Neuroscience Major Requirements (Fall 2017 or later)

Undergraduate Program in Neuroscience
: 2200 Biological Sciences Bldg. (BSB) :http://www.lsa.umich.edu/neurosci
: lsa-biology-advising@umich.edu : 734-763-7984 (front desk)

Why study Neuroscience?

Neuroscience is the study of the nervous system. Neuroscientists aim to understand how the nervous system develops and functions on a cellular level as well as the mechanisms that underlie behavior, mental disorders and disease. The faculty teaching courses in the major include cellular and molecular neuroscientists appointed in the Department of Molecular, Cellular and Developmental Biology (MCDB) and behavioral and cognitive neuroscientists appointed in the Department of Psychology. This interdisciplinary program gives students the best of both of these worlds.

Who should major in Neuroscience?

Any student who wishes to pursue a career studying the nervous system or behavior. This is an excellent major for anyone interested in pre-health careers, graduate studies, or careers in the biotech industry.

Exclusions:

Students who elect a major in Neuroscience may **not** elect the following majors:

- Biochemistry
- Biology
- Biology, Health & Society (BHS)
- Biomolecular Science (BMS)
- Biopsychology, Cognition and Neuroscience (BCN)
- Plant Biology
- CMBS (formerly CMB:BME)
- Molecular, Cellular, and Developmental Biology (MCDB)
- Microbiology
- Biotechnology & Bioenvironmental Sciences (BBS)

Students who elect a major in Neuroscience may not elect a minor in Biology or Biochemistry.

Students can double major in Psychology and Neuroscience or Cognitive Science and Neuroscience, but may only share a maximum of 3 courses between their two programs.

How do I declare?

Students interested in neuroscience are encouraged to meet with an advisor to discuss their academic plans as soon as possible! Students need not have completed all of the prerequisites of the major to declare, but should usually have completed the biology introductory sequence and CHEM 210 with a 2.0 or better and be in good academic standing. Make an advising appointment online through the Neuroscience website: www.lsa.umich.edu/neurosci.

What courses should I take first?

Students with full **AP Biology credit** (Biology 195 and 196) are considered to be completed with the Introductory Biology Sequence. Students with partial **AP Biology credit** (Biology 195) should take the Introductory Biology Lab (BIOLOGY 173) during their first year. **Transfer students** who receive credit for BIOLOGY 191 should take BIOLOGY 192 and BIOLOGY 173 to complete the introductory biology sequence. All other students should begin the introductory biology sequence during their first year and complete it no later than their second year. BIOLOGY 171 and 172/174 can be taken in either order. Students should take BIOLOGY 173 when they enroll in their second semester of introductory biology.

BIOLOGY 171	BIOLOGY 172 or 174
…focuses on ecology, biodiversity, and genetics and evolutionary processes. Students engage with biological hypotheses dealing with prominent current issues such as human evolutionary origins, emerging diseases, conservation biology, and global change.	**(prerequisite: prior or concurrent credit for CHEM 130)** …aims to provide factual and conceptual knowledge of how cells, organs, and organisms work; and to develop scientific hypothesis-testing and critical-thinking skills.
BIOLOGY 173 - **(prerequisite = BIOLOGY 171, 172, 174, 191, or 195)** …is the accompanying lab component to the introductory sequence. The course provides an integrated introduction to experimental biology. Topics focus on biochemistry, molecular genetics, evolution, and ecology.	

Can I transfer courses from another institution?

Yes, students will work with the applicable department for the transferring subject to have your course evaluated (i.e., the Psychology department for PSYCH classes) and with the transferring institution to issue your official transcript to UM. Check the Undergraduate Program in Neuroscience website for more detailed instructions.
https://lsa.umich.edu/neurosci/undergraduates/transfer-credit.html

What can I do with my Neuroscience undergraduate degree?

The undergraduate degree in neuroscience is a great starting point for graduate programs in neuroscience, psychology, or biology. The degree will also prepare students for medical, dental, veterinary or pharmacy school. Other possible jobs are in health services, industry, government, teaching, and sales. http://www.lsa.umich.edu/neurosci/careers

How do I get involved in research?

Neuroscientists with faculty appointments in MCDB and Psychology represent the core faculty of the major, and almost all faculty members in these departments involve undergraduates in their research programs. However, mentors from over 20 additional departments also sponsor undergraduate research on neuroscience related topics. Two useful resources to identify the full range of potential research mentors are the web sites of the Neuroscience Graduate Program, https://neuroscience.med.umich.edu and the Program in Biomedical Sciences https://medicine.umich.edu/medschool/education/phd-programs.

If you want to receive credit in the major for your research, the project must be sponsored or co-sponsored by a neuroscientist from MCDB or Psychology. A list of potential co-sponsors as well as a detailed description of undergraduate research policies can be found at: http://www.lsa.umich.edu/neurosci/studentresearch .

