Neuroscience is a rapidly growing interdisciplinary field concerned with understanding the relationship between brain, mind, and behavior. The interdisciplinary nature of the field is apparent when surveying those who call themselves neuroscientists. Among these are anatomists, physiologists, chemists, psychologists, philosophers, molecular biologists, computer scientists, linguists, and ethologists. The areas that neuroscience addresses are equally diverse and range from physiological and molecular studies of single neurons, to investigations of how systems of neurons produce phenomena such as vision and movement, to the study of the neural basis of complex cognitive phenomena such as memory, language, and consciousness. Applications of neuroscience research are rapidly growing and include the development of drugs to treat neurodegenerative disorders such as Alzheimer’s disease and Parkinson’s disease, the use of noninvasive techniques for imaging the human brain such as fMRI and near infrared optical imaging, and the development of methods for repair of the damaged human brain such as the use of brain explants and implants. Combining this wide range of approaches and research methods to study a single remarkably complex organ—the brain—and the behavioral outcomes of its activity requires a unique interdisciplinary approach. The Neuroscience Program is designed to provide students with the opportunity to explore this approach.

THE PROGRAM

The program in neuroscience consists of seven courses: The Cell (Biology 101); Introductory Psychology (Psychology 101); Neuroscience (Neuroscience 201); Topics in Neuroscience (Neuroscience 401); and three electives. Either Biology 101 or Psychology 101 must be taken prior to enrolling in the core course, Neuroscience (Neuroscience 201), which is the foundational neuroscience course and provides the background for upper-level electives in the concentration. Ideally, Neuroscience is taken the fall of the sophomore year. Electives are designed to provide in-depth coverage of specific areas within the field and many electives include laboratory experiences. At least one elective course is required from those designated as Group A (Neuroscience courses cross-listed with Biology). At least one elective course is required from those designated as Group B (Neuroscience courses cross-listed with Psychology). A third required elective may come from Group A or Group B offerings or it may come from Group C which consists of courses that are not cross-listed with neuroscience but include significant neuroscience content. Students may also petition the advisory committee to consider courses that are not listed among these groups including neuroscience-related courses that may be taken while studying abroad. Topics in Neuroscience (Neuroscience 401) is designed to provide an integrative culminating experience and is taken by all senior concentrators during the senior year.

Required Courses

Biol 101(F) LEC The Cell
  Taught by: Steven Swoap, Tim Lebestky
  Catalog details

NSCI 201 / BIOL 212 / PSYC 212(F) LEC Neuroscience
  Taught by: Matt Carter, Shivon Robinson
  Catalog details

NSCI 401(F) SEM Topics in Neuroscience
  Taught by: Yunshu Fan
  Catalog details

PSYC 101(F, S) LEC Introductory Psychology
  Taught by: Jeremy Cone, Kris Kirby, Ryan Smith
Students can ask the Neuroscience Program Chair whether courses not listed here might count as electives.

Elective Courses

Three elective courses are required. At least one elective must be from Group A and at least one elective must be from Group B. The third elective may come from Group A, Group B, or Group C. Students may also consult the Chair to consider courses that are not listed among these groups including neuroscience-related courses that may be taken while studying abroad.

Group A

BIOL 209 / NSCI 209(F) TUT Animal Communication
  Taught by: Heather Williams

BIOL 311 / NSCI 311 LEC Neural Systems and Circuits
  Taught by: Matt Carter

BIOL 312 / NSCI 312 LEC Sensory Biology
  Taught by: Heather Williams

BIOL 314(S) LEC Neuroethology
  Taught by: Charlotte Barkan

BIOL 407 / NSCI 347(S) SEM Neurobiology of Emotion
  Taught by: Tim Lebestky

BIOL 437(F) SEM Neural flexibility: plasticity, modulation and evolution
  Taught by: Charlotte Barkan

BIOL 455 / NSCI 455 SEM Neural Regeneration
  Taught by: Martha Marvin

Group B

PSYC 312 / NSCI 322 SEM From Order to Disorder(s): The Role of Genes & the Environment in Psychopathology
  Taught by: Victor Cazares

PSYC 313 / NSCI 313(S) SEM Opioids and the Opioid Crisis: The Neuroscience Behind an Epidemic
  Taught by: Shivon Robinson

PSYC 314 / NSCI 314 SEM Learning and Memory in Health and Disease
  Taught by: Shannon Moore

