NEUROBIOLOGY, B.A.

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/#requirementsforundergraduatetext) 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 (B.A.)

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.

Foreign Language
- Complete the fourth unit of a foreign language; OR
- Complete the third unit of a foreign language and the second unit of an additional foreign language.

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

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<tr>
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<td>MATH 221</td>
<td>Calculus and Analytic Geometry 1</td>
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<td>MATH 275</td>
<td>Topics in Calculus</td>
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<tr>
<td>Statistics (complete one):</td>
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<tr>
<td>STAT 371</td>
<td>Introductory Applied Statistics for the Life Sciences</td>
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<td>STAT/B MI 541</td>
<td>Introduction to Biostatistics</td>
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<td>BOTANY 575</td>
<td>Special Topics (Intro to Modern Statistical Methods for Biologists)</td>
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<td>General Chemistry (complete one):</td>
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<td>CHEM 103</td>
<td>General Chemistry I &amp; General Chemistry II</td>
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<td>CHEM 109</td>
<td>Advanced General Chemistry</td>
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<td>CHEM 115 &amp; CHEM 116</td>
<td>Chemical Principles I &amp; Chemical Principles II</td>
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<td>Organic Chemistry (complete one):</td>
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<td>CHEM 341</td>
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<td>Physics (complete one):</td>
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<td>PHYSICS 207 &amp; PHYSICS 208</td>
<td>General Physics &amp; General Physics</td>
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</table>
### Neurobiology, B.A.

**PHYSICS 247**
- A Modern Introduction to Physics

**PHYSICS 248**
- A Modern Introduction to Physics

**E M A 201**
- Statics

**E M A 202**
- Dynamics

**Total Credits**
- 24-33

### 30 CREDITS OF BIOLOGY AND NEUROBIOLOGY

Will be calculated from General Biology, Neurobiology, Lab/Research Experience and Additional Elective (if required) sections.

#### General Biology

<table>
<thead>
<tr>
<th>Code</th>
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<td>ZOOLOGY/</td>
<td>Introductory Biology</td>
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<td>BOTANY 151</td>
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<td>ZOOLOGY/</td>
<td>Introductory Biology</td>
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<td>BIOLOGY/</td>
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<td>BOTANY 152</td>
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**Biology Core Curriculum**
- Evolution, Ecology, and Genetics
- Cellular Biology
- Principles of Physiology
- Biological Interactions

**Animal Biology**
- Animal Biology
- Animal Biology Laboratory
- General Botany

**Neurobiology**

<table>
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<th>Title</th>
<th>Credits</th>
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<td>Neurobiology</td>
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<td>PSYCH 523</td>
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<td>PSYCH 454</td>
<td>Behavioral Neuroscience</td>
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<td>ZOOLOGY 500</td>
<td>Undergraduate Neurobiology Seminar</td>
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**Distributed Neuroscience Coursework—choose three courses**

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<td>ANAT&amp;PHY 435</td>
<td>Fundamentals of Human Physiology</td>
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<td>AN SCI/</td>
<td>Animal Physiology</td>
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<td>DY SCI 373</td>
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<tr>
<td>BIOCHEM 501</td>
<td>Introduction to Biochemistry</td>
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<tr>
<td>BIOCHEM 508</td>
<td>General Biochemistry II</td>
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**BIOCHEM/PHMCOL-M/ZOOLOGY 630**
- Cellular Signal Transduction
- Mechanisms

**BIOCHEM/NUTR SCI 645**
- Molecular Control of Metabolism
- Metabolic Disease

**B M E/CBE 520**
- Stem Cell Bioengineering

**B M E 601**
- 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

**GENETICS 520**
- Neurogenetics

**KINES 531**
- Neural Control of Movement

**NTP/NEURODPT 610**
- Cellular and Molecular Neuroscience

**NTP/NEURODPT/PSYCH 611**
- Systems Neuroscience

**NTP/ZOOLOGY 616**
- Lab Course in Neurobiology and Behavior

**NTP/NEURODPT 629**
- Molecular and Cellular Mechanisms of Memory

**NTP/NEURODPT 630**
- Neuronal Mechanisms for Sensation and Memory in Cerebral Cortex

**NTP/NEURODPT 631**
- Methods for Neuroimaging Research

**NTP 670**
- Stem Cells and the Central Nervous System

**NTP 675**
- Special Topics (Functional Brain Imaging of Cognitive Disorders)

**NTP 675**
- Special Topics (Molecular Mechanisms of Brain Damage)

**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

**PHM SCI 310**
- Drugs and Their Actions

**PHM SCI/PHMCOL-M 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 (Neuroeconomics)
PSYCH 603  Epigenetics and the Brain
PSYCH 606  Hormones and Behavior
PSYCH 612  Neuropharmacology
ZOOLOGY 400  Topics in Biology (Neurogenetics of Sleep)
ZOOLOGY 400  Topics in Biology (Music and the Brain)
ZOOLOGY 470  Introduction to Animal Development
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.

