

NEUROSCIENCE AND BEHAVIOR

Overview and Contact Information

The program in neuroscience and behavior is intended for students with strong, integrative interests in both biological sciences and psychology and in the biological bases of behavior.

See Also

- Cognitive Neuroscience (<http://catalog.mtholyoke.edu/areas-study/cognitive-neuroscience/>)

Contact Information

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<https://www.mtholyoke.edu/acad/neuroscience> (<https://www.mtholyoke.edu/acad/neuroscience/>)

Learning Goals

Students should attain a broad understanding of the development, physiology, anatomy, and evolutionary history of the nervous system in both human and non-human animals. Toward this end, they should have a general understanding of the electrochemical behavior of nerve cells and synapses, sensorimotor processes, anatomical features, and circuit-level processes underlying various cognitive and behavioral outcomes.

Students will be introduced to technology appropriate to the field, including electrophysiological recordings and cytological and molecular techniques. Neuroscience and Behavior majors will learn how to construct novel hypotheses from existing literature and design relevant experiments to challenge underlying assumptions. As a result, students will understand how to design laboratory-based and field experiments and be well versed in methods of data collection, statistical analysis and written and oral presentation.

Students should be exposed to the primary literature of the discipline and should be taught to use this as a major resource for their own learning. Finally, students should be aware of major events and trends in the history of neuroscience and ethical issues in research.

Faculty

This area of study is administered by the Neuroscience and Behavior Committee:

Katherine Binder, William R. Kenan, Jr. Professor of Psychology

Renae Brodie, Professor of Biological Sciences

Gary Gillis, Norman Wait Harris and Emma Gale Harris Foundation Professor of Biological Sciences; Associate Dean of Faculty; Director of the Science

Mara Breen, Associate Professor of Psychology and Education

Kathryn McMenimen, Associate Professor of Chemistry, On Leave 2021-2022

Jared Schwartzer, Associate Professor of Psychology and Education

Kenneth Colodner, Assistant Professor of Neuroscience and Behavior

Marta Sabariego, Assistant Professor of Neuroscience and Behavior

André White, Assistant Professor of Biological Sciences, Teaching Spring Only

Requirements for the Major

A minimum of 48 credits:

Code	Title	Credits
Required Core Curriculum		
NEURO-100	Introduction to Neuroscience and Behavior	4
CHEM-150	General Chemistry: Foundations of Structure and Reactivity	4
	or CHEM-160 Integrated Introduction to Biology and Chemistry	
CHEM-202	Organic Chemistry I	4
NEURO-221	Research Techniques in Neuroscience	4
PSYCH-204	Research Methods in Psychology	4
PSYCH-246	Cognitive Neuroscience	4
	or PSYCH-254 Psychopharmacology	
BIOL-200	Introductory Biology II: How Organisms Develop	4
BIOL-230	Molecular Genetics and Cell Biology	4
An appropriate prerequisite to qualify for the quantitative inference course		
A course in quantitative inference:		4
PSYCH-201	Statistics	
	or STAT-240 Elementary Data Analysis and Experimental Design	
	or STAT-242 Intermediate Statistics	
Two of the following laboratory-based courses at the 300 level:		8
BIOCH-311	Protein Biochemistry and Cellular Metabolism (with BIOCH-318 lab)	
BIOL-307	Vertebrate Anatomy	
BIOL-315	Behavioral Ecology	
BIOL-321AD	Conference Course: 'Addiction, Superior Memory, and Diseases of the Brain'	
BIOL-333	Neurobiology	
BIOL-328	Human Physiology	
COMSC-334	Artificial Intelligence	
COMSC-341NL	Topics: 'Natural Language Processing'	
NEURO-324	Cellular and Molecular Neuroscience	
NEURO-336	Systems Neuroscience	
NEURO-395	Independent Study (4 credits)	
PSYCH-350AN	Lab in Biological Bases of Behavior: 'Analyzing Human Brain Signals'	
PSYCH-350BN	Lab in Biological Bases of Behavior: 'Laboratory in Behavioral Neuroscience'	
PSYCH-340CL	Laboratory in Perception and Cognition: 'Cognition and Literacy'	
A third 300-level course from the preceding list, or from the following:		4
BIOL-338	Evolution and Human Sexual Behavior	
CHEM-312	Chemistry of Biomolecules	

NEURO-309SE	Topics in Neuroscience and Behavior: 'Philosophy and Science of Emotion'
NEURO-331	Glial Cells in Health and Disease
PSYCH-349AM	Seminar in Perception and Cognition: 'Art, Music, and the Brain'
PSYCH-349LT	Seminar in Perception and Cognition: 'Language and Thought'
PSYCH-359GE	Seminar in Biological Bases of Behavior: 'Neuroscience and Psychology of Sex and Gender'
PSYCH-359CN	Seminar: Biological Bases of Behavior: 'Clinical Neuroscience'
Total Credits	48

Other Requirements

- The three required courses at the 300 level must span at least two departments or programs.

