NEUROBIOLOGY & BEHAVIOR (BIONB)

BIONB 1100 - Natural History of the Magic Kingdom: Understanding Animal Behavior through Animated Films (3 Credits)
Animals are frequently used to tell children's stories, especially in animated cinema. For the most part depictions of animals in classic films such as Lion King, Finding Nemo, or The Land Before Time are clearly not intended to depict an accurate natural history of their subjects. However, the ways in which movies get things wrong by having animals portray human roles opens an opportunity to explore the diversity of animal behavior. This course focuses on understanding the evolution, ecology, and natural history of diverse animals portrayed in films. It will cover a range of topics that apply generally to animated animal movies (e.g., Do animals use language?) as well as issues raised by specific movies (Does it make any sense for Scar to kill Mufasa in Lion King?). During this course students will engage with data and analyses used in the field of animal behavior, appreciate the diversity of experiences among animals, and consider our own biology and behavior in the light of the natural world.
Distribution Requirements: (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS)
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023
Learning Outcomes:

- Participants will be able to describe broad evolutionary and ecological principles shaping animal behavioral diversity.
- Participants will be able to distinguish between mechanistic and functional approaches to the study of life sciences.
- Participants will learn to distinguish peer-reviewed scientific literature from popular scientific accounts.
- Participants will examine the role of human social constructs in shaping popular and scientific views of animal behavior.
- Participants will create a novel story using animals as main characters and evaluate the choices that alter or maintain aspects of their life history and or behavior.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 1220 - FWS: Special Topics in Neurobiology and Behavior (3 Credits)
The First-Year Writing Seminar is about introducing concepts in neuroscience and behavior and writing extensively about them. Topics vary by section.
Distribution Requirements: (WRT-AG)
Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Schedule of Classes (https://classes.cornell.edu/)

BIONB 2210 - Neurobiology and Behavior I: Introduction to Behavior (3-4 Credits)
General introduction to the field of animal behavior. Topics include evolution and behavior, behavioral ecology, sociobiology, chemical ecology, communication, orientation and navigation.
Prerequisites: two majors-level biology courses.
Enrollment Information: Priority given to: students studying Neurobiology and Behavior. Not open to: first-year students.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Fall 2024, Spring 2024, Fall 2023, Fall 2022
Learning Outcomes:

- To develop your awareness of, and curiosity about, the diversity of natural history and the exciting puzzles raised by the behavior of living things.
- To gain mastery at asking and answering questions about the mechanisms and evolution of behavior by performing observations, generating hypotheses, deriving predictions, and developing tests to investigate the causes of behavior.
- To compare the social systems of different species and to understand how the study of behavior is relevant to your other courses, to your own life, and to the world around you.
- To learn to read, interpret and critically evaluate scientific discoveries communicated through the primary, peer-reviewed literature.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 2220 - Neurobiology and Behavior II: Introduction to Neuroscience (3-4 Credits)
An introduction to neuroscience: the structure and function of the nervous system of humans and other animals. Topics include the cellular and molecular basis for cell signaling, the functions of neurons in communication and in decision making; neuroanatomy, neurochemistry, sensory systems, motor systems, neural development, learning and memory, and other complex brain functions. The course will emphasize how the nervous system is built during development, how it changes with experiences during life, how it functions in normal behavior, and how it is disrupted by injury and disease. Discussion sections will include a dissection of a preserved sheep brain.
Prerequisites: one year of college level biology for majors and one year of chemistry.
Enrollment Information: Priority given to: students studying Neurobiology and Behavior. Not open to: first-year students.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Summer 2025, Spring 2025, Summer 2024, Spring 2024
Learning Outcomes:

- Demonstrate knowledge of core concepts and principles in neuroscience through writing, speaking, and problem solving.
- Link neuroscience concepts to observations and experiments using the scientific method.
- Categorize the functions of the major components of the central and peripheral nervous system to the extent they are known.
- Apply the laws of chemistry and physics to understanding mechanisms of neural activity.
- Assess how mechanisms of animal and human neural function at multiple scales, from molecules and molecular interactions to interaction of neural circuits and brain pathways.
- Explain how information is encoded by neurons and neural circuits: describe how perceptions are represented, stored, and recalled for later use in decision making and control of behavior.
- Interpret modern views of how the nervous system changes with experience, and how it is disrupted by injury and disease.
- Interpret modern views of how the brain generates complex cognitive function including communication, emotions, sleep, and cognition.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 3215 - Gender and the Brain (3 Credits)
Crosslisted with FGSS 3210, LGBT 3210
Why are boys more likely than girls to be diagnosed with autism, and why are women more likely than men to be diagnosed with depression? Are there different gay and straight brains? And how does brain science interact with gender and sexuality in popular debate? Reading and discussing the original scientific papers and related critical texts, we will delve into the neuroscience of gender. In this course, we will delve into the neuroscience of gender difference. Reading the original scientific papers and related critical texts, we will ask whether we can find measurable physical differences in male and female brains, and what these differences might be. Do men and women solve spatial puzzles differently, as measured physiologically? Do nonhuman animals display sex-specific behaviors mediated by brain structure, and can we extrapolate these findings to human behavior? Why are boys three times more likely than girls to be diagnosed as autistic, and is there any connection between the predominantly male phenomenon of autism and other stereotypically male mental traits? Are there physical representations of sexual orientation in the brain, and how are these related to gender identity? And how are scientific studies represented and misrepresented in popular debate?
Prerequisites: BIONB 2220, BIOMG 3320, FGSS 2010, and LGBT 2290 or permission of instructor.
Distribution Requirements: (BIO-AS, SCD-AS), (BSC-AG, D-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022
Learning Outcomes:

