</tr>
<tr>
<td>NSCI 29101</td>
<td>Neuroscience Thesis Research</td>
</tr>
<tr>
<td>NSCI 29102</td>
<td>Neuroscience Thesis Research</td>
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<tr>
<td>NSCI 29200</td>
<td>Neuroscience Honors Thesis Research</td>
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<tr>
<td>NSCI 29201</td>
<td>Neuroscience Honors Thesis Research</td>
</tr>
<tr>
<td>NSCI 29202</td>
<td>Neuroscience Honors Thesis Research</td>
</tr>
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</table>

While it is possible to complete a double major in Neuroscience and another program, this is not encouraged. Neuroscience majors are generally better suited to achieving breadth through a combination of courses that provides the desired expertise in neuroscience and carefully selected courses outside of neuroscience.

Requirements for the Bachelor of Science Degree in Neuroscience

Students can earn a BS in Neuroscience by completing three quarters of Neuroscience elective courses over and above the BA requirements, which must include one to three quarters of faculty-supervised research that results in a written thesis (NSCI 29100, NSCI 29101, NSCI 29102 Neuroscience Thesis Research). The additional courses and the thesis work require approval by the office of the director of undergraduate studies and the thesis advisor. The thesis may be either research-based or literature-based.
Grading

All courses used to satisfy prerequisites and requirements must be taken for quality grades. Students must pass all required courses with an average GPA of 2.0 or higher to continue in the program.

Summary of Requirements for the Major in Neuroscience

**GENERAL EDUCATION**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 20186</td>
<td>Fundamentals of Cell and Molecular Biology</td>
<td>200</td>
</tr>
<tr>
<td>BIOS 20150</td>
<td>How Can We Understand the Biosphere?</td>
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<tr>
<td>BIOS 20151</td>
<td>Introduction to Quantitative Modeling in Biology (Basic)</td>
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</tr>
<tr>
<td>BIOS 20152</td>
<td>Introduction to Quantitative Modeling in Biology (Advanced)</td>
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</tr>
<tr>
<td>BIOS 20187</td>
<td>Fundamentals of Genetics</td>
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</tr>
<tr>
<td>BIOS 20188</td>
<td>Fundamentals of Physiology</td>
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</tr>
<tr>
<td>BIOS 20191</td>
<td>Integrative Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOS 20170</td>
<td>Microbial and Human Cell Biology</td>
<td></td>
</tr>
<tr>
<td>BIOS 20171</td>
<td>Human Genetics and Developmental Biology</td>
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**MATH sequences:**

<table>
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<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>MATH 13100-13200</td>
<td>Elementary Functions and Calculus I-II</td>
<td>200</td>
</tr>
<tr>
<td>MATH 15100-15200</td>
<td>Calculus I-II</td>
<td></td>
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<tr>
<td>MATH 16100-16200</td>
<td>Honors Calculus I-II</td>
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**CHEM sequences:**

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<td>CHEM 10100-10200</td>
<td>Introductory General Chemistry I</td>
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<tr>
<td>CHEM 11100-11200</td>
<td>Comprehensive General Chemistry I-II</td>
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<td>CHEM 12100-12200</td>
<td>Honors General Chemistry I-II</td>
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<tr>
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<tr>
<td>CHEM 11300</td>
<td>Comprehensive General Chemistry III</td>
<td>100</td>
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<td>Honors General Chemistry III</td>
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</tr>
<tr>
<td>PHYS 12100-12200</td>
<td>General Physics I-II (or higher)</td>
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<tr>
<td>STAT 22000</td>
<td>Statistical Methods and Applications</td>
<td>100</td>
</tr>
<tr>
<td>NSCI 20110</td>
<td>Fundamental Neuroscience</td>
<td>100</td>
</tr>
<tr>
<td>NSCI 20120</td>
<td>Cellular Neuroscience</td>
<td>100</td>
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<tr>
<td>NSCI 20130</td>
<td>Systems Neurobiology</td>
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<tr>
<td>NSCI 20140</td>
<td>Sensation and Perception</td>
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<tr>
<td>NSCI 20100</td>
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<tr>
<td>Seven electives</td>
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**Total Units** 600

**MAJOR: BACHELOR OF ARTS**

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<tr>
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| Three additional electives |       |
|                          | 300   |

**Total Units** 1600

**MAJOR: BACHELOR OF SCIENCE**

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<th>Units</th>
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<td>700</td>
</tr>
</tbody>
</table>

| Three additional electives |       |
|                          | 300   |

**Total Units** 1900
Credit may be granted by examination.

BIOS 20171 must be taken concurrently with BIOS 20172.

Must include one to three courses of NSCI 29100, 29101, 29102 Neuroscience Thesis Research or NSCI 29200, 29201, 29202 Neuroscience Honors Thesis Research

Honors

To obtain honors in Neuroscience, students must have a minimum cumulative GPA (3.25) at the point of entering the honors track, no later than the end of the third year. Entry into the honors track must be approved by the director of undergraduate studies. Students must do experimental research for three quarters and submit a thesis (NSCI 29200, NSCI 29201, NSCI 29202 Neuroscience Honors Thesis Research). As part of the research course work, honors students participate in regular group meetings in which they share their research with each other and supervising faculty, and receive guidance on formulating testable hypotheses, experimental design, report writing, and oral presentations. They also receive training in the responsible conduct of research. Experimental research may not be credited toward honors in more than one major.

Minor Options

A minor in Neuroscience is not offered. The College offers a minor program in Computational Neuroscience, and students majoring in Biological Sciences have the option of completing a Specialization in Neuroscience.
Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

- Times was used instead of Trajan.
- Times was used instead of Palatino.

The editor may contact Leepfrog for a draft with the correct fonts in place.