PSYC 316 / NSCI 316(S) SEM Neuroscience of Decision-Making
  Taught by: Yunshu Fan

PSYC 319 / NSCI 319 / STS 319 TUT Neuroethics
  Taught by: Noah Sandstrom

Group C

BIOL 204(S) LEC Animal Behavior
  Taught by: Manuel Morales

BIOL 421 TUT Thermoregulation: From Molecules to Organisms
  Taught by: Steven Swoap

PSYC 335(F) SEM Early Experience and the Developing Infant
  Taught by: Amie Hane

PSYC 351(F) SEM Clinical Neuropsychology
  Taught by: Anna Miley Akerstedt
THE DEGREE WITH HONORS IN NEUROSCIENCE

The degree with honors in Neuroscience provides students with the opportunity to undertake an original research project under the supervision of one or more of the Neuroscience faculty. In addition to completing the requirements of the Neuroscience Program, candidates for an honors degree must enroll in Neuroscience 493-W31-494 and write a thesis based on an original research project. Presentation of a thesis, however, should not be interpreted as a guarantee of a degree with honors. Students interested in pursuing a degree with honors should contact the Neuroscience Advisory Committee by winter study of their junior year.

STUDY ABROAD

FAQ

Can your department or program typically pre-approve courses for major/concentration credit?

Yes, in some cases, if appropriate course information is available in advance (e.g. syllabi and/or course descriptions). Securing syllabi is often difficult, so a discussion with the program Chair is certainly necessary. Under no circumstances should a student assume that a course taken at another institution will count toward the concentration.

What criteria will typically be used/required to determine whether a student may receive major/concentration credit for a course taken while on study away?

The program Chair and advisory committee will consider the course title, course description, and complete syllabus, including readings/assignments. Exams or other written work will also be considered. Written work may be requested if the course description suggests that it is only tangentially related to the field of neuroscience. Written work would, therefore, need to demonstrate that there was sufficient emphasis on neuroscience material.

Does your department/program place restrictions on the number of major/concentration credits that a student might earn through study away?

Yes. Generally there is a maximum of 2 credits that can be completed through a study abroad program.

Does your department/program place restrictions on the types of courses that can be awarded credit towards your major?

No.

Are there specific major requirements that cannot be fulfilled while on study away?

Yes. NSCI 201 and NSCI 401 can not generally be completed abroad. NSCI should be taken during the sophomore year if possible and includes a laboratory component that is rarely comparable in study abroad courses.

Are there specific major requirements in your department/program that students should be particularly aware of when weighing study away options? (Some examples might include a required course that is always taught in one semester, laboratory requirements.)

NSCI 201 is only taught during the fall semester. As such, students planning to study away should plan to take it during the sophomore year.

Give examples in which students thought or assumed that courses taken away would count toward the major or concentration and then learned they wouldn’t:

Some students (rarely) have failed to discuss the course in advance of their study abroad experiences. They may also have assumed that approval of a course by another department (e.g., Biology or Psychology) would necessarily mean that they would receive Neuroscience credit for the course. This is not necessarily the case.
emphasize a) practical hands-on exercises that amplify the material presented in class; b) interpreting and analyzing data; c) presenting the results in written form and placing them in the context of published work; and d) reading and critiquing scientific papers.

**Requirements/Evaluation:** Evaluation will be based on participation in discussion groups, exercises, problem sets and quizzes performed in small groups, lab reports, midterm exams, and a final exam.

**Prerequisites:** PSYC 101 or BIOL 101; open to first-year students only with permission of instructor

**Enrollment Limit:** 72

**Enrollment Preferences:** Sophomores and Biology and Psychology majors

**Expected Class Size:** 72

**Grading:** yes pass/fail option, no fifth course option

**Distributions:** (D3)

**This course is cross-listed and the prefixes carry the following divisional credit:**

PSYC 212(D3) PSYC 212(D3) PSYC 212(D3) NSCI 201(D3) BIOL 212(D3) NSCI 201(D3) BIOL 212(D3) BIOL 212(D3) BIOL 212(D3) BIOL 212(D3) NSCI 201(D3)

