NEUROBIOLOGY, BA

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the *Guide*.

General Education	• Breadth—Humanities/Literature/Arts: 6 credits • Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits • Breadth—Social Studies: 3 credits • Communication Part A & Part B * • Ethnic Studies * • Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF ARTS (BA)

Students pursuing a bachelor of arts degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either a bachelor of arts or a bachelor of science curriculum.

BACHELOR OF ARTS DEGREE REQUIREMENTS

Mathematics	Complete the University General Education Requirements for Quantitative Reasoning A (QR-A) and Quantitative Reasoning B (QR-B) coursework.
Language	• Complete the fourth unit of a language other than English; OR • Complete the third unit of a language and the second unit of an additional language other than English.
L&S Breadth	• 12 credits of Humanities, which must include 6 credits of literature; and • 12 credits of Social Science; and • 12 credits of Natural Science, which must include one 3+ credit Biological Science course and one 3+ credit Physical Science course.
Liberal Arts and Science Coursework	Complete at least 108 credits.
Depth of Intermediate/Advanced work	Complete at least 60 credits at the intermediate or advanced level.
Major	Declare and complete at least one major.
Total Credits	Complete at least 120 credits.
UW-Madison Experience	• 30 credits in residence, overall; and • 30 credits in residence after the 86th credit.
Quality of Work	• 2.000 in all coursework at UW–Madison • 2.000 in Intermediate/Advanced level coursework at UW–Madison

NON–L&S STUDENTS PURSUING AN L&S MAJOR

Non–L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements. They do not need to complete the L&S Degree Requirements above.

REQUIREMENTS FOR THE MAJOR

MATH, STATISTICS, CHEMISTRY & PHYSICS

Code	Title	Credits
Mathematics (complete one):		**5**
MATH 211	Survey of Calculus 1	
MATH 217	Calculus with Algebra and Trigonometry II	
MATH 221	Calculus and Analytic Geometry 1	
Statistics (complete one):		**3**
STAT 371	Introductory Applied Statistics for the Life Sciences	
STAT/B M I 541	Introduction to Biostatistics	
General Chemistry (complete one):		**5-9**
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
CHEM 109	Advanced General Chemistry	
CHEM 115 & CHEM 116	Chemical Principles I and Chemical Principles II	
Organic Chemistry (complete one):		**3-6**
CHEM 341	Elementary Organic Chemistry	
CHEM 343 & CHEM 345	Organic Chemistry I and Organic Chemistry II	
Physics (complete one)		**8-10**
PHYSICS 103 & PHYSICS 104	General Physics and General Physics	

PHYSICS 201 & PHYSICS 202	General Physics and General Physics
PHYSICS 207 & PHYSICS 208	General Physics and General Physics
PHYSICS 247 & PHYSICS 248	A Modern Introduction to Physics and A Modern Introduction to Physics

Total Credits **24-33**

BIOLOGY AND NEUROBIOLOGY

Complete 30 credits from General Biology, Neurobiology, Lab/Research Experience and Additional Elective (if required) sections.

General Biology

Code	Title	Credits
Choose one of these three sequences:		
Introductory Biology		*10*
ZOOLOGY/ BIOLOGY/ BOTANY 151	Introductory Biology	
ZOOLOGY/ BIOLOGY/ BOTANY 152	Introductory Biology	
Biology Core Curriculum		*16-18*
BIOCORE 381	Evolution, Ecology, and Genetics	
BIOCORE 383	Cellular Biology	
BIOCORE 485	Principles of Physiology	
BIOCORE 587	Biological Interactions	
Plus two from:		
BIOCORE 382	Evolution, Ecology, and Genetics Laboratory	
BIOCORE 384	Cellular Biology Laboratory	
BIOCORE 486	Principles of Physiology Laboratory	
Animal Biology		*10*
ZOOLOGY/ BIOLOGY 101	Animal Biology	
ZOOLOGY/ BIOLOGY 102	Animal Biology Laboratory	
BOTANY/ BIOLOGY 130	General Botany	

