Neuroscience, B.S.

Degree Offered
• Bachelor of Science

Nature of the Program
As the population of West Virginia and the nation age and as the opioid crisis expands, the demand for basic and applied neuroscience researchers and clinicians continues to grow. The goal of the BS in neuroscience program is to attract new students to West Virginia University from diverse cultural backgrounds and train them as neuroscience professionals. Students graduating from the BS in Neuroscience program are uniquely prepared for admission into advanced degree programs in neuroscience, biomedical engineering, medicine, and biomedical sciences at WVU or other institutions. These graduates are also prepared to serve in academic and technical positions in private industry as well as the broader healthcare industry.

Areas of Emphasis
• Behavioral Neuroscience
• Cellular, Molecular, and Systems Neuroscience

Minors
All students have the possibility of earning one or more minors; a list of all available minors and their requirements is available at http://catalog.wvu.edu/undergraduate/minors/. Please note that students may not earn a minor in their major field.

Certificate of Global Engagement
Students in the Eberly College, regardless of their major, can earn a Certificate of Global Engagement. Completion of the Certificate demonstrates the student’s knowledge of diverse cultures, as well as the ability to communicate and interact effectively with people of different cultural backgrounds. Students will be required to apply their knowledge of contemporary issues and global social contexts to their course work and their broader citizenship. For details regarding Certificate requirements, please visit the Eberly College page (http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/#otherdegreestext).

FACULTY

PROGRAM COORDINATOR
• Kris Martens - Ph.D. (Southern Illinois University - Carbondale)
  Behavioral Neuroscience, Recovery from Traumatic Brain Injury

PROFESSORS
• Kevin C. Daly - Ph.D. (University of Arizona)
  Sensory Neurobiology, Neural Coding, Brain-Behavior Interactions, Comparative Psychobiology
• Kevin T. Larkin - Ph.D. (University of Pittsburgh)
  Department of Psychology Chair. Clinical Health Psychology, Applied Psychophysiology, Cardiovascular Behavioral Medicine
• Randy Nelson - Ph.D. (Psychology; University of California - Berkeley), Ph.D. (Endocrinology; University of California - Berkeley)
  Hazel Ruby McQuain Chair for Neurological Research. Department of Neuroscience Chair. Disrupted Circadian Rhythms on Immune Functioning, Neuroinflammation, Metabolism, Sleep & Mood, Behavioral Neuroendocrinology
• Richard B. Thomas - Ph.D. (Clemson University)
  Physiological Plant Ecology, Forest Ecology, Global Climate Change

ASSOCIATE PROFESSORS
• Karen Anderson - Ph.D. (University of Florida)
  Behavioral Pharmacology, Self-Control & Impulsivity
• Melissa Blank - Ph.D. (Virginia Commonwealth University)
  Behavioral Neuroscience, Tobacco Use, Tobacco-Related Health Risks, Genetics of Substance Use
• Andrew Dacks - Ph.D. (University of Arizona)
  Neurobiology
• Sarah M. Farris - Ph.D. (University of Illinois - Urbana-Champaign)
  Evolution & Development of the Insect Brain, Neuroanatomy
• Jennifer Hawkins - Ph.D. (Iowa State University)
Neuroscience, B.S.

Department of Biology Chair. Plant Genomics
• Gary Marsat - Ph.D. (McGill University)
  Neurobiology
• John Navaratnam - Ph.D. (West Virginia University)
  Wetland ecology

ASSISTANT PROFESSORS
• Kevin Barry - Ph.D. (University of Maryland - College Park)
  Biology, Ecology, Evolution
• Sadie Bergeron - Ph.D. (University of Massachusetts - Amherst)
  Developmental Neurobiology
• Mariya Cherkasova - Ph.D. (McGill University)
  Behavioral Neuroscience, Addiction, Reward-Related Behavior
• Eric Horstick - Ph.D. (University of Michigan)
  Molecular Neuroscience, Functional Lateralization
• Kris Martens - Ph.D. (Southern Illinois University - Carbondale)
  Behavioral Neuroscience, Recovery from Traumatic Brain Injury
• Kathleen Morrison - Ph.D. (University of Tennessee - Knoxville)
  Behavioral Neuroscience, Stress, Development, Neuropsychiatric Disease
• Sharon Tenenholz - Ph.D. (University of California - Los Angeles)
  Teaching of Psychology, Curriculum Design, Academic Advising