- Demonstrate knowledge of the state of the field in gender and neuroscience.
- Be able to apply concepts from history, philosophy, and critical theory to scientific texts.
- Demonstrate understanding of the interaction of experimental design, stereotypes, and preconceptions in how studies are carried out and communicated.
- Be aware of the range of experimental techniques available in neuroscience, and their advantages and limitations.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 3220 - Hormones and Behavior (3 Credits)
Crosslisted with PSYCH 3220, HD 3220
Covers comparative and evolutionary approaches to the study of the relationship between peripheral hormones and neuroendocrine mechanisms in vertebrates, including humans, with sexual behavior, affiliative bonds and social grouping, parental behavior, aggression, mating systems, stress, learning and memory, and biological rhythms.
Prerequisites: Recommended prerequisite: any one of the following PSYCH 2230, BIONB 2210 or BIONB 2220, or two biology courses plus a psychology course.
Enrollment Information: Enrollment limited to: juniors and seniors.
Distribution Requirements: (BIO-AS), (OPHLS-AG)
Last Four Terms Offered: Spring 2025, Fall 2023, Fall 2022, Fall 2021
Schedule of Classes (https://classes.cornell.edu/)

BIONB 3240 - Behavioral Neuroscience Laboratory (3 Credits)
Crosslisted with PSYCH 3240, COGST 3240
This course is designed to provide an introduction to experimental research on the neural basis of behavior and cognition in animals. Topics will include basic neuroanatomy and neurophysiology, neural and hormonal control of behavior, and learning and memory. Students will gain extensive hands on experience with a variety of laboratory techniques, and animal species, and behaviors.
Prerequisites: PSYCH 2230 or BIONB 2220.
Course Fee: Course Fee, $100. Lab fee.
Distribution Requirements: (BIO-AS), (OPHLS-AG)
Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Schedule of Classes (https://classes.cornell.edu/)

BIONB 3280 - Biopsychology of Learning and Memory (3 Credits)
Crosslisted with PSYCH 3320
Surveys the approaches that have been or are currently being used in order to understand the biological bases for learning and memory. Topics include invertebrate, simple system approaches, avian song learning, hippocampal and cerebellar function, research using MRI in humans. Many of the readings are from primary literature.
Prerequisites: one year of biology, and either a biopsychology course or BIONB 2220.
Distribution Requirements: (BIO-AS), (OPHLS-AG)
Last Four Terms Offered: Spring 2024, Spring 2022, Spring 2021, Spring 2020
Schedule of Classes (https://classes.cornell.edu/)

BIONB 3300 - Introduction to Computational Neuroscience (3-4 Credits)
Crosslisted with PSYCH 3300, COGST 3300, BME 3300
Covers the basic ideas and techniques involved in computational neuroscience. Surveys diverse topics, including neural dynamics of small networks of cells, neural coding, learning in neural networks and in brain structures, memory models of the hippocampus, sensory coding, and others.
Prerequisites: BIONB 2220 or permission of instructor.
Distribution Requirements: (BIO-AS, SDS-AS), (OPHLS-AG)
Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2018, Fall 2016
Learning Outcomes:

- Basic understanding of current theories of brain function.
- How to construct representations from tuning curves.
- Plasticity and how it relates to memory.
- Models of human memory.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 3500 - NeuroAI: Bridging Brains and AI (3 Credits)
We are in an AI revolution, yet these systems still can't match the brain's remarkable ability to build deep understanding of the world and use it flexibly for reasoning, planning, and adapting to new situations. This course examines neural information processing across multiple scales - from single neurons to brain systems - and their parallels in AI architectures. The course emphasizes how neuroscience insights drive AI innovation, from memory systems and neural dynamics to predictive processing and world models. For students with AI/CS/Math backgrounds, it provides deep insights into brain computation principles for developing neuroinspired algorithms. For neuroscience students, it introduces modern AI frameworks for understanding neural systems. Through topics spanning biological/artificial neural networks, hippocampal-cortical interactions, world models, and emerging neuroinspired architectures, students will explore how understanding the brain's computational principles can lead to more robust and general AI systems.
Distribution Requirements: (BIO-AS, SDS-AS), (PSC-AG)
Exploratory Studies: (CU-UG)

