BEHAVIORAL NEUROSCIENCE

Program Overview
The Behavioral Neuroscience major educates the next generation of scientists with a foundation in biological sciences and behavioral neuroscience. Students in the behavioral neuroscience major are prepared to join the workforce or attend professional or graduate school. Rider achieves this through small class and laboratory sizes, faculty accessibility, and guidance tailored to each student's needs. Areas of professional and graduate study include medical, dental, and veterinary school; allied health programs in optometry, podiatry, physical therapy, occupational therapy, nursing; as well as programs leading to M.S. or Ph.D. degrees in the life sciences; and programs in science education.

Students in this major can have direct, hands-on instruction and guidance through the Science Learning Community (SLC). The SLC was established to provide academic and social support for science majors and is open to all students studying science. The program includes residence hall-based tutoring and mentoring programs, as well as social programming for science majors to enhance their knowledge and experience outside of the classroom.

Many graduates of the Behavioral Neuroscience program have pursued graduate studies at prestigious institutions including Johns Hopkins University, University of Pennsylvania, Dartmouth College and Cornell University. Others have entered medical school, or have gone on to become educators, surgical assistants, marine biologists, mental health technicians, nurses, behavioral therapists, occupational therapists or physical therapists.

Curriculum Overview
The curriculum for majors has been shaped to prepare students for a life of learning in the sciences. Rider's faculty are research-oriented, and encourage students to take advantage of the opportunity to engage in independent research and internships. Students are expected to gain knowledge, and develop technical and analytical skills and competency in writing and speaking. Classes include coursework focused on the principles of evolution and diversity, neuroscience, and psychology, among other courses. Students also have the opportunity to take part in three-week internship courses through the Capital Health System Hospitals, summer research and other off-site internships.

Student Learning Outcomes
Graduates of the Behavioral Neuroscience major will be able to:

1. Explain foundational concepts in biological sciences.
2. Apply scientific methods of inquiry through testing of newly formed hypotheses with observation and experimentation.
3. Apply concepts from other disciplines in the analysis and interpretation of biological information.
4. Demonstrate the ability to locate, critically analyze, and communicate relevant scientific information.
5. Explain the ethical practice of scientific research and its societal applications.

Honors Programs
Honors in Behavioral Neuroscience
The objective of the honors program in Behavioral Neuroscience is to introduce talented undergraduate majors to the methods of basic research in behavioral neuroscience. Qualified biology or behavioral neuroscience majors may participate in the Departmental Honors program. For consideration, a student must have at least a 3.25 overall grade point average at the end of their junior year. In the senior year, a student seeking Honors must write and orally defend a written honors thesis based upon their independent research. A candidate who has a 3.25 cumulative average, a 3.5 average in their science courses, and who has completed an acceptable Honors research, will be awarded Honors in Behavioral Neuroscience upon graduation.

Beta Beta Beta Biological Honor Society
"Tri-Beta" is a national honor society affiliated with the American Association for Advancement of Science and the American Institute of Biological Sciences. Invitations for membership are extended to majors in the life sciences who have demonstrated superior academic achievement. Students are usually invited to join their sophomore year when they have accumulated 12 credits in the sciences. Active membership is available to those with an overall grade point average of at least 2.8, and at least 3.0 in their science courses. The benefits of membership include academic recognition; a subscription to the journal Bios, to which members may submit research articles; opportunities to present papers at conventions; and research awards. Behavioral neuroscience majors should make membership in Tri-Beta one of their goals.

Pre-medical and Pre-allied Health Advising Programs
The premedical studies and pre-allied health advising programs assist students with academic and extra-curricular planning required to become competitive applicants for programs in the health professions.

Rider and Thomas Jefferson University have a long-standing articulation agreement for students who wish to pursue training in the allied health professions. This agreement does not guarantee admission of Rider students into Jefferson's programs; it does mean that Rider faculty members are familiar with Jefferson's academic requirements and that Rider's courses are eligible for transfer to Jefferson.