Admissions
• First Time Freshmen are admitted to the major directly. For the timely completion of the degree, it is recommended that students have a minimum MATH ACT of 19, a MATH SAT of 510, or an ALEKS score of 30. Test optional students are encouraged to take ALEKS upon admission to the major.
• Students who transfer from another major at WVU must have a minimum overall GPA of a 2.0 and completed BIOL 115 & BIOL 116 and CHEM 115 & CHEM 115L with a C- or better.
• Students who transfer from another institution must have a minimum overall GPA of a 2.0 and completed BIOL 115 & BIOL 116 and CHEM 115 & CHEM 115L with a C- or better.

Due to Covid-19 – Admission requirements may differ from what is listed on this page. Please review the most up-to-date program admission requirements for the Bachelor of Science in Neuroscience (https://admissions.wvu.edu/academics/majors/neuroscience/) major.

ADMISSION REQUIREMENTS 2022-2023
The Admission Requirements above will be the same for the 2022-2023 Academic Year.

Major Code: 14C9

General Education Foundations
Please use this link to view a list of courses that meet each GEF requirement. (http://registrar.wvu.edu/gef/)

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

General Education Foundations

<table>
<thead>
<tr>
<th>General Education Foundations</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 - Composition &amp; Rhetoric</td>
<td>3-6</td>
</tr>
<tr>
<td>ENGL 101 &amp; ENGL 102 or ENGL 103</td>
<td>Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research or Accelerated Academic Writing</td>
</tr>
<tr>
<td>F2A/F2B - Science &amp; Technology</td>
<td>4-6</td>
</tr>
<tr>
<td>F3 - Math &amp; Quantitative Reasoning</td>
<td>3-4</td>
</tr>
<tr>
<td>F4 - Society &amp; Connections</td>
<td>3</td>
</tr>
<tr>
<td>F5 - Human Inquiry &amp; the Past</td>
<td>3</td>
</tr>
<tr>
<td>F6 - The Arts &amp; Creativity</td>
<td>3</td>
</tr>
<tr>
<td>F7 - Global Studies &amp; Diversity</td>
<td>3</td>
</tr>
</tbody>
</table>
Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

**Degree Requirements**

Students must complete WVU General Education Foundations requirements, College B.S. requirements, major requirements, and electives with a minimum of 120 hours. For complete details on these requirements, visit the B.S. Degrees tab on the Eberly College of Arts and Sciences (http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/#bachelorofsciencetext) page.

**Departmental Requirements for the B.S. in Neuroscience**

- **Capstone Requirement**: The university requires the successful completion of a capstone course: NRSC 320 Neuroscience Research Capstone.
- **Writing and Communication Skills Requirement**: Students in the Neuroscience Bachelor of Science complete this requirement by completing ENGL 101 and ENGL 102, or ENGL 103 and BIOL 115, BIOL 117, BIOL 219 and NRSC 201.
- **Calculation of the Grade Point Average (GPA) in the Neuroscience major**: Students must maintain an overall GPA of 2.0 or higher in all courses applied to the Neuroscience Major Requirements. A minimum grade of C- is required in NRSC 101 and BIOL 219. If a course is repeated, all attempts will be used to calculate the GPA in the Neuroscience major.
- **Area of Emphasis (AOE)**: Students must select an area of emphasis and complete all requirements for the selected AOE.
- **Benchmark Expectations**: For details, go to the Neuroscience Degree Progress tab (http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/neuroscience/#degreeprogresstext).

**Curriculum Requirements**

**University Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Requirements</td>
<td>38</td>
</tr>
<tr>
<td>ECAS B.S. Requirements</td>
<td>12</td>
</tr>
<tr>
<td>Departmental Requirements</td>
<td>16</td>
</tr>
<tr>
<td>Neuroscience Major Requirements</td>
<td>54</td>
</tr>
<tr>
<td>Total Hours</td>
<td>120</td>
</tr>
</tbody>
</table>

**University Requirements**

- General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)
- Outstanding GEF Requirements 1, 5, 6, and 7 | 15 |
- NRSC 191 First-Year Seminar | 1 |
- General Electives | 22 |
- Total Hours | 38 |

