**NEUROSCIENCE AND BEHAVIOR**

Neuroscience is a discipline that probes one of the last biological frontiers in understanding ourselves. It asks fundamental questions about how the brain and nervous system work in the expression of behavior. As such, the field takes on a clear interdisciplinary character: All scientific levels of organization (behavioral, developmental, molecular, cellular, and systems) contribute to our understanding of the nervous system. Neuroscience has been a field of particularly active growth and progress for the past two decades, and it is certain to be an area where important and exciting developments will continue to occur. At Wesleyan, the neurosciences are represented by the teaching and research activities of faculty members in the departments of biology and psychology. The neuroscience and behavior (NS&B) curriculum is both comprehensive and provides diverse approaches to learning. Through lecture/seminars, lab-based methods courses, and hands-on research experience, students are afforded a rich educational experience. Unique among schools of comparative size, Wesleyan has small but active graduate programs leading to BA/MA and PhD degrees. This attribute, together with the high success rate of faculty in obtaining research grant support, further enhances the education of undergraduates by providing additional mentoring, more research opportunities, and access to state-of-the-art laboratories. The mission of the NS&B program is to provide the foundation for a variety of career options in science, medicine, and private industry. For more information, see wesleyan.edu/nsb/ (http://wesleyan.edu/nsb).

**FACULTY**

Gloster B. Aaron  
BA, Oberlin College; PHD, University of Pennsylvania  
Associate Professor of Biology; Chair, Neuroscience and Behavior; Associate Professor, Neuroscience and Behavior; Associate Professor, Integrative Sciences

David Bodzick  
BS, University of Illinois Urbana; MAA, Wesleyan University; PHD, University of Washington  
Professor of Biology; Professor, Neuroscience and Behavior

Barbara Jean Juhasz  
BA, Binghamton University; MA, University Mass Amherst; PHD, University of Massachusetts Amherst  
Associate Professor of Psychology; Associate Professor, Neuroscience and Behavior; Associate Professor, Integrative Sciences

John Kirn  
BA, University of Denver; MA, Bucknell University; PHD, Cornell University  
Professor of Biology; Professor, Neuroscience and Behavior

Matthew M. Kurtz  
BA, Reed College; MA, Princeton University; PHD, Princeton University  
Professor of Psychology; Chair, Psychology; Professor, Neuroscience and Behavior

Psyche Loui  
BS, Duke University; PHD, University of California, Berkeley  
Assistant Professor of Psychology; Assistant Professor, Neuroscience and Behavior; Assistant Professor, Integrative Sciences

Janice R. Naegele  
BA, Mount Holyoke College; PHD, Massachusetts Institute of Technology  
Associate Professor of Science; Professor of Biology; Professor, Neuroscience and Behavior

Andrea L. Patalano  
BA, Brown University; MA, University of Michigan; PHD, University of Michigan  
Professor of Psychology; Professor, Neuroscience and Behavior

Mike Robinson  
BS, University of Sussex; MS, McGill University; PHD, McGill University  
Assistant Professor of Psychology; Assistant Professor, Neuroscience and Behavior; Assistant Professor, Integrative Sciences

Charles A. Sanislow  
BS, Northrn Michigan Unv; MA, Ball State University; PHD, Duke University  
Associate Professor of Psychology; Associate Professor, Neuroscience and Behavior

Helen B. Treloar  
BS, University of Melbourne; PHD, University of Melbourne  
Assistant Professor of the Practice in Neuroscience and Behavior

**AFFILIATED FACULTY**

Stephen H. Devoto  
BA, Haverford College; PHD, Rockefeller University  
Professor of Biology; Professor, Neuroscience and Behavior

**VISITING FACULTY**

Nihal C. de Lanerolle  
BA, Cambridge University; DS, University of Sussex; MA, Cambridge University; PHD, University of Sussex  
Visiting Professor of Neuroscience and Behavior

**DEPARTMENTAL ADVISING EXPERT**

Gloster Aaron

- Undergraduate Neuroscience and Behavior Major (catalog.wesleyan.edu/departments/nsb/ugrd-nsb)

**NS&B102 Science Information Literacy**

Information literacy is the set of skills needed to find, retrieve, analyze, and use information. This course will focus on teaching these skills as especially applied to scientific information. Students will learn to determine the nature and extent of information needed, to acquire needed information effectively and efficiently, to evaluate information and its sources critically, and to use information effectively to accomplish a specific purpose. Students will also examine the economic, ethical, legal, and social issues surrounding the use of information and how information literacy is important to lifelong learning and keeping current to new developments in his/her field. Topics will include the structure of scientific information and scientific publishing, the research process, types of information retrieval systems, search strategies and syntax, use of bibliographic management software (e.g., EndNote), criteria for critical evaluation, open-access publication, plagiarism, and copyright.

