Neuroscience is one of the newest and most exciting areas of study in the sciences. It integrates aspects of both biology and psychology in the investigation of the brain and behavior. The Neuroscience Program at Bowdoin College is an interdisciplinary program that provides students with a wealth of opportunities to explore the brains and the nervous systems of species ranging from invertebrates to humans. With four full-time faculty members in neuroscience, Bowdoin has one of the largest programs in the country at a small liberal arts college.

The research and activity in Bowdoin’s neuroscience laboratories are both diverse and complementary. Though the faculty have their own areas of specialization, they work collaboratively with students, colleagues, and scholars throughout the world. The program includes many of the courses taught in both biology and psychology at Bowdoin. Introductory courses in both departments provide a solid grounding in the principles and concepts that form the core of knowledge upon which the field of neuroscience has developed, as well as in the nature of experimentation in these fields.

Neuroscience is an exciting major for students intending to continue in research in neuroscience or in related areas of biology or psychology, for students interested in pursuing careers in medicine, and for those who simply find the subject interesting and wish to pursue it as part of a liberal education.

The Curriculum

Students wishing to major in neuroscience take one of two introductory-level neuroscience courses to provide an introduction to the field. A series of mid-level laboratory courses, including Neurophysiology, Molecular Neurobiology, a course in learning and memory, and a course on social behavior, provide students with more in-depth experience and laboratory work in areas of neuroscience ranging from molecular to cognitive. More specialized courses, including upper-level seminars, allow students to pursue areas of interest to them. These courses cover such diverse topics as neurobiology, developmental neuroscience, hormones and behavior, and animal cognition.

The Major Program

The major in neuroscience consists of twelve courses, including an introductory course in neuroscience (either Introduction to Neuroscience or Physiological Psychology), as well as Introduction to Psychology, either Introductory Biology or Biological Principles II, as well as Organic Chemistry I, and a data analysis course in psychology.

Students then take three of a group of four midlevel laboratory courses in neuroscience designed to give them exposure to many aspects of the field: Molecular Neurobiology, Neurophysiology, Laboratory in Behavioral Neuroscience: Social Behavior, and Laboratory in Behavioral Neuroscience: Learning and Memory.

The major culminates in an upper-level seminar in neuroscience; the specific topics for these may vary from year to year, but in recent years they have included: Hormones and Behavior, Comparative Neuroanatomy, Comparative Animal Cognition, Memory and Brain, Topics in Neuroscience, and Developmental Neurobiology.

Facilities & Resources

Bowdoin has excellent facilities for both teaching and research in neuroscience. Kanbar Hall, opened in 2004, houses brand new state-of-the-art research and teaching facilities for the Neuroscience Program. These are equipped for multi-channel recordings and behavioral experiments in awake rats, as well as experiments involving hormonal manipulations and behavior in lower vertebrates. Extensive facilities for computerized data acquisition and analysis are used in all the neuroscience laboratories.

The laboratories in Stanley F. Druckenmiller Hall, Bowdoin’s 106,000-square-foot interdisciplinary science facility, are well equipped for cellular- and molecular-level neuroscience. Students in courses routinely record the activity of nerves using a variety of extracellular amplifiers, and they record intracellularly from individual neurons using microelectrodes. An impressive array of up-to-date neurophysiological equipment is available in the research labs. Students also strain for specific neuronal molecules, including transmitters and growth factors, which they can then visualize using fluorescent microscopy. Druckenmiller houses a specialized laser scanning confocal microscope, as well as a scanning electron microscope, and a number of conventional fluorescent microscopes, all of research quality.

The Hatch Science Library, located on the second floor of the Druckenmiller science building, houses science-related materials such as books, periodicals, maps, and electronic resources.