Degrees Offered
• B.S. in Behavioral Neuroscience

Contact
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Professor and Chairperson
Science Hall 339D
609-895-5421
pjivoff@rider.edu

Program Website: Behavioral Neuroscience (http://www.rider.edu/academics/colleges-schools/college-liberal-arts-education-sciences/science-programs/biology-behavioral-neuroscience)
Associated Department: Department of Biology, Behavioral Neuroscience, and Health Sciences (http://www.rider.edu/academics/colleges-schools/college-liberal-arts-education-science/science-programs/biology-behaviora)

Related Programs
- Biology (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/biology)
- Chemistry (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/chemistry)
- Health Sciences (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/healthsciencesbs)
- Mathematics (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/mathematics)
- Psychology (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/psychology)

Major Requirements
(51-54 credits)

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See CLAS General Education Curriculum Page (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/general_education_requirements)

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<th>Biology</th>
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<tr>
<td>BNS 275</td>
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Select two of the following: 8

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<tr>
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<td>BNS 360</td>
<td>Neurochemistry &amp; Neurochemistry Lab</td>
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<td>BNS 375</td>
<td>Neuroethology: Circuits of Behavior &amp; Lab</td>
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Select one of the following

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Mathematics

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<td>ENV 200</td>
<td>Statistical and Computer Applications in the Natural Sciences &amp; 200L</td>
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<td>PSY 201</td>
<td>Statistics and Research Design (requires PSY 105 prerequisite) ²</td>
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Chemistry

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<td>CHE 122</td>
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<td>CHE 123</td>
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Biology/Psychology Electives

Select two (2) of the following: 6-8

Upper-level Biology Course

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<tr>
<td>BIO 260</td>
<td>Principles of Biology: Evolution, Diversity, and Cells &amp; 260L</td>
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<td>BIO 300 &amp; 300L</td>
<td>Developmental Biology &amp; Developmental Biology Lab</td>
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<td>BIO 305 &amp; 305L</td>
<td>Vertebrate Physiology &amp; Vertebrate Physiology Lab</td>
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<td>BIO 321</td>
<td>Microbiology &amp; Microbiology Lab</td>
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<td>BIO 335 &amp; 335L</td>
<td>Modern Plant Biology &amp; Modern Plant Biology Lab</td>
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<td>BIO 340</td>
<td>Evolutionary Biology &amp; Evolutionary Biology Lab</td>
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<td>BIO 350 &amp; 350L</td>
<td>General Ecology &amp; General Ecology Lab</td>
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<td>BIO 370</td>
<td>Immunology &amp; Immunology Lab</td>
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<tr>
<td>BIO 372</td>
<td>Behavior of Marine Organisms: Evolutionary &amp; 372L</td>
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<td></td>
<td>Approach &amp; Beh Mar Org: Evol Apprch Lab</td>
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Any PSY 200-level or higher course

Additional Electives

Select one (1) of the following: 4

Any additional BNS 300-level course with a lab
Any PSY 300-level course with a lab
Any BCH 200 or higher course with a lab

Senior Capstone Seminar
BNS 415 Seminar in Behavioral Neuroscience 3
Total Credits 51-54

Students must earn a grade of "C" or better in this course to meet the major requirements and before enrolling in upper-level courses for which these courses are prerequisites.

Students must place into MTH 105 Algebra & Trigonometry or higher level mathematics in order to register for BIO 115, BIO 116 and BNS 275.

Department of Biology, Behavioral Neuroscience, and Health Sciences Course Repeat Policy

The following guidelines apply to courses offered by the Department of Biology, Behavioral Neuroscience, and Health Sciences. Students may not repeat any biology (BIO), behavioral neuroscience (BNS) or health sciences (HSC) course without special permission. A course will be considered repeated if the student has previously earned a letter grade in the course, or if the student has previously withdrawn from the course during Withdrawal II or Withdrawal III. If a student wishes to retake a biology, behavioral neuroscience or health science course, permission must be submitted by the departmental chairperson before the registrar will allow the student to enroll in that course.

4 Year Academic Plan of Study

The following educational plan is provided as a sample only. Rider students who do not declare a major during their freshman year; who change their major; or those who transfer to Rider may follow a different plan to ensure a timely graduation. Each student, with guidance from his or her academic advisor, will develop a personalized educational plan.