Neurobiology

Code	Title	Credits
Required Neurobiology Courses		
ZOOLOGY/ PSYCH 523	Neurobiology	3
PSYCH 454	Behavioral Neuroscience	3
ZOOLOGY 500	Undergraduate Neurobiology Seminar	1
Distributed Neuroscience Coursework—choose three courses		*9*
ANAT&PHY 335	Physiology [1]	
ANAT&PHY 435	Fundamentals of Human Physiology [1]	
AN SCI/ DY SCI 373	Animal Physiology	
BIOCHEM 501	Introduction to Biochemistry [1]	
BIOCHEM 508	General Biochemistry II [1]	
BIOCHEM/ NUTR SCI 645	Molecular Control of Metabolism and Metabolic Disease [1]	
B M E 520	Stem Cell Bioengineering [1]	
B M E 602	Special Topics in Biomedical Engineering (Introduction to Neuroengineering)	
CS&D 210	Neural Basis of Communication	
CS&D 503	Neural Mechanisms of Speech, Hearing and Language	
ED PSYCH 326	Mind, Brain and Education	
ED PSYCH 506	Contemporary Issues in Educational Psychology (Brain Behavioral Development)	
GENETICS 520	Neurogenetics	
KINES 531	Neural Control of Movement	
NEURODPT/ ZOOLOGY 616	Lab Course in Neurobiology and Behavior	
NTP/ NEURODPT 610	Cellular and Molecular Neuroscience	
NTP/NEURODPT/ PSYCH 611	Systems Neuroscience	
NTP/ NEURODPT 629	Molecular and Cellular Mechanisms of Memory	
NTP/ NEURODPT 640	Computational Neuroscience: From Single Cells to Whole Brain Models	
NTP/ MED PHYS 651	Methods for Neuroimaging Research	
NTP 666	Neuroscience of Consciousness and its Disorders	
NTP 670		
NTP 675	Special Topics (Functional Brain Imaging of Cognitive Disorders)	
NTP 675	Special Topics (Molecular Mechanisms of Brain Damage)	
NTP 675	Special Topics (Trauma and Physiology Therapy)	
NTP 675	Special Topics (Neuroendocrinology)	
NTP 675	Special Topics (Reproductive Neuroendocrinology)	
NTP 675	Special Topics (Brain Mapping in Health and Disease: Applications)	
NTP 677	Basic Sleep Mechanisms and Sleep Disorders: from Neurobiology to Sleep Medicine	
PHARMACY 632	Neuroscience of Psychedelics	
PHM SCI 310	Drugs and Their Actions	
PHM SCI 521	Pharmacology I	
PSYCH 406	Psychology of Perception	
PSYCH 414	Cognitive Psychology	
PSYCH 505	Depth Topic in Biological Science (Cognitive Neuroscience: Bridging Mind and Brain)	
PSYCH 513	Hormones, Brain, and Behavior	

PSYCH 601	Current Topics in Psychology (Neural Basis of Cognitive Control)
PSYCH 601	Current Topics in Psychology (Neuropsychology and Development)
PSYCH 603	Epigenetics and the Brain
PSYCH 606	
PSYCH 612	Neuropharmacology
ZOOLOGY 400	Topics in Biology (Brain Communication Evolution)
ZOOLOGY 400	Topics in Biology (Music and the Brain)
ZOOLOGY 400	Topics in Biology (Neuronal Cell Biology in Health Disease)
ZOOLOGY 400	Topics in Biology (Neuroscience and Society)
ZOOLOGY 400	Topics in Biology (Neural Movement Health Disease)
ZOOLOGY 400	Topics in Biology (Neuroanatomy and Systems)
ZOOLOGY 400	Topics in Biology (Cell Biology: Neurons and Neural Circuits)
ZOOLOGY 470	Introduction to Animal Development [1]
ZOOLOGY 555	Laboratory in Developmental Biology
ZOOLOGY 603	Endocrinology
ZOOLOGY 604	Computer-based Gene and Disease/Disorder Research Lab
ZOOLOGY 611	Comparative and Evolutionary Physiology
ZOOLOGY/ ANTHRO/NTP/ PSYCH 619	Biology of Mind
ZOOLOGY/ NTP 620	Neuroethology Seminar
ZOOLOGY 625	Development of the Nervous System
ZOOLOGY 655	Modeling Neurodevelopmental Disease
ZOOLOGY/ NEURODPT/ PSYCH 674	Behavioral Neuroendocrinology Seminar

Lab/Research Experience

Choose one option from the 3 listed: Neuroscience Laboratory Course, or Directed Study, or Honors/Senior Thesis.