**ECAS Bachelor of Science Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECAS B.S. Requirements</td>
<td>12</td>
</tr>
<tr>
<td>Global Studies and Diversity Requirement</td>
<td></td>
</tr>
<tr>
<td>Math Requirement (Select One)</td>
<td></td>
</tr>
<tr>
<td>MATH 155</td>
<td>Calculus 1</td>
</tr>
<tr>
<td>MATH 153 &amp; MATH 154</td>
<td>Calculus 1a with Precalculus and Calculus 1b with Precalculus</td>
</tr>
<tr>
<td>MATH 150</td>
<td>Applied Calculus</td>
</tr>
<tr>
<td>Science Requirement</td>
<td></td>
</tr>
<tr>
<td>See Eberly College of Arts and Sciences B.S. tab. Credits may vary depending on overlap with GEF and major requirements.</td>
<td></td>
</tr>
<tr>
<td>Credits may vary depending on course selection.</td>
<td></td>
</tr>
<tr>
<td>Total Hours</td>
<td>12</td>
</tr>
</tbody>
</table>

**Departmental Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM Foundation Courses</td>
<td>16</td>
</tr>
<tr>
<td>BIOL 115</td>
<td>Principles of Biology</td>
</tr>
<tr>
<td>&amp; BIOL 116</td>
<td>and Principles of Biology Laboratory</td>
</tr>
</tbody>
</table>
Neuroscience, B.S.

BIOL 117 & BIOL 118
Introductory Physiology and Introductory Physiology Laboratory

CHEM 115 & 115L
Fundamentals of Chemistry and Fundamentals of Chemistry 1 - Laboratory
or CHEM 117 & 117L
Principles of Chemistry 1 and Principles of Chemistry 1 - Laboratory

CHEM 116 & 116L
Fundamentals of Chemistry and Fundamentals of Chemistry 2 - Laboratory
or CHEM 118 & 118L
Principles of Chemistry 2 and Principles of Chemistry 2 - Laboratory

Total Hours 16

Neuroscience Major Requirements

Core Courses 20
BIOL 219 & BIOL 220
The Living Cell and The Living Cell Laboratory
BIOL 348
Neuroscience 1
BIOL 349
Neuroscience 2
NRSC 101
Introduction to the Neural Sciences
NRSC 201
Biological Foundations of Behavior
PSYC 101
Introduction to Psychology

Research Methods 6
Select one option:
PSYC 203 & PSYC 204
Research Methods & Analysis 1 and Research Methods & Analysis 2
STAT 211 & BIOL 302
Elementary Statistical Inference and Biometry
STAT 211 & STAT 312
Elementary Statistical Inference and Intermediate Statistical Methods

Advanced Chemistry 4
Select one course:
BIOC 339
Introduction to Biochemistry
CHEM 231 & 231L
Organic Chemistry: Brief Course and Organic Chemistry: Brief Course - Laboratory
CHEM 233 & CHEM 235
Organic Chemistry and Organic Chemistry Laboratory

Area of Emphasis 12
Select one Area of Emphasis:
Behavioral Neuroscience
Cellular, Molecular, & Systems Neuroscience

Neuroscience Electives: 9
Complete 9 credits from one area outside the AoE at the 300 level or above

CAPSTONE: 3
NRSC 320
Neuroscience Research Capstone

Total Hours 54

* Excluding BIOL 490 and 491, PSYC 490 and 491, and NRSC 490 and 491.

SUGGESTED PLAN OF STUDY

First Year

Fall Hours Spring Hours
BIOL 115 4 BIOL 117 4
& BIOL 116 (GEF 2; B.S. First Area 1) & BIOL 118 (GEF 8; B.S. First Area 2)
### Areas of Emphasis Offered:

- Behavioral Neuroscience (p. 5)
- Cellular, Molecular, & Systems Neuroscience (p. 6)

### BEHAVIORAL NEUROSCIENCE AOE REQUIREMENTS:

This focused training will prepare the graduate for careers from basic research to translational or clinical settings. Students interested in medicine or other healthcare-related fields should consider this option.

