ECOLOGY & EVOLUTIONARY BIOLOGY (BIOEE)

BIOEE 1130 - The Art and Science of Birds (2 Credits)
Crosslisted with UNILWYL 1130
Art and science have always been fundamentally linked. Before the invention of photography, illustration was the main documentation tool in science; even now, artistic representations are used to communicate important scientific discoveries. In this course students learn the basics of bird anatomy in tandem with sketching techniques to foster an appreciation of how science and art can reinforce each other in enriching one's life and study. Led by the staff biological illustrator at the Cornell Lab of Ornithology, students begin with the fundamentals of observational drawing to improve accuracy before moving onto watercolors. Interwoven into art lessons are scientific lectures produced by Cornell ornithologists, blending art with current science to cover a range of interconnected topics.
Last Four Terms Offered: Spring 2025, Spring 2023, Spring 2022, Spring 2021
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 1150 - Techniques of Avian Specimen Preparation (2 Credits)
This course has two main objectives: 1) to illustrate the diverse uses of natural history collections for research, teaching and conservation, and 2) to introduce students to the fine art of avian specimen preparation. Students will learn multiple specimen preparation techniques (skeletons, spread wings, and round skins) and will be required to prepare 20 round skins to receive course credit. Students will be evaluated on the quality of their specimens and on their participation in an in-class debate surrounding the value of natural history collections.
Course Fee: Course Fee, $20. Course fee.
Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- Practice avian specimen preparation.
- Integrate examples of diverse uses of specimens to articulate the value of natural history collections.

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

BIOEE 1180 - Evolution (3 Credits)
Crosslisted with STS 1180
Evolution is the central unifying concept in biology. This course examines evolution as a science and places it in an historical context. Classes focus on descent with modification, natural selection, evolutionary genetics, the history of the earth, the information content of the fossil record, and diversification processes. The science of evolutionary biology is presented in the context of a broader history of ideas in science. The course also explores the importance of evolutionary thinking in the 21st century, including antibiotic and pesticide resistance, personalized genomics, human evolution, and evolutionary ecology. Courses of Study: Intended for students with no background in college biology.
Enrollment Information: Primarily for: students with no background in college biology.
Distribution Requirements: (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS), (SCT-IL)
Exploratory Studies: (EUAREA)

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

- Provide examples of the kinds of questions evolutionary biologists ask, and the types of tools and evidence they use to answer them.
- Recognize and correct common misunderstandings about evolution.
- Differentiate between the four main mechanisms of evolution (mutation, natural selection, migration, genetic drift).
- Communicate about evolutionary principles to classmates and the general public.
- Describe examples of evolution occurring in the modern day.
- Articulate specific applications of evolutionary biology in medicine and agriculture.

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

BIOEE 1540 - Introductory Oceanography (3 Credits)
Crosslisted with EAS 1540
This class relies more on intuitive reasoning rather than complicated mathematical formulas to convey basic concepts about how the ocean works. For this reason, the class is very accessible to non-science majors. The class covers standard material about how the ocean works, but also includes current environmental threats facing the ocean such as global warming, ocean acidification, overfishing and coastal pollution. Students will gain a depth of knowledge about the ocean and global warming to enable them to speak and write confidently about contemporary public issues regarding the health of the ocean, global warming and a sustainable future. This course satisfies the Physical and Biological Sciences (PBS) requirement for students in most colleges. For students in A&S and CALS, this course counts as in-college credit.
Forbidden Overlaps: BIOEE 1540, BIOEE 1560, EAS 1540, EAS 1560
Distribution Requirements: (OPHLS-AG), (PHS-AS), (SCT-IL)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 1560 - Introductory Oceanography with Laboratory (4 Credits)
Crosslisted with EAS 1560
This class relies more on intuitive reasoning rather than complicated mathematical formulas to convey basic concepts about how the ocean works. For this reason, the class is very accessible to non-science majors. The class covers standard material about how the ocean works, but also includes current environmental threats facing the ocean such as global warming, ocean acidification, overfishing and coastal pollution. Students will gain a depth of knowledge about the ocean and global warming to enable them to speak and write confidently about contemporary public issues regarding the health of the ocean, global warming and a sustainable future. This course satisfies the Physical and Biological Sciences (PBS) requirement for students in most colleges and the Introductory Life Sciences/Biological Sciences requirement for students in CALS. For students in A&S and CALS, this course counts as in-college credit. This course is suitable for non-life sciences majors.
Forbidden Overlaps: BIOEE 1540, BIOEE 1560, EAS 1540, EAS 1560
Distribution Requirements: (BIO-AG, OPHLS-AG), (PHS-AS), (SCT-IL)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 1610 - Introductory Biology: Ecology and the Environment (3-4 Credits)
This course provides an introduction to ecology, covering interactions between organisms and the environment at scales of populations, communities, and ecosystems. Ecological principles are used to explore the theory and applications of major issues facing humanity in the 21st century, including population dynamics, disease ecology, biodiversity and invasive species, global change, and other topics of environmental sustainability.
Forbidden Overlaps: BIOEE 1610, BIOSM 1610
Distribution Requirements: (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS), (SCT-IL)
Exploratory Studies: (CU-SBY)

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

- Demonstrate understanding of the ecological principles that affect organismal, population, community, ecosystem, and biospheric processes.
- Explain the significance of natural history and contrast the diversity of life-history strategies and habitats as it relates to the structure and function of communities and ecosystems.
- Apply ecological principles to contemporary environmental problems, including climate change and loss of biodiversity.
- Use experimental and synthetic approaches to analyze and identify patterns and processes at various scales of ecological organization.
- Combine tools and basic concepts to identify the causes and consequences of complex ecological relationships.

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

BIOEE 1640 - FWS: Topics in Ecology and Evolutionary Biology (3 Credits)
The First-Year Writing Seminar provides the opportunity to write extensively about issues related to ecology and evolutionary biology. Topics vary by section.
Distribution Requirements: (WRT-AG)
Last Four Terms Offered: Fall 2024, Fall 2023, Spring 2023, Fall 2022
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 1760 - Biostatistics with R programming language (3 Credits)
This course in Biostatistics uses the R programming language as a platform for analysis. Students will be introduced to different types of statistical analysis while becoming comfortable writing basic code in the R programming language. Topics will include: descriptive statistics, inference, experimental design and hypothesis testing; assumptions behind statistical models and choice of statistical tests; analysis of variance and covariance; general linear models and interactions; regression; and parametric and non-parametric tests, bootstrapping, and permutation testing. No prior statistical or programming experience is required.
Last Four Terms Offered: Summer 2025, Summer 2024
Learning Outcomes:

- Explain, evaluate and effectively interpret factual claims, theories and assumptions in the student's discipline(s).
- Integrate quantitative and qualitative information to reach defensible and creative conclusions.
- Demonstrate the capability to work both independently and in cooperation with others.