Offering: Crosslisting  
Grading: OPT  
Credits: 0.50
NS&B149 Neuroethology: Sensory Basis of Animal Orientation and Navigation
This course will examine the experimental method as a means of gaining knowledge about human cognition. Students in this course will learn about general research methods in cognitive psychology related to experimental design, understanding and interpreting research, and ethical issues involved in research with human subjects. Classic research paradigms in cognitive psychology will be explored through the use of interactive demonstrations and in-class experiments. In addition, students will be instructed in how to write well-organized research reports.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB, NSM-NSB, NSM-NSB
Identical With: BIOL149, BIOL149, BIOL149, BIOL149, BIOL149, BIOL149, BIOL149, BIOL149
Prereq: None

NS&B210 Research Methods in Cognition
This course will examine the experimental method as a means of gaining knowledge about human cognition. Students in this course will learn about general research methods in cognitive psychology related to experimental design, understanding and interpreting research, and ethical issues involved in research with human subjects. Classic research paradigms in cognitive psychology will be explored through the use of interactive demonstrations and in-class experiments. In addition, students will be instructed in how to write well-organized research reports.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC
Identical With: PSYC210, PSYC210, PSYC210, PSYC210, PSYC210, PSYC210, PSYC210
Prereq: PSYC215, PSYC215, PSYC215, PSYC215, PSYC215, PSYC215, PSYC215

NS&B213 Behavioral Neurobiology
This course will introduce the concepts and contemporary research in the field of neuroscience and behavior. The course is intended for prospective neuroscience and behavior majors (for whom it is required) and for biology and psychology majors who wish a broad introduction to neuroscience. The initial few weeks will be devoted to fundamental concepts of neuroanatomy and neurophysiology. Subsequent classes will deal in-depth with fundamental problems of nervous system function and the neural basis of behavior, including neurotransmitter systems; organization of the visual system and visual perception; the control of movement; neurological and neuropsychiatric disorders; the neuroendocrine system; control of autonomic behaviors such as feeding, sleep, and temperature regulation; the stress response; and language, learning, and memory. Experimental results from a variety of species, including humans, will be considered.
Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-NSB
This course is designed to provide students with an in-depth overview of the different human memory systems revealed by empirical research in the fields of cognitive psychology and cognitive neuroscience. The different systems include procedural memory, working memory, perceptual memory, semantic memory, and episodic memory.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-PSC, SBS-PSC, NSM-NSB
Identical With: [PSYC221, PSYC221, PSYC221, PSYC221, PSYC221, PSYC221]
Prereq: [PSYC105 OR [PSYC220 or NS&B220] OR [NS&B213 or BIOL213 or PSYC240] OR [PSYC222 or NS&B222]]

NS&B222 Sensation and Perception
This course explores our perceptual systems and how they create and shape our experience of the world around us. We will consider the neurophysiology of perceptual systems as well as psychological approaches to the study of perception, covering all of the human senses with a special emphasis on vision. Class demonstrations will introduce students to interesting perceptual phenomena.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-PSC, NSM-PSC
Identical With: [PSYC222, PSYC222, PSYC222, PSYC222]
Prereq: [PSYC105 OR [NS&B213 or BIOL213 or PSYC240]]

NS&B224 Hormones, Brain, and Behavior
Hormones coordinate the anatomical, physiological, and behavioral changes necessary for developmental, seasonal, and diurnal transition in animals. These molecules have profound effects on the development of the brain and on adult brain function. How do hormones orchestrate brain assembly and the expression of specific behaviors? How do behavior, social context, and the environment influence hormone secretion? This course will provide a critical survey of our understanding of the relationship between endocrinology, the brain, and behavior in a variety of animal systems. Select topics include insect metamorphosis; sexual differentiation of the vertebrate brain and behavior; reproductive and aggressive behavior in birds, lizards, and rodents; song learning and song production in birds; and the effects of hormones on sexual behavior and cognitive function in primates, including humans. The exploration of a variety of systems will provide students with an appreciation of the ways in which the relationships between hormones and behavior vary across species, as well as the extent to which these relationships are conserved.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL224
Prereq: [NS&B213 or BIOL213 or PSYC240] OR [BIOL182 or MB&B182]

