The Departments of Psychology and Biology offer a course major and an honors major in Neuroscience. Each Neuroscience major will be assigned a faculty advisor from whichever of the two departments best reflects the focus of that student’s plan of study.

A. Entry Requirements for the Neuroscience Course Major and Honors Major

The study of Neuroscience involves advanced coursework with the following prerequisites. For admission to the Neuroscience special major, students must

a. complete (or otherwise satisfy) the following required courses (up to two credits of these taken at Swarthmore may be counted as Group B electives for the major), and

b. obtain a minimum GPA of 3.0 (B) for these courses overall, as well as within all Biology courses and within all Psychology courses.

<table>
<thead>
<tr>
<th>Biology</th>
<th>BIOL 001: Cellular and Molecular Biology</th>
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<tr>
<td></td>
<td>BIOL 002: Organismal and Population Biology</td>
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<tr>
<td>Chemistry</td>
<td>CHEM 010: General Chemistry</td>
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<td>CHEM 022: Organic Chemistry I</td>
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<tr>
<td>Math/Stat</td>
<td>MATH 015: Elementary Single-Variable Calculus</td>
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<td>STAT 011: Statistical Methods</td>
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<tr>
<td>Psychology</td>
<td>PSYC 001: Introduction to Psychology</td>
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<tr>
<td></td>
<td>PSYC 025: Research Design and Analysis</td>
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- The requirement for BIOL 001 and/or BIOL 002 may be satisfied by credit from the Biology AP exam (score of 5) if at least one credit in Biology has been completed at Swarthmore.
- The requirement for CHEM 010 will be satisfied if the student has placed out of it and completed CHEM 022.
- The requirements for MATH 015 and STAT 011 may be satisfied by placement out of these courses, as determined by the Department of Mathematics and Statistics
- The requirement for PSYC 001 may be satisfied with a Psychology AP exam score of 5.
- Provisional admission to the special major will normally be granted based on substantial progress in satisfying these entry requirements at the time of application.

B. Neuroscience Course Major Requirements

A special major at Swarthmore must include at least 10 credits and no more than 12 credits. A Neuroscience major will normally include two (2) Entry Requirement Courses (i.e., any two that have been taken at Swarthmore) and eight (8) Elective credits as specified below, including fulfilling the comprehensive requirement. Up to twelve credits may be included in the major, but only ten are required.

1. Electives

Majors will complete at least eight (8) elective credits from the following lists, to include at least one seminar. Normally, the seminar for course majors should be a Group A seminar; a Group B seminar may fill this requirement only with the approval of the Neuroscience Administrator (currently, Cat Norris). At least five (5) elective credits must be from Group A including at least one Foundation course and at least one course from each of Psychology and Biology. The remaining three (3) elective credits can be from either Group A, Group B, or Group C (see restrictions below). It
is possible to substitute or add electives from other universities (e.g., Systems Neuroscience at UPenn), including abroad, but students should seek Swarthmore faculty approval for such courses in advance.

**Group A: Neuroscience Electives**

- BIOL 022  Neurobiology [Foundation Course*]
- PSYC 030  Behavioral Neuroscience [Foundation Course*]

* At least one Foundation Course must be included. Both are recommended. Note that BIOL 022 (Neurobiology) is only offered every other year.

- BIOL 020  Animal Physiology
- BIOL 029  Developmental Neurobiology
- BIOL 030  Animal Behavior
- BIOL 121  Neural Systems and Behavior seminar (2 credits)
- BIOL 123  Learning and Memory seminar (2 credits)
- BIOL 124  Hormones and Behavior seminar (2 credits)
- BIOL 127  Advanced Topics in Behavioral Biology (2 credits)
- BIOL 129  Developmental Neurotoxicology (2 credits)
- BIOL 131  Animal Communication seminar (2 credits)
- BIOL 134  Evolution of Social Behavior (2 credits)
- PSYC 031  Cognitive Neuroscience
- PSYC 031A Social, Cognitive, and Affective Neuroscience
- PSYC 091  Advanced Topics in Behavioral Neuroscience
- PSYC 130  Behavioral Neuroscience seminar (1 credit)
- PSYC 131  Cognitive Neuroscience seminar (1 credit)
- PSYC 131A Psychology and Neuroscience: The Social Brain seminar (1 credit)
- PSYC 032/132  Perception: Laboratory Course & Seminar (2 credits)