When contacting faculty members to enquire about potential research opportunities, it is expected that you will have done background reading on the current research projects of the faculty member and their recent publications. You should provide a brief introduction and a resume that includes a list of relevant classes you have completed and examples of leadership, self-motivation, and dedication to work tasks. If invited for an interview, be prepared to explain how you will be an asset to the lab, and how this experience will help you as you develop your career. You should be aware that each faculty member sets his or her own policies for how they manage undergraduate researchers.

Scholarships for research may be available. https://lsa.umich.edu/neurosci/undergraduates/awards---scholarships.html

What are the requirements for a senior thesis (Honors or non-honors)?

A subset of our students chose to focus intensively on research, and submit a senior thesis as part of their degree. A senior thesis reports on neuroscience research carried out over at least two semesters; most thesis students start their research in their sophomore or junior year and apply for permission to submit a thesis by the end of their junior year. The due date for submission of a thesis is approximately one month prior to the end of the semester of graduation.

If a student submits a thesis judged acceptable by three faculty readers, makes a public presentation of their work and achieves an overall and major GPA of 3.4 or better, their diploma will indicate that they graduated with Honors in Neuroscience. If the student does not meet the GPA cutoffs, but satisfies all other thesis requirements, the successful completion of a non-honors thesis will be indicated on their transcript by a course grade, but not on their diploma.

Prior to applying to submit a thesis, students must either i) identify a research mentor who is a neuroscientist in the Department of Psychology or MCDB or ii) identify a research mentor who is a neuroscientist in another University of Michigan department AND a co-sponsor who is a neuroscientist in the Department of Psychology or MCDB. Once this mentor is identified, students must receive approval to submit a senior thesis by submitting a Neuroscience Thesis Application, which includes a brief research proposal to https://umichlsa.qualtrics.com/jfe/form/SV_ab2FBB2Whcitzec. Applications are due no later than the end of the add/drop period one semester prior to graduation (i.e., approximately Sep 25 for students graduating at the end of Winter term, and approximately January 25 for students graduating at the end of the Fall term or Summer term). When special circumstances apply, the honors committee may accept an application beyond the normal due date.

How do I find out about internships, study abroad, or summer programs?

Information about study abroad, faculty-led intercultural internships, faculty-led courses and field experiences, and Spring/Summer language study is available through the Center for Global and Intercultural Study. Please refer to www.lsa.umich.edu/cgis for detailed information about options. LSA also offers many programs. https://www.lsa.umich.edu/summer/summerprograms

Related Student Groups:

Neuroscience Students Association (NSA) - The NSA is a student organization for students interested in neuroscience. This organization provides networking opportunities, seminars, and exposure to the depth of neuroscience. The organization also aims to actively participate in service to its community and provide the public with information on neuroscience, health, and general science topics. They hope to broaden their horizons of members by exposing them to medicine, public health, research, and engineering. The organization hopes to expose students to the many facets of this broad, advancing field.
Email: NeuroscienceStudentAssociation@umich.edu.

Biology Student Alliance (BSA) - The BSA is a student organization intended for Neuroscience, CMB, MCDB, Biology, Plant Biology, Microbiology and Biochemistry concentrators. BSA provides opportunities for undergraduates to enhance their learning in the natural sciences and gain exposure to various careers in scientific research and health-related fields. BSA aims to foster scientific discussion and stimulate innovative thinking in biology, seeks to build and sustain meaningful relationships among like-minded peers, and offer informal tutoring, academic advising, community service events, and coordinate events with various faculty guest speakers to help introduce undergraduates to various research fields. In addition, the BSA provides a space for students to present their own research in a low-pressure environment and give participants constructive feedback to help acquire skills that will be applicable to their current and future academic/professional careers. Email: BSA-Board@umich.edu

Quantitative Prerequisite Electives List (Elect two courses)

With permission from director, courses that develop quantitative skills or a 5th upper- level elective can substitute for the 2nd quantitative prerequisite.

MATH 115, 120, 185 (or equivalent) Calculus I
MATH 116, 121, 156, 176, and 186 (or equivalent) Calculus II
PHYSICS 125, 135, 139, 140, 150, 160 General Physics I (or Honors)
PHYSICS 126, 235, 239, 240, 250, 260 General Physics II (or Honors)
PHYSICS 290

Data and Programming: EECS 180 **OR** EECS 183 (4) Elementary Programming Concepts **OR** DATASCI 101/STATS 206 (4) Intro Data Science **OR** BIOLOGY 202 (3) Bio Data Analysis & Programming **OR** BIOLOGY/BIOPHYS/COMPFOR 131