**Attributes:** COGS Interdepartmental Electives NSCI Required Courses PSYC 200-level Courses

---

**Fall 2023**

**LEC Section: 01** TR 9:55 am - 11:10 am Matt E. Carter, Shivon A. Robinson

**LAB Section: 02** M 1:00 pm - 4:00 pm Martha J. Marvin

**LAB Section: 03** T 1:00 pm - 4:00 pm Martha J. Marvin

**LAB Section: 04** W 1:00 pm - 4:00 pm Martha J. Marvin

**NSCI 209 (F) Animal Communication** (WS)

**Cross-listings:** BIOL 209 NSCI 209

**Secondary Cross-listing**

Animal communication systems come in as many varieties as the species that use them. What they have in common are a sender that encodes information into a physical signal and a receiver that senses the signal, extracts the information, and adjusts its subsequent behavior accordingly. This tutorial will consider all aspects of communication, using different animal systems to explore different aspects of the biology of signaling. Topics will include the use of syntax to carry meaning in chickadee calls, the "piracy" of signaling system by fireflies, statements of identity and affiliation in the form of toothed whales' signature whistles, long-distance chemical attractants that allow male moths to find the object of their desire, and cultural evolution within learned signaling systems.

**Requirements/Evaluation:** evaluation will be based on five 5-page papers, five short response papers, & the student's effectiveness in tutorial presentations.

**Prerequisites:** BIOL 101 and 102; open to sophomores, juniors, and seniors

**Enrollment Limit:** 10

**Enrollment Preferences:** Biology majors and senior Neuroscience concentrators who need a Biology elective to complete the concentration

**Expected Class Size:** 10

**Grading:** no pass/fail option, no fifth course option

**Distributions:** (D3) (WS)

**This course is cross-listed and the prefixes carry the following divisional credit:**

BIOL 209(D3) NSCI 209(D3)

**Writing Skills Notes:** This course is a tutorial, and each student will write five position papers and five response papers, and may rewrite any of them.

**Attributes:** COGS Related Courses NSCI Group A Electives

---

**Fall 2023**

**TUT Section: T1** TBA Heather Williams
**NSCI 311 (F) Neural Systems and Circuits**

**Cross-listings:** NSCI 311 BIOL 311

**Secondary Cross-listing**

This course will examine the functional organization of the mammalian brain, emphasizing both neuroanatomy and neurophysiology. How do specific populations of neurons and their connections encode sensory information, form perceptions of the external and internal environment, make cognitive decisions, and execute movements? How does the brain produce feelings of reward/motivation and aversion/pain? How does the nervous system regulate homeostatic functions such as sleep, food intake, and thirst? We will explore these questions using a holistic, integrative approach, considering molecular/cellular mechanisms, physiological characterizations of neurons, and connectivity among brain systems. Journal article discussions will complement course topics, providing experience in reading, understanding, and critiquing primary research papers. Writing an original literature review article will provide experience in expository writing and anonymous peer review. Laboratory sessions will provide experience in examining macroscopic and microscopic neural structures, as well as performing experiments to elucidate the structure and function of neural systems using classical and cutting-edge techniques.

**Requirements/Evaluation:** Class participation, completion of labs, literature review assignment, hour exams, a final exam

**Prerequisites:** BIOL 212 (same as PSYC 212 or NSCI 201) or BIOL 205

**Enrollment Limit:** 24

**Enrollment Preferences:** Biology majors and Neuroscience concentrators

**Expected Class Size:** 24

**Grading:** no pass/fail option, no fifth course option

**Unit Notes:** does not satisfy the distribution requirement for the Biology major

**Distributions:** (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

NSCI 311(D3) BIOL 311(D3)

**Attributes:** NSCI Group A Electives

Not offered current academic year

---

**NSCI 312 (F) Sensory Biology**

**Cross-listings:** BIOL 312 NSCI 312

**Secondary Cross-listing**

How do animals sense properties of the physical world? How do they convert physical or chemical energy to a signal within a cell that carries information? How is that information represented? What are the limits on what can be sensed? We will look for answers to these questions by investigating the molecular and cellular mechanisms of sensory transduction and how these mechanisms constrain the types of information that the nervous system encodes and processes. We will also ask how natural selection shapes the type of sensory information that animals extract from the world, and what adaptations allow some species to have "special" senses. Some of the examples we will consider are: bat echolocation (hair cells in the ear), detecting visual motion (amacrine cells in the mammalian retina), the constant reshaping of the olfactory system (chemical mapping of odors), what makes a touch stimulus noxious, and enhanced color vision (in birds, bees, and shrimp). Laboratory exercises will focus on the nematode *C. elegans*, an important model system, to explore and extend how we understand touch, temperature sensation, chemosensation, and light sensation.