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

BIOEE 1780 - An Introduction to Evolutionary Biology and Diversity (4-5 Credits)
Considers explanations for pattern of diversity and the apparent good fit of organisms to the environment. Topics include the diversity of life, the genetics and developmental basis of evolutionary change, processes at the population level, evolution by natural selection, modes of speciation, long-term trends in evolution, origin of humans.
Forbidden Overlaps: BIOEE 1780, BIOEE 1781, BIOSM 1780
Enrollment Information: Enrollment preference given to: first-year, sophomore, and transfer students.
Distribution Requirements: (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS)
Exploratory Studies: (CU-SBY)

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

- Understand the underlying causal principles of evolutionary diversification.
- Apply these principles to understand historical and contemporary evolutionary scenarios.
- Identify ~100 core taxa in the tree of life, their characteristics, and understand the relationships among them.
- Use basic conceptual and analytical tools to describe complex relationships within the tree of life.
- Become familiar with a number of experimental and synthetic approaches to analyzing and discovering evolutionary processes (microevolution) and establishing evolutionary patterns (macroevolution).
- Write and discuss knowledgeably about the dimensions of evolutionary issues that require decisions in our society.

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

BIOEE 1781 - Introduction to Evolution and Diversity (4 Credits)
Considers explanations for pattern of diversity and the apparent good fit of organisms to the environment. Topics include the diversity of life, the genetics and developmental basis of evolutionary change, processes at the population level, evolution by natural selection, modes of speciation, long-term trends in evolution, origin of humans.
Forbidden Overlaps: BIOEE 1780, BIOEE 1781, BIOSM 1780
Distribution Requirements: (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS)
Last Four Terms Offered: Summer 2025, Spring 2025, Fall 2024, Summer 2024
Learning Outcomes:

- Understand the underlying causal principles of evolutionary diversification.
- Apply these principles to understand historical and contemporary evolutionary scenarios.
- Identify ~100 core taxa in the tree of life, their characteristics, and understand the relationships among them.
- Use basic conceptual and analytical tools to describe complex relationships within the tree of life.
- Become familiar with a number of experimental and synthetic approaches to analyzing and discovering evolutionary processes (microevolution) and establishing evolutionary patterns (macroevolution).
- Write and discuss knowledgeably about the dimensions of evolutionary issues that require decisions in our society.

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

BIOEE 2001 - Bringing Specimens to Life: Using Natural History Collections to Engage Communities in Sci Outreach (3 Credits)
This course has three broad themes centered on natural history collections: 1) understanding the values and perceived controversies of scientific collections, 2) learning diverse methods of specimen collection and preparation, and 3) making specimens accessible to the public through outreach with community partners. Students will be introduced to all four vertebrate collections housed at the Cornell University Museum of Vertebrates (CUMV) and discuss the ethical dilemmas inextricably connecting to scientific collecting. Students will participate in a 1-week collecting trip over spring break, where they learn diverse techniques of specimen collecting and preparation. Finally, students will work with the Cornell Lab of Ornithology and/or the Cayuga Nature Center in creative ways that ultimately inform the public about the value of natural history collections.
Exploratory Studies: (CU-CEL)

Last Four Terms Offered: Spring 2022, Spring 2020
Learning Outcomes:

- Assess the impact of scientific collecting to populations in relation to other sources of mortality.
- Articulate differences between historical and modern collecting practices and the information gained from historical and modern specimens.
- Evaluate both pro- and anti-collecting perspectives.
- Become familiar with using mist-nets.
- Set Sherman traps.
- Gain familiarity for using seines and dipnets.
- Bait and set minnow traps.
- Become familiar with preparation techniques for three different specimen types: fluids, skins, skeletons, and additional preparations as needed, e.g. tissues for DNA.
- Illustrate case studies where collections have been used in conservation, research, and education to the general public.
- Explain the value of scientific collecting in conscientious, respectful ways to those that may not understand the role specimens play in understanding the world around us.

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

BIOEE 2150 - Advanced Techniques of Avian Specimen Preparation (2 Credits)
This course builds upon skills introduced in BIOEE 1150 (Techniques of Avian Specimen Preparation) and offers students opportunities to improve and diversify specimen preparation skills and become more involved in CUMV activities. Students will gain experience preparing a diversity of birds (e.g., waterbirds, long-necked birds, big birds, long-legged birds), many of which require species-specific preparation techniques. Students will also improve skills in identifying key anatomical structures for aging birds, evaluating reproductive status, documenting appropriate metadata for modern scientific specimens, and further hone skills in discussing the values of natural history collections.
Prerequisites: BIOEE 1150.
Last Four Terms Offered: Spring 2023
Learning Outcomes:

- Apply specimen preparation techniques to a variety of avian species.
- Explain the importance of data accuracy and thoroughness.
- Articulate the value of natural history collections.

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

BIOEE 2233 - Field Lectures in Biodiversity and Evolution (1 Credit)
A surprisingly diverse, beautiful, and intriguing set of species live in our backyard. This class will meet outdoors for 3 hours per week, rain or shine, with extensive walking in natural areas (forests, fields, streams, agricultural lands). Field lectures will be on the specific plants and animals we encounter, discussing their ecology and exploring the evolutionary relationships between species. The class is hands-on, students can expect to get dirty and must be comfortable in the field. Connections will be drawn between theory learned in the classroom and real world biology and biodiversity out of doors. We will experience habitats and species, take notes, and write about biodiversity.
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 2525 - Ecology and Conservation of Wildlife in the Neotropics (2 Credits)
This on-campus and international field course combination provides participating students with a broad introduction to the research process in field ecology, with literature and hands-on examples drawn from the fauna and flora of coastal Patagonia (Argentina), an area that provides us with unprecedented access to both marine and terrestrial wildlife as well as exposure to conservation challenges and success stories. The course begins in the latter part of the Fall semester (BIOEE 2525) when it meets twice weekly for seven weeks, largely to discuss relevant papers from the scientific literature with an emphasis on best practices in designing field studies to address questions in Neotropical ecology, behavioral ecology, conservation, and evolutionary biology. During the 2+ week field component in January (BIOEE 2526), students travel among field sites in Patagonia and put this knowledge to work in an experiential context by designing and implementing a series of research projects, including numerous short 'blitz' projects and several longer, more intensive independent projects; many of these field studies involve close-hand observations of marine mammals, penguins, or other seabirds. The course (BIOEE 2527) is focused on building skills in data analysis and scientific writing, based on the data collected in the field by each student.
Distribution Requirements: (BIO-AG, OPHLS-AG)
Exploratory Studies: (CU-ITL, CU-SBY)

Last Four Terms Offered: Fall 2023, Fall 2022, Fall 2021, Fall 2019
Learning Outcomes:

- Experience the scientific process from field- inquiry and hypothesis development, through project design, data collection, analyses, and presentation and dissemination of results.
- Develop depth of knowledge related to the ecology, behavior, and evolutionary biology of Neotropical wildlife.
- Comprehend the intricacy of wildlife conservation and management.

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

BIOEE 2526 - Ecology and Conservation of Wildlife in the Neotropics II (1 Credit)
This on-campus and international field course combination provides participating students with a broad introduction to the research process in field ecology, with literature and hands-on examples drawn from the fauna and flora of coastal Patagonia (Argentina), an area that provides us with unprecedented access to both marine and terrestrial wildlife as well as exposure to conservation challenges and success stories. The course begins in the latter part of the Fall semester (BIOEE 2525) when it meets twice weekly for seven weeks, largely to discuss relevant papers from the scientific literature with an emphasis on best practices in designing field studies to address questions in Neotropical ecology, behavioral ecology, conservation, and evolutionary biology. During the 2+ week field component in January (BIOEE 2526), students travel among field sites in Patagonia and put this knowledge to work in an experiential context by designing and implementing a series of research projects, including numerous short 'blitz' projects and several longer, more intensive independent projects; many of these field studies involve close-hand observations of marine mammals, penguins, or other seabirds. The course (BIOEE 2527) is focused on building skills in data analysis and scientific writing, based on the data collected in the field by each student.
Prerequisites: BIOEE 2525.
Course Fee: Field Trip Fee, $3500. Course fee.
Distribution Requirements: (BIO-AG, OPHLS-AG)
Exploratory Studies: (CU-ITL, CU-SBY); (LAAREA)

Last Four Terms Offered: Winter 2024, Winter 2023, Winter 2022, Winter 2020
Learning Outcomes:

- Experience the scientific process from field- inquiry and hypothesis development, through project design, data collection, analyses, and presentation and dissemination of results.
- Develop depth of knowledge related to the ecology, behavior, and evolutionary biology of Neotropical wildlife.
- Comprehend the intricacy of wildlife conservation and management.