#### Behavior Neuroscience Courses:

Select a minimum of 12 credits from the following options:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 339</td>
<td>Animal Communication</td>
</tr>
<tr>
<td>BIOL 439</td>
<td>Neuroethology</td>
</tr>
<tr>
<td>PSYC 302</td>
<td>Behavior Principles</td>
</tr>
<tr>
<td>PSYC 423</td>
<td>Cognition and Memory</td>
</tr>
<tr>
<td>PSYC 425</td>
<td>Perception</td>
</tr>
<tr>
<td>PSYC 426</td>
<td>Physiological Psychology</td>
</tr>
<tr>
<td>PSYC 427</td>
<td>Psychobiology of Sleep</td>
</tr>
<tr>
<td>PSYC 428</td>
<td>Hormones and Behavior</td>
</tr>
</tbody>
</table>

Total Hours: 12
CELLULAR, MOLECULAR, & SYSTEMS NEUROSCIENCE AOE REQUIREMENTS:

This focused training will prepare the graduate for careers from basic research to translational or clinical settings. Students interested in medicine or other healthcare-related fields should consider this option.

Cellular, Molecular, & Systems Neuroscience Courses:

Select a minimum of 12 credits from the following options:

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>BIOL 339</td>
<td>Animal Communication</td>
</tr>
<tr>
<td>BIOL 439</td>
<td>Neuroethology</td>
</tr>
<tr>
<td>BIOL 474</td>
<td>Neurogenetics and Behavior</td>
</tr>
<tr>
<td>BIOL 475</td>
<td>Neurobiological Diseases</td>
</tr>
<tr>
<td>BIOL 476</td>
<td>Computational Neuroscience</td>
</tr>
<tr>
<td>BIOL 478</td>
<td>Sensory Neural Systems and Behavior</td>
</tr>
<tr>
<td>BIOL 479</td>
<td>Principles of Systems Neuroscience</td>
</tr>
</tbody>
</table>

Total Hours 12

Degree Progress

• By the end of their third semester into the major, students should have completed the following classes with a minimum grade of C-:
  • BIOL 115 & BIOL 116
  • BIOL 117 & BIOL 118
  • BIOL 219 & BIOL 220
  • CHEM 115 & CHEM 115L
  • NRSC 101
  • PSYC 101
• Students must meet with their neuroscience adviser at least once per semester.

Students who do not meet their benchmarks may be removed from the major.

Major Learning Outcomes

NEUROSCIENCE

This B.S. curriculum will provide a comprehensive introduction to the field of neuroscience and many of the professional skills needed for post-graduation career options.

Upon completion of the B.S. in Neuroscience program at WVU, the graduate will be able to:

1. Describe the structure and function of the nervous system at the molecular, cellular, and behavioral/organismal levels.
2. Apply fundamental principles underlying the organization and function of the nervous system across sub-systems and species.
3. Synthesize information from across the field of neuroscience to:
   a. Read and comprehend basic neuroscience literature
   b. Critically evaluate new neuroscience research and emerging techniques
   c. Establish testable hypotheses
   d. Design approaches to test hypotheses about nervous system function
4. Collect, analyze, and interpret basic neuroscience research data
5. Communicate research via a variety of venues including:
   a. Written reports
   b. Oral presentation of journal articles
   c. Poster-based oral presentations of their research

COURSES

NRSC 101. Introduction to the Neural Sciences. 3 Hours.
Introduction to neuroscience that includes a survey of the history of neuroscience and an intensive exploration of its sub-fields.

NRSC 191. First-Year Seminar. 3 Hours.
Engages students in active learning strategies that enable effective transition to college life at WVU. Students will explore school, college and university programs, policies and services relevant to academic success. Provides active learning activities that enable effective transition to the academic environment. Students examine school, college and university programs, policies and services.
NRSC 201. Biological Foundations of Behavior. 4 Hours.
PR: NRSC 101 and PSYC 101 and (PSYC 204 or BIOL 219 and BIOL 220). Introduction to brain and behavior. Survey of fundamental concepts in understanding the workings of the nervous system and resulting behavior in human and non-human animals. Includes laboratory exercises.

NRSC 298. Honors. 1-3 Hours.
PR: Students in the Honors Program and consent by the honors director. Independent reading, study, or research.

NRSC 320. Neuroscience Research Capstone. 3 Hours.
PR: BIOL 348. Neuroscience research experience incorporating critical skills of being a research scientist, including writing grant proposals, manuscripts, and materials for presentation of results in a public forum. Students conceive, design, propose, execute, analyze, and report an experiment with a Neuroscience focus. Fulfills the capstone requirement in neuroscience and provides a realistic exposure to performing scientific research.