**Group B: Course Electives in Related/Overlapping Scientific Areas**

- BIOL 010  Genetics
- BIOL 014  Cell Biology
- BIOL 019  Omics
- BIOL 024  Developmental Biology
- BIOL 026  Invertebrate Biology
- BIOL 027  Systems Biology
- BIOL 034  Evolution
- BIOL/CPSC 068  Bioinformatics
- BIOL 111  Genome Regulation by Noncoding RNA seminar (2 credits)
- BIOL 112  From Cells to Organs (2 credits)
- BIOL 115  Plant Molecular Genetics (2 credits)
- BIOL 119  Genomics and Systems Biology seminar (2 credits)
- BIOL 125  Cellular Basis of Embryonic Development & Cancer seminar (2 credits)
- BIOL 126  Biomechanics seminar (2 credits)
- BIOL 136  Molecular Ecology and Evolution seminar (2 credits)
- CHEM 038  Biological Chemistry
- COGS 001  Introduction to Cognitive Science
- CPSC 021  Introduction to Computer Science
- MATH 056  Modeling
- PSYC 027  Scientific Computing for Psychology
PSYC 028  Stereotypes, Prejudice, and Discrimination  
PSYC 033  Cognitive Psychology  
PSYC 034  Psychology of Language  
PSYC 035  Social Psychology  
PSYC 038  Clinical Psychology  
PSYC 039  Developmental Psychology  
PSYC 043  Computational Methods for Psychology and Neuroscience  
PSYC 133  Metaphor and Mind seminar (1 credit)  
PSYC 134  Psycholinguistics seminar (1 credit)  
PSYC 138A  Clinical Psychology seminar (1 credit)*  
PSYC 138B  Clinical Psychology seminar (1 credit)*  
PSYC 139  Developmental Psychology seminar (1 credit)

* Note that only one PSYC 138 seminar (either A or B) may be used as an honors preparation.

**Group C: Research Electives**

One unit of research (of up to 2 credits) in neuroscience from the following may be counted toward the minimum required 10 credits of the major. Additional research units may be counted for optional credits up to 12. Research electives are one way of fulfilling the comprehensive requirement (see below) for the Neuroscience major.

- BIOL 098  Neuroscience Thesis Research  
- PSYC 096/097  Senior Thesis (2 credits)  
- PSYC 099  Senior Neuroscience Thesis  
- PSYC 102  Research Practicum in Perception and Cognition  
- PSYC 103  Research Practicum in Behavioral Neuropharmacology  
- PSYC 104  Research Practicum in Language and Mind  
- PSYC 105  Research Practicum in Psychology and Neuroscience: Social Imitation  
- PSYC 110  Research Practicum in Cognitive Neuroscience

2.  **Comprehensive Requirement for Course Majors**

The comprehensive requirement is a Neuroscience Research Thesis, a complete scientific paper based on a research project conducted in Biology or Psychology or some other area related to neuroscience. Each Neuroscience major must identify their faculty thesis mentor before the end of the junior fall semester. A thesis project will be developed in collaboration with the thesis mentor.

**Thesis options.** Each Neuroscience major must write their own Thesis, from one of the following options:

1. The thesis may be based on an individual research project directly supported by a faculty member as a Group C elective in either Biology or Psychology.

2. Students in Biology seminars and Psychology Research Practica often work on group projects and sometimes produce multi-authored research papers. Such a project may serve as the basis of a Neuroscience Research Thesis, but the paper must be a unique product of the student who submits it as their Thesis and should be undertaken under the guidance of the faculty member who taught the seminar or research practicum.

3. The thesis may be based on a separate research project, such as might occur during a summer (either at Swarthmore or at another institution). In this case,
a student must secure the preliminary consent of a faculty mentor in either Biology or Psychology (whichever is more appropriate for the project) before beginning work on the project (i.e., before the summer research experience). The student must provide a one-page summary of the research project to both the faculty mentor and their academic advisor at the beginning of the fall semester of the senior year (no later than Friday of the first week of classes). If the faculty mentor approves the project for a Neuroscience Thesis, and consents to mentor the student through the process of writing the thesis, then the student will register for a 0.5 credit unit of Neuroscience Thesis during either (but not both) semester of the senior year.

Neuroscience Research Thesis: Guidelines for content and organization.

