NEUROSCIENCE

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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 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 (through biochemistry), genetics, and statistics; many cognitive neuroscience programs emphasize coursework in psychology.

Requirements

The neuroscience concentration requires six courses: two foundation courses, three electives (two with lab), and one seminar.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PSYCH 238</td>
<td>Biopsychology</td>
<td>1.00</td>
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<tr>
<td>PSYCH 238</td>
<td>Introduces students to the fundamental principles underlying the relationship between the brain and behavior, with an emphasis on the systems and cognitive levels.</td>
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<tr>
<td>NEURO 239</td>
<td>Cellular and Molecular Neuroscience</td>
<td>1.00</td>
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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).

<table>
<thead>
<tr>
<th>Elective</th>
<th>Credits</th>
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<tr>
<td>Any course from Category A, B, or C. (See lists on courses tab.)</td>
<td>1.00</td>
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One level III seminar. (See lists on courses tab.)

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 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

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 395 Advanced Research in Behavioral Neuroscience

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

BIO 227 Cell Biology
Category C: Additional Elective (examples)

- BIO 298 Independent Study (if neuroscience focus)
- CSCI 121 Principles of Computer Science
- ESTH 373 Motor Control and Learning
- ESTH 374 Biomechanics
- ESTH 375 Physiology of Exercise
- ID 245 Integrated Science/Society: Interdisciplinary Approach Contemporary Iss (when topic is 'Addiction from Brain to the Social')
- ID 271 Topics in Interdisciplinary Studies (when topic is 'Frontiers in Aging')
- MATH 236 Mathematics of Biology
- MATH 330 Differential Equations II
- NEURO 298 Independent Study
- PHIL 231 Philosophy of Mind
- PHIL 244 Philosophy of Science
- PHIL 250 Biomedical Ethics
- PHYS 116 Light, Vision, and Art
- PHYS 390 Selected Topics (if neuroscience focus)
- PSYCH 222 Psychology of Hearing
- PSYCH 239 Drugs, the Brain and Behavior
- PSYCH 298 Independent Study (if neuroscience focus)
- SCICN 213 The Rise of Modern Science: Origins and Revolutions
- SCICN 215 The Well-Ordered Universe: Patterns and Models in Science
- SCICN 217 The Cultural Context: Science and Society
- STAT 272 Statistical Modeling

NOTE: Neuroscience courses from other institutions (e.g., Carleton or DIS) may be counted as Category C with approval of the program director

Seminars

- BIO 385 The Neuron
- BIO 391 Selected Topics (when topic is 'Developmental Neurobiology')
- PSYCH 336 Neuroscience of Addiction
- PSYCH 337 Neurobiology of Learning and Memory
- PSYCH 338 Neurobiology of Psychopathology
- PSYCH 339 Cognitive Neuroscience
- PSYCH 390 Issues in Psychology (when topic is 'Stress and Development' or 'Aging Brain and Cognition')

Faculty

**Director, 2019-2020**

**Shelly D. Dickinson**
Associate Professor of Psychology
behavioral neuroscience; addiction; conditioning and learning; psychopharmacology

**Kevin M. Crisp**
Associate Professor of Biology
electrophysiology; computational neuroscience; microglia

**James A. Demas**
Associate Professor of Biology and Physics
neuronal biophysics; sensory circuits; retinal neurophysiology

**Anna E. Johnson Roach**
Visiting Assistant Professor of Psychology
developmental psychology; social neuroscience; health psychology; stress

**Norman Lee**
Assistant Professor of Biology

**Jeremy L. Loebach**
Associate Professor of Psychology
cognitive neuroscience; speech and hearing sciences; psycholinguistics

**Gary M. Muir**
Associate Professor of Psychology
behavioral neuroscience; cognitive neuroscience; neurobiology of spatial navigation; neurobiology of learning and memory

**Jessica R. Petok**
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