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>
</tr>
</thead>
<tbody>
<tr>
<td>PSYCH 238</td>
<td>Biopsychology</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 247</td>
<td>Animal Physiology</td>
</tr>
<tr>
<td>BIO 386</td>
<td>Animal Behavior</td>
</tr>
<tr>
<td>PSYCH 235</td>
<td>Sensation and Perception</td>
</tr>
<tr>
<td>PSYCH 236</td>
<td>Conditioning and Learning</td>
</tr>
<tr>
<td>PSYCH 237</td>
<td>Cognitive Psychology</td>
</tr>
<tr>
<td>PSYCH 395</td>
<td>Advanced Research in Behavioral Neuroscience</td>
</tr>
</tbody>
</table>

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

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).

Elective: 1.00

Any course from Category A, B, or C. (See lists on courses tab.) 1.00

One level III seminar. (See lists on courses tab.) 1.00
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
BIO 396 Directed Undergraduate Research
BIO 398 Independent Research
CHEM 373 Experimental Biochemistry (0.25) and CHEM 379 Biochemistry I (both courses required)
NEURO 396 Directed Undergraduate Research
NEURO 398 Independent Research
PHYS 246 Electronics
PHYS 396 Directed Undergraduate Research (if neuroscience focus)
PHYS 398 Independent Research (if neuroscience focus)
PSYCH 396 Directed Undergraduate Research
PSYCH 398 Independent Research (if neuroscience focus)

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