

## Neuroscience

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wp.stolaf.edu/neuroscience (<http://wp.stolaf.edu/neuroscience>)

Neuroscience is the study of nervous systems: organized collections of neurons, such as brains, that sense the environment, process and store information and generate physiological and behavioral responses in animals, including humans. An interdisciplinary field, neuroscience integrates diverse academic perspectives (such as biology, psychology, chemistry, computer science, and philosophy) and employs numerous levels of inquiry (from the molecular to the cognitive). Modern neuroscience research ranges from basic science questions examining how nerve cells generate signals to clinical research exploring treatments for Alzheimer's disease.

### Overview of the Concentration

Neuroscience is a multidisciplinary program that provides students access to the field by linking curricula, faculty, and students in a contract concentration that requires foundations in at least two natural sciences and stretches to connect with courses in the arts, humanities, and social sciences. It provides students with a broad introductory exposure to the field of neuroscience by requiring students to integrate material from several disciplines to answer questions about the brain, behavior, and consciousness. Students must first consult with the director of the neuroscience concentration by the end of the sophomore year and develop a contract. The contract may be altered by mutual consent at any time.

### Intended Learning Outcomes for the Concentration (<http://wp.stolaf.edu/curriculum-committee/neuroscience-concentration-ilos>)

### Recommendations for Graduate Study

Graduate programs in neuroscience vary widely in their admission requirements, so students intending to attend graduate school in neuroscience are advised to determine the requirements of the specific programs they are considering. In general, however, a number of neuroscience graduate programs recommend chemistry (through biochemistry), genetics, and statistics; many cognitive neuroscience programs emphasize coursework in psychology.

### Requirements

Core courses (taken in either order):

PSYCH 238	Biopsychology	1.00
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PSYCH 238 introduces students to the fundamental principles underlying the relationship between the brain and behavior, with an emphasis on the systems and cognitive levels.

NEURO 239	Cellular and Molecular Neuroscience	1.00
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NEURO 239 focuses on the physiology and development of neurons and neural circuits across the animal kingdom.

One level II foundation elective (see list in courses tab) <sup>1</sup>	1.00
One level III advanced science elective (see list in courses tab) <sup>1</sup>	1.00
One interdisciplinary elective from neuroscience related offerings outside the natural sciences (see list in courses tab)	1.00
Capstone seminar (see list in courses tab)	1.00
<b>Total Credits</b>	<b>6</b>

<sup>1</sup> The foundation elective and the advanced science elective must be from different departments.

## Courses

### NEURO 239: *Cellular and Molecular Neuroscience*

Neuroscience is one of the fastest-growing fields in the sciences, with research interests ranging from molecular genetics to whole animal behavior. Topics include membrane biophysics, synaptic transmission and plasticity, intracellular signaling, sensory transduction, motor control systems, and development. Offered annually in the spring semester. Counts toward biology and exercise science majors and mathematical biology concentration.

**Prerequisite:** BIO 143 or CH/BI 227 or BIO 227 or PSYCH 238.

### NEURO 294: *Academic Internship*

### NEURO 298: *Independent Study*

### NEURO 394: *Academic Internship*

### NEURO 396: *Directed Undergraduate Research*

This course provides a comprehensive research opportunity, including an introduction to relevant background material, technical instruction, identification of a meaningful project, and data collection. The topic is determined by the faculty member in charge of the course and may relate to his/her research interests. Offered based on department decision. May be offered as a 1.00 credit course or .50 credit course.

**Prerequisite:** determined by individual instructor.

### NEURO 398: *Independent Research*

## Approved Courses:

### Level II Foundation Elective Courses (1 required)

BIO 227 Cell Biology

BIO 233 Intermediate Genetics

BIO 243 Human Anatomy and Physiology: Organs and Organ Systems

BIO 247 Animal Physiology

BIO 248 Invertebrate Biology

PSYCH 225 Psychophysiology

PSYCH 235 Sensation and Perception

PSYCH 236 Conditioning and Learning

PSYCH 237 Cognitive Psychology

Another appropriate biology or psychology course with permission of the program director.

## Level III Advance Science Elective Courses (1 required)

BIO 341 Advanced Cell Biology

BIO 364 Molecular Biology

BIO 372 Developmental Biology

BIO 386 Animal Behavior\*

CHEM 379 Biochemistry I\*

PHYS 390 Selected Topics

PSYCH 336 Neuroscience of Addiction\*

PSYCH 338 Neurobiology of Psychopathology\*

PSYCH 339 Cognitive Neuroscience\*

PSYCH 395 Advanced Research in Behavioral Neuroscience

Directed Undergraduate Research (BIO 396, PSYCH 396, or NEURO 396) on a neuroscience topic with permission of the program director.

Independent Research (BIO 398, PSYCH 398, or NEURO 398) on a neuroscience topic with permission of the program director.

Another appropriate advanced science course with advanced laboratory experience with permission of the program director.

\*Note: These four courses do not have labs. A ten-week summer-research experience can substitute for advanced lab experience. Or students taking Chemistry 379 can take the corresponding lab course CHEM 373.

## Interdisciplinary Elective Courses (1 required)

Note that a short, 1-2 page reflective piece relating this course to your neuroscience studies must be submitted to the program director in order to receive credit for this course toward your concentration.

CSCI 253 Algorithms and Data Structures

CSCI 315 Bioinformatics

CSCI 333 Theory of Computation

DANCE 201 The Body Movable (0.50)\*

DANCE 212 Articulate Body (0.50)\*

DANCE 301 Advanced Body Movable (.50)\*

ESTH 374 Biomechanics

ESTH 375 Physiology of Exercise

MATH 230 Differential Equations I

MATH 236 Mathematics of Biology

MATH 330 Differential Equations II

PHIL 231 Philosophy of Mind

PHIL 244 Philosophy of Science

PHIL 250 Biomedical Ethics

PHIL 251 Science, Ethics, and Religion

STAT 272 Statistical Modeling

STAT 316 Advanced Statistical Modeling

STAT 322 Statistical Theory

Another appropriate interdisciplinary course with permission of the program director.

\*Note: Two 0.5 credit dance classes must be taken to count for the interdisciplinary elective.

## Capstone Seminar (required)

Designated seminary in biology (e.g., BIO 385 The Neuron)

Designated seminar in psychology (e.g., PSYCH 336 Neuroscience of Addiction, PSYCH 338 Neurobiology of Psychopathology, or PSYCH 339 Cognitive Neuroscience)

Other designated seminars in chemistry or biology or psychology.

Note that PSYCH 336 or PSYCH 338 or PSYCH 339 cannot count for both a level III and a capstone seminar.

## Faculty

### Director, 2015-2016

#### Gary M. Muir

Associate Professor of Psychology  
behavioral neuroscience; cognitive neuroscience; neurobiology of spatial navigation; neurobiology of learning and memory

#### Kevin M. Crisp

Associate Professor of Biology  
electrophysiology; computational neuroscience; medical devices

#### James A. Demas

Assistant Professor of Biology and Physics  
neuronal biophysics; sensory circuits; retinal neurophysiology

#### Shelly D. Dickinson

Associate Professor of Psychology  
behavioral neuroscience; addiction; conditioning and learning; psychopharmacology

#### Jeremy L. Loebach

Assistant Professor of Psychology  
cognitive neuroscience; speech and hearing sciences; psycholinguistics

#### Jessica R. Simon

Assistant Professor of Psychology  
aging; adult development; cognition; memory and learning

#### Anne Walter

Professor of Biology  
comparative animal and cell physiology; membrane physiology and biophysics; comparative enzymology; applying biology in international settings