Course Title Credits Year 1
Fall Semester
BIO 115 Principles of Biology I and Principles of Biology I Lab 4
& 115L
CHE 120 Principles of Chemistry 3
CHE 121 Principles of Chemistry Lab 1
MTH 105 Algebra and Trigonometry 4
CMP 120 Expository Writing 3
NCT 010 Freshman Seminar 0
Semester Credit Hours 15

Spring Semester
BIO 116 Principles of Biology II and Principles of Biology II Lab 4
& 116L
CHE 122 Intro to Chemical Systems 3
CHE 123 Quantitative Methods Lab 1
CMP 125 Research Writing 3
Social Perspectives 3
Semester Credit Hours 14

Year 2
Fall Semester
BNS 275 Behavioral Neuroscience and Behavioral Neuroscience Lab 4
& 275L
BNS 250 Biostatistics and Biostatistics Lab 4

Semester Credit Hours 17

Spring Semester
BNS 310 Neurobiology and Neurobiology Lab 4
BCH 225 Introduction to Organic and Biochemistry and Introduction to Organic & Biochemistry Lab 4
HIS 151 World History Since 1500 3
Foreign Language 3
Aesthetic Perspectives: Fine Arts 3
Semester Credit Hours 16

Year 3
Fall Semester
Upper-level Neuroscience (select one) 4
BNS 360 Neurochemistry and Neurochemistry Lab
& 360L
BNS 375 Neuroethology: Circuits of Behavior and Neuroethology Lab
& 375L
Social Perspectives 3
Foreign Language 3
Philosophical Perspective 3
Semester Credit Hours 16

Spring Semester
Biology/Psychology Elective (select one) 3-4
BIO 215 Medical Microbiology and Microbiology Lab
& 215L
BIO 260 Principles of Biology: Evolution, Diversity, and Biology of Cells and Principle of Biology: Cells Lab
& 260L
BIO 265 Genetics and Genetics Lab
& 265L
BIO 272 Intro to Marine Biology and Marine Biology Laboratory
& 272L
BIO 300 Developmental Biology and Developmental Biology Lab
& 300L
BIO 305 Vertebrate Physiology and Vertebrate Physiology Lab
& 305L
BIO 321 Microbiology and Microbiology Lab
& 321L
BIO 335 Plant Biology and Modern Plant Biology Lab
& 335L
BIO 340 Evolutionary Biology and Evolutionary Biology Lab
& 340L
BIO 350 General Ecology and General Ecology Lab
& 350L
BIO 370 Immunology and Immunology Lab
& 370L
BIO 372 Behavior of Marine Organisms: Evolutionary Approach and Behavior of Marine Organisms: Evolutionary Approach Lab
& 372L
Any 200-level PSY course
Behavioral Neuroscience

Aesthetic Perspectives: Literature 3
Elective Course 3
Elective Course 3
Elective Course 3

Semester Credit Hours 15-16

Year 4
Fall Semester
Upper-level Neuroscience 4
BNS 360 Neurochemistry or BNS 375 Neuroethology
Elective Course 3
Elective Course 3
Elective Course 3
Elective Course 3

Semester Credit Hours 16

Spring Semester
Biology/Psychology Elective 3-4
BNS 415 Seminar in Behavioral Neuroscience 3
Elective Course 3
Elective Course 3
Elective Course 3

Semester Credit Hours 15-16
Total Credit Hours for Graduation 122-124

Notes:
1. Please note that elective credits may be used to complete requirements in a second major or minor.
2. Natural and Physical Sciences and Mathematics core requirement included in a major.

Courses and Descriptions

BNS 107 Life Science: Brain and Behavior 3 Credits
An introduction to the biology of the human brain and the rest of the human nervous system. Topics in neuroscience are covered in molecular, cellular, and systematic terms. Additional material is presented on the origins and effects of neurological and psychiatric diseases. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

BNS 250 Biostatistics 4 Credits
This course will assist students with acquiring the skills necessary to design, conduct, and interpret research studies. Emphasis will be on learning how to develop experimental designs to translate theoretical concepts into testable hypotheses. Experiments conducted during laboratory sessions will use laboratory mice and will use equipment for measuring animal behavior. Students will gain experience collecting, analyzing, writing and orally presenting their research results. Three hours of lecture and one three-hour lab per week. Prerequisite(s): MTH 105 or higher or placement into MTH 210, grade of "C" or better in one lab science course.
Corequisite(s): BNS 250L.