**Requirements/Evaluation:** Four take-home exams, an independent group research project (proposal, followed by results/discussion), presentation about a non-standard sensory system, many short online quizzes, and lab + class participation.

**Prerequisites:** BIOL 101 and either BIOL 212/NSCI 201 or BIOL 205

**Enrollment Limit:** 24

**Enrollment Preferences:** Preference to senior Biology majors who need a 300-level course; then to senior Neuroscience concentrators who need a Group A elective; then to Biology majors. Not open to students who have taken Biology 213.

**Expected Class Size:** 20

**Grading:** no pass/fail option, no fifth course option

**Distributions:** (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

BIOL 312(D3) NSCI 312(D3)
**NSCI 313 (S) Opioids and the Opioid Crisis: The Neuroscience Behind an Epidemic**

*Cross-listings: PSYC 313 PSYC 313 NSCI 313 NSCI 313*

**Secondary Cross-listing**

Opioid misuse, including addiction, has emerged as a major health epidemic in the United States. This course will explore the science of opioids as well as the historical and societal context surrounding their use and abuse. We will examine the neurobiological mechanisms through which opioids interact with pain pathways and reward circuits within the brain and we will explore how changes in these systems contribute to opioid tolerance, dependence, and addiction. We will consider how genetic, environmental and behavioral factors can powerfully influence these processes. Finally, we will consider alternative approaches to pain management as well as interventions for the treatment of opioid abuse. Students will be expected to design and conduct an empirical project related to the course material. Critical evaluation of peer-reviewed primary literature from animal and human studies will serve as a foundation for class discussions. Evaluation will be based on class presentations, participation in discussions and empirical projects, written assignments, and a poster presentation of the empirical project.

**Requirements/Evaluation:** class presentations, participation in discussions and empirical projects, five short position papers (approximately 2 pages double-spaced), an APA style empirical paper (approximately 20 pages double-spaced) and poster presentation of the empirical project.

**Prerequisites:** PSYC 212 (same as BIOL 212 or NSCI 201)

**Enrollment Limit:** 16

**Enrollment Preferences:** Psychology majors and Neuroscience concentrators

**Expected Class Size:** 16

**Grading:** no pass/fail option, no fifth course option

**Distributions:** (D3)

**This course is cross-listed and the prefixes carry the following divisional credit:**

PSYC 313(D3) PSYC 313(D3) NSCI 313(D3) NSCI 313(D3)

**Attributes:** NSCI Group B Electives PHLH Biomedical Determinants of Health PSYC Area 1 - Behavioral Neuroscience PSYC Empirical Lab

---

**Spring 2024**

**SEM Section:** 01    TR 11:20 am - 12:35 pm    Shivon A. Robinson

**LAB Section:** 02    W 1:00 pm - 4:00 pm    Shivon A. Robinson

---

**NSCI 314 (S) Learning and Memory in Health and Disease**

*Cross-listings: NSCI 314 PSYC 314*

**Secondary Cross-listing**

This class will examine the neuroscientific basis of different types of learning and memory (such as declarative memory, motor memory, and associative memory), including the brain circuits, cellular mechanisms, and signaling pathways that mediate these different processes. In addition, we will explore how these processes can be disrupted in different diseases and disorders (such as Alzheimer's disease or post-traumatic stress disorder) and we will discuss the strategies and targets for therapeutic intervention. Class meetings will include a mix of lectures, discussions, and student presentations. Critical evaluation of peer-reviewed studies involving both human and animal models will serve as a foundation for class discussions. Working in small teams, students will also design and conduct an empirical project related to the course material.

**Requirements/Evaluation:** In-class presentations and participation in discussions, completion of an empirical research project which will include a project proposal (3-5 pages), data collection and analysis, and a final report (10-20 pages) along with a poster presentation.

