

NEUROSCIENCE, BACHELOR OF SCIENCE

Neuroscience Major Requirements

(Also see Requirements for a Bachelor's Degree. (<https://e-catalogue.jhu.edu/ksas-wse/undergraduate-policies/academic-policies/requirements-bachelors-degree/>))

Neuroscience is the study of the nervous system and how it functions. Neuroscientists study the nervous system from all levels, ranging from molecules interacting with cell membranes to brain systems subserving cognitive functions such as language. Dramatic progress has been made at all levels, and the field continues to grow. On the Homewood campus, researchers studying the nervous system are in the departments of Biology, Biomedical Engineering, Biophysics, Cognitive Science, and Psychological and Brain Sciences and in the Krieger Mind/Brain Institute. Their presence provides the opportunity for an innovative, interdepartmental program which offers a broad overview of the neuroscience field, as well as more advanced training in one of four focus areas.

General Information

- Students are encouraged to complete an optional introductory course in their freshman year, such as AS.200.141 Foundations of Brain, Behavior and Cognition or AS.050.105 Introduction to Cognitive Neuropsychology. Either of these courses will satisfy the prerequisite for AS.080.305 Neuroscience: Cellular and Systems I. Foundations of Brain, Behavior and Cognition will also satisfy the prerequisite for AS.080.250 Neuroscience Laboratory.
- Students interested in attending medical school will need to take a second semester of organic chemistry and its corresponding laboratory and biochemistry to meet medical school admission requirements; however, these courses are not major requirements.
- Students are required to select their advanced neuroscience elective courses from one of four approved focus areas: cellular and molecular neuroscience (NEUR-CM), cognitive neuroscience (NEUR-CG), computational neuroscience (NEUR-CP), or systems neuroscience (NEUR-ST). Approved courses fulfilling this requirement are found on the neuroscience website (<http://krieger.jhu.edu/neuroscience/bs-program/courses/>) or in the schedule of classes where they can be identified by their POS-Tag.
- To apply towards the major, all courses must be taken for a letter grade and a grade of C- or better is required.

Writing and Communication Requirement in the Major (for students entering JHU fall 2024 and later)

Neuroscience students must take 6 credits of Writing and Communication foundational ability (FA#1) courses within the major. The required two semesters of Scientific Communications and Mentoring will satisfy 3 of the 6 credits. The remaining 3 credits can be satisfied by taking one of the advanced courses designate with the FA#1 tag. See specific course offerings on the neuroscience website (<http://krieger.jhu.edu/neuroscience/bs-program/courses/>).

Code	Title	Credits
Neuroscience Sequence		
AS.050.203	Neuroscience: Cognitive (spring)	3
AS.080.250	Neuroscience Laboratory (fall/spring)	3

AS.080.305	Neuroscience: Cellular and Systems I (fall)	3
AS.080.306	Neuroscience: Cellular and Systems II (spring)	3

Mathematics, Statistics, and Science Courses

EN.553.211	Probability and Statistics for the Life Sciences	4
or EN.553.310	Probability & Statistics for the Physical Sciences & Engineering	
or EN.553.311	Intermediate Probability and Statistics	
or EN.553.111	Statistical Analysis I	
& EN.553.112	and Statistical Analysis II	
or AS.280.345	Public Health Biostatistics	
AS.110.106	Calculus I (Biology and Social Sciences)	4
or AS.110.108	Calculus I (Physical Sciences & Engineering)	
AS.110.107	Calculus II (For Biological and Social Science)	4
or AS.110.109	Calculus II (For Physical Sciences and Engineering)	
or AS.110.113	Honors Single Variable Calculus	

AS.030.101	Introductory Chemistry I	4
& AS.030.105	and Introductory Chemistry Laboratory I	