Code	Title	Credits
1. Neuroscience Laboratory Course—one course: [2]		
BIOCORE 486	Principles of Physiology Laboratory	
ANAT&PHY 435	Fundamentals of Human Physiology	
NTP/ NEURODPT 640	Computational Neuroscience: From Single Cells to Whole Brain Models	
ZOOLOGY 555	Laboratory in Developmental Biology	
ZOOLOGY 604	Computer-based Gene and Disease/Disorder Research Lab	
ZOOLOGY 612	Comparative Physiology Laboratory	
ZOOLOGY/ NEURODPT 616	Lab Course in Neurobiology and Behavior	
2. Directed Study—3 credits from: [3]		
ANATOMY 699	Independent Study	
ANESTHES 699	Independent Study	
BIOCHEM 699	Special Problems	
BIOLOGY 699	Directed Studies	
B M E 399	Independent Study	
BMOLCHEM 699	Special Research Problems	
CBE 699	Advanced Independent Studies	
CHEM 699	Directed Study	
COMP BIO 699	Directed Study	
CRB 699	Independent Study	
CS&D 699	Directed Study	
ED PSYCH 470	Research Experience in Educational Psychology	
ED PSYCH 699	Independent Reading Undergrad	
FAM MED 699	Directed Study	
GENETICS 699	Special Problems	
H ONCOL 699	Independent Study in Human Cancer Biology	
KINES 399	Independent Study	
KINES 699	Independent Study	
MED PHYS 699	Independent Reading or Research	
MEDICINE 699	Independent Study	
MED SC-V 669	Small Animal Cardiology Rotation	
M M & I 699	Directed Study	
MOL BIOL 699	Directed Studies in Molecular Biology	
NEURSURG 699	Neurosurgery: Directed in Study in Research	
NEUROL 699	Directed Research in Neurology	
NEURODPT 699	Directed Study	
NUTR SCI 699	Special Problems	
OBS&GYN 699	Directed Study	
ONCOLOGY 699	Special Research Problems	
OPHTHALM 699	Directed Study	
PATH 699	Independent Study	
PATH-BIO 699	Directed Study	
PEDIAT 699	Independent Study	
PHMCOL-M 699	Independent Study	
PHM SCI 699	Advanced Independent Study	
PHYSIOL 699	Independent Work	
POP HLTH 699	Independent Reading	
PSYCH 621	Mentored Research and Seminar	
PSYCH 699	Directed Study	
PSYCHIAT 699	Independent Study	
SURGERY 699	Independent Study	
SURG SCI 699	Directed Study	
ZOOLOGY 699	Directed Studies in Zoology	

3. Honors/Senior Thesis (two semesters):

ZOOLOGY 681 & ZOOLOGY 682	Senior Honors Thesis and Senior Honors Thesis
ZOOLOGY 691 & ZOOLOGY 692	Senior Thesis and Senior Thesis
B M E 389 & B M E 489	Honors in Research and Honors in Research

Additional Electives (if needed)

Students may take additional credits from the list of Distributed Neuroscience Coursework, Independent/Directed study, or the following list, to attain 30 credits in the major:

Code	Title	Credits
ANAT&PHY 337	Human Anatomy	
ANAT&PHY 338	Human Anatomy Laboratory	
AN SCI/ DY SCI 362	Veterinary Genetics	
AN SCI/ DY SCI 434	Reproductive Physiology	
AN SCI/ F&W ECOL/ ZOOLOGY 520	Ornithology	
AN SCI 610	Quantitative Genetics	
ANATOMY 329		
BIOCHEM 507	General Biochemistry I	
BIOCHEM/ NUTR SCI 510	Nutritional Biochemistry and Metabolism	
BIOCHEM 601	Protein and Enzyme Structure and Function	
BIOCHEM/ GENETICS/ MICROBIO 612	Prokaryotic Molecular Biology	
BIOCHEM/ GENETICS/ MD GENET 620	Eukaryotic Molecular Biology	
BIOCHEM 625	Mechanisms of Action of Vitamins and Minerals	
F&W ECOL 401	Physiological Animal Ecology	
GENETICS 466	Principles of Genetics	
GENETICS 545	Genetics Laboratory	
GENETICS/ MD GENET 565	Human Genetics	
GENETICS/ BIOCHEM/ MD GENET 620	Eukaryotic Molecular Biology	
KINES 200	Introductory Neuroscience	
KINES 227	Introduction to Clinical Anatomy of Human Movement	
KINES 314	Physiology of Exercise	
M M & I 301	Pathogenic Bacteriology	
M M & I 341	Immunology	
M M & I/ENTOM/ PATH-BIO/ ZOOLOGY 350	Parasitology	
M M & I/ BIOCHEM 575	Biology of Viruses	
MICROBIO 303	Biology of Microorganisms	
MICROBIO 304	Biology of Microorganisms Laboratory	
MICROBIO 330		
MICROBIO 450	Diversity, Ecology and Evolution of Microorganisms	
MICROBIO 470	Microbial Genetics & Molecular Machines	
MICROBIO/ SOIL SCI 523	Soil Microbiology and Biochemistry	
MICROBIO 526	Physiology of Microorganisms	
MICROBIO 527	Advanced Laboratory Techniques in Microbiology	
MICROBIO 551	Capstone Research Project in Microbiology	
MICROBIO 607		
PATH-BIO/ M M & I 528	Immunology	
PL PATH/M M & I/ ONCOLOGY 640	General Virology-Multiplication of Viruses	
MICROBIO/ BMOLCHEM 668	Microbiology at Atomic Resolution	
NTP/NEURODPT/ PSYCH 611	Systems Neuroscience	
NTP 660	Neuroscience & Public Policy Seminar	
NUTR SCI 431	Nutrition in the Life Span	
NUTR SCI 631	Clinical Nutrition I	
ONCOLOGY 401	Introduction to Experimental Oncology	
ONCOLOGY/ M M & I/ PL PATH 640	General Virology-Multiplication of Viruses	
PHM SCI 558	Laboratory Techniques in Pharmacology and Toxicology	
PSYCH 449	Animal Behavior	
PSYCH 450	Primate Psychology: Insights into Human Behavior	
PSYCH 505	Depth Topic in Biological Science (Comparative Psychology: What Animals Think)	
ZOOLOGY/ ANTHRO/ BOTANY 410	Evolutionary Biology	
ZOOLOGY 425	Behavioral Ecology	
ZOOLOGY 430	Comparative Anatomy of Vertebrates	
ZOOLOGY 470	Introduction to Animal Development	
ZOOLOGY/ GEOSCI 541	Paleobiology	
ZOOLOGY/ GEOSCI 542	Invertebrate Paleontology	
ZOOLOGY 570	Cell Biology	