• The thesis should be organized in the format of a formal scientific paper, including the following sections: abstract, introduction, materials and methods, results, discussion, acknowledgments, and references.
• The thesis should report new empirical data on a research project that was conducted by the student.
• As the comprehensive exercise for an interdisciplinary special major, students should endeavor to explain their scientific question(s) and how their work is related to larger themes in neuroscience in the thesis introduction and/or discussion.
• The length of the thesis is normally to be no more than 20 pages, double-spaced (exclusive of figures, tables, and references).
• The deadline for submitting the complete draft of the thesis will be set by the faculty research mentor; normally this would be within a week of the last day of spring semester classes.


• A 0.5- or 1-credit thesis will be evaluated by the Swarthmore faculty thesis mentor.
• A 2-credit thesis will be evaluated by two faculty members, normally one from Biology and one from Psychology. One of these is the faculty thesis mentor, and the second will be determined by the student in consultation with the thesis mentor.

3. Sample Neuroscience Course Majors

The Neuroscience Major is demanding, but can be very flexible. It is important to receive advising from a faculty member in planning your program. Here we show several different possible programs. These are intended to be illustrative, and they should not take the place of advising.

ENTRY REQUIREMENTS (including 2 credits toward major)
AP in BIOL 001 plus BIOL 002 (1 credit counted toward major credits)
AP in PSYC (no credit) plus PSYC 025 (1 credit counted toward major credits)
AP in Calculus, STAT 011, CHEM 010, CHEM 022

SAMPLE PLANS FOR COMPLETING COURSE MAJOR REQUIREMENTS

• “Minimalist” Neuroscience Major (fewest credits, minimum in Group A). A total of 8 Elective credits = 5 from Group A (including 1 Foundation) + 3 from Groups B/C:
  PSYC 030 (Group A, Foundation)
BIOL 030 (Group A elective)
PSYC 031 (Group A elective)
PSYC 032 (Group A elective)
PSYC 130 (Group A elective/seminar)
BIOL 014 (Group B elective)
COGS 001 (Group B elective)
PSYC 105 (Research Practicum/Thesis)

• **“Core Emphasis” Neuroscience Major** – A total of 9-10 Elective credits = 8 credits from Group A (including 2 Foundation courses) + 1 or 2 Research credits:
  - BIOL 022 (Group A, Foundation)
  - PSYC 030 (Group A, Foundation)
  - PSYC 130 (Group A, seminar)
  - BIOL 123 (2-credit Group A seminar)
  - PSYC 031/131A (2-credit Group A electives)
  - PSYC 032 (Group A elective)
  - PSYC 105 or PSYC 096/097 (1-credit Research Practicum/Thesis or 2-credit Thesis)

• **“Cognitive Neuroscience Emphasis” Neuroscience Major** – A total of 8 Elective credits = 7 credits from Group A (including 1-2 Foundation courses) + 1 Research credit:
  - PSYC 030/130 (Group A Foundation + Group A elective)
  - BIOL 022 or BIOL 030 (Group A elective)
  - PSYC 031A/131A (2-credit Group A electives)
  - PSYC 032/132 (Group A electives)
  - PSYC 102, 104 or 105 (1-credit Research Practicum/Thesis)

• **“Biology Emphasis” Neuroscience Major** - A total of 9 Elective credits = 7 from Group A (including 1-2 Foundation courses) + 1 from Group B + 1 Research credit:
  - BIOL 022 (Group A Foundation)
  - PSYC 030, 031, or 032 (Group A)
  - BIOL 030 (Group A)
  - BIOL 123 (2-credit Group A seminar)
  - BIOL 127 (2-credit Group A seminar)
  - BIOL 131 (2-credit Group A seminar)
  - BIOL 010 (Group B)
  - BIOL 098 (1-credit Research Thesis)

C. Honors Neuroscience Major Requirements

Entry Requirements for admission to the Neuroscience Honors major are the same as those for admission to the Course major (see section A above).

The Neuroscience Honors major comprises two (2) Entry Requirement courses, at least one (1) of the two Foundation Courses, three (3) Honors Seminar preparations, and an Honors Research Thesis.

Students will be officially added to Honors on the Major/Minor Portal ONLY by the Academic Assistant to the Neuroscience Special Major (currently Kim ngan Hoang) once ALL of the following requirements have been met:
• A copy of the honors form, signed by the Neuroscience Special Major Administrator (currently Cat Norris), has been received by the Academic Assistant to the Neuroscience Special Major.