1. Neuroscience Laboratory Course—one course: 2
   BIOCORE 486  Principles of Physiology Laboratory
   ANAT&PHY 435  Fundamentals of Human Physiology
   ZOOLOGY 555  Laboratory in Developmental Biology
   ZOOLOGY 604  Computer-based Gene and Disease/Disorder Research Lab
   ZOOLOGY 612  Comparative Physiology Laboratory
   ZOOLOGY/NEURODPT/NTP 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 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 699  Independent Reading Undergrad
   FAM MED 699  Directed Study
   GENETICS 699  Special Problems
   H ONCOL 699  Independent Study in Human Cancer Biology
   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
   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 & Senior Honors Thesis
   ZOOLOGY 691 & ZOOLOGY 692  Senior Thesis & Senior Thesis
   B M E 389 & B M E 489  Honors in Research & 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:

1. Neuroscience Laboratory Course—one course: 2
   BIOCORE 486  Principles of Physiology Laboratory
   ANAT&PHY 435  Fundamentals of Human Physiology
   ZOOLOGY 555  Laboratory in Developmental Biology
   ZOOLOGY 604  Computer-based Gene and Disease/Disorder Research Lab
   ZOOLOGY 612  Comparative Physiology Laboratory
   ZOOLOGY/NEURODPT/NTP 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 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 699  Independent Reading Undergrad
   FAM MED 699  Directed Study
   GENETICS 699  Special Problems
   H ONCOL 699  Independent Study in Human Cancer Biology
   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
   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 & Senior Honors Thesis
   ZOOLOGY 691 & ZOOLOGY 692  Senior Thesis & Senior Thesis
   B M E 389 & B M E 489  Honors in Research & 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
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<td>AN SCI/ F&amp;W ECOL/ ZOOLOGY 520</td>
<td>Ornithology</td>
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<td>AN SCI 610</td>
<td>Quantitative Genetics</td>
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<td>ANATOMY 329</td>
<td>Human Anatomy-Kinesiology</td>
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<td>BIOCHEM 507</td>
<td>General Biochemistry I</td>
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<tr>
<td>BIOCHEM/ NUTR SCI 510</td>
<td>Nutritional Biochemistry and Metabolism</td>
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<td>BIOCHEM 601</td>
<td>Protein and Enzyme Structure and Function</td>
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<tr>
<td>BIOCHEM/ GENETICS/ MICR 612</td>
<td>Prokaryotic Molecular Biology</td>
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<td>BIOCHEM/ GENETICS/ MD GENET 620</td>
<td>Eukaryotic Molecular Biology</td>
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<tr>
<td>BIOCHEM 625</td>
<td>Mechanisms of Action of Vitamins and Minerals</td>
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<tr>
<td>BMOLCHEM 314</td>
<td>Introduction to Human Biochemistry</td>
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<td>BMOLCHEM 503</td>
<td>Human Biochemistry</td>
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<td>BMOLCHEM 504</td>
<td>Human Biochemistry Laboratory</td>
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<td>F&amp;W ECOL 401</td>
<td>Physiological Animal Ecology</td>
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<td>GENETICS 466</td>
<td>Principles of Genetics</td>
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<td>GENETICS/ MD GENET/ ZOOLOGY 562</td>
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<td>M M &amp; I 341</td>
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<td>MICROBIO 527</td>
<td>Advanced Laboratory Techniques in Microbiology</td>
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<td>PSYCH 449</td>
<td>Animal Behavior</td>
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<td>PSYCH 450</td>
<td>Primates and Us: Insights into Human Biology and Behavior</td>
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<td>Depth Topic in Biological Science (Comparative Psychology: What Animals Think)</td>
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<td>Comparative Anatomy of Vertebrates</td>
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<td>ZOOLOGY 470</td>
<td>Introduction to Animal Development</td>
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<td>ZOOLOGY/ GEOSCI 541</td>
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<td>ZOOLOGY/ GEOSCI 542</td>
<td>Invertebrate Paleontology</td>
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<tr>
<td>ZOOLOGY 570</td>
<td>Cell Biology</td>
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**RESIDENCE AND QUALITY OF WORK**

- 2.000 GPA in all major courses
- 2.000 GPA on 15 upper-level major credits, taken in residence
- 15 credits 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:

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<td>Senior Honors Thesis and Senior Honors Thesis</td>
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<tr>
<td>BIOLOGY 681 &amp; BIOLOGY 682</td>
<td>Senior Honors Thesis and Senior Honors Thesis</td>
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<tr>
<td>B M E 389 &amp; B M E 489</td>
<td>Honors in Research and Honors in Research</td>
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<td>CHEM 681 &amp; CHEM 682</td>
<td>Senior Honors Thesis and Senior Honors Thesis</td>
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<tr>
<td>CS&amp;D 681 &amp; CS&amp;D 682</td>
<td>Senior Honors Thesis and Senior Honors Thesis</td>
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**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.