NEUROSCIENCE UPPER LEVEL ELECTIVES – 4 Classes (1-2 from Group A; 2-3 from Group B; 0-1 from Group C)

Group A: Molecular and Cellular Neuroscience (Elect at least one course)

NEURO/MCDB 421 (3) Topics in Cellular & Molecular Neurobio
NEURO/MCDB 422 (3) Brain Development, Plasticity and Circuits
NEURO/MCDB 426 (3) Molecular Endocrinology
NEURO/MCDB 441 (3) Cell Biology and Disease
NEURO/MCDB 451 (3) Molecular Neurobiology of Health and Disease
NEURO/MCDB 452 (3) The Visual System
NEURO/MCDB 453 (3) Ion Channels & Channelopathies
NEURO/MCDB 458 (3) Neuroepigenetics
NEURO/MCDB 459 (3) Brain States & Behavior
NEURO/MCDB 463 (3) Sensory Circuits & Diseases
NEURO/MCDB 464 (3) Cell Diversity Immune & Nervous Systems
NEURO/MCDB 465 (3) Computation & Sensory Processing in the Neocortex
NEURO/NEUROSCI 525 (3) Intro to Pain, Neuroscience
HUMGEN 480 (3) Neurodevelopmental Disorders

Group B: Behavioral & Cognitive Neuroscience (Elect at least two courses)

NEURO/PSYCH 240 (4) Introduction to Cognitive Psychology
NEURO/PSYCH 330 (2-4) Topics in Biopsychology
NEURO/PSYCH 333 (3) Affective Neuroscience
NEURO/PSYCH 334 (3) Neurosci of Learning and Memory
NEURO/PSYCH 336 (3) Drugs of Abuse, Brain, and Behavior
NEURO/PSYCH 337 (3) Hormones and Behavior
NEURO/PSYCH 339 (3) Biopsychology of Cooperation
NEURO/PSYCH 340 (2-4) Topics in Cognition & Cognitive Neuroscience
NEURO/PSYCH 345 (4) Introduction to Human Neuropsychology
NEURO/PSYCH 430 (3) Advanced Topics in Biopsychology
NEURO/PSYCH 431 (2-4) Adv Topics in Behavioral Neurosci
NEURO/COGSCI/LING 432 (3) Intro to NeurolinguisticS
NEURO/PSYCH 433 (2-4) Advanced Topics in Neuroscience
NEURO/PSYCH 436 (3) Sleep: Brain and Behavior, From Flies to Humans
NEURO/PSYCH 438 (3) Determinants of Health and Disease
NEURO/PSYCH 439 (3) The Developing Brain
NEURO/PSYCH 440 (2-4) Advanced Topics in Cognitive Neuroscience
NEURO/PSYCH 442 (3) The Neuroscience of Perception
NEURO/PSYCH 454 (3) Developmental Cog Neurosci
NEURO/NEUROSCI 470 (4) Neuroanatomy
NEURO/NEUROL 475 (3) Neurobiology of Parkinson Disease
NEURO/PSYCH 532/ANATOMY 541/PHYSIOL 541 (4) Mammalian Reproductive Physiology

Group C: Additional Courses on topics highly relevant to some types of Neuroscience (Elect no more than 1 course.)

BIO 205 (3) Developmental Biology
BIO 207 (4) Microbiology
BIO 272 (4) Fundamentals of Cell Biology
EEB 492 (4) Behavioral Ecology (BIOSTATION: 5 cr]
MCDB 397/EEB 397 (3) Writing in Biology (ULWR)
MCDB 401 (3) Advanced Topics in Biology
MCDB 405 (3) Molecular Basis of Development
MCDB 411 (3) Protein Structure and Function
MCDB 416 (3) Introduction to Bioinformatics
MCDB 417 (3) Chromosome Structure and Function
MCDB 420/BIOPHYS 420 (3) Structural Biology: The Architecture of Life
MCDB 427 (4) Molecular Biology
MCDB 428 (4) Cell Biology
MCDB 435 (3) Intracellular Trafficking
MCDB 436 (3) Human Immunology
MCDB 440 (3) Cell Cycle Control & Cancer
MCDB 448 (3) Telomerase Function in Stem Cells and Cancers
MCDB 454 (3) Cytoskeletal Dynamics
MCDB 462 (3) Epigenetics
PSYCH 235 (4) Intro to Evolution & Behavior
PSYCH 338/ANTHRBIO 368 (4) Primate Behavior (ULWR)
PSYCH 346 (3) Learning and Memory
PSYCH 349/LING 347 (3) Talking Minds
PSYCH 363 (3) Human Cognitive Evolution
PSYCH 364 (3) Biopsychology of Sports
PSYCH 365 (3) Advanced Animal Behavior
PSYCH 373 (3) Child & Adolescent Psychopathology
PSYCH 441 (3) Neuroscience & Society
PSYCH 446 (3) Altruism
PSYCH 447 (3) Current Topics in Cognition and Cog. Neuroscience
PSYCH 448 (3) Mathematical Psychology
PSYCH 461 (3) Animal Cognition
PSYCH 462 (3) Primate Communication & Language
PSYCH 468/ANTHRBIO 468 (3) Evolutionary Endocrinology
PSYCH 469/ANTHRBIO 478 (3) Advanced Primate Behavior
LING 336 (3) Reading: Language, the Brain, and Cognition
BIOLCHEM 640 (2) Regulatory RNA & Control of Gene Expression
PHRMACOL 310 (4) Pharmacology and Therapeutics
MICRBIOL 440 (3) Human Immunology
IHS 340 (3) Germ Wars, Asthma, & the Food Allergy Epidemic (ULWR)