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

BIOEE 2527 - Neotropical Wildlife Biology (1 Credit)
This on-campus and international field course combination provides participating students with a broad introduction to the research process in field ecology, with literature and hands-on examples drawn from the fauna and flora of coastal Patagonia (Argentina), an area that provides us with unprecedented access to both marine and terrestrial wildlife as well as exposure to conservation challenges and success stories. The course begins in the latter part of the Fall semester (BIOEE 2525) when it meets twice weekly for seven weeks, largely to discuss relevant papers from the scientific literature with an emphasis on best practices in designing field studies to address questions in Neotropical ecology, behavioral ecology, conservation, and evolutionary biology. During the 2+ week field component in January (BIOEE 2526), students travel among field sites in Patagonia and put this knowledge to work in an experiential context by designing and implementing a series of research projects, including numerous short 'blitz' projects and several longer, more intensive independent projects; many of these field studies involve close-hand observations of marine mammals, penguins, or other seabirds. This course (BIOEE 2527) is focused on building skills in data analysis and scientific writing, based on the data collected in the field by each student.
Prerequisites: BIOEE 2525 and BIOEE 2526.
Distribution Requirements: (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS)
Exploratory Studies: (CU-ITL, CU-SBY); (LAAREA)

Last Four Terms Offered: Spring 2024, Spring 2023, Spring 2022, Spring 2020
Learning Outcomes:

- Experience the scientific process from field- inquiry and hypothesis development, through project design, data collection, analyses, and presentation and dissemination of results.
- Develop depth of knowledge related to the ecology, behavior, and evolutionary biology of Neotropical wildlife.
- Comprehend the intricacy of wildlife conservation and management.

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

BIOEE 2641 - Tropical Field Ornithology II (1.5 Credits)
Exploratory Studies: (LAAREA)

Last Four Terms Offered: Winter 2023, Winter 2020, Winter 2019
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 2642 - Analysis and Interpretation of Bird Observations (1 Credit)
Last Four Terms Offered: Spring 2023, Spring 2020, Spring 2019, Spring 2018
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 2740 - The Vertebrates: Comparative Anatomy, Function, Paleontology, and Evolution (4 Credits)
This course in vertebrate organismal biology explores the anatomy and function of vertebrates with an emphasis on vertebrate evolution. Lectures cover topics such as the origin, anatomy, physiology, paleontology, and evolution of vertebrate groups, with a focus on organ systems (such as the nervous, circulatory, and respiratory systems), life history, locomotion, behavior, ecology, and conservation. This course prepares students for advanced courses on the biology of fishes, amphibians and reptiles, birds, and mammals; pre-vet and pre-med students benefit from its comparative anatomical approach to understanding the organization of the vertebrate body.
Prerequisites: BIOEE 1780 or equivalent, or instructor permission.
Course Fee: Course Fee, $35. Course fee.
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:

- Explain the basic organization of the vertebrate body and its ten organ systems.
- Describe broad patterns of vertebrate evolution and diversity during the Phanerozoic.
- Use your knowledge of anatomy to make predictions about a vertebrate's mode of life.
- Explain why some groups of vertebrates are more diverse than others.
- Develop and compare examples of convergent evolution in different clades of vertebrates.
- Review conservation issues specific to different major groups of vertebrates and relate these to differences in life history patterns, ecology, and behavior.

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

BIOEE 3250 - Evolutionary Medicine (3 Credits)
This course focuses on how evolutionary principles can help us better understand health and disease. Concepts from evolutionary biology (e.g., life history theory, coevolution, conflict, constraints and trade-offs) will be applied to key problems in medicine and public health, with case studies on antibiotic resistance, aging, cancer, autoimmune disease, and why pathogenic organisms cause harm to their hosts.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 3550 - Data Analysis and Visualization in Ecology and Environmental Science (3 Credits)
Ecology and Environmental Science are running into a 'big data' era. The unprecedented data sources provide opportunities for novel scientific exploration and solutions to real-world problems, which, however, usually requires robust quantitative analysis and informative visualization. This course aims to increase students' literacy and hands-on skills on common quantitative methods in ecology and environmental sciences, including accessing and curating data, statistical inference, regression, data-based predictions (also known as machine learning), and visualizing the results. Students will be using public data sets from organismal to landscape scales, including spatial data sets from the Google Earth Engine platform. Example codes will be provided in both Python and R.
Prerequisites: Introductory Calculus and Statistics, BIOEE 1610 or equivalent, or permission of instructor.
Distribution Requirements: (DLG-AG)
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023
Learning Outcomes:

- Demonstrate quantitative reasoning and computational thinking skills over heterogenous data sets.
- Contrast motivation, theoretical basis, limitation, and applicable scenarios for common statistical inference and machine learning methods.
- Compare and evaluate different quantitative models to explain realistic ecological/environmental questions.
- Design and conduct scientific visualization on quantitative analysis results in Python/R.
- Access and analyze public spatial environmental data set on Google Earth Engine.

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

BIOEE 3610 - Advanced Ecology (4 Credits)
This course provides an in-depth survey of ecology emphasizing conceptual foundations and the integration of experimental and quantitative approaches, including physiological ecology, population and community ecology, ecosystem biology, and ecological modeling. Current and classical ecological research is used to introduce major concepts and methods, derive major ecological principles, and critically discuss their applicability on multiple organizational levels, on multiple scales, and in a variety of ecosystems. Lab sections focus on discussion, experimental techniques, and computational skills.
Prerequisites: one semester of calculus and BIOEE 1610 or equivalent, or permission of instructor.
Distribution Requirements: (BIO-AS, SMR-AS), (BSC-AG, DLG-AG, OPHLS-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- Read, synthesize, and critically discuss contemporary published research in ecology. Analyze ecological systems in terms of proximate and ultimate causation, and be able to work with multi-level systems interactions.
- Use basic conceptual and analytical tools for describing and quantifying ecological relationships.
- Understand and use fundamental analytical methods to describe structure and dynamics of populations and communities. Make predictions about population and community dynamics based on knowledge about biotic and abiotic factors influencing species interactions. Integrate knowledge about species interactions to explain higher level ecosystem processes.
- Evaluate differences across ecosystems in terms of differences in rates of metabolism and the relative open-ness of ecosystem cycles.
- Critically evaluate data from whole-ecosystem experiments and cross-ecosystem studies.
- Analyze some of the complex interactions between global change and ecological structure and function.
- Read a model, interpreting its equations as statements about underlying processes and assumptions about system structure and function.
- Modify existing models for applications to related systems or alternative scenarios.
- Use the R scripting language as an environment for implementing ecological models and studying their behavior.