RESIDENCE AND QUALITY OF WORK

- 2.000 GPA in all major courses
- 2.000 GPA on 15 upper-level major credits, taken in residence [4]
- 15 credits in in the major, taken on the UW–Madison campus

HONORS IN THE MAJOR

Students may declare Honors in the Neurobiology Major in consultation with the Neurobiology undergraduate advisor(s).

HONORS IN THE MAJOR REQUIREMENTS

To earn Honors in the Major in Neurobiology, students must satisfy both the requirements for the major (above) and the following additional requirements:

- Earn a 3.300 University GPA
- Earn a 3.300 GPA for all major courses
- Complete 14 credits, taken for Honors, with individual grades of B or better, while in residence, to include:
  - Two courses from PSYCH 454, ZOOLOGY/PSYCH 523, and ZOOLOGY 500
  - One course from the Required Neuroscience or Distributed Neuroscience course lists (above), taken for honors credit
  - A two-semester Senior Honors Thesis[5], for a total of 6 credits, from:

Code	Title	Credits
BIOCHEM 681 & BIOCHEM 682	Senior Honors Thesis and Senior Honors Thesis	
BIOLOGY 681 & BIOLOGY 682	Senior Honors Thesis and Senior Honors Thesis	
B M E 389 & B M E 489	Honors in Research and Honors in Research	
CHEM 681 & CHEM 682	Senior Honors Thesis and Senior Honors Thesis	
CS&D 681 & CS&D 682	Senior Honors Thesis and Senior Honors Thesis	
GENETICS 681 & GENETICS 682	Senior Honors Thesis and Senior Honors Thesis	
H ONCOL 681 & H ONCOL 682	Senior Honors Thesis in Human Oncology 1 and Senior Honors Thesis in Human Oncology 2	
NUTR SCI 681 & NUTR SCI 682	Senior Honors Thesis and Senior Honors Thesis	
PSYCH 681 & PSYCH 682	Senior Honors Thesis and Senior Honors Thesis	
ZOOLOGY 681 & ZOOLOGY 682	Senior Honors Thesis and Senior Honors Thesis	

FOOTNOTES

1 Students may apply only one DNS course toward the elective requirement

2 Lab courses may also count in the Distributed Neuroscience Coursework above.

3 Only Directed Study courses taken **after**—and not concurrent with—the completion of an Introductory Biology sequence are accepted in the major.

4 Major courses numbered 300–699 are considered upper-level.

5 The Senior Honors Thesis project must be approved by the Neurobiology Major Program Committee at least one month before beginning the first course (681). The project must focus on its relevance to a neuroscience-related topic. Please see the Neurobiology major website (https://neuromajor.wisc.edu/) for more information.

UNIVERSITY DEGREE REQUIREMENTS

Total Degree	To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.
Residency	Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.
Quality of Work	Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.