The remaining three elective courses are taken from a specific group of psychology, biology, physics, and computer science courses.
Neuroscience

Independent Study and Honors Program

One of the strengths of the Neuroscience Program at Bowdoin is the number and breadth of research opportunities available to students. Advanced neuroscience majors are encouraged to undertake a program of independent study or honors research in the senior year. In addition, many students pursue research at Bowdoin over the summer or during their sophomore and junior years. Students work closely with faculty members on projects of their own interest or on projects related to the research interest of the faculty member. In this setting, students are able to apply the skills they have learned in other courses, and to develop their skills in experimental design, critical thinking, and scientific writing. Student projects are often of very high quality. Students have been co-authors with faculty on a number of publications, and honors students frequently present their research at regional or national neuroscience meetings.

The program encourages students who are interested in the honors program to begin planning early, as it is often possible for students to begin their research during the summer after their junior year or earlier. This concentrated research time has been a valuable educational experience for many majors. Students pursuing honors in neuroscience give oral presentations at the end of each semester and write a senior thesis.

Faculty

Patsy S. Dickinson, Josiah Little Professor of Natural Sciences, A.B. (Pomona), M.S., Ph.D. (Washington), teaches comparative physiology and neurobiology. Her research focuses on the control of behavior by neural networks in simple model systems such as those found in crustaceans.

Hadley Wilson Horsch, assistant professor of biology and neuroscience, B.A. (Swarthmore), M.A. (SUNY–Stony Brook), Ph.D. (Duke), teaches introductory neuroscience courses as well as upper-level courses in molecular-level neuroscience. Her research focuses on mechanisms of neuronal regeneration in simple model systems such as the cricket and crayfish.

Paul A. Lipton, adjunct assistant professor of psychology and neuroscience, B.A. (SUNY–Buffalo), M.A. (SUNY–Stony Brook), Ph.D. (Boston University), teaches courses on memory, drugs and behavior, and general psychology. His research focuses on how anatomically connected brain regions interact to support aspects of episodic memory and spatial navigation.

Seth J. Ramus, assistant professor of psychology and neuroscience, B.A. (California–Berkeley), M.S., Ph.D. (California–San Diego), teaches courses in animal cognition, neuro-psychology, and learning and memory. His research focuses on the brain basis for long-term memory in mammalian species.

Richmond R. Thompson, associate professor of psychology and neuroscience, B.S. (Furman), Ph.D. (Cornell), teaches courses in neuroendocrinology. His research focuses on the neurochemistry of social behavior in species ranging from lower vertebrates to humans.

Honors Projects

Recent honors projects completed by majors in the program have included:

- Quantification of Vasotocin Release in Response to Sex Pheromones in Roughskin Newts
- Cortical Representations of Hippocampally-Dependent Declarative Memory in Rats
- Neuropeptides and Social Behavior: Gene Sequences for Alternative Versions of the Vasotocin Receptor in the Goldfish Brain
- The Relationship of Vasotocin Gene Activity and Social Approach Behavior in Goldfish (C. auratus)
- The Role of Semaphorin during Compensatory Regeneration in Cricket Auditory Internurons
- Differences in Hippocampus Formation and Septum Volumes in Storing and Non-Storing Birds across Seasons
- The Effects of Female Pheromone on Somatosensory Neural Activity in Taricha granulosa and Its Possible Mediation by AVT
- Effects of Vasotocin on Social and Anxiety-Related Behaviors in Male and Female Goldfish
- Interactions between the Hippocampus and Orbitofrontal Cortex in Rat Long-Term Declarative Memory
- Dopaminergic Modulation of Feeding Behaviors in the Leech, Hirudo medicinalis
- The Effects of the Novel Peptide Val1-SIFamide on the Central Pattern Generators in the Stomatogastric Ganglion of the American Lobster, Homarus americanus
- Val1-SIFamide Evokes a Novel Pattern in the Pyloric IC Neuron of the Stomatogastric System in the Lobster, Homarus americanus
- Interactions between the Orbitofrontal Cortex and the Hippocampal Memory System
- Three-Dimensional Analysis of Compensatory Growth in Gryllus bimaculatus Auditory Internurons

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Revised January 2007

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For more information, visit:
http://academic.bowdoin.edu/neuroscience/