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

BIOEE 3611 - Field Ecology (3 Credits)
Exercises designed to give students direct experience with field research to address ecological hypotheses, with emphasis on developing observational skills and basic methods in population and community ecology. Topics include methods in plant succession, niche relationships, influence of herbivores and competitors on plant communities, aquatic food web analysis, use of scientific collections, and presenting research results in written and oral form. We will visit a diversity of habitats and natural areas in Central New York. Students will conduct an independent research project and present their findings.
Prerequisites: Prerequisite or corequisite: BIOEE 1610.
Distribution Requirements: (BIO-AS), (BSC-AG, DLG-AG, OPHLS-AG)
Exploratory Studies: (CU-SBY, CU-UG)

Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- Identify habitat types and characterize habitats based on key structural features and organisms.
- Integrate textbook knowledge with field observations to formulate and discuss research questions in ecology based on personal observation and scientific theory.
- Creatively identify research questions and derive appropriate scientific hypotheses.
- Design and plan experiments and surveys based on scientific hypotheses.
- Conduct field experiments/surveys and analyze and discuss the results.

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

BIOEE 3690 - Chemical Ecology (3 Credits)
Crosslisted with BIONB 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/)

BIOEE 3730 - Biodiversity and Biology of the Marine Invertebrates (3 Credits)
Introduction to the biology, natural history, and evolution of the major invertebrate phyla, concentrating on marine representatives. In addition to the evolution of form and function, lectures cover aspects of ecology, behavior, physiology, chemical ecology, and current research. The discussion section will focus on current research papers with marine invertebrates.
Prerequisites: BIOEE 1780 or BIOEE 1781, or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2019, Fall 2017
Learning Outcomes:

- Learn the major phyla of marine invertebrates through lectures, videos, exposure to the Blaschka glass collection and a field trip.
- Understand phylo genetic relationships among the major phyla and within selected major phyla.
- Develop an appreciation for some major avenues of research with marine invertebrates and develop critical reading skills, by reading and discussing original research.
- Develop critical research and thinking skills and oral presentation skills through a project.
- Gain experience in giving a formal presentation.
- Learn to work as a group through take home essays and paper discussion sessions.
- Gain experience in organismal biology.

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

BIOEE 3780 - Digital Morphology through CT (1 Credit)
This course is an introduction to CT visualization for its applications in comparative biology of the vertebrates. Students will learn and practice the exploration of vertebrate anatomy with OSIRIX 3-D visualization software or its future replacement; work on student-designed projects and/or a large survey of the vertebrates based on CT scans from specimens in the Cornell museum as well as the Smithsonian and other museums around the world.
Prerequisites: BIOEE 2740.
Exploratory Studies: (CU-UG)

Last Four Terms Offered: Fall 2023, Fall 2022, Spring 2022, Spring 2021
Learning Outcomes:

- CT-Visualization and Methods: Perform the following basic functions: work with three separate 2-D slices of anatomy (3D-MPR) to orient each of the frames to a desired coordinate system; find organs across multiple views and delineate them as 3-D regions of interest (ROI's); apply different Color Look Up Tables (CLUTs) to images; produce simple single-orientation videos moving through one dimension of 3-D structure. Discuss the pros and cons of different staining and scanning methods and resolutions, and describe the strengths of the different software packages used in the class.
- Vertebrate Anatomy: Recognize in CT images all the major organs of the avian digestive, circulatory, respiratory, excretory and reproductive systems as well as all major bones.
- Comparative Biology: Discuss the fundamental challenge of comparative biology in the context of anatomy: teasing apart phylogenetic and functional influences on anatomical character variation. Discuss the concept of homology and the interpretation of anatomical features across representatives of multiple clades.
- Projects and Hypothesis-Testing: Present the results of their first CT explorations of vertebrate anatomy as a powerpoint presentation to the group. These presentations will include an outside rendering of the specimen plus one video through one of the planes of view.

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

BIOEE 4000 - Ecology and Evolution of Infectious Diseases (4 Credits)
Crosslisted with ENTOM 4000
This course introduces students to the field of infectious disease ecology, an area of study that has developed rapidly over the past three decades and addresses some of the most significant challenges to human health and conservation. Students will learn about the incredible diversity of parasitic organisms, arguably the most abundant life forms on the planet, and examine how pathogens invade and spread through host populations. Throughout the course, an emphasis will be placed on understanding of infectious diseases dynamics at the population level, and on quantitative approaches for studying pathogen spread and impacts. Specific topics include types of pathogens and their ecological properties, epidemiology and impacts on host populations, types of transmission, evolution of resistance and virulence, drivers of the emergence of new diseases, parasites in the context of ecological communities, strategies for controlling outbreaks, and the role of parasites in biodiversity and conservation.
Prerequisites: Recommended prerequisite: BIOEE 1610, BIOG 1101, BIOG 1102, or BIOG 1190 and MATH 1106, MATH 1110, MATH 1120, MATH 2210, MATH 1710, or STSCI 2150; or equivalencies; or by instructor permission.
Distribution Requirements: (BSC-AG, DLG-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2024
Learning Outcomes:

- Apply an understanding of ecological and evolutionary interactions between hosts and their microbes/parasites across multiple scales of biological organization.
- Utilize quantitative approaches for studying infectious disease spread.
- Critically review current research and case studies in the field of infectious disease ecology and evolution.
- Contextualize an understanding of the diversity of parasitic organisms and their importance in conservation and human health.
- Predict pathogen emergence and develop responses to epidemics based on ecological and evolutionary principles.

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

BIOEE 4460 - Plant Behavior and Biotic Interactions, Lecture (3 Credits)
Crosslisted with BIONB 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/)

BIOEE 4461 - Plant Behavior and Biotic Interactions, Laboratory (1 Credit)
Crosslisted with BIONB 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/)

BIOEE 4530 - Speciation: Genetics, Ecology, and Behavior (4 Credits)
Crosslisted with BIONB 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/)

BIOEE 4550 - Insect Ecology (4 Credits)
Crosslisted with ENTOM 4550
You will learn to think like an ecologist by studying the fundamental principles of insect ecology and the types of questions ecologists ask, seeing how ecology can be used to understand and solve environmental problems, and putting this knowledge into action during group activities in the lab and field.
Prerequisites: introductory biology or permission of instructor recommended.
Distribution Requirements: (BSC-AG, OPHLS-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2020, Fall 2018
Learning Outcomes:

- 1.1 Students will be able to explain the fundamental principles of population and community ecology. 1.2 Students will be to identify what interactions are important for insects. 1.3 Students will learn natural history of local insects.
- 2.1 Students will be able to interpret data presented in graphs. 2.2 Students will be able to pose their own questions and design and execute experiments to answer these questions. 2.3 Students will be able to read and interpret the scientific literature. 2.4 Students will be able to use basic statistical methods to interpret their data.
- 3.1 Students will participate actively in debate with peers using information they research in the primary literature
- 4.1 Students will write full reports based on the field and laboratory projects they conduct. 4.2 Students will have opportunities to summarize and evaluate the important factors in insect ecology

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

BIOEE 4560 - Stream Ecology (4 Credits)
Crosslisted with NTRES 4560
Lecture examines patterns and processes in stream ecosystems, including geomorphology and hydrology, watershed-stream interactions, trophic dynamics, biogeochemistry, disturbance, and conservation and management. Field and laboratory exercises focus on experimental and analytical techniques used to study stream ecosystems, including techniques to measure stream discharge, physical habitat, water chemistry, and stream biota. Field project with lab papers.
Prerequisites: BIOEE 1610 or permission of instructor.
Distribution Requirements: (OPHLS-AG)
Last Four Terms Offered: Fall 2023, Fall 2021, Fall 2019, Fall 2017
Learning Outcomes:

- Students will understand the morphology and classification of streams based on channel formation and characteristics of stream networks and watersheds.
- Students will understand the basic chemical and physical dynamics of stream ecosystems.
- Students will be familiar with the important organic matter sources that fuel running water ecosystems.
- Students will understand the major longitudinal, vertical, and lateral linkages that connect streams to the surrounding land- and riverscape.
- Students will gain knowledge and appreciation of the tremendous diversity of stream ecosystems found around the world, along with basic characteristics that distinguish them.
- Students will learn common groups of stream biota including fish, invertebrates, and stream algae.
- Students will gain knowledge of the importance of different biotic interactions and abiotic factors that shape patterns and processes in stream ecosystems.
- Students will learn basic conceptual models that link stream ecosystem structure and function.
- Students will gain basic knowledge of stream conservation biology, factors contributing to degradation of stream environments, and strategies for the restoration of damaged running water ecosystems.
- Students will conduct field and lab exercises throughout the course to familiarize them with methods for collecting and analyzing stream ecological data. Students will engage in a semester-long project in which they set up a field experiment, collect and analyze samples from their experiment, and summarize and interpret experimental results.

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

BIOEE 4570 - Limnology: Ecology of Lakes, Lectures (3 Credits)
Limnology is the study of inland freshwaters, which includes lakes, ponds, reservoirs, rivers, streams, and wetlands. This course focuses on lakes and ponds, and examines their physical, chemical, and biological properties. A lake's physical (e.g., size, light, temperature, mixing) and chemical (elements and compounds) structure directly affects aquatic organisms in terms of species abundance, diversity, and interactions. Organisms in turn influence their physical and chemical environment. This class will introduce students to fundamental concepts in limnology, which we will build upon to examine real-world challenges facing freshwater ecosystems (e.g., eutrophication, invasive species, climate change).
Prerequisites: BIOEE 1610 or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2022, Spring 2019, Fall 2016
Learning Outcomes:

- Explain fundamental concepts that govern lakes and ponds, including physical, chemical, and biological properties.
- Describe interactions between aquatic organisms and their physical and chemical environments, which regulate abundance and community structure of organisms.
- Compare the multiple approaches used to examine lake dynamics (e.g., experiments, observational studies, models).
- Assess the human impacts to lake organisms and ecosystems, identify the ecological processes underlying those effects, and explain possible mitigation management actions.
- Critically read, evaluate, and discuss scientific literature.

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

BIOEE 4571 - Limnology: Ecology of Lakes, Laboratory (2 Credits)
Laboratories and field trips devoted to studies of the biological, chemical, and physical properties of lakes and other freshwater environments. Exercises focus on understanding the freshwater environment, on experimentation, and on understanding ecological processes within lakes.
Prerequisites: BIOEE 4570.
Course Fee: Course Fee, $20. For food.
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2016, Fall 2014
Learning Outcomes:

- Use routine limnological methods to sample the physical, chemical, and biological parameters of lakes and ponds.
- Use microscopy to examine aquatic phytoplankton, zooplankton, and macroinvertebrates, with familiarity on identification and taxonomic counts.
- Perform basic statistical analyses and data visualization using R.
- Effectively communicate research findings through scientific writing and an oral presentation.

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

BIOEE 4660 - Physiological Ecology, Lectures (3 Credits)
Detailed survey of how physiological processes help organisms meet the challenges of their environment. Lectures explore physiological adaptation, thermal biology, respiration and oxygen transport, resource acquisition and allocation, water use and limitation, energetics and nutrition, hormones, stress physiology, and developmental physiology. Readings draw from the primary literature and textbooks.
Prerequisites: BIOEE 1610, BIOG 1440, BIOAP 3110 or permission of instructor.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG, SCH-AG)
Last Four Terms Offered: Spring 2025, Spring 2023, Spring 2020, Spring 2018
Learning Outcomes:

- Describe how key environmental factors, including temperature, water, and nutrient availability, affect physiological function.
- Recognize physiological adaptation to the environment in animals.
- Describe the physiological stress response, and how it differs across environments.
- Evaluate physiological adaptations to life history strategies.
- Read, evaluate, and present relevant papers from the primary literature.
- Independently plan and present physiological ecological experiments.

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

BIOEE 4661 - Physiological Ecology, Laboratory (2 Credits)
Detailed survey of the physiological approaches used in understanding the relationships between organisms and their environment. Laboratories apply physiological techniques to specific ecological problems and cover aspects of experimental design and computer-aided data analysis.
Prerequisites: Prerequisite or corequisite: BIOEE 4660.
Last Four Terms Offered: Spring 2020, Spring 2009
Learning Outcomes:

- Translate the methods and ideas covered in class to field and glasshouse experimental exercises.
- Independently plan, conduct, and revise physiological ecological experiments.
- Conduct appropriate statistical analyses of physiological data.
- Structure and write scientific reports.
- Lucidly present research findings.

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

BIOEE 4690 - Food, Agriculture, and Society (3 Credits)
Crosslisted with BSOC 4691, STS 4691
Multidisciplinary course dealing with the social and environmental impact of food production in the United States and developing countries. Agroecosystems of various kinds are analyzed from biological, economic, and social perspectives. The impacts of traditional, conventional, and alternative agricultural technologies are critically examined in the context of developed and developing economies. Specific topics include biodiversity and ecosystem services in agriculture, transgenic crops, land use for energy production, urban agriculture, and sustainable development.
Prerequisites: introductory ecology course or permission of instructor.
Distribution Requirements: (AFS-AG, CA-AG, OPHLS-AG, SCH-AG), (BIO-AS, GLC-AS)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021
Learning Outcomes:
- Use conceptual and analytical knowledge to understand the complexity of food systems.
- Identify biological, environmental, and social processes that influence agricultural systems.
- Improve ability to develop and articulate a position on a controversial agricultural topic.
- Participate actively in debate and appraisal of agricultural issues with peers.
- Analyze, synthesize, and write about diverse disciplinary perspectives on agricultural issues.

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

BIOEE 4700 - Herpetology, Lectures (3 Credits)
Lectures cover various aspects of the biology of amphibians and reptiles, including evolution, zoogeography, ecology, behavior, and physiology.
Distribution Requirements: (BSC-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Spring 2025, Fall 2023, Spring 2021, Spring 2019
Learning Outcomes:
- Acquire knowledge of the major groups of amphibians and reptiles, with respect to their main diagnostic characteristics.
- Move freely back and forth between classifications and evolutionary trees of amphibians and reptiles on a global basis.
- Synthesize, integrate, and discuss details of morphology, ecology, behavior, and physiology for major lineages of amphibians and reptiles.
- Have a working familiarity with the characteristics that distinguish ~50 species of amphibians and reptiles, including primarily those found in NY, as well as construct a key to an initially unknown fauna.
- Think integratively and synthetically about the biology and future of amphibians and reptiles on a global and local basis.