Schedule of Classes (https://classes.cornell.edu/)

BIONB 3690 - Chemical Ecology (3 Credits)
Crosslisted with BIOEE 3690, ENTOM 3690
Why are chilies so spicy? This course examines the chemical basis of interactions between species and is intended for students with a basic knowledge of chemistry and biology. Focuses on the ecology and chemistry of plants, animals, and microbes. Stresses chemical signals used in diverse ecosystems, using Darwinian natural selection as a framework. Topics include: plant defenses, microbial warfare, communication in marine organisms, and human pheromones.
Prerequisites: one majors-level biology course and one semester introductory chemistry for majors or non-majors or equivalents, or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022
Learning Outcomes:

- Categorize ecological interactions and potential mechanisms by which they are mediated.
- Discuss these mechanisms in light of evolutionary theory and draw conclusions about potential agricultural applications.
- Become familiar with the general structures of organic molecules and the relationship between structure and function.
- Become familiar with a number of analytical, behavioral, and experimental techniques used to analyze chemical compounds that mediate ecological interactions.
- Read and synthesize findings from original scientific research in chemical ecology by studying and discussing the primary literature.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 3920 - Drugs and the Brain (4 Credits)
Introduction to neuropharmacology, with an emphasis on the neural mechanisms of psychoactive drugs. Topics include a brief introduction to neuropharmacology and a discussion of the major neurotransmitter families. The rest of the course covers the major psychoactive drugs, including cocaine, heroin, psychedelics, marijuana, and alcohol, as well as pharmaceuticals for the treatment of anxiety, schizophrenia, and depression. Includes a term paper in the form of a grant proposal to study a current problem in neuropharmacology.
Prerequisites: BIONB 2220 or equivalent course in neurobiology.
Distribution Requirements: (BIO-AS), (OPHLS-AG)
Last Four Terms Offered: Fall 2023, Fall 2021, Fall 2019, Fall 2017
Learning Outcomes:

- Master the basics of pharmacology and understand the biochemical, physiological, and neural pathways of drug actions in the brain.
- Understand the neural mechanisms of addiction and withdrawal of psychoactive drugs and the therapeutic actions of major psychiatric drugs in the brain.
- Critically analyze and evaluate papers from the neuropharmacology literature.
- Design research plans utilizing modern neurobiological techniques to test hypotheses in neuropharmacology.
- Search the literature, to propose solutions to currently unsolved problems in neuropharmacology, and to test them experimentally.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 3950 - Molecular and Genetic Approaches to Neuroscience (3 Credits)
Focuses on how different molecular and genetic approaches have led to major advances in neuroscience. Lectures, student presentations, and discussions examine original research articles. Topics include: ligand-gated channels, potassium channels, seven membrane spanning receptors, olfaction, pain and cold receptors, neurotransmitter release, neural networks, epilepsy, optogenetics, and circadian rhythms.
Prerequisites: BIONB 2220 or BIOMG 3300 or BIOMG 3320.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Fall 2023, Fall 2020, Fall 2018, Fall 2016
Learning Outcomes:

- Demonstrate mastery of reading primary scientific literature in molecular neuroscience.
- Present scientific information from primary literature to a broad audience by oral presentation.
- Apply basic scientific principles to formulate hypotheses that explain raw scientific data.
- Articulate the utility of model genetic organisms in the field of neuroscience.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4140 - Principles of Pharmacology (3 Credits)
Crosslisted with BIOAP 4140, BIOMS 4140
Undergraduate course surveying system- and organ-related aspects of pharmacology. Topics include mechanisms of drug action; drug disposition; pharmacokinetics; autonomic pharmacology; pharmacology of inflammation, allergy and platelet function; and endocrine, cardiovascular, respiratory, gastrointestinal, and renal pharmacology. The course is designed for undergraduate life science majors, particularly those interested in medical or veterinary school.
Prerequisites: BIOAP 3110 or NS 3410.
Distribution Requirements: (BIO-AS), (OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022
Learning Outcomes:

- Describe fundamental concepts of drug-receptor interactions.
- Describe the relation between cell membrane or intracellular drug targets and intracellular signaling systems that mediate cellular response.
- Describe the impact of drug accessibility to biological compartments on drug action.
- Describe the purpose as well as the detailed mechanisms of the biochemical reactions that render drug and xenobiotic compounds more suitable for elimination from the body.
- Describe the fundamental mechanisms responsible for various types of drug interactions.
- Describe the mechanism of therapeutic action of a selected drug at the molecular, cellular, and organ system level.
- Describe the common adverse effects of a selected drug and their mechanism of production.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4200 - Topics in Neurobiology and Behavior (1-4 Credits)
Courses on selected topics in neurobiology and behavior; can include lecture and seminar courses.
Enrollment Information: Enrollment preference given to: undergraduates.
Distribution Requirements: (OPHLS-AG)
Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Schedule of Classes (https://classes.cornell.edu/)

BIONB 4220 - Modeling Behavioral Evolution (4 Credits)
Intensive lecture and computer lab course on modeling strategies and techniques in the study of behavioral evolution. Population-genetic (including quantitative-genetic), static optimization, dynamic programming, and game-theoretic methods are emphasized. These approaches are illustrated by application to problems in optimal foraging, sexual selection, sex ratio evolution, animal communication, and the evolution of cooperation and conflict within animal social groups. Students learn to critically assess recent evolutionary theories of animal behavior, as well as to develop their own testable models for biological systems of interest or to extend preexisting models in novel directions. The Mathematica software program is used as a modeling tool in the accompanying computer lab.
Prerequisites: BIONB 2210, one year calculus, course in probability or statistics, or permission of instructor.
Enrollment Information: Enrollment limited to: seniors and juniors.
Distribution Requirements: (BIO-AS, SMR-AS), (OPHLS-AG)
Last Four Terms Offered: Spring 2025, Fall 2018, Fall 2016, Fall 2013
Learning Outcomes:

- To be able to understand and create single-locus population genetic models of selection.
- To be able to understand and manipulate the Price equation.
- To understand and use static and dynamic optimization methods, both constrained and unconstrained, as in models of patch residence time from optimal foraging theory.
- To understand and create discrete and continuous strategy game theory models and derive ESS's from them with appropriate checks on stability.
- To understand and use kin selection theory, using both inclusive fitness and neighbor-modulated methods.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4260 - Animal Communication (4 Credits)
Communication is the glue that holds societies together. This course examines how and why animals communicate. Topics include the role of the environment in shaping animal signals, whether animals tell the truth to each other, why some bird songs are simple and others complex, and what kinds of signals might be exchanged between species.
Prerequisites: BIONB 2210.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2024, Spring 2022, Spring 2020, Spring 2018
Learning Outcomes:

- Demonstrate mastery of the core principles of animal communication.
- Discuss and explain methodological approaches to studying communication.
- Describe the mechanistic bases of communication systems, and the function and evolution of animal signals.
- Formulate hypotheses, predictions and tests in order to investigate active research questions in the field of animal communication.
- Apply bioacoustic methods to analyze one key modality of communication, acoustic signals.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4300 - Experimental Molecular Neurobiology (4 Credits)
Experiments include PCR, western blots, RNAi, antibody staining, optogenetics, calcium imaging of neurons and behavioral assays. Students will also construct their own epifluoresence microscope. Experiments emphasize how molecular techniques can be applied to studying neurobiological problems and will culminate in designing your own experiments. If you have additional questions please contact dld14@cornell.edu.
Prerequisites: BIOMG 3300 or BIOMG 3310.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022
Learning Outcomes:

- Demonstrate competence in basic molecular biology and protein biochemistry skills in the laboratory and the underlying principles of these techniques.
- Demonstrate mastery of basic bioinformatics tools such as BLASTN, TBLASTN, and BLASTP and using model organism databases such as FlyBase.
- Weigh how various laboratory methods offer complementary insights into the characterization of gene expression.
- Demonstrate a mastery of scientific procedures and data analysis by crafting comprehensive laboratory reports.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4320 - Neural Circuits for Motor Control in Health and Disease (3 Credits)
Almost all behaviors-from speech to a cross court forehand-are mediated by the contraction of muscles. This course examines the neural origins of motor behavior, from simple reflexes to complex learned motor sequences. Ascending the motor hierarchy, we will study the neuromuscular junction, spinal cord, brainstem, cerebellum, basal ganglia and cerebral cortex. At each level, we will examine the structure and function of the local microcircuit, as well as diseases-such as myasthenia gravis, stroke, ALS, ataxia and Parkinson's-that result from that circuit's dysfunction.Each week we will discuss a topic relating to the neurobiology of motor control, with a combination of lectures (both video and real-life) and student-led presentations of relevant research papers. Students will be evaluated on the basis of their participation, their presentations, their final project (a 5 page grant proposal on a research question relevant to the course), and a final exam.
Prerequisites: BIONB 2220 or ECE 2100.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2020, Fall 2018
Learning Outcomes:

- To understand the structure and function of the vertebrate motor system, including neural mechanisms of human movement disorders.
- To critically read and comprehend primary literature.
- To distill large amounts of information into central concepts of nervous system function, and to articulate these concepts both verbally and in writing.
- To creatively come up with new ideas and design experiments to test them.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4380 - Topics in Computational Methods for Neurobiology and Behavior (3 Credits)
This course is intended for advanced undergraduate and graduate students interested in computational methods for analyzing neural and behavioral data. Potential topics include signal processing, spectral analysis, information theory, cluster analysis, fitting parametrized models and maximum entropy models. We will also look at applications of modern machine learning techniques to scoring, analyzing and interpreting data. Although the course will be geared towards students who are new to computational methods, familiarity with calculus is recommended. Students will be asked to give a short oral presentation at the end of the semester on the use of methods from the class to analyze a real dataset.
Prerequisites: basic calculus is recommended.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Fall 2024, Fall 2021, Fall 2019
Learning Outcomes:

- By the end of this class, students will be able to analyze real neurobiological and behavioral data using a suite of traditional and modern methods in computational neuroscience.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4460 - Plant Behavior and Biotic Interactions, Lecture (3 Credits)
Crosslisted with BIOEE 4460
How do plants respond to antagonists, such as herbivores and pathogens? What are the checks and balances that keep mutualist organisms in their tight interactions? How are symbioses organized on molecular, metabolic and ecological levels? What are the molecular, plant hormonal, and metabolic mechanisms mediating plant biotic interactions with other organisms? What ecological and evolutionary consequences do these interactions have for the fitness of the plants and their interactors? This course provides an overview of plants' myriad interactions with antagonists and mutualists, from microbes to multicellular organisms, and explains the underlying ecological and evolutionary concepts. It gives an introduction to the study of induced plant responses in the light of a behavioral biology framework.
Distribution Requirements: (BIO-AS, SDS-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2024, Spring 2022, Spring 2021, Spring 2020
Learning Outcomes:

- Identify, explain, categorize and examine the ecological, physiological and molecular mechanisms of plant biotic interactions.
- Discuss these mechanisms and interpret associated data analyses in the light of evolutionary theory and draw conclusions about potential agricultural applications.
- Broadly apply and critically evaluate the four levels of proximate and ultimate causation for the study of biotic interactions in general.
- Apply, categorize and integrate basic conceptual and analytical tools to describe complex behavioral interactions.
- Discuss, contrast and design a number of experimental and synthetic approaches to analyzing and discovering chemical ecological processes including bioassays and chemical and molecular analyses.
- Read, discuss, evaluate, and objectively criticize original studies in the field.
- Provisioned with observations or a theoretical framework, students will be able to formulate scientific questions, derive hypotheses and design an appropriate experimental plan.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4461 - Plant Behavior and Biotic Interactions, Laboratory (1 Credit)
Crosslisted with BIOEE 4461
Laboratory course covering topics presented in BIOEE 4460/BIONB 4460/PLSCI 4460.
Prerequisites: Prerequisite or corequisite: BIOEE 4460, BIONB 4460 or PLSCI 4460.
Last Four Terms Offered: Spring 2024, Spring 2021, Spring 2020, Spring 2019
Learning Outcomes:

- Identify, explain, categorize and examine the ecological, physiological and molecular mechanisms of plant biotic interactions.
- Discuss these mechanisms and interpret associated data analyses in the light of evolutionary theory and draw conclusions about potential agricultural applications.
- Broadly apply and critically evaluate the four levels of proximate and ultimate causation for the study of biotic interactions in general.
- Apply, categorize and integrate basic conceptual and analytical tools to describe complex behavioral interactions.
- Discuss, contrast and design a number of experimental and synthetic approaches to analyzing and discovering chemical ecological processes including bioassays and chemical and molecular analyses.
- Read, discuss, evaluate, objectively criticize original studies in the field.
- Provisioned with observations or a theoretical framework, students will be able to formulate scientific questions, derive hypotheses and design an appropriate experimental plan.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4530 - Speciation: Genetics, Ecology, and Behavior (4 Credits)
Crosslisted with BIOEE 4530
Advanced course in evolutionary biology focusing on the pattern and process of speciation and the nature of origin of behavioral, morphological, physiological and ecological traits that form the intrinsic barriers to gene exchange. Lecture topics include species concepts and definitions, the history of ideas about speciation, the biological basis of intrinsic barriers to gene exchange, current models for the origin of such barriers, genetic architecture of speciation, rates of speciation. Emphasis is on developing a rigorous conceptual framework for discussing speciation and on detailed analysis of a series of case histories.
Prerequisites: BIOEE 1780 or BIOEE 1781 or equivalent, or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2023, Spring 2021, Spring 2019
Learning Outcomes:

- Understand phylogenetics, how evolutionary trees serve as a framework for interpreting evolutionary history, and the distinction between gene trees and species trees.
- Understand basic principles of population genetics and the utility of population genetic analyses in estimating gene flow, inferring selection, etc.
- Understand the diversity of species concepts and what they imply.
- Understand how gene flow, natural and sexual selection, and recombination operate in natural populations to promote and/or inhibit divergence of populations.
- Develop familiarity with basic models of speciation (e.g., vicariance, sympatric, reinforcement, polyploidy).
- Develop familiarity with case histories that illustrate the above models.
- Understand where and when barriers act in the life cycle of organisms.
- Develop familiarity with specific examples of reproductive barriers.
- Understand how data are collected and analyzed.
- Develop the ability to think critically about data from observation and experiment.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4560 - Neural Control of Food Intake and Energy Metabolism (3 Credits)
Food intake is a complex behavior that is strictly regulated by sensory, homeostatic, and hedonic neural circuits, which balance energy intake with energy expenditure. An integrated system of external sensory information works together with peripheral body organs and the central nervous system to produce the sensation of food and the drive to consume. The balanced functioning of this interconnected physiological system is critical for humans and other organisms to control the nutrient intake and maintain stable body weight. In eating disorders, such as anorexia nervosa, or in metabolic syndromes, such as obesity, the perception of food and the homeostatic balance between hunger and satiety is dysregulated leading to weight loss or gain and associated health problems. In this course, students will learn about the current and past research on neural control of food intake and energy metabolism. I will introduce the topic and cover the main discoveries in a discussion-based lecture. After the lecture, each week, students will collaboratively present a topic. The first student will present an overview of the research topic. The second student will present the research article for the week. Each student will present twice (once in each slot). Everyone must do the readings each week and come prepared to discuss the science. There will be ample time for discussion and questions, which are strongly encouraged.
Prerequisites: BIONB 2210 and BIONB 2220.
Distribution Requirements: (BSC-AG)
Last Four Terms Offered: Spring 2024
Learning Outcomes:

- Students will be able to critically read and discuss the primary neuroscience literature.
- Students will have a general knowledge in common methods used in neuroscience research.
- Students will be able to describe neural circuits that regulate food intake and metabolism in the mammalian brain.
- Students will be able develop a research proposal and give concise, organized oral presentations to peers.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4700 - Biophysical Methods (3 Credits)
Crosslisted with AEP 4700
Overview of the diversity of modern biophysical experimental techniques used in the study of biophysical systems at the molecular, cellular, and population level. Emphasis is placed on groundbreaking methods behind recent Nobel Prizes and other techniques likely to be encountered in cutting-edge research and industry. Topics include: 1) super-resolution, multi-photon, and single molecule microscopy, 2) crystallography and structural biology methods used to characterize DNA, RNA, proteins, cells, tissues, 3) microfluidics, lab-on-a-chip, and single cell culture techniques, 4) molecular dynamics simulations, stochastic modeling, and physical models of a cell, and 5) next-generation sequencing, protein engineering, synthetic biology, genome editing, and other experimental techniques at the intersection of applied physics and biological engineering.
Enrollment Information: Recommended prerequisite: solid knowledge of basic physics and mathematics through sophomore level.
Last Four Terms Offered: Fall 2021, Fall 2020, Fall 2019, Fall 2018
Schedule of Classes (https://classes.cornell.edu/)

BIONB 4720 - Visual Ecology (3 Credits)
This course will explore the wide diversity in visual systems across organisms and how evolution shapes these visual systems to solve a wide range of daily challenges. Vision often plays a key role in navigation, finding food, avoiding predators, and even choosing potential mates, but there isn't one best visual system for all these tasks in all environments. We will be examining how differences in eye structure and photoreceptors lead to differences in spatial acuity, color vision, polarized light detection, and even the speed of vision.
Prerequisites: BIONB 2210.
Distribution Requirements: (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Fall 2024, Fall 2022
Learning Outcomes:

- Classify the diversity in visual systems across organisms.
- Explain methods and interpret data from a primary publication in this field.
- Formulate hypotheses about an organism's behavior by studying their visual system.
- Construct an engaging scientific outreach program.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4740 - Neural Dynamics of Learning, Memory and Decision Making (3 Credits)
This course examines the neural circuit dynamics that support learning, memory and flexible decision making. We will critically read and discuss classic and current papers in these subjects. Topics may include neural mechanisms of different types of learning, memory-guided behavior, spatial navigation, memory replay, neural oscillations, brain computation, etc. We will critically read and discuss classic and current papers in these subjects. Topics may include neural mechanisms of different types of learning, memory-guided behavior, spatial navigation, memory replay, neural oscillations, brain computation, etc. Topics will cover both fundamental and translational research in different animal models and humans.
Prerequisites: BIONB 2220 or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2023
Learning Outcomes:

- Develop proficiency with current approaches and discoveries on the neural dynamics and circuit mechanisms that support learning, memory and decision making in health and disease.
- Critically read, synthetize, and evaluate both the primary scientific literature and review articles summarizing this literature.
- Generate creative new ideas about the neural circuits that mediate flexible behaviors and their dysfunction and design experiments to test these ideas.
- Articulate these new ideas in the form of a research plan that can advance our understanding of the neural mechanisms of cognition, behavior or disease.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4750 - Sleep - Evolution and Neural Basis (3 Credits)
This class examines the neural circuits that regulate sleep and how sleep changes or preserves across different species. It will help students to extract critical information from research literature regarding sleep and related biological rhythms. Topics will range from comparison of sleep in different animals, description of the different sleep stages, brain computations during different sleep phases and pathological implications of sleep associated disorders.
Prerequisites: BIONB 2220.
Distribution Requirements: (BSC-AG)
Last Four Terms Offered: Spring 2024
Learning Outcomes:

- Formulate hypotheses that can be tested with state of the art research strategies.
- Learn to design methods and interpret results of a scientific study.
- Have the capability to compose an essay in a scientific topic understandable for a broader audience.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4910 - Principles of Neurophysiology (4 Credits)
Crosslisted with BME 4910, ECE 4910
Laboratory-oriented course designed to teach the concepts and tools of cellular neurophysiology through hands-on experience with extracellular and intracellular electrophysiological techniques, and computer acquisition and analysis of laboratory results. Students explore signal transmission in the nervous system by examining the cellular basis of resting and action potentials, and synaptic transmission and optogenetic control of behavior and physiology. Lecture time is used to review nervous system physiology, introduce laboratory exercises, discuss lab results and primary research papers, and for presentation of additional experimental preparations and methods. Invertebrate preparations are used as model systems.
Prerequisites: one of the following courses: general biology, BIONB 2220, physiology covering neuronal excitability and synaptic transmission, or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022
Learning Outcomes:

- Students should understand the contemporary experimental paradigms in modern neurophysiology and become technically competent with the extracellular and intracellular recording techniques used to explore nervous system physiology.
- Students should deepen their understanding of the ionic mechanisms underlying neuronal excitability and synaptic communication in the nervous system.
- Students should develop their skills in communicating scientific results effectively through written lab reports and oral presentations.
- Students should refine their critical reading skills of primary scientific literature.
- Students should refine their ability to develop testable hypotheses, and develop independent scientific thinking.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 4980 - Teaching Experience (1-4 Credits)
Designed to give qualified undergraduate students teaching experience through actual involvement in planning and assisting in biology courses. This experience may include supervised participation in a discussion group, assisting in a biology laboratory, assisting in field biology, or tutoring.
Prerequisites: previous enrollment in course to be taught or equivalent.
Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Schedule of Classes (https://classes.cornell.edu/)

BIONB 5910 - Principles of Neurophysiology (4 Credits)
Crosslisted with BME 5320, ECE 5090
Laboratory-oriented course designed to teach the concepts and tools of cellular neurophysiology through hands-on experience with extracellular and intracellular electrophysiological techniques, and computer acquisition and analysis of laboratory results. Students explore signal transmission in the nervous system by examining the cellular basis of resting and action potentials, and synaptic transmission. Lecture time is used to review nervous system physiology, introduce laboratory exercises, discuss lab results and primary research papers, and for presentation of additional experimental preparations and methods. Invertebrate preparations are used as model systems. Students must complete and additional semester-long project. The project includes exploration of experimental neuroscience questions not covered in the undergraduate laboratory class, novel, low cost instrumentation design, computational approaches to nervous system function and development of active learning activities. It will require a project proposal early in the semester, and a final project presentation and research journal style paper at the end of the semester.
Prerequisites: one of the following courses: general biology, BIONB 2220, physiology covering neuronal excitability and synaptic transmission, or permission of instructor.
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022
Learning Outcomes:

- Students should understand the contemporary experimental paradigms in modern neurophysiology and become technically competent with the extracellular and intracellular recording techniques used to explore nervous system physiology.
- Students should deepen their understanding of the ionic mechanisms underlying neuronal excitability and synaptic communication in the nervous system.
- Students should develop their skills in communicating scientific results effectively through written lab reports and oral presentations.
- Students should refine their critical reading skills of primary scientific literature.
- Students should refine their ability to develop testable hypotheses, and develop independent scientific thinking.
- Graduate students will be able to prioritize, rate, evaluate, compare and contrast, and summarize Neuroscience research literature.
- Graduate students will be able to lead discussion of scientific literature, and justify, construct a scientific argument, and investigate reliability of research findings.
- Graduate students will be able to analyze and interpret research methods and data, design experiments to test hypotheses, and teach active learning activities.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 7200 - Advanced Topics in Neurobiology and Behavior (1-4 Credits)
Designed to provide several study groups each semester on specialized topics. A group may meet for whatever period is judged adequate to enable coverage of the selected topics. Discussion of current literature is encouraged. See course roster for offerings.
Enrollment Information: Enrollment limited to: graduate students or permission of instructor.
Last Four Terms Offered: Fall 2022, Fall 2020, Spring 2019, Fall 2018
Schedule of Classes (https://classes.cornell.edu/)

BIONB 7201 - Research Design in the Study of Animal Social Behavior (1 Credit)
A weekly journal club-style discussion. Graduate students may be expected to present a summary of their research or a summary of research in the literature related to their thesis once per year.
Enrollment Information: Primarily for: graduate students.
Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Learning Outcomes:

- Become exposed to a wide variety of lines of study of animal behavior.
- Deepen your understanding of how to conduct research on animal behavior.
- Get to know the various graduate students, postdocs, and faculty studying animal behavior.
- Get critical, but also encouraging, feedback on your own research project.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 7202 - Topics in Neural Basis of Behavior (1 Credit)
A weekly journal club-style discussion. Graduate students may be expected to present a summary of their research or a summary of research in the literature related to their thesis once per year.
Enrollment Information: Primarily for: graduate students.
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023, Fall 2022
Learning Outcomes:

- To be able to present a scientific paper in a clear and concise manner.
- To be able to critique and discuss scientific papers with peers and faculty members.
- To understand scientific methods and their implications.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 7210 - Introductory Graduate Survey in Neurobiology and Behavior (2 Credits)
Designed to assist students in mapping their graduate careers and in choosing and pursuing transformative and tractable thesis topics. The core of the course will be open-ended discussions directed by paired neurobiology and behavioral ecology faculty on novel research frontiers in the study of mechanisms and the evolution of behavior (including in the zone of their conceptual intersection). Occasional laboratory experiences may also be included. Professional development topics will include how to: navigate graduate school, allocate time between reading, thinking creatively, and investing in research, design experiments, write grant proposals, give talks, and publish peer-reviewed papers.
Corequisites: BIONB 2210 (Fall) and BIONB 2220 (Spring).
Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- To know and understand the current frontiers of both behavioral and neurobiological studies, including which unanswered questions are considered to be the most important ones, and which questions might actually be answerable in a doctoral thesis project or longer term study.
- To hone critical thinking skills with respect to identifying important questions and designing strategies to address them.
- To become familiar with the most compelling current tools, both conceptual and experimental, for answering behavioral and neurobiological questions

Schedule of Classes (https://classes.cornell.edu/)

BIONB 7212 - Professional Development for Biology Graduate Students (1 Credit)
In-depth discussions of career choices for academic biologists to empower them to manage their careers. Topics to be covered include: developing strong CVs, personal statements, public speaking and interview skills, competing for postdoctoral, faculty and other professional positions, interviewing, dual careers, where to publish, grand administration, dealing with editors, tenure promotion and other issues. Workshops will include panel discussions with postdocs, former NBB graduates and faculty members.
Enrollment Information: Primarily for: graduate students, post A exam preferred.
Last Four Terms Offered: Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- To prepare professional documents (CVs, resumes, personal statements) needed to compete for internships, jobs and other forms of professional advancement.
- To improve in public speaking, networking, job negotiation and other skills essential to professional job interviews.
- To be exposed to a broad spectrum of professional options and opportunities for PhD biologists, including but not limited to academic research and teaching positions, government, bio/health related industry, publishing, non-profit organizations, etc. through interactive panel discussions with present and former Cornell scientists.

Schedule of Classes (https://classes.cornell.edu/)

BIONB 7640 - Plant-Insect Interactions Seminar (1 Credit)
Crosslisted with BIOEE 7640, ENTOM 7640
Group intensive study of current research in plant-insect interactions. Topics vary from semester to semester but include chemical defense, coevolution, insect community structure, population regulation, biocontrol, tritrophic interactions, and mutualism.
Enrollment Information: Enrollment limited to: graduate students or permission of instructor.
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Learning Outcomes:

- Read, synthesize, and discuss findings from original scientific research in the ecology and evolution of plants interacting with their environment.

Schedule of Classes (https://classes.cornell.edu/)