AS.030.102	Introductory Chemistry II	4
& AS.030.106	and Introductory Chemistry Laboratory II	

or AS.030.103	Applied Chemical Equilibrium and Reactivity w/Lab	
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AS.030.205	Introductory Organic Chemistry I	4
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AS.171.101	General Physics: Physical Science Major I	4
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or AS.171.103	General Physics I for Biological Science Majors	
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or AS.171.107	General Physics for Physical Sciences Majors (AL)	
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AS.173.111	General Physics Laboratory I	1
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AS.171.102	General Physics: Physical Science Major II	4
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or AS.171.104	General Physics/Biology Majors II	
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or AS.171.108	General Physics for Physical Science Majors (AL)	
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AS.173.112	General Physics Laboratory II	1
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Biology Sequence ^{1 and 2}

Select one biology course with lab of the following: 6-8

AS.020.151	General Biology I	
& AS.020.153	and General Biology Laboratory I (see footnote about AP Biology credits) ¹	

AS.020.152	General Biology II	
& AS.020.154	and General Biology Lab II (see footnote about AP Biology credits) ¹	

AS.020.303	Genetics	
& AS.250.253	and Protein Engineering and Biochemistry Lab (see footnote) ³	

or AS.020.311 Biochemistry Project lab

AS.020.305	Biochemistry	
& AS.020.315	and Biochemistry Project lab	

or AS.250.255 Protein Engineering and Biochemistry Lab

AS.020.306	Cell Biology	
& AS.020.316	and Cell Biology Lab	

AS.020.374	Comparative Physiology	
& AS.020.377	and Comparative Physiology Lab	

Advanced Neuroscience Elective Courses and Focus Area

Nine credits of 300-level or higher approved courses from one of four focus areas: systems neuroscience, cognitive neuroscience, computational neuroscience, or cellular and molecular neuroscience 9

Three credits of 300-level or higher approved course outside of focus area selected above 3

If pursuing the Computational Neuroscience focus area, EN.553.291 0-11 (or the combo of AS.110.201/212 and AS.110.302) and AS.250.205 are required in addition to the 12 credits in advanced courses required for the focus area.

If pursuing the Cellular and Molecular Neuroscience focus area, AS.020.306 and AS.020.316 must be selected as the required biology course with lab

Neuroscience Research and Scientific Communication & Mentoring ⁴

AS.080.541	Research Neuroscience – Neuroscience Majors (6 1-3 credits total)	
	or AS.080.544	Research Neuroscience – Neuroscience Majors
AS.080.499	Scientific Communication and Mentoring (two semesters)	1.5

Total Credits 66.5-81.5

¹ For students with Biology credit from an exam (AP, IB, GCE), exam credit may not use credits towards this requirement. Therefore, these student must take at least one biology course and its lab at JHU. Students who elect to take General Biology I or II with its lab will lose the corresponding exam credits.

² Students planning on taking the MCAT should consider whether or not they have a solid biology background coming into JHU. If they are unsure they should consult with the Office of Pre-Professional Advising and consider taking General Biology I and II along with the associated labs.

³ AS.020.340 Developmental Genetics Lab may also be used for this lab requirement and it may have seats during the **fall semester only for Neuroscience majors**. AS.250.253 Protein Engineering and Biochemistry Lab OR AS.020.315 Biochemistry Project Lab can be taken either in the fall or spring semester.

⁴ Neuroscience Research (AS.080.521, AS.080.531, AS.080.534, AS.080.541, AS.080.544, AS.080.555, AS.080.592, or AS.080.594) must be conducted in one of the neuroscience laboratories participating in the program and can be completed in 1 to 3 credits per term. **Students must register for two semesters** of AS.080.499 Scientific Communication and Mentoring. Students are strongly encouraged to only take Scientific Communication and Mentoring when they are either actively involved in research or have completed at least three credits of research.

Sample Program

The following course sequence is only a suggestion and is based on the assumption that there are no AP/IB/TR credits applied. Please consult with your academic advisor when selecting and registering for classes, as there are multiple ways to complete the major.