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

BIOEE 4750 - Ornithology, Lectures (3 Credits)
This course covers many aspects of avian biology, including ecology, behavior, evolution, anatomy, physiology, and conservation. This is an active learning-style offering in which students complete pre-class work through the Cornell Lab of Ornithology's Bird Academy online learning platform, and then engage in interactive activities and exercises during class periods. BIOEE 4750 may be taken alone, or students can choose to enroll simultaneously in the associated laboratory classes, BIOEE 4751.
Prerequisites: one year of college-level biology, environmental science, or the equivalent.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2024, Spring 2022, Spring 2020, Spring 2018
Learning Outcomes:
- Demonstrate the ability to summarize key concepts in classifying avian diversity including terminology, classification tools, and species concepts. Identify the defining features of avian orders and a subset of avian families as well as the geographic distribution of birds. Describe the challenges of delimiting species as well as the evolutionary processes that contribute to the formation of new species, including a thorough understanding of the importance of natural selection, sexual selection, and genetic drift.
- Exhibit comprehensive knowledge of avian plumage, including an understanding of feather development and function, the differences between structural and pigmentary coloration, and molt patterns.
- Explain the basic physical requirements of flight and the way that avian feathers, physiology, and behavior are adapted to meet these requirements.
- Identify the important physical features of birds and explain how these systems (skeletal, muscular, respiratory, digestive, circulatory, nervous) work in conjunction to allow birds to adapt to such varied environments.
- Demonstrate a basic ability to summarize the major physiological systems in birds (sensory, endocrine, brain, immune, metabolism) with a particular focus on how these systems are shaped by different life history characteristics.
- Differentiate the major morphological and behavioral adaptations that are associated with variation in foraging style and nutritional demands in birds.
- Characterize the costs and benefits of the most common types of avian social interactions including mate choice, cooperation, territory defense, dominance hierarchies, and group living.
- Describe the importance and diversity of avian vocalizations, including the variation in focal repertoires, the process of song learning and development, mechanisms of song production, and functional role of bird song in communication.
- Identify the main features of avian breeding biology (phenology, nests, clutch size, incubation, parental care) and describe how these characteristics vary across species with different life histories. Identify the key abiotic and biotic factors that limit bird populations and explain how those factors structure avian populations.
- Define avian dispersal and migration and identify the selective forces and key adaptations that are critical for long distance migration, such as physiological flexibility, orientation, and seasonal timing.

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

BIOEE 4751 - Ornithology, Laboratory (1 Credit)
This laboratory course covers many aspects of avian biology, including ecology, behavior, evolution, anatomy, physiology, and conservation. Some laboratory sessions will involve dissection of avian material, and the study of skeleton and scientific study skin specimens. Other sessions will involve outdoor activities including observations of avian behavior and demonstrations of standard ornithological field techniques, including methods of capturing, handling, and banding birds.
Prerequisites: 1 year of college-level biology, environmental science, or the equivalent. Corequisite: BIOEE 4750.
Last Four Terms Offered: Spring 2024, Spring 2020
Learning Outcomes:

- Demonstrate understanding of key concepts in classifying avian diversity including terminology, classification tools, and species concepts. Identify the defining features of avian orders and a subset of avian families as well as the geographic distribution of birds. Describe the challenges of delimiting species as well as the evolutionary processes that contribute to the formation of new species, including a thorough understanding of the importance of natural selection, sexual selection, and genetic drift.
- Exhibit comprehensive knowledge of avian plumage, including an understanding of feather development and function, the differences between structural and pigmentary coloration, and molt patterns.
- Explain the basic physical requirements of flight and the way that avian feathers, physiology, and behavior are adapted to meet these requirements.
- Identify the important physical features of birds and explain how these systems (skeletal, muscular, respiratory, digestive, circulatory, nervous) work in conjunction to allow birds to adapt to such varied environments.
- Demonstrate a basic understanding of the major physiological systems in birds (sensory, endocrine, brain, immune, metabolism) with a particular focus on how these systems are shaped by different life history characteristics.
- Differentiate the major morphological and behavioral adaptations that are associated with variation in foraging style and nutritional demands in birds.
- Characterize the costs and benefits of the most common types of avian social interactions including mate choice, cooperation, territory defense, dominance hierarchies, and group living.
- Describe the importance and diversity of avian vocalizations, including the variation in focal repertoires, the process of song learning and development, mechanisms of song production, and functional role of bird song in communication.
- Identify the main features of avian breeding biology (phenology, nests, clutch size, incubation, parental care) and describe how these characteristics vary across species with different life histories. Identify the key abiotic and biotic factors that limit bird populations and explain how those factors structure avian populations, life histories, and geographic distributions.
- Define avian dispersal and migration and identify the selective forces and key adaptations that are critical for long distance migration, such as physiological flexibility, orientation, and seasonal timing.

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

BIOEE 4752 - Ornithology, Worldwide Avian Diversity Laboratory (2 Credits)
Birds present a wondrous diversity of behaviors, ecological lifestyles, and appearances. This course provides an in-depth survey of the natural history and evolutionary relationships of all Orders and Families of living birds from across the globe. Cornell is the home of the Birds of the World online resource which provides background information on worldwide avian diversity, and BIOEE 4752 also makes extensive use of the avian specimen materials of the Cornell University Museum of Vertebrates, where the weekly lab sessions are held.
Prerequisites: 1 year of college-level biology, environmental science, or the equivalent.
Last Four Terms Offered: Fall 2023, Fall 2021, Spring 2020
Learning Outcomes:

- List all orders of birds and the families they include.
- Recognize the main defining characteristics of each bird family, in relation to their geographic distribution, phenotypic characters, behavior and natural history.
- Assign bird specimens to their corresponding family and order.
- Recognize the systematic relationships between extant avian orders and their position in the avian tree of life, and become generally conversant with a 'tree thinking' perspective on biological diversity and phylogenetic relationships.

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

BIOEE 4760 - Ichthyology: Biology of Fishes, Lectures (3 Credits)
Introduction to the systematic study of fossil and living fishes: their anatomy, physiology and functional morphology, behavior, ecology, diversity, evolution, classification, and identification. Emphasizes marine fishes from different habitats (temperate, tropical coral reef, intertidal, and deep sea), local freshwater species, and interesting freshwater fishes from around the world, especially South America, Africa and Australia.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2020, Fall 2018
Learning Outcomes:

- Understand the organismal biology of fishes, including their structure, physiology, functional morphology, and behavior.
- Use knowledge of fishes in any basic research or applied context.
- Understand the evolutionary history of fishes and phylogenetic interpretation based on morphological and molecular study.
- Interpret phylogenies and use tree thinking in the service of any kind of biological research field.
- Become familiar with the taxonomy and phenotypic diversity of the world's fishes as well as human-induced challenges to that diversity.
- Through study of the local fish fauna, students will be able to apply the tools of fish identification to learn a new fauna in any region of the world.