Group D: Laboratory Requirement (Elect at least two courses, **with at least one being from D1**, for a min. of 4 cred. total)

Group D1: Method-based laboratory courses *(Elect at least one course.)*
BIO 226 (2) Animal Physiology Laboratory
MCDB 306 (3) Introductory Genetics Laboratory
NEURO/MCDB 423 (3) Cellular and Molecular Neurobiology Laboratory
NEURO/MCDB 424 (2) Behavior Neurobiology Laboratory
MCDB 429 (3) Cellular and Molecular Biology Laboratory
NEURO/PSYCH 302 (3) Research Methods in Cognitive Neurosci (ULWR)
PSYCH 331 (4) Resrch Mthds in Brain, Behavior, Cog Sci (ULWR)
PSYCH 342 (3) Research Methods in Human Electroencephalography

Group D2: Research-based laboratory courses
MCDB 300/400 (2-3) Undergraduate Research*
NEURO 360/460 (2-3) Undergraduate Neurobio. Research*
PSYCH 326 (2-4) Research for Psychology as a Natural Science
PSYCH 422 (3) Adv. Research for Psych. as a Natural Science
PSYCH 424 (3) Honors Research I for Psych. as a Nat. Science**
PSYCH 426 (3) Honors Research II for Psych. as a Nat. Science**
NEURO/PSYCH 428 (2-4) Senior Thesis

*Max. of 3 cr. of ind. research may count toward the major. Must be taken for a min. of 2 cr. and be completed in a single term.
**Optional path for Neuroscience Honors with Psychology mentor

NEUROSCIENCE MAJOR REQUIREMENTS

NEUROSCIENCE PREREQUISITES:

Introductory Biology Sequence:	**TERM:**	**COURSE:**	**GRADE:**
□ Complete Sequence A, B, or C:			
A: BIO 171, 172 or 174, & 173			
B: BIO 195 (AP) & BIO 176 (AP) or 173			
C: BIO 191 (transfer credit), 192, & 173			

Chemistry Sequence:

□ CHEM 210			
□ CHEM 211			
□ CHEM 215			
□ CHEM 216			

Quantitative Prerequisites

□ Statistics: STATS 250 or 280			
□ 2 courses from list of MATH, PHYSICS, and Data/Programming course options (or with advisor approval one course and a fifth course from the list of upper level electives).			

NEUROSCIENCE MAJOR:

Core Courses

□ Introduction to Behavioral Neuroscience: NEURO/PSYCH 230			
□ Principles of Human and Animal Physiology: BIO 225			
□ Principles of Cellular and Molecular Neuroscience: NEURO/MCDB 322			
□ Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351			
□ Genetics: BIO 305			

Upper Level Electives (4 courses)

□ One Course from Molecular & Cellular Neuroscience - Group A			
□ Two Courses from Behavioral & Cognitive Neuroscience - Group B			
□ One Additional Course – Can be from Group A, B, or C			

Lab Courses – Group D (2 courses, 4 credits minimum, **at least one from D-1**)

□ Method-based laboratory courses – Group D1			
□ Second lab course – Group D1 or D2			

Total Units and GPA Requirement for Neuroscience

□ Minimum 32 cr. in Major (200-level & above) = Core Courses (19 cr.) + 4 Electives + Labs (min. 4 cr.)			
□ Minimum 2.0 GPA in Major (GPA is calculated from all courses used for major requirements, and all courses in BIOLOGY, MCDB, and Natural Science PSYCHOLOGY courses)			
SENIOR THESIS STUDENTS ONLY (Honors or Non-honors) □ Independent Research (2 terms required, more recommended) **[RECOMMENDED]**: NEURO 360, NEURO 460, and NEURO 461 Optional for PSYCHOLOGY mentors: PSYCH 424 & 426 **HONORS STUDENTS ONLY:** □ Minimum 3.4 Major GPA at Graduation □ Minimum 3.4 Cum. GPA at Graduation			