NS&B225 Cognitive Neuroscience
This course provides an introduction to cognitive neuroscience—the study of how the brain enables the mind. We will begin with an overview of the neural substrates of cognition and the tools for understanding the structure and function of the human brain. Then we will cover neural processes that support sensory perception and attention, memory, motor control, language, executive control, and emotional and social functioning. We will also discuss mechanisms of brain evolution, development, and repair, and their implications for various diseases and disorders.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL, NSM-BIOL
Identical With: BIOL239, PSYC239, BIOL239, PSYC239, BIOL239, PSYC239, BIOL239, PSYC239, BIOL239, PSYC239, BIOL239, PSYC239, BIOL239, PSYC239, BIOL239, PSYC239
Prereq: [NS&B213 or BIOL213 or PSYC240]
NS&B243 Neurohistology
The aim of this course is to study the microscopic structure of the nervous system. Structural and functional relationships between neurons and glia, as well as the organization of major brain regions (cortex, hippocampus, and cerebellum) will be examined. In addition to traditional histological preparations, modern techniques including confocal microscopy and immunohistochemistry will be studied and performed. Laboratory exercises will include the preparation and visualization of microscopic slides using a variety of techniques. While this course will focus on mammalian nervous system, skills learned in this course will be applicable in a variety of research models.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB, NSM-NSB
Identical With: BIOL243, BIOL243, BIOL243, BIOL243, BIOL243, BIOL243
Prereq: [NS&B213 or BIOL213 or PSYC240] OR [MB&B181 or BIOL181]

NS&B245 Cellular Neurophysiology
This course will deal with basic aspects of neuronal physiology, including the function of excitable membranes and the transfer of information between cells (synaptic physiology, neurochemistry, membrane receptors). In connection with each of these topics, consideration will be given to short- and long-term modification of neuronal function. Toward the end of the course, we will examine the neurophysiology of auditory perception in birds and mammals, focusing on the initial transduction of sound waves into neuronal codes.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL, NSM-BIOL
Identical With: BIOL245, BIOL245, BIOL245, BIOL245, BIOL245, BIOL245
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B247 Laboratory in Neurophysiology
This course introduces a wide range of techniques for recording the electrical signals from nerve and muscle cells. We will make use of a range of preparations and both invertebrate and vertebrate species (except birds and mammals). Experiments deal with sensory, motor, and coordinating elements and include studies of single cells and simple nervous systems using extracellular, intracellular recording techniques.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL, NSM-BIOL
Prereq: [(NS&B213 or BIOL213 or PSYC240) AND [BIOL182 or MB&B182]] OR [(NS&B213 or BIOL213 or PSYC240) AND [BIOL182 or MB&B182]] OR [(NS&B213 or BIOL213 or PSYC240) AND [BIOL196 or MB&B196]] OR [(NS&B213 or BIOL213 or PSYC240) AND [BIOL182 or MB&B182] OR [BIOL196 or MB&B196]]

NS&B250 Laboratory in Cellular and Behavioral Neuroscience
The goals of the course are to introduce cellular, molecular, and behavioral laboratory techniques within a framework of solving research problems. Students will be given the opportunity to design experiments through an independent research project. Both quantitative and qualitative approaches will be used to analyze experimental data obtained by the student so that the student will not only gain experience in specific laboratory techniques, but will also gain a feel for the research process itself by active participation in research. In addition to techniques practiced in the course, additional techniques employed in research will be presented through lecture. Techniques will include studies of transgenic mouse nervous system, primary neuronal cell culture, immunohistochemistry, and behavioral analyses of learning, memory, social behavior, and social dominance.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL, NSM-BIOL, NSM-BIOL, NSM-BIOL
Identical With: BIOL250, NS&B555, BIOL250, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555, NS&B555, BIOL250, BIOL555,

NS&B252 Cell Biology of the Neuron
Neuronal cell biology is an important and fast-moving field. The brain cannot be understood without first elucidating the properties and functions of its component neurons. This course will focus on cell biological studies of the nervous system. We will explore the structure and function of neurons, synapses, and circuits. Using both text books and primary literature, we will examine the basic cell biological mechanisms that underlie the formation, function, and plasticity of neurons and circuits. Areas studied will include polarity, synapse formation, synaptic transmission, intracellular transport, plasticity, and regeneration.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB
Identical With: BIOL252, BIOL252, BIOL252, BIOL252