• The Neuroscience Special Major Administrator has approved the student’s application to Honors via email to the Academic Assistant.

• The mentor of the student’s Honors Thesis has emailed their request to enroll the student in BIOL/PSYC 180 (i.e., Neuroscience Honors Thesis).

1. Neuroscience Foundation Courses: Honors majors will complete at least one of:

- BIOL 022 Neurobiology
- PSYC 030 Behavioral Neuroscience

2. Honors Seminar Preparations

Majors will complete three (3) seminar preparations from the following groups, with at least two from Group A (normally one from BIOL and one from PSYC) and no more than two in one department.

Group A: Neuroscience Honors Preparations (Seminars)

- BIOL 121 Neural Systems and Behavior seminar (2 credits)
- BIOL 123 Learning and Memory seminar (2 credits)
- BIOL 124 Hormones and Behavior seminar (2 credits)
- BIOL 127 Behavioral Biology (2 credits)
- BIOL 129 Developmental Neurotoxicology (2 credits)
- BIOL 127 Advanced Topics in Behavioral Biology (2-credits)
- BIOL 131 Animal Communication seminar (2 credits)
- BIOL 134 Evolution of Social Behavior (2 credits)
- PSYC 030/130 Behavioral Neuroscience course and seminar (1 credit each)
- PSYC 031/131 Cognitive Neuroscience course and seminar (1 credit each)
- PSYC 131A +1 Social Brain seminar (plus a pre-req; 1 credit each)
  Pre-req: Either PSYC 031 or PSYC 031A
- PSYC 032/132 Perception: Laboratory Course & Seminar (2 credits)

Group B: Honors Preparations (Seminars) in Related Scientific Areas

- BIOL 111 Genome Regulation by Noncoding RNA seminar (2 credits)
- BIOL 112 From Cells to Organs seminar (2 credits)
- BIOL 115 Plant Molecular Genetics seminar (2 credits)
- BIOL 119 Genomics and Systems Biology seminar (2 credits)
- BIOL 125 Cellular Basis of Embryonic Development & Cancer seminar (2 credits)
- BIOL 136 Molecular Ecology and Evolution seminar (2 credits)
- PSYC 133 +1 Metaphor and Mind seminar (plus a pre-req; 1 credit each)
  Pre-req: Either PSYC 033, PSYC 034 or COGS 001
- PSYC 134 +1 Psycholinguistics seminar (plus a pre-req; 1 credit each)
  Pre-req: Either PSYC 033, PSYC 034 or COGS 001
- PSYC 038/138 Clinical Psychology course and seminar (1 credit each)
- PSYC 039/139 Developmental Psychology course and seminar (1 credit each)

Neuroscience Honors Majors that have conducted their honors thesis research in conjunction with a member of the Biology Department at Swarthmore (or another institution but sponsored by a faculty member in Swarthmore’s Biology Department) must enroll in one credit of BIOL 199 (Senior Honors Study) during their senior spring semester. This course is taken by honors candidates that are Biology,
Biochemistry, and Neuroscience majors with theses that are biology focused. Students will participate in weekly meetings focused on presenting their thesis research orally and providing peer-feedback.

3. Honors Research Thesis (2 credits)

The Neuroscience Honors Thesis is a complete scientific paper based on a substantial research project that, according to the practices of the host department, may be completed in two semesters of research OR in one or two summers plus one semester of research. The project will be taken for one or two credits (of PSYC 180 or BIOL 180) and will be graded by an External Examiner. Normally, Neuroscience Honors students that complete their theses with a Psychology mentor enroll for 2 1-credit semesters of PSYC 180; Neuroscience Honors students that complete their theses with a Biology mentor enroll for (a) 1 or 2 1-credit semesters of BIOL 180, and (b) 1 1-credit semester of BIOL 199 (in their senior spring semester).

The Honors thesis normally has a page limit of 20 pages, not counting references, figures, figure legends or tables.

An Honors thesis requires a significant investment of thought and time. This begins with careful advance planning. A Neuroscience Honors major will normally identify a faculty member in either Psychology or Biology who consents to be their thesis mentor no later than the end of the junior fall semester. Each Honors student will develop a thesis plan in collaboration with their thesis mentor by the end of their junior spring semester.