**Prerequisites:** PSYC 212/NSCI 201/BIOL 212

**Enrollment Limit:** 16

**Enrollment Preferences:** Psychology majors and Neuroscience concentrators

**Expected Class Size:** 16

**Grading:** no pass/fail option, no fifth course option
NSCI 316 (S) Neuroscience of Decision-Making

Cross-listings: PSYC 316 NSCI 316 PSYC 316 NSCI 316

Secondary Cross-listing
Humans are constantly making decisions: big and small, conscious and unconscious. This seminar will explore different aspects of the decision-making process, including (1) the algorithms for decision-making, (2) the neurological basis of decision-making and (3) the psychological, social, and physiological factors that influence our decision-making. We will examine how scientific approaches can help us understand complex social issues related to decision making. For example: how can stereotypes be understood as a failure in belief updating; how does confirmation bias lead to partisanship; and how to think of xenophobia from the "explore-exploit trade-off" perspective? In this course, we will explore how the brain and its neural networks contribute to these phenomena. The laboratory component of the course will introduce the research tools for studying different aspects of decision-making, including experimental paradigms, computational models and methods of analysis. Students will apply these tools to collaboratively design and conduct behavioral experiments and will analyze neural recording data to understand the relationship between neural activity and decision-making behaviors. Over the course of the semester, students will have the opportunity to develop skills in computer programming to better understand computational models and data analysis.

Requirements/Evaluation: Class presentations, participation in discussions, keeping a decision journal, short response papers and laboratory assignments, participation and presentation of empirical laboratory studies.

Prerequisites: PSYC 212 (same as BIOL 212 or NSCI 201) or permission of instructor.

Enrollment Limit: 16

Enrollment Preferences: Psychology majors, Neuroscience concentrators, and Cognitive Science concentrators

Expected Class Size: 16

Grading: no pass/fail option, no fifth course option

Distributions: (D3)
This course is cross-listed and the prefixes carry the following divisional credit:
PSYC 316(D3) NSCI 316(D3) PSYC 316(D3) NSCI 316(D3)

Attributes: COGS Interdepartmental Electives NSCI Group B Electives PSYC Area 1 - Behavioral Neuroscience PSYC Empirical Lab Course

Spring 2024
SEM Section: 01 TR 9:55 am - 11:10 am Yunshu Fan
LAB Section: 02 M 1:00 pm - 4:00 pm Yunshu Fan

NSCI 319 (F) Neuroethics (WS)

Cross-listings: STS 319 PSYC 319 NSCI 319

Secondary Cross-listing
Neuroscience studies the brain and mind, and thereby some of the most profound aspects of human existence. In the last decade, advances in our understanding of brain function and in our ability to manipulate brain function have raised significant ethical challenges. This tutorial will explore a variety of important neuroethical questions. Potential topics will include pharmacological manipulation of "abnormal" personality; the use of "cosmetic pharmacology" to enhance cognition; the use of brain imaging to detect deception or to understand the ability, personality or vulnerability of an individual; the relationship between brain activity and consciousness; manipulation of memories; the neuroscience of morality and decision making. In addition to exploring these and other ethical issues, we will explore the basic science underlying them.

Requirements/Evaluation: six 5-page position papers and five 2-page response papers as well as participation in discussions

Prerequisites: PSYC 212 (same as BIOL 212 or NSCI 201); or permission of instructor
Enrollment Limit: 10

Enrollment Preferences: Psychology majors and Neuroscience concentrators

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (WS)

This course is cross-listed and the prefixes carry the following divisional credit:

STS 319(D2) PSYC 319(D3) NSCI 319(D3)

Writing Skills Notes: In alternating weeks, each student in a tutorial pair will write a 5-page essay based on the assigned readings. Essays will be discussed during tutorial meetings and written feedback from the professor will be provided for each essay. At the end of the semester, students will choose one of their prior essays to revise as their final submission. Students will receive from the instructor timely comments on their writing skills, with suggestions for improvement.

Attributes: NSCI Group B Electives PSYC Area 1 - Behavioral Neuroscience

Not offered current academic year

NSCI 322 (F) From Order to Disorder(s): The Role of Genes & the Environment in Psychopathology

Cross-listings: NSCI 322 PSYC 312

Secondary Cross-listing

This course examines how experimental methods in neuroscience can be used to understand the role of nature (genes) and nurture (the environment) in shaping the brain and behavior. In particular, we will explore how neuroscience informs our understanding of psychiatric disorders such as anxiety, depression, and schizophrenia. We will investigate the biological underpinning of these disorders as well as their treatments. Readings will include human studies as well as work based on animal models. Topics will include: the ways in which environmental and genetic factors shape risk and resiliency in the context of psychiatric disease, the neural circuits and peripheral systems that contribute to psychopathology, and the mechanisms through which interventions may act. In the laboratory component of the course, students will gain hands-on experience in using animal models to study complex behavior and their associated neural mechanisms.