BNS 250L Biostatistics Lab 0 Credits
This lab is a co-requisite and must be taken with the corresponding course. Corequisite(s): BNS 250.

BNS 275 Behavioral Neuroscience 4 Credits
An introductory behavioral neuroscience course including basic neuroanatomy and neurophysiology of movement, ingestive, reproductive, emotional, and learning behaviors. Emphasis is on the structure/function relationships that allow animals to make appropriate physiological and behavioral responses to the environment. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115 & BIO 116.
Corequisite(s): BNS 275L.

BNS 275L Behavioral Neuroscience Lab 0 Credits
This lab is a co-requisite and must be taken with the corresponding course.
Corequisite(s): BNS 275.

BNS 310 Neurobiology 4 Credits
A lecture-laboratory course investigating the structure and function of the nervous system. Lecture topics include organization of the nervous system, neuroanatomy, neurophysiology, neurochemistry, physiology of sensory systems, biological aspects of nervous system diseases, and behavior. Laboratory exercises include study of anatomy of the nervous system, nerve cell recording, modern neuroanatomical techniques, and the neural basis of animal behavior. Three hours of lecture and one three-hour per week. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course. Corequisite(s): BNS 310L.

BNS 310L Neurobiology Lab 0 Credits
This lab is a co-requisite and must be taken with the corresponding course.
Corequisite(s): BNS 310.

BNS 360 Neurochemistry 4 Credits
Examines the fundamentals of neurochemistry, including the neuroanatomical distribution, pharmacology, and functions of neurotransmitters; signal transduction pathways; behavioral and physiological effects of chemicals either used therapeutically to treat biopsychological disorders or that may be abused for their psychotropic effects; and mechanisms and models for the study of drug action. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116, CHE 122, CHE 123 with a grade of C or better in each course.
Corequisite(s): BNS 360L.

BNS 360L Neurochemistry Lab 0 Credits
This lab is a co-requisite and must be taken with the corresponding course. Corequisite(s): BNS 360.

BNS 375 Neuroethology 4 Credits
The study of the neural and physiological basis of animal behavior. This course focuses on the specific behavioral problems faced by animals in their natural habitats, and the ways in which their nervous systems solve these problems. The mechanisms that underlie complex behaviors such as spatial orientation and navigation, escape mechanisms, and animal communication will be examined, as well as the extraordinary sensory adaptation of organisms to their environments (e.g., echolocation, electroreception, and magnetic reception). The neural control of motor programs and temporally-patterned behaviors will be studied in simpler neuronal systems. Finally, recent cellular and molecular approaches to the study of behavior will be addressed. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course.
Corequisite(s): BNS 375L.
BNS 375L Neuroethology Lab 0 Credits
This lab is a co-requisite and must be taken with the corresponding course.
Corequisite(s): BNS 375.

BNS 415 Seminar in Behavioral Neuroscience 3 Credits
Critical analysis of the scientific literature pertaining to current topics in behavioral neuroscience. Topics include mechanisms through which the brain influences physiology and behavior and the integration of nervous and endocrine systems. Three hours of lecture per week.
Prerequisite(s): BIO 115, BIO 116 or BNS 118, BIO 117, junior standing and permission of instructor.

BNS 490 Independent Study: Research and Creative Expression 1-4 Credits
Immerses the student in laboratory research. The student learns to organize material, use the literature, make precise measurements, and obtain reproducible data. If possible, the student will publish the results or present them at a scientific meeting.

BNS 491 Internship in Behavioral Neuroscience 1-4 Credits
A supervised work experience in an approved organization where qualified students gain real-world knowledge and utilize their academic training in a professional environment. Placement may be in private, public, non-profit, or governmental organizations. These can include educational or research institutions. The method of evaluation will be formalized prior to the approval of the internship by the sponsoring faculty and should include keeping a journal of activities, a term paper or project report and a poster presentation.
Prerequisite(s): 2.5 GPA and permission of the instructor.