First Year			
First Semester	Credits	Second Semester	Credits
AS.030.101	3	AS.030.102	3
AS.030.105	1	AS.030.106	1
AS.110.106	4	AS.110.107	4
Biology Option 1 ¹	3		
Biology Lab Option 1	1		
	12		8
Second Year			
First Semester	Credits	Second Semester	Credits
AS.080.305 ²	3	AS.080.306 ²	3
AS.030.205	4	EN.553.211	4

AS.080.499 ³	1.5	AS.080.499 ³	1.5
AS.080.541 ³	1 - 3	AS.080.544 ³	1-3
	9.5-11.5		9.5-11.5

Third Year

First Semester	Credits	Second Semester	Credits
AS.171.103	4	AS.171.104	4
AS.173.111	1	AS.173.112	1
AS.080.499 ³	1.5	AS.050.203	3
AS.080.541 ³	1 - 3	AS.080.499 ³	1.5
Upper Level Neuroscience Course #1	3	AS.080.544 ³	1 - 3
		Upper Level Neuroscience Course #2	3
	10.5-12.5		13.5-15.5

Fourth Year

First Semester	Credits	Second Semester	Credits
AS.080.250 ⁴	3	Upper Level Neuroscience Course #4	3
Upper Level Neuroscience Course #3	3		
	6		3

Total Credits 72-80

¹ The biology course with lab requirement can be taken in any semester. For students who are obtaining a Cellular and Molecular focus area, the biology course with lab requirement must be fulfilled with AS.020.306 Cell Biology and AS.020.316 Cell Biology Lab.

² AS.080.305 Neuroscience: Cellular and Systems I & AS.080.306 Neuroscience: Cellular and Systems II can be taken sophomore or junior year.

³ Research in Neuroscience (AS.080.521, AS.080.531, AS.080.534, AS.080.541, AS.080.544, AS.080.555, AS.080.592, or AS.080.594) and Scientific Communication & Mentoring (AS.080.499) can be taken at any time. Students are strongly encouraged to only take Scientific Communication and Mentoring when they are either actively involved in research or have completed at least three credits of research.

⁴ AS.080.250 Neuroscience Laboratory can be taken any time after completing AS.200.141 Foundations of Brain, Behavior and Cognition or AS.080.305 Neuroscience: Cellular and Systems I & AS.080.306 Neuroscience: Cellular and Systems II.

Honors in the Major

Effective Fall 2023, the honors requirements are changing from prior years. **Students who entered JHU prior to Fall 2022 should refer to their catalogue year of entry to review their honors requirements.**

For students entering JHU in Fall 2022 and beyond, the honors requirements are:

- Earn a GPA of **3.8** or better in major requirements
- Earn **6** credits of required research (this overlaps with major requirements)
- Presentation of research findings at the Day of Research in Engineering, Arts, Medicine and Sciences (DREAMS) during the Fall or Spring semester
- Receive a recommendation from research mentor

Neuroscience Undergraduate Honors Thesis

The Neuroscience Undergraduate Honors Thesis program is designed for students wishing to distinguish themselves via the writing and defense of a thesis. Students wishing to gain more hands-on experience in the construction of a research hypothesis, experimental design, and scientific communication should consider the thesis. In particular, students thinking about pursuing a career in research may find the preparation of an Undergraduate Honors Thesis will provide valuable insight into the research endeavor. While this option is new for the 2023-2024 academic year, students who entered in prior years may pursue this opportunity.

Criteria:

- Design and conduct an experiment in Neuroscience under the direction of mentor
- Submit an application, a recommendation letter from the primary mentor, and a research proposal describing your planned project to the Undergraduate Honors Thesis Director (Dr. Robert Ross) via email at rross32@jhu.edu during the Spring semester the year before your planned graduation date
- Earn 9 credits of Independent Research
- Write an Undergraduate Honors Thesis
- Defend the Thesis orally to a committee comprised of members from the Johns Hopkins University Neuroscience community by mid-April of your graduation year
- Present your research at the DREAMS conference Fall or Spring of your final undergraduate year
- Attend a weekly Honors Thesis Seminar during Spring semester of your graduation year focused on assisting with Thesis writing (AS.080.599 Honors Thesis Seminar)
- Maintain minimum 3.5 GPA in all required courses for the Neuroscience major