ECOLOGY & EVOLUTIONARY BIOLOGY (E&EB)

* E&EB 035a, *The Ecology of Food*  Linda Puth
Food and ecology are inextricably linked, both in the production of domesticated food through agriculture and livestock, and in the harvesting of wild plants and animals. Furthermore, the production and consumption of food has downstream consequences through energy consumption, food waste, trophic interactions and the transportation of food around the globe. These topics link to many of the fundamental concepts of ecology, including population biology, the niche, trophic interactions, nitrogen cycling and the effects on biodiversity. In this class we explore each of these topics intensively through a combination of lectures, readings and interactive field trips to on/near campus ecosystems, the Marsh Botanical Gardens and the Yale Sustainable Farm. Each week, we meet twice for 50 minutes for a combination of lecture and discussion (online – ZOOM), and for 110 minutes for field trips, discussions, and guest lectures. Discussions and guest lectures are generally online (ZOOM). If conditions permit, we will visit several locations on campus: Yale’s botanical gardens, the Yale Experimental Watershed, and the Yale Sustainable Farm. All are accessible by walking on/from campus. SC

* E&EB 075Lb, *Virus Discovery and Evolution*  Alita Burmeister
An introduction to empirical research with a hybrid between lab exercises and mentored research on bacteriophage, which are viruses that infect bacteria. A general goal of this course is for each student to decide whether they want to continue with undergraduate research. Specific learning objectives and assessments focus on experimental design, hypothesis testing, data analysis, and presentation. Students will practice these skills and conduct independent research projects. Students will gain basic experience with methods and principles from microbiology, genetics, ecology, and evolutionary biology. Enrollment limited to first-year students. Preregistration required; see under First-Year Seminar Program. SC

* E&EB 106a / HLTH 155a / MCDB 106a, *Biology of Malaria, Lyme, and Other Vector-Borne Diseases*  Alexia Belperron
Introduction to the biology of pathogen transmission from one organism to another by insects; special focus on malaria, dengue, and Lyme disease. Biology of the pathogens including modes of transmission, establishment of infection, and immune responses; the challenges associated with vector control, prevention, development of vaccines, and treatments. Intended for non-science majors; preference to freshmen and sophomores. Prerequisite: high school biology. SC

E&EB 115a / F&ES 315a, *Conservation Biology*  Linda Puth
An introduction to ecological and evolutionary principles underpinning efforts to conserve Earth’s biodiversity. Efforts to halt the rapid increase in disappearance of both plants and animals. Discussion of sociological and economic issues. SC

* E&EB 125b / EPS 125b, *History of Life*  Derek Briggs, Pincelli Hull, and Bharat-Anjan Bhullar
Examination of fossil and geologic evidence pertaining to the origin, evolution, and history of life on Earth. Emphasis on major events in the history of life, on what the fossil record reveals about the evolutionary process, on the diversity of ancient and living organisms, and on the evolutionary impact of Earth’s changing environment. SC

* E&EB 145b, *Plants and People*  Linda Puth
The interaction of plants and people throughout history explored from biological, historical, anthropological, and artistic perspectives. Basic botany; plants in the context of agriculture; plants as instruments of trade and societal change; plants as inspiration; plants in the environment. Includes field trips to the greenhouses at Yale Marsh Botanical Garden, the Yale Peabody Museum and Herbarium, the Yale Farm, and the Yale Art Gallery. SC

Statistical and probabilistic analysis of biological problems, presented with a unified foundation in basic statistical theory. Problems are drawn from genetics, ecology, epidemiology, and bioinformatics. QR

E&EB 220a / EVST 223a, *General Ecology*  David Post and David Vasseur
The theory and practice of ecology, including the ecology of individuals, population dynamics and regulation, community structure, ecosystem function, and ecological interactions at broad spatial and temporal scales. Topics such as climate change, fisheries management, and infectious diseases are placed in an ecological context. Prerequisite: MATH 112 or equivalent. SC

E&EB 223Lb, *Laboratory for Principles of Ecology, Evolutionary Biology, and the Tree of Life*  Marta Wells
Study of evolutionary novelties, their functional morphology, and their role in the diversity of life. Introduction to techniques used for studying the diversity of animal body plans. Evolutionary innovations that have allowed groups of organisms to increase their diversity. SC ½ Course cr

E&EB 225b, *Evolutionary Biology*  Paul Turner
An overview of evolutionary biology as the discipline uniting all of the life sciences. Reading and discussion of scientific papers to explore the dynamic aspects of evolutionary biology. Principles of population genetics, paleontology, and systematics; application of evolutionary thinking in disciplines such as developmental biology, ecology, microbiology, molecular biology, and human medicine. SC

E&EB 250a, *Biology of Terrestrial Arthropods*  Marta Wells
Evolutionary history and diversity of terrestrial arthropods (body plan, phylogenetic relationships, fossil record); physiology and functional morphology (water relations, thermoregulation, energetics of flying and singing); reproduction (biology of reproduction, life cycles, metamorphosis, parental care); behavior (migration, communication, mating systems, evolution of sociality); ecology (parasitism, mutualism, predator-prey interactions, competition, plant-insect interactions). To be taken concurrently with E&EB 251L. SC
E&EB 251La, Laboratory for Biology of Terrestrial Arthropods  Marta Wells
Comparative anatomy, dissections, identification, and classification of terrestrial arthropods; specimen collection; field trips. Concurrently
with or after E&EB 250. SC ½ Course cr