Additional Specifications

- Students planning postgraduate study in a related discipline or in medicine are urged to participate in independent laboratory research within either or both departments.
- Students who declare a neuroscience and behavior major automatically fulfill the College's "outside the major" requirement.

Course Offerings

NEURO-100 Introduction to Neuroscience and Behavior

Fall and Spring. Credits: 4

This comprehensive survey course explores the brain and the biological basis of behavior. We will examine the anatomy of the nervous system and the unique properties of the cells that make up the brain. We will discuss the mechanisms by which individual brain cells communicate with each other, and how networks of cells underlie more complex processes such as perception, learning, memory, and behavior.

Applies to requirement(s): Math Sciences

K. Colodner, M. Sabariego

Restrictions: This course is limited to first-years and sophomores.

Coreq: NEURO-100L.

NEURO-221 Research Techniques in Neuroscience

Spring. Credits: 4

This course will introduce students to modern techniques utilized in neuroscience research. Students will learn the underlying principles of an array of techniques spanning the fields of cellular/molecular, behavioral, and cognitive neuroscience. In lab, students will perform experiments that demonstrate these skills firsthand. Emphasis will be placed on the tools necessary to implement these studies, proper experimental design, and the critical interpretation of generated data.

Applies to requirement(s): Math Sciences

K. Colodner

Restrictions: This course is offered to neuroscience majors only.; This course is limited to sophomores and juniors.

Prereq: NEURO-100 and PSYCH-201 (or equivalent). Coreq: NEURO-221L.

NEURO-246 Cognitive Neuroscience

Spring. Credits: 4

Cognitive psychologists investigate the features and functions of the human mind through behavioral techniques; neuroscientists explore the physiology of the human brain. Cognitive Neuroscience lies at the intersection of these disciplines, and asks questions like: How are memories represented in the brain? Is our brain pre-prepared to learn language and if so, how? How does the average human brain still outperform most face recognition software? This course explores the cognitive and neural processes that support vision, attention, language, memory, and music. It introduces basic neuroanatomy, functional imaging techniques, and behavioral measures of cognition.

Crosslisted as: PSYCH-246

Applies to requirement(s): Social Sciences

M. Breen

Prereq: PSYCH-100, NEURO-100, or AP Psychology.

Notes: This course counts in the cognitive or biol bases area of the psychology major.

NEURO-254 Psychopharmacology

Fall. Credits: 4

Psychopharmacology focuses on the impact that drugs (both illicit and prescription) have on the brain, neurocircuitry, and behavior. Students will explore the underlying neurotransmitter systems of the brain and discover how substances influence nervous system function including the experience of pain, sleep, emotional states, motivation, addiction, and mental health. The course will bridge concepts in chemistry, biology, psychology, and neuroscience by highlighting major drug classes and their underlying mechanisms of action. Additional discussions will focus on the economic, social, and political aspects of the drug market, as well as ethics and legalities of the drug industry.

Crosslisted as: PSYCH-254

Applies to requirement(s): Social Sciences

J. Schwartz

Prereq: PSYCH-100, NEURO-100, or AP Psychology.

NEURO-295 Independent Study

Fall and Spring. Credits: 1 - 4

The department

Instructor permission required.

NEURO-309 Topics in Neuroscience and Behavior

NEURO-309NE Topics in Neuroscience and Behavior: 'Neuroethics'

Spring. Credits: 4

Neuroethics draws on the tools of philosophical analysis to investigate the role of neuroscience in our personal, social, and ethical lives. This class will look at the ethics of neuroscientific interventions such as cognitive enhancement, mind reading, and lie detection. We will examine how the neurosciences might inform philosophical discussions about human nature, personality, and ethics. In addition, we will look at the evidential role of neuroscientific evidence and how neuroscience technologies such as fMRI have influenced our thinking about the mind/ brain and person.