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

BIOEE 4761 - Ichthyology: Biology of Fishes, Laboratory (1 Credit)
Laboratory course covering topics presented in BIOEE 4760. Two field trips, including one full-day weekend trip required. Live animals are studied in the field and are sometimes used in the laboratory for nondestructive demonstrations or experiments. The systematics and dissection laboratories use preserved specimens.
Prerequisites: Prerequisite or corequisite: BIOEE 4760.
Course Fee: Course Fee, $35. Course fee.
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2022, Fall 2018, Fall 2016
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 4762 - The Biology, Evolution, and Lives of Fishes (3 Credits)
Fishes and fishing are linked throughout the history of humans. While early fishing was assuredly for survival, its modern form includes both subsistence and sport. This course will dive into the target of fishing- the most diverse vertebrate group; the fishes. Together we will explore numerous aspects about the biology of fishes including the diversity, evolution, anatomy, ecology, behavior, physiology, and conservation of the fishes of the world. Cornell is a world leading institution in the study of vertebrate biology, and has a long history of training students in the importance of specimen-based research. This is a college level course that will utilize the methods from many scientific disciplines in our approaches to studying fishes, though the only prerequisite is a strong interest in fishes.
Learning Outcomes:

- Upon completion of this course, students will demonstrate the ability to summarize the key components used for classifying the vast diversity of fishes. This includes competent use of anatomical terminology related to differentiating the Orders and Families of fishes in both a phylogenetic (evolutionary) and biogeographic context.
- Upon completion of this course, students will be able to compare and contrast the anatomy of fishes with respect to their ecology and use that information to classify various aspects of the life history and biology of fishes, including feeding, movement, and behavior. Further, students will be able to use this information from known species to predict these various aspects for fishes they are unfamiliar with.
- Students will be able to identify the physical features of fishes including both hard anatomy, i.e. skeleton and scales, and soft anatomy, i.e. skin, muscles, alimentary canal, cardiovascular system, gas bladder, kidney, gonads, reproductive systems, and nervous system.
- Students will demonstrate the ability to summarize the major aspects of physiological function including comparing how fishes respire, transport gases, control buoyancy, balance ions and water, and regulate body temperature.
- Students will demonstrate knowledge of the sensory functions of fishes including vision, hearing, electroreception, chemoreception, and mechanoreception.

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

BIOEE 4780 - Ecosystem Biology and Global Change (4 Credits)
Examines ecosystem structure, carbon and energy flow, and nutrient cycles, and how these processes respond to environmental variations. Reviews classic ecosystem experiments, and considers effects on ecosystems from human-driven environmental changes, such as climate change, air pollution, excess nitrogen use, and land-use change.
Prerequisites: BIOEE 1610 or equivalent.
Distribution Requirements: (BIO-AS), (BSC-AG, OPHLS-AG, SCH-AG)
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Spring 2023, Spring 2021, Spring 2019, Spring 2017
Learning Outcomes:

- Understand the theory and measurement of central processes in ecosystem ecology, across a range of ecosystems.
- Predict the response of these processes to variation in biotic and abiotic factors, such as light, water, nutrient supply, community structure, and disturbance.
- Apply understanding of ecosystem processes to predict the impacts of human-accelerated environmental change on ecosystem processes and function.
- Apply a quantitative approach to ecosystem biology.
- Critically evaluate literature on ecosystem ecology through regular reading assignments throughout the term.
- Synthesize information from the primary literature to address a central question of interest in ecosystem ecology.

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

BIOEE 4790 - Paleobiology (4 Credits)
Crosslisted with EAS 4790
Surveys the major groups of invertebrate organisms and their evolutionary histories, and the theoretical and practical principles of paleontology, from biostratigraphy to macroevolution. Intended to fill out the biological backgrounds of Earth and atmospheric science students concerning the nature and significance of the fossil record for their respective studies, and the paleontological backgrounds of biology students interested in ecology and evolution.
Prerequisites: BIOEE 1780 or BIOSM 1780, EAS 3010, or permission of instructor.
Distribution Requirements: (BIO-AS), (OPHLS-AG)
Last Four Terms Offered: Spring 2024, Spring 2023, Spring 2022, Spring 2021
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 4800 - Ecological Genetics (4 Credits)
Crosslisted with ENTOM 4700
Ecological Genetics focuses on the application of population genetic concepts in ecological contexts, with emphases on measuring adaptation in natural populations, detecting the effects of population demography, and determining the genetic basis of quantitative traits. Illustrative examples will be drawn from the primary research literature to demonstrate experimental techniques and methods of data analysis on single-gene, multi-locus and genome-wide scales.
Prerequisites: BIOEE 1780. Recommended prerequisite: introductory course in genetics and/or statistics. Permission of instructor required if prerequisite(s) are not met.
Distribution Requirements: (BSC-AG, DLG-AG, OPHLS-AG)
Last Four Terms Offered: Spring 2025, Spring 2023, Spring 2021, Spring 2019
Learning Outcomes:

- Students will be able to apply and test basic models of genetic evolution to real biological scenarios, guided by case examples from the primary scientific literature as well as the lecture-based presentations of abstract concepts.
- Students will be able to apply analytical tests to empirical data sets and draw statistically robust conclusions.
- Students will be able to interpret data and results in a broader context to reach plausible biological conclusions. Students will employ scientific thinking to solve problems that mirror real-life experimental scenarios.

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

BIOEE 4940 - Special Topics in Ecology and Evolutionary Biology (1-6 Credits)
The department offers trial courses or seminars under this number. Offerings vary by semester. The same course is not to be offered more than twice under this number. For 2022-2023 descriptions, please go to the department website.
Last Four Terms Offered: Spring 2025, Spring 2024, Fall 2023, Summer 2023
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 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/)

BIOEE 6000 - Ecology and Evolution of Infectious Diseases (4 Credits)
Crosslisted with ENTOM 6000
This course introduces students to the field of infectious disease ecology, an area of study that has developed rapidly over the past three decades and addresses some of the most significant challenges to human health and conservation. Students will learn about the incredible diversity of parasitic organisms, arguably the most abundant life forms on the planet, and examine how pathogens invade and spread through host populations. Throughout the course, an emphasis will be placed on understanding of infectious diseases dynamics at the population level, and on quantitative approaches for studying pathogen spread and impacts. Specific topics include types of pathogens and their ecological properties, epidemiology and impacts on host populations, types of transmission, evolution of resistance and virulence, drivers of the emergence of new diseases, parasites in the context of ecological communities, strategies for controlling outbreaks, and the role of parasites in biodiversity and conservation.
Prerequisites: Recommended prerequisite: BIOEE 1610, BIOG 1101, BIOG 1102, or BIOG 1190 and MATH 1106, MATH 1110, MATH 1120, MATH 2210, MATH 1710, or STSCI 2150; or equivalencies; or by instructor permission.
Last Four Terms Offered: Spring 2024
Learning Outcomes:

- Apply an understanding of ecological and evolutionary interactions between hosts and their microbes/parasites across multiple scales of biological organization.
- Utilize quantitative approaches for studying infectious disease spread.
- Critically review current research and case studies in the field of infectious disease ecology and evolution.
- Contextualize an understanding of the diversity of parasitic organisms and their importance in conservation and human health.
- Predict pathogen emergence and develop responses to epidemics based on ecological and evolutionary principles.

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

BIOEE 6550 - Data Analysis and Visualization in Ecology and Environmental Science (3 Credits)
Ecology and Environmental Science are running into a 'big data' era. The unprecedented data sources provide opportunities for novel scientific exploration and solutions to real-world problems, which, however, usually requires robust quantitative analysis and informative visualization.
This course aims to increase students' literacy and hands-on skills on common quantitative methods in ecology and environmental sciences, including accessing and curating data, statistical inference, regression, data-based predictions (also known as machine learning), and visualizing the results. Students will be using public data sets from organismal to landscape scales, including spatial data sets from the Google Earth Engine platform. Example codes will be provided in both Python and R.
Prerequisites: Introductory Calculus and Statistics, BIOEE 1610 or equivalent, or permission of instructor.
Last Four Terms Offered: Spring 2025, Spring 2024, Spring 2023
Learning Outcomes:

- Demonstrate quantitative reasoning and computational thinking skills over heterogenous data sets.
- Contrast motivation, theoretical basis, limitation, and applicable scenarios for common statistical inference and machine learning methods.
- Compare and evaluate different quantitative models to explain realistic ecological/environmental questions.
- Design and conduct scientific visualization on quantitative analysis results in Python/R.
- Access and analyze public spatial environmental data set on Google Earth Engine.
- Organize quantitative analysis into a report in the format of a typical research manuscript.

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

BIOEE 6602 - Graduate Field Course in Ecology (3 Credits)
Designed to give graduate students experience in defining questions and designing field investigations. The course is based at the Archbold Biological Station in central Florida over spring break and during the following week. The class visits several ecosystems including sand pine scrub, cattle ranches, cypress swamps, and the Everglades.
Enrollment Information: Enrollment limited to: graduate students.
Course Fee: Course Fee, TBA. TBA to cover food and lodging in Florida.
Last Four Terms Offered: Spring 2024, Spring 2022, Spring 2018, Spring 2016
Learning Outcomes:

- Identify the most ecologically significant organisms in Florida scrub habitats.
- Explain the ecological roles of these critical species in their habitats.
- Formulate two or more original hypotheses about an ecological issue in the Florida scrub.
- Design experimental or observational tests of hypotheses that can be carried out in a week's time.
- Design an experiment or set of observations (both theoretical and practical) to execute a meaningful research project.
- Accomplish research tasks effectively.
- Design experiments that can be carried out using the equipment and supplies that can be carried with them. They will work out ways to sample, carry out experiments, and fill simple scientific needs with materials that can be purchased locally (such as at hardware stores, etc.).

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

BIOEE 6680 - Principles of Biogeochemistry (4 Credits)
Lectures cover the biotic controls on the chemistry of the environment and the chemical control of ecosystem function. Emphasis is on cycles of major elements and minor elements globally and in selected ecosystems, stressing the coupling of element cycles. A comparative approach is used to illustrate similarities and differences in element cycling among ecosystems. Analysis of both theoretical and applied issues, including global atmospheric changes and factors controlling the acidification of lakes and soils.
Prerequisites: solid background in ecology, environmental chemistry, or related environmental science.
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Spring 2022, Spring 2016, Spring 2014, Spring 2012
Learning Outcomes:

- Understand how the metabolism of organisms and the interaction of ecological processes control the chemistry of the Earth's atmosphere, waters, and soils.
- Understand how the chemistry of the environment (waters, soils) affects key ecological processes and their controls.
- Understand how the interactions of element cycles can modify the influences of environmental chemistry on ecological processes.
- Use the tools of basic aqueous chemistry and equilibrium thermodynamics in evaluating biogeochemical questions.
- Develop the tools to critically evaluate contradictory information on major environmental issues, using the tools of biogeochemistry.
- Write and give oral presentations showing biogeochemical approaches to understanding major environmental issues.

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

BIOEE 6900 - Seminar in Ecology and Evolution of Infectious Diseases (1 Credit)
Crosslisted with ENTOM 6900
Graduate-level discussion of the ecology, epidemiology, genetics, and evolution of infectious disease in animal and plant systems. Weekly discussion of research papers published in the primary scientific literature. Participation in discussion and presentation of at least one paper required for course credit.
Last Four Terms Offered: Spring 2025, Fall 2024, Fall 2023, Spring 2023
Learning Outcomes:

- Students will become conversant in general topics in the ecology and evolution of infection and disease across a variety of plant and animal systems-approaches will be both empirical and theoretical.
- Students will learn how to read and evaluate the peer-reviewed scientific literature.
- Students will gain experience giving oral presentations as a means for sharing their evaluations of the scientific literature.

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

BIOEE 7600 - Special Topics in Evolution and Ecology (1-3 Credits)
Lectures and intensive study of special topics in the field of Ecology & Evolutionary Biology. Content varies each semester.
Exploratory Studies: (LAAREA)

Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 7640 - Plant-Insect Interactions Seminar (1 Credit)
Crosslisted with BIONB 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/)

BIOEE 7650 - Professional Development in Ecology and Evolutionary Biology (1 Credit)
Group discussion on professional activities for academic ecologists and evolutionary biologists. Topics include: writing a CV, publication strategies, finding a postdoc, the tenure process, grant writing, manuscript reviews, networking, public speaking, and scientific collaboration.
Enrollment Information: Enrollment limited to: graduate students or permission of instructor.
Last Four Terms Offered: Spring 2024, Spring 2020, Spring 2017, Spring 2014
Learning Outcomes:

- Evaluate factors that lead to success in academia that are not directly related to conducting research and teaching.
- Deliver critiques of oral or written presentations.
- Apply skills to improve written professional documents.

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

BIOEE 7670 - Current Topics in Ecology and Evolutionary Biology (4.5 Credits)
Critical evaluation and discussion of theory and research in ecology and evolutionary biology. Lectures by faculty and student-led discussions of topics in areas of current importance.
Enrollment Information: Enrollment limited to: Ecology and Evolutionary Biology graduate students or permission of instructor.
Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- Become familiar with major research questions in Ecology and Evolutionary Biology.
- Discuss these questions with peers.
- Develop a research proposal, including scientific justification, background, hypotheses, methods, and broader impacts.
- Provide commentary and suggestions on proposals written by their peers.
- Create personal reference list of papers and bibliographies.
- Enhance understanding of diversity, equity, and inclusion in higher education and STEM fields.
- Become familiar with grant writing, choosing a thesis topic, navigating graduate school and advisors, giving talks, mental health resources and scientific resources on campus.

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

BIOEE 7800 - Graduate Seminar in Ornithology (1 Credit)
Group intensive study of current research in ornithology built around a research seminar series covering a wide variety of projects and topics in ornithology and related disciplines, including avian ecology, evolution, conservation, behavior, and physiology. Each weekly seminar is followed by informal discussion and networking that builds connections among the large community of Cornell students and scholars with an interest in avian biology. All students with an interest in this subject area are welcome and deep knowledge of ornithology is not expected or required. Instructor permission is not required for enrollment.
Exploratory Studies: (CU-SBY)

Last Four Terms Offered: Fall 2024, Fall 2023, Fall 2022, Fall 2021
Learning Outcomes:

- Describe research projects presented during the semester's seminars.
- Understand the concepts presented in seminars.
- See the implications of opportunities and research approaches and findings for developing the student's own interests in ornithology.
- Greater linkages among students and Cornell researchers, providing students with new contacts and research opportunities.

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

BIOEE 8990 - M.S. Thesis Research (1-15 Credits)
Thesis research conducted by an M.S. student in the field of ecology and evolutionary biology with advice and consultation of a major professor who is a member of the field.
Enrollment Information: Enrollment limited to: Ecology and Evolutionary Biology students.
Last Four Terms Offered: Spring 2025, Fall 2020, Spring 2020, Fall 2019
Schedule of Classes (https://classes.cornell.edu/)

BIOEE 9990 - Ph.D. Dissertation Research (1-15 Credits)
Dissertation research conducted by a Ph.D. student in the field of ecology and evolutionary biology with advice and consultation of a major professor who is a member of the field.
Enrollment Information: Enrollment limited to: Ecology and Evolutionary Biology Ph.D. students.
Last Four Terms Offered: Spring 2025, Fall 2024, Spring 2024, Fall 2023
Schedule of Classes (https://classes.cornell.edu/)