* E&EB 269a, Bird Behavior  Richard Prum
A seminar discussion of classic and recent scientific literature on topics in bird behavior. Students develop experience in critical reading of
the literature through the exploration of topics in bird behavior including courtship, breeding behavior, song and song learning, foraging
ecology, migration and orientation, and sensory ecology. Prerequisite: BIOL 104 or permission of the instructor. SC

* E&EB 272b, Ornithology  Richard Prum
An overview of avian biology and evolution, including the structure, function, behavior, and diversity of birds. The evolutionary origin of
birds, avian phylogeny, anatomy, physiology, neurobiology, breeding systems, and biogeography. Enrollment limited to 50. SC

* E&EB 273Lb, Laboratory for Ornithology  Richard Prum
Laboratory and field studies of avian morphology, diversity, phylogeny, classification, identification, and behavior. Enrollment limited to 12. SC ½ Course cr

* E&EB 275b / EVST 400b, Biological Oceanography  Mary Beth Decker
Exploration of a range of coastal and pelagic ecosystems. Relationships between biological systems and the physical processes that control
the movements of water and productivity of marine systems. Anthropogenic impacts on oceans, such as the effects of fishing and climate
change. Includes three Friday field trips. Enrollment limited to 15. SC

E&EB 290b, Comparative Developmental Anatomy of Vertebrates  Gunter Wagner
A survey of the development, structure, and evolution of major vertebrate groups. Topics include the micro-anatomy of major organ
systems, the developmental underpinnings of the vertebrate body plan, and the development, structure, and evolution of the major organ
systems such as the locomotory system, sensory organs, digestive tract, reproductive tract, and nervous system. SC

E&EB 291Lb, Comparative Anatomy of Vertebrates Laboratory  Gunter Wagner
Microscopic examination of histological and embryological preparations. Dissection of selected vertebrate species including shark, bony
fish, frog, lizard, and rat. To be taken with E&EB 290. SC ½ Course cr

E&EB 295a, Life in Motion: Ecological and Evolutionary Physiology  Martha Munoz
Physiology is the study of the functions that organisms perform and how they use those functions to interact with the environment.
To survive, grow, and reproduce, all organisms must acquire energy and avoid conditions that exceed their physiological limits. These
interactions all involve motion—ions traveling across membranes, muscle fibers twitching, respiration, and locomotion, to name a few.
In this course, we tackle physiological processes from both “bottom up” and “top down” approaches, with integration among these
dimensions, to extract general physiological rules of life. Then, we link our discoveries to the broader context of ongoing global change,
and consider whether and how organisms can physiologically respond to contemporary selective pressures. While the course focuses
heavily on animal physiology, plants, fungi, and microbes are also featured. Prerequisites: BIOL 101–104, and CHEM 161, or permission of the instructor. SC

* E&EB 335a / HLTH 250a, Evolution and Medicine  Stephen Stearns
Introduction to the ways in which evolutionary science informs medical research and clinical practice. Diseases of civilization and their
relation to humans’ evolutionary past; the evolution of human defense mechanisms; antibiotic resistance and virulence in pathogens;
cancer as an evolutionary process. Students view course lectures on line; class time focuses on discussion of lecture topics and research
papers. Prerequisite: BIOL 101–104. WR, SC

E&EB 352b / E&EB 200, Evolutionary Theory  Alvaro Sanchez
This course introduces students to the theory behind evolutionary biology. The aim of the course is for the student to understand how
evolution works, focusing on the quantitative and predictive theory that is the backbone of modern evolutionary thinking. The course
covers three main areas: An introduction to population genetics, an introduction to quantitative genetics and the genotype-phenotype
map, and an introduction to life-history evolution. To master this material and to put the concepts studied in class into practice, students
work on weekly problem sets. Through the completion of the course assignments, students gain valuable quantitative and mathematical
modeling skills. Prerequisites: One of the following: E&EB 225, PHYS 170/171 or 180/181 or permission of the instructor. QR

E&EB 354a, Phylogenetic Biology  Casey Dunn
Phylogenetic Biology is the study of the evolutionary relationships between organisms, and the use of evolutionary relationships to
understand other aspects of organism biology. This course surveys phylogenetic methods, providing a detailed picture of the statistical,
mathematical, and computational tools for building phylogenies and using them to study evolution. We also examine the application of
these tools to particular problems in the literature and emerging areas of study. Prerequisites: E&EB 225 and an organismal course. SC

* E&EB 362b, Tropical Field Biology  Linda Puth and Martha Munoz
Firsthand experience of a region can inspire great insights and understanding of ecology and evolutionary biology. This course immerses
students in the communities and ecosystems of a single tropical region each year, but locations rotate among a small group of sites. We
spend the first half of the semester learning about the geology, history, biomes and organisms of the region. The spring 2021 class will
travel to 1-2 tropical forest research stations in Costa Rica. Prerequisites: E&EB 220, E&EB 225, and permission of the instructor. SC
E&EB 428a / AMTH 428a / EPS 428a / PHYS 428a, Science of Complex Systems  Jun Korenaga
Introduction to the quantitative analysis of systems with many degrees of freedom. Fundamental components in the science of complex systems, including how to simulate complex systems, how to analyze model behaviors, and how to validate