Crosslisted as: PHIL-334NE

Applies to requirement(s): Humanities

L. Sizer

Prereq: 8 credits from the Philosophy department or 4 credits from Philosophy and 4 credits from Neuroscience and Behavior.

NEURO-309SE Topics in Neuroscience and Behavior: 'Philosophy and Science of Emotion'

Not Scheduled for This Year. Credits: 4

This course is an interdisciplinary investigation of the nature of emotions and their influences on our thoughts and actions. While we will draw from a variety of disciplines, the nature and motivations of the inquiry are philosophical. We will consider: what are emotions? Are they bodily responses? Thoughts? Feelings? What roles do cultures play in shaping our emotions? What functions do emotions serve? We will examine evidence and arguments offered by philosophy, psychology, neuroscience, anthropology and evolutionary theory, and consider how these perspectives do or don't inform each other, as well as how they can help us understand the nature of emotions.

Crosslisted as: PHIL-350SE

Applies to requirement(s): Humanities

Other Attribute(s): Writing-Intensive

L. Sizer

Prereq: 8 credits in Philosophy or Neuroscience and Behavior, or 4 credits in each.

NEURO-324 Cellular and Molecular Neuroscience

Not Scheduled for This Year. Credits: 4

This course will explore cellular and molecular mechanisms of nervous system development and function through lectures, laboratory exercises, and the critical analysis of primary literature. Topics include synapse formation and synaptic transmission, neuronal-glia interactions, the molecular basis of behavior, and applied genetic engineering techniques.

Applies to requirement(s): Math Sciences

K. Colodner

Prereq: NEURO-100 and BIOL-230 (or BIOL-220).

Notes: This course meets the 300-level laboratory-based course requirement for the Neuroscience and Behavior major.

NEURO-331 Glial Cells in Health and Disease

Fall. Credits: 4

This course will explore the "other" cells in your brain, the glial cells. While neuronal cells receive most of the attention, glial cells are now recognized as essential players in normal brain physiology. Through the critical analysis of primary literature, we will highlight recent advances in glial cell biology and discuss how the various glial cell subtypes (astrocytes, microglia, myelinating cells, etc.) contribute to the healthy and diseased brain. We will examine the glial contribution to a variety of disorders (e.g. multiple sclerosis, spinal cord injury, neurodegenerative diseases, etc.) as we cultivate a better understanding of these often overlooked brain cells.

Applies to requirement(s): Math Sciences

K. Colodner

Restrictions: This course is offered to neuroscience majors only.

Prereq: NEURO-100 and BIOL-230.

NEURO-336 Systems Neuroscience

Fall. Credits: 4

This course will cover the functioning of neural circuits in the brain and how they give rise to cognition and behavior. Using primary literature and activities, students will delve into current topics in systems neuroscience. Labs will provide exposure and training in common neuroscience techniques, practice in thinking like a scientist, and an appreciation for how basic research can lead to major advances in the treatment of disease.

Applies to requirement(s): Math Sciences

Other Attribute(s): Speaking-Intensive

M. Sabariego

Restrictions: This course is offered to neuroscience majors only.

Prereq: NEURO-100 and PSYCH-204. Coreq: NEURO-336L.

NEURO-338 Mobilizing the Hippocampus

Spring. Credits: 4

This course will provide a research site to investigate the functions of the hippocampal brain region to then embody that learning through choreographic structures. In particular, students will (1) use dance expression to aid the understanding of complex neuroscience topics, and (2) apply neuroscience knowledge to deepen creative expression. "Mobilizing the hippocampus" will help to bridge a gap between science and art, serving as a tool to stimulate a heightened understanding of both disciplines.

Crosslisted as: DANCE-338

Applies to requirement(s): Meets No Distribution Requirement

B. Diewald, M. Sabariego

Restrictions: This course is open to juniors and seniors; This course is limited to Dance and Neuroscience majors.

NEURO-341 Advances in Neuroscience

Not Scheduled for This Year. Credits: 4

Neuroscience is a rapidly changing field. This seminar will prepare students for the next generation of neuroscience while also providing the foundation for important principles that have guided the field during the last few decades. In particular, using primary literature to guide the discussion, this class will examine topical subjects of modern neuroscience that are shaping our understanding of how the brain works.

Applies to requirement(s): Math Sciences

K. Colodner

Restrictions: This course is offered to neuroscience majors only.

Prereq: BIOL-230 and PSYCH-204.

NEURO-395 Independent Study

Fall and Spring. Credits: 1 - 8

The department

Instructor permission required.