Requirements/Evaluation: class presentations, participation in discussions, two article previews (1-2 pages each), literature review (5 pages), research project proposal (5 pages), oral presentation of project proposal.

Prerequisites: PSYC 212 (same as BIOL 212 or NSCI 201)

Enrollment Limit: 19

Enrollment Preferences: Psychology majors and Neuroscience concentrators

Expected Class Size: 19

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

NSCI 322(D3) PSYC 312(D3)

Attributes: BIGP Courses NSCI Group B Electives PSYC Area 1 - Behavioral Neuroscience

Not offered current academic year

NSCI 347 (S) Neurobiology of Emotion

Cross-listings: BIOL 407 NSCI 347 NSCI 347 BIOL 407

Secondary Cross-listing

Emotion is influenced and governed by a number of neural circuits and substrates, and emotional states can be influenced by memory, cognition, and many external stimuli. We will read and discuss articles about mammalian neuroanatomy associated with emotion as defined by classic lesion studies, pharmacology, electrophysiology, fMRI imaging, knockout and optogenetic mouse studies, for investigating neural circuit function in order to gain an understanding of the central circuits and neurotransmitter systems that are implicated in emotional processing. We will focus initially on the neural circuits involved in fear, as a model for how human and animal emotion and physiology is studied, with special sessions on emotional responses to music and art, as well as discussions about burgeoning neurobiological research into the emotion of disgust. The larger goal of the course is to give students opportunities and experience in critical evaluation and discussion of primary scientific literature, and to develop and refine strategies on how
to use scientific evidence in building arguments in essays.

Requirements/Evaluation: class participation and several short papers

Prerequisites: BIOL212/NSCI201; open to juniors and seniors. Sophomores must get instructor's consent prior to enrolling.

Enrollment Limit: 12

Enrollment Preferences: senior Biology majors who have not taken a 400-level Biology course; then to eligible NSCI concentrators

Expected Class Size: 12

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:
BIOL 407(D3) NSCI 347(D3) NSCI 347(D3) BIOL 407(D3)

Attributes: BIMO Interdepartmental Electives  NSCI Group A Electives

Spring 2024

SEM Section: 01 TR 9:55 am - 11:10 am Tim J. Lebestky
SEM Section: 02 TR 11:20 am - 12:35 pm Tim J. Lebestky

NSCI 397 (F) Independent Study: Neuroscience

Independent study.

Requirements/Evaluation: Determined by individual instructors

Prerequisites: Permission of instructor

Enrollment Limit: none

Enrollment Preferences: Upperclass students

Expected Class Size: NA

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3)

Fall 2023

IND Section: 01 TBA Tim J. Lebestky

NSCI 398 (S) Independent Study: Neuroscience

Independent study.

Requirements/Evaluation: Determined by individual instructors

Prerequisites: Permission of instructor

Enrollment Limit: none

Enrollment Preferences: Upperclass students

Expected Class Size: NA

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3)

Spring 2024

IND Section: 01 TBA Tim J. Lebestky

NSCI 401 (F) Topics in Neuroscience

Neuroscientists explore issues inherent in the study of brain and behavior. The overall objective of this seminar is to create a culminating senior
experience in which previous course work in specific areas in the Neuroscience Program can be brought to bear in a synthetic, interdisciplinary approach to understanding complex problems. The specific goals for students in this seminar are to evaluate original research and critically examine the experimental evidence for theoretical issues in the discipline. Topics and instructional formats will vary somewhat from year to year, but in all cases the course will emphasize an integrative approach in which students will be asked to consider topics from a range of perspectives including molecular, cellular, systems, behavioral and clinical neuroscience. Previous topics have included autism, depression, stress, neurogenesis, novel neuromodulators, language, retrograde messengers, synaptic plasticity, and learning and memory.

