

NEUROSCIENCE

Katherine Towler, Regents Science 260
507-786-3100
towler2@stolaf.edu
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 allows students to explore connections 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 and behavior. 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

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, genetics, and statistics; many cognitive neuroscience programs emphasize coursework in psychology.

Requirements

Requirements for the Concentration

| Code | Title | Credits |
|---|-------------------------------------|---------|
| Foundation courses (taken in either order): | | |
| PSYCH 238 | Biopsychology | 1.00 |
| 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 |
| NEURO 239 focuses on the physiology and development of neurons and neural circuits across the animal kingdom. | | |

Select two lab electives. The first must be from the approved list of Neuroscience Core courses (see Category A list on courses tab). The second may be from either Category A or Category B. If the second is NOT from Category A, it must be from Category B and from a different department. (See Category B list on courses tab).

2.00

Elective: 1.00

Any course from Category A, B, or C. (See lists on courses tab.)

One level III seminar. (See lists on courses tab.) 1.00

Total Credits 6

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. Students attend lectures plus one three-hour laboratory per week. Offered annually in the spring semester. Also counts toward biology and kinesiology 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 398: Independent Research

Neuroscience Electives and Seminars

Category A: Core Neuroscience Courses

BIO 247 Animal Physiology

BIO 386 Animal Behavior

PSYCH 235 Sensation and Perception

PSYCH 236 Conditioning and Learning

PSYCH 237 Cognitive Psychology

PSYCH 393 Advanced Research Collaborations (ARC) (when topic is Neuroscience-based and in consultation with neuroscience program director)

Category B: Lab Elective Courses (from different department than first elective in Category A)

BIO 227 Cell Biology

BIO 233 Intermediate Genetics

BIO 243 Human Anatomy and Physiology: Organs and Organ Systems

BIO 364 Molecular Biology

BIO 372 Developmental Biology

CHEM 373 Laboratory Research in Biochemistry (0.25)

and CHEM 379 Biochemistry I (both courses required)

NOTE: CHEM 373 alone can count as Category C

PHYS 246 Electronics

* Directed Undergraduate Research (396) and Independent Research (398) courses allowed with pre-approval of the program director

Category C: Additional Elective (examples)

CHEM 379 Biochemistry I

CSCI 121 Principles of Computer Science

CSCI 125 Computer Science for Scientists and Mathematicians

CSCI 253 Algorithms and Data Structures

ECON 372 Behavioral Economics

ID 271 Topics in Interdisciplinary Studies (when topic is "Addiction from the Brain to the Social" or "Frontiers in Aging")

KINES 375 Physiology of Exercise

MATH 236 Mathematics of Biology

MATH 230 Differential Equations I

PHIL 231 Philosophy of Mind

PHIL 244 Philosophy of Science

PHIL 250 Biomedical Ethics

PHIL 251 Science, Ethics, and Religion

PHYS 116 Light, Vision, and Art

PHYS 390 Selected Topics (if neuroscience focus)

PSYCH 239 Drugs, the Brain and Behavior

SDS 164 Data Science 1

SDS 264 Data Science 2

SDS 272 Statistics 2

NOTE: Independent Study (298) courses and courses from other institutions (e.g., Carleton or DIS) may be counted as Category C with pre-approval of the program director

Seminars

BIO 385 The Neuron

BIO 391 Selected Topics (when topic is "Developmental Neurobiology or Computational Neuroscience")

PSYCH 336 Neuroscience of Addiction

PSYCH 337 Neurobiology of Learning and Memory

PSYCH 338 Neurobiology of Psychopathology

PSYCH 339 Cognitive Neuroscience

PSYCH 340 Frontiers in Aging: Cells to Society

PSYCH 390 Issues in Psychology (when topic is "Stress and Development" or "Aging Brain and Cognition")

Faculty

Program Director, 2024-2025

Norman Lee

Associate Professor of Biology

Kevin M. Crisp

Professor of Biology

electrophysiology; computational neuroscience; microglia

Jay A. Demas (on sabbatical 2024-25)

Associate 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 (on sabbatical 2024-25)

Associate Professor of Psychology

cognitive neuroscience; speech and hearing sciences; psycholinguistics

Gary M. Muir

Professor of Psychology; Grace A. Whittier Endowed Chair of Science

behavioral neuroscience; cognitive neuroscience; neurobiology of spatial navigation; neurobiology of learning and memory

Jessica R. Petok

Associate Professor of Psychology

aging; adult development; cognition; memory and learning