NS&B254 Comparative Animal Behavior
An introduction to the study of animal behavior, this course will examine the factors that control the behavior of vertebrates and invertebrates within evolutionary, social, and physiological contexts.
Offering: Crosslisting
Grading: A-F
have yielded a wealth of new membrane protein structures that have helped to
limited in the past by technological obstacles. In spite of this, the past 10 years
drug targets, but our understanding of their structure and function has been
Membrane proteins constitute a third of all cellular proteins and half of current
lessons to examine original research articles about the neuroscience of music,
waveforms that we interpret as sound. The third part of the course uses these
processes (physiology) by which the mammalian brain analyzes the periodic
The second part of the course (brains) examines the known mechanical
approaches for therapy.
accounts as a window to understanding heterogeneity in the disease and novel
mechanisms, and correspondingly diverse treatment interventions? We will
engage these questions through three separate units that will evaluate the
outcome, a wide array of competing theories regarding etiology and biological
psychiatric disorder that has changed so substantially in definition over time,
with wide interindividual difference in symptom expression and functional
phenomenological approaches, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and phenomenological perspectives, and the implications of these views for our
understanding of treatment in the disorder. How are we to make sense of a
psychiatric disorder that has changed so substantially in definition over time,
and neural networks, especially of the association cortices (prefrontal Cortex - ventromedial, dorsolateral and orbitofrontal cortex; the cingulate cortex; temporal association cortex; and the inferior and superior parietal lobes). The course will review studies on the development of moral values in children and their neural underpinnings, leading to studies of the functions of the adult brain in moral or ethical decision-making. Topics such as the neural basis of resolving the "Trolley Problem", neuroeconomics, altruism, poverty, forgiveness, compassion will provide the basis for this discussion. We will evaluate from a neuroscience perspective questions such as determinism and free will, and the sense of "self", which ideas have played a significant role in ethical theories. Based on this body of knowledge, we will look at emerging ethical issues arising from technological developments that allow for manipulating the normal and diseased brain. A variety of questions will be examined, among them - brain imaging and privacy, enhancement of normal brain function through chemical, electrical and electromagnetic stimulation, implanted neural interfaces, restoring brain damage, neuroscience and the law.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB
Prereq: [NS&B225 or PSYC225] OR [NS&B213 or BIOL213 or PSYC240] OR [NS&B225 or PSYC225] OR [NS&B213 or BIOL213 or PSYC240]

NS&B325 Stem Cells: Basic Biology to Clinical Application
This course will cover recent advances in stem cell biology, including adult and embryonic stem cells. We will examine the ethics as well as the science of this emerging field.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL, NSM-BIOL, NSM-BIOL, NSM-BIOL, NSM-BIOL
Identical With: BIOL325, BIOL325, BIOL325, BIOL325, BIOL325, BIOL325
Prereq: ([MB&B181 or BIOL181] AND [BIOL182 or MB&B182]) OR [BIOL182 or MB&B182] OR [BIOL196 or MB&B196]

NS&B326 Drugs of Abuse from Neurobiology to Behavior
This course provides a comprehensive analysis of the neuroscience of substance abuse. This is a lecture course with seminar-style student presentations and group discussions. The lecture portion of the course emphasizes basic principles of neuropharmacology, distribution and elimination of drugs, drug-receptor interactions and dose-response relationships, structure of neurons, neuropsychological mechanisms involved in synaptic activity, and the distribution of specific neurotransmitter systems. With a focus on pharmacokinetics, research methodology, and addiction processes, the mechanism of drug action as a basis for evaluation of behavioral functions will be explored. The seminar portion of the course will focus on the neurobiological actions of specific drug classes, including stimulants, depressants, hallucinogens, and opioids.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB
Identical With: BIOL326, BIOL326
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B328 Chemical Senses
The least well understood of the senses, chemical sensation, is key to survival and behavior of many species. In this course, you will study the structure and function of sensory neurons in both the gustatory and olfactory systems, as well as in chemosensory irritation. We will examine coding of sensory information to understand how higher cortical areas interpret stimuli. We will look at a variety of animal models and discover common organizing principles across phyla. An emphasis will be placed on the cell biology of these systems. Students will participate in reading, analyzing, and presenting recent studies from different areas within chemical sense to highlight recent findings and where the emphasis in chemosensory research is focused.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB, NSM-NSB
Identical With: BIOL328, BIOL328, BIOL328, BIOL328, BIOL328, BIOL328, BIOL328
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B329 Neural Costs of War
This course focuses on stress reactions that result of exposure to war, combat, and related atrocities. You will learn about the diagnosis of PTSD, including its development and history. There is a strong emphasis on the neural and cognitive mechanisms for stress-related psychopathology, and the overlap of psychological and neural systems with the damaging effects of traumatic brain injury are studied. While the impact of these mechanisms on the social, interpersonal, and occupational is considered, this is not the focus of the course. To be fully prepared for this course, students should have a solid grounding in neuroscience and behavior, as well as basic psychopathology.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-PSYC, SBS-PSYC
Identical With: PSYC329, PSYC329, PSYC329, PSYC329
Prereq: None