**Requirements/Evaluation:** Participation in class discussion, presentation of research articles, several short papers

**Prerequisites:** Open only to seniors in the Neuroscience program

**Enrollment Limit:** 20

**Enrollment Preferences:** Senior Neuroscience concentrators

**Expected Class Size:** 20

**Grading:** no pass/fail option, yes fifth course option

**Unit Notes:** Required of all senior students in the Neuroscience program

**Distributions:** (D3)

**Attributes:** NSCI Required Courses

---

**Fall 2023**

**SEM Section:** 01  MR 2:35 pm - 3:50 pm  Yunshu Fan

**NSCI 455 (S) Neural Regeneration**

**Cross-listings:** NSCI 455 BIOL 455

**Secondary Cross-listing**

Injury to the human nervous system can cause lasting impairment, but non-mammalian animals have prodigious capacity to regenerate neurons, regrow axons, and repair scars. What accounts for these differences? Regeneration can occur in multiple modes: replacement of injured neurons, repairs such as axonal regrowth to reconnect to a target structure, or repurposing existing neurons for new tasks through neural plasticity. We will explore the molecular foundations that underlie neuronal proliferation, neural plasticity, and inflammatory responses. We will consider the potential for translating these findings to inform treatments for humans who suffer from neural injury or neurodegenerative disease. Class discussions will focus on readings from the primary literature.

**Class Format:** Discussion, 3 hours per week

**Requirements/Evaluation:** Evaluation will be based on class participation, brief weekly responses, and four short research proposals.

**Prerequisites:** BIOL 212/NSCI 201 or permission of instructor.

**Enrollment Limit:** 10

**Enrollment Preferences:** Biology seniors who have not yet taken a 400 level course and Neuroscience senior concentrators who need a Group A elective.

**Expected Class Size:** 10

**Grading:** no pass/fail option, no fifth course option

**Distributions:** (D3)

**This course is cross-listed and the prefixes carry the following divisional credit:**

NSCI 455(D3) BIOL 455(D3)

**Attributes:** NSCI Group A Electives

Not offered current academic year

---

**NSCI 493 (F) Senior Thesis: Neuroscience**

Neuroscience senior thesis; this is part of a full-year thesis (493-494). Independent research for two semesters and a winter study under the guidance of one or more neuroscience faculty. After reviewing the literature in a specialized field of neuroscience, students design and conduct an original research project, the results of which are reported in a thesis. Senior thesis work is supervised by the faculty participating in the program.
**NSCI 494 (S) Senior Thesis: Neuroscience**

Neuroscience senior thesis; this is part of a full-year thesis (493-494). Independent research for two semesters and a winter study under the guidance of one or more neuroscience faculty. After reviewing the literature in a specialized field of neuroscience, students design and conduct an original research project, the results of which are reported in a thesis. Senior thesis work is supervised by the faculty participating in the program.

**Requirements/Evaluation:** Determined by the thesis advisor

**Prerequisites:** Permission of the thesis advisor

**Enrollment Limit:** none

**Enrollment Preferences:** Senior Neuroscience concentrator

**Expected Class Size:** NA

**Grading:** yes pass/fail option, yes fifth course option

**Distributions:** (D3)

Fall 2023

HON Section: 01 TBA Noah J. Sandstrom

---

**NSCI 10 (W) Neuroscience of Learning**

An interactive and collaborative exploration of what neuroscience research reveals about how the brain learns and what factors can be influenced to facilitate successful learning. Topics include the neuroscience of attention, emotion, understanding, memory, and executive functions. Emphasis will be on the neuroscience itself with opportunities for students to make connections to their own learning processes and strategies. Students will create and teach (to fellow classmates) a presentation/lesson that incorporates strategies they develop, based on the neuroscience of learning, regarding a topic they select.

**Requirements/Evaluation:** Presentation(s)

**Prerequisites:** None

**Enrollment Limit:** 12

**Enrollment Preferences:** None

**Expected Class Size:** NA

**Grading:** pass/fail only

**Unit Notes:** Dr. Judy Willis combined her 15 years as a board-certified practicing neurologist with ten subsequent years as a classroom teacher to become a leading authority in the neuroscience of learning. She has written nine books and more than 200 articles. Paul Willis, M.D., Williams '71, will add additional instruction on topics of his expertise from his years neurology practice and lecturing.

**Attributes:** EXPE Experiential Education Courses  STUX Winter Study Student Exploration  WELL Winter Study Wellness
NSCI 31 (W) Senior Thesis: Neuroscience
To be taken by students registered for Neuroscience 493-494.

Class Format: thesis
Grading: pass/fail only

NSCI 99 (W) Independent Study: Neuroscience
Open to upperclass students. Students interested in doing an independent project (99) during Winter Study must make prior arrangements with a faculty sponsor. The student and professor then complete the independent study proposal form available online. The deadline is typically in late September. Proposals are reviewed by the pertinent department and the Winter Study Committee. Students will be notified if their proposal is approved prior to the Winter Study registration period.

Class Format: independent study
Grading: pass/fail only