NS&B334 Psychopharmacology
The purpose of this course is to examine basic principles of psychopharmacology. After reviewing the bases of neural communication and functioning, the use and/or misuse of various classes of drugs will be reviewed. Special emphasis will be given to the role of drugs in treating psychological disorders. Topics to be discussed include treatment of psychological disorders, analgesic medications, pharmacology of drug abuse, and psychopharmacology of special populations (adolescents and geriatric populations). Class activities include lectures and discussions.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-PSYC, SBS-PSYC
Identical With: PSYC334, PSYC334
Prereq: [PSYC220 or NS&B220] OR [NS&B213 or BIOL213 or PSYC240]

NS&B341 Psychology of Learning and Memory
This course aims to provide students with an in-depth overview/exploration of the psychological and neural processes underlying learning and memory. Topics to be covered include different memory systems and frameworks (e.g., working memory, semantic memory, episodic memory), and the influence of emotional and social factors on learning and memory (e.g., social remembering). We will explore these topics through critical reading/discussion of theoretical and empirical research articles in the fields of cognitive psychology and cognitive neuroscience.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-PSYC, SBS-PSYC, SBS-PSYC
knowledge recently concerning the wide heterogeneity of neuronal classes and conscious perception and thought, there has been a tremendous explosion of

While scientists are still very unsure of how the mammalian cortex enables

Identical With: PSYC341, PSYC341, PSYC341, PSYC341, PSYC341, PSYC341, PSYC341, PSYC341
Prereq: None

NS&B342 Music Perception and Cognition
This course provides an overview of the perceptual, cognitive, and neural bases of performing, composing, and listening to music. Topics include acoustics and biological processing of sound; theories and empirical research on pitch, rhythm, harmony, melody, timbre, orchestration; similarities and differences between music and language; evolution and development of musical ability, and special populations in musical functions. Meetings each week will include laboratory demonstrations and exercises in experiment design and data analysis.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-PSYC, NSM-PSYC
Identical With: PSYC342, PSYC342, PSYC342, PSYC342
Prereq: None

NS&B343 Muscle and Nerve Development
We will examine the structure and function of muscle cells, the development of muscle cell identity, the development of motor neurons, and the interactions between nerve and muscle that lead to a functioning neuromuscular system. The course will focus primarily on vertebrate model systems such as chick, mouse, and fish. We will also examine human diseases, including muscular dystrophies and other neuromuscular disorders.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL
Identical With: BIOL343, NS&B543, BIOL543, BIOL343, NS&B543, BIOL543, BIOL343, NS&B543, BIOL543
Prereq: BIOL218 OR ([BIOL182 or MB&B182] AND [BIOL212 or MB&B212]) OR ([BIOL182 or MB&B182] AND [NS&B213 or BIOL213 or PSYC240]) OR ([BIOL196 or MB&B196] AND [BIOL212 or MB&B212]) OR ([BIOL196 or MB&B196] AND [NS&B213 or BIOL213 or PSYC240])

NS&B345 Developmental Neurobiology
Near the top of the list of unsolved mysteries in biology is the enigma of how the brain constructs itself. Here is an organ that can make us feel happy, sad, amused, and in love. It responds to light, touch, and sound; it learns; it organizes movements; it controls bodily functions. An understanding of how this structure is constructed during embryonic and postnatal development has begun to emerge from molecular-genetic, cellular, and physiological studies. In this course, we will discuss some of the important events in building the brain and the role of genes and the environment in shaping the brain. With each topic in this journey, we will ask what the roles of genes and the environment are in forming the nervous system. We will also discuss developmental disorders resulting from developmental processes that have gone astray. This is a reading-intensive seminar course emphasizing classroom discussions, with readings from a textbook and the primary scientific literature.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL345, NS&B545, BIOL545

NS&B347 Mammalian Cortical Circuits
While scientists are still very unsure of how the mammalian cortex enables conscious perception and thought, there has been a tremendous explosion of knowledge recently concerning the wide heterogeneity of neuronal classes and the specific kinds of connections between these classes. Detailed wiring diagrams of local cortical circuits are emerging, colored with dynamic connections that have created a wellspring of ideas motivated toward understanding the cortex with reverse-engineering strategies. This course will focus on cortical circuit studies in neocortex, with an emphasis on somatosensory cortex. Students will come to know, for example, many different varieties of inhibitory interneurons in terms of their firing properties, synaptic plasticities, the connections they make with other neurons, and what roles they might play in governing cortical dynamics.

Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL, NSM-BIOL, NSM-BIOL
Identical With: BIOL347, BIOL347, BIOL347, BIOL347, BIOL347, BIOL347
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B348 Origins of Knowledge
In this course we will discuss in-depth a selection of current topics in cognitive development, centering on questions concerning the origins of knowledge. (What kinds of knowledge do we possess even very early in life? How does that knowledge change over time?) We will examine these questions within specific subject areas such as object perception, space perception, number understanding, and understanding of other minds, surveying evidence from different stages of human individual development as well as evidence from different nonhuman species.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-PSYC, SBS-PSYC
Identical With: PSYC348, PSYC348, PSYC348, PSYC348
Prereq: None

NS&B351 Neurobiology of Learning and Memory
Animals as varied as sea slugs and humans display a number of types of learning, ranging from the capacity to acquire species-specific behavior to the ability to form arbitrary associations. Just as varied are the philosophies governing the choice of how to best study the neurobiology of learning and memory. Through lectures, class discussion, student presentations, and a critical reading of the primary literature, the advantages and disadvantages of these various approaches will be investigated. While the specific focus of this class will be on learning and memory, other ways in which the brain learns will also be explored. Normal brain ontogeny relies to some extent on invariant cues in the animal’s environment, making this process somewhat analogous to learning. In fact, the neural substrates for learning are likely to be a subset of the basic steps used during brain development. Moreover, the developmental rules guiding brain assembly place constraints on the what, how, and when of brain function and learning. Therefore, this course will also cover select topics in basic developmental neurobiology.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL351
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B353 Neurobiology of Neurological Disorders
This course aims to provide a foundation in the underlying mechanisms of neurological and psychiatric disorders. We will explore through lectures and readings of primary literature a number of important neurological and psychiatric diseases, including autism, schizophrenia, Alzheimer’s disease, mental retardation, epilepsy, and Parkinson’s disease. This course focuses on the fundamental molecular and cellular mechanisms that underlie neurological disorders and is designed to engage students who wish to study basic aspects of brain function.
Neuroscience and Behavior

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: BIOL353, PSYC353
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B356 Neurodevelopmental Disorders
This course aims to provide a foundation in the underlying mechanisms of neurodevelopmental disorders. We will explore through lectures and readings of primary literature a number of important neurological and psychiatric diseases, including genetic disorders such as Down syndrome, Fragile X, and Williams syndrome; spectrum disorders such as autism and fetal alcohol syndrome; ADHD, Tourettes, Cerbral Palsy, and some motor disorders including developmental coordination disorder, stereotypic movement disorder, sensory inegration disorder, and neonatal hypoxia. This course focuses on the fundamental molecular and cellular mechanisms that underlie neurological disorders and is designed to engage students who wish to study basic cellular aspects of brain function.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB
Identical With: BIOL356, PSYC356, BIOL356, PSYC356, BIOL356, PSYC356, BIOL356, PSYC356
Prereq: [NS&B213 or BIOL213 or PSYC240] OR [NS&B213 or BIOL213 or PSYC240]

NS&B350 Capstone Experience in Neuroscience and Behavior
In this cohesive and interactive experience for junior and senior neuroscience and behavior majors, students read the primary literature on the topic of how experience changes the brain, gain proficiency in scientific writing and editing, and carry out service-learning projects in local high schools. This course is part of the course clusters in Disability Studies and Service Learning, as well as the certificate in Writing.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-NSB, NSM-NSB, NSM-NSB, NSM-NSB, NSM-NSB
Identical With: BIOL360, BIOL360, BIOL360, BIOL360
Prereq: [NS&B213 or BIOL213 or PSYC240]

NS&B381 Advanced Seminar in Memory Theory and Research
This course is designed to allow students to conduct supervised research in the area of human learning and memory. In this advanced research course, students will become familiar with both classic and contemporary studies in memory and undertake a semester-long experimental research project that seeks to answer a current question in the field of memory research either individually or as a group. Students will get to work on all aspects of the research project, including reviews of the background literature; generation of research ideas; the design, conduct, and analysis of a study; and a write-up of research findings in a journal-article format.

Offering: Crosslisted
Grading: OPT
Credits: 1.00
Gen Ed Area: SBS-PSYC, SBS-PSYC
Identical With: PSYC383, PSYC383, PSYC383, PSYC383
Prereq: None

NS&B383 Advanced Research in Learning and Memory
This course is designed to allow students to conduct supervised research in the area of human learning and memory. In this advanced research course, students will become familiar with both classic and contemporary studies in memory and undertake a semester-long experimental research project that seeks to answer a current question in the field of memory research either individually or as a group. Students will get to work on all aspects of the research project, including reviews of the background literature; generation of research ideas; the design, conduct, and analysis of a study; and a write-up of research findings in a journal-article format.

Offering: Crosslisted
Grading: OPT
Credits: 1.00
Gen Ed Area: SBS-PSYC, SBS-PSYC
Identical With: PSYC382, PSYC382
Prereq: None

NS&B390 Experimental Investigations into Reading
Experienced readers can easily recognize thousands of words. The mental dictionaries of these readers are efficiently organized to allow rapid and seemingly effortless word recognition. There are still many unanswered questions about the processes involved in visual word recognition. In this class, students will work together with the instructor to design and carry out an experimental investigation relating to reading and word recognition. The semester will provide students with a chance to integrate all aspects of the experimental process: idea formation, experimental design, data collection and analysis, interpretation, write-up, and presentation.

Offering: Crosslisted
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC
Identical With: PSYC390, PSYC390, PSYC390, PSYC390, PSYC390, PSYC390, PSYC390, PSYC390, PSYC390, PSYC390
Prereq: None

NS&B392 Behavioral Methods in Affective Neuroscience
This research methods course teaches experimental design and methods in experimental psychopathology using tools to conduct behavioral research in cognitive-affective neuroscience. Course material includes studies from the contemporary psychopathology research literature, with a focus on emotion interactions. Methods taught include statistical procedures (e.g., repeated measures ANOVA) and tools for carrying out research and analyzing data (e.g., computer programming for stimuli presentation and data processing). Neuroimaging techniques including the Evoke Response Potential are also sometimes included. Students in this course are expected to work independently.

Offering: Crosslisted
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-PSYC, NSM-PSYC, NSM-PSYC
Identical With: PSYC392, PSYC392, PSYC392, PSYC392, PSYC392, PSYC392, PSYC392
Prereq: None

NS&B393 Advanced Research in Cognition and Neuropsychiatric Illness
Students in this advanced undergraduate research course will work in teams on novel and ongoing research studies focused on understanding neurocognitive dysfunction and its treatment in neuropsychiatric illness. Students will be
matched to a research project and will participate in different aspects of this research including background literature review, acquiring elementary skills in neurocognitive and symptom assessment, and collecting and/or analyzing extant data using SPSS. Students may also be involved in learning cognitive training procedures.

Offering: Crosslisting
Grading: OPT
Credit: 1.00
Gen Ed Area: NSM-PSYC, NSM-PSYC
Identical With: PSYC393, PSYC393
Prereq: None

**NS&B398 Advanced Research in Auditory Cognitive Neuroscience**
This course provides in-depth training on the methods of auditory cognitive neuroscience. We will review contemporary studies in auditory cognitive neuroscience, specifically in speech, language, and music. Students will design and implement a group project, learn to analyze the data, and write up the results in an end-of-term paper.

Offering: Crosslisting
Grading: OPT
Credit: 1.00
Gen Ed Area: NSM-PSYC
Identical With: PSYC398
Prereq: None

**NS&B399 Lab in Gambling, Drugs and Junk-Food**
This intensive laboratory course provides in-depth training on the experimental methods of behavioral neuroscience of motivation and reward using rodent research techniques. We will review contemporary studies with a particular focus on gambling, diet-induced obesity and drug addiction. Some of the models examined in more detail will focus on the role of reward uncertainty and the concept of loss in gambling, the individual differences in the attraction to reward cues in subjects prone to obesity versus those that are resistant (with a particular emphasis on prenatal and developmental exposure to high-fat diets), and finally the individual differences in the resistance to adverse consequences in models of intense desire and addiction (such as the conflict-based model and Pavlovian autoshaping). Students will learn how to handle and inject rats in a behavioral neuroscience research setting, and how to measure reward and motivation using operant (skinner) boxes to carry out tasks such as progressive ratio, Pavlovian conditioned approach, conditioned reinforcement, and loco-motor sensitization. They will be exposed and become familiar with several different forms of these research techniques including the hardware and software necessary for this type of research, and will be encouraged to adapt existing behavioral paradigms to answer new questions.

Offering: Crosslisting
Grading: OPT
Credit: 1.00
Gen Ed Area: NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC, NSM-PSYC
Identical With: PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399, PSYC399
Prereq: None

**NS&B400 Academic Skills**
The objectives of this course are 1) build a supportive cohort that will help students sustain their goals when they enter graduate school, and 2) provide students with skills they will need to succeed in graduate school. Students will work on writing, presentation, and discussion skills. This will be done by reading some classic books on writing, critiquing the ability of different figures and graphs to convey information, reading and discussing scientific papers and giving research presentations.

Offering: Crosslisting
Grading: A-F
Credit: 0.25
Gen Ed Area: NSM-EE, NSM-EE, NSM-EE, NSM-EE
Identical With: E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400, PHYS400, PSYC400, E&ES400
Prereq: None

**NS&B401 Individual Tutorial, Undergraduate**
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

**NS&B402 Individual Tutorial, Undergraduate**
Offering: Host
Grading: OPT

**NS&B407 Senior Tutorial**
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor.
Offering: Host
Grading: A-F

**NS&B408 Senior Tutorial**
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor.
Offering: Host
Grading: A-F

**NS&B409 Senior Thesis Tutorial**
Offering: Host
Grading: OPT

**NS&B410 Senior Thesis Tutorial**
Offering: Host
Grading: OPT

**NS&B411 Group Tutorial, Undergraduate**
Offering: Host
Grading: OPT

**NS&B412 Group Tutorial, Undergraduate**
Offering: Host
Grading: OPT

**NS&B420 Student Forum**
Offering: Host
Grading: Cr/U

**NS&B421 Undergraduate Research, Science**
Offering: Host
Grading: OPT

**NS&B422 Undergraduate Research, Science**
Offering: Host
Grading: OPT

**NS&B423 Advanced Research Seminar, Undergraduate**
Offering: Host
Grading: OPT

**NS&B424 Advanced Research Seminar, Undergraduate**
Offering: Host
Grading: OPT
movements; it controls bodily functions. An understanding of how this structure-mouth amused, and in love. It responds to light, touch, and sound; it learns; it organizes the brain constructs itself. Here is an organ that can make us feel happy, sad, near the top of the list of unsolved mysteries in biology is the enigma of how NS&B545 Developmental Neurobiology Prereq: [NS&B213 or BIOL213 or PSYC240] AND [BIOL182 or MB&B182] OR (NS&B213 AND MBB195 AND BIOL196) OR (NS&B213 AND MB&B181 AND BIOL196) OR (NS&B213 AND MB&B181 AND BIOL182) OR (NS&B213 AND MB&B195 AND BIOL182) OR (NS&B213 AND MB&B195 AND BIOL196) NS&B549 Advanced Research Seminar, Graduate Offering: Host Grading: OPT NS&B550 Advanced Research Seminar, Graduate Offering: Host Grading: OPT NS&B555 Laboratory in Cellular and Behavioral Neuroscience The goals of the course are to introduce cellular, molecular, and behavioral laboratory techniques within a framework of solving research problems. Students will be given the opportunity to design experiments through an independent research project. Both quantitative and qualitative approaches will be used to analyze experimental data obtained by the student so that the student will not only gain experience in specific laboratory techniques, but will also gain a feel for the research process itself by active participation in research. In addition to techniques practiced in the course, additional techniques employed in research will be presented through lecture. Techniques will include studies of transgenic mouse nervous system, primary neuronal cell culture, immunohistochemistry, and behavioral analyses of learning, memory, social behavior, and social dominance. Offering: Crosslisting Grading: A-F Host NS&B559 Advanced Research, BA/MA Intensive investigation of special research problems leading to a BA/MA thesis. Offering: Host Grading: A-F NS&B560 Advanced Research, BA/MA Intensive investigation of special research problems leading to a BA/MA thesis. Offering: Host Grading: OPT
NS&B591 Advanced Research, Graduate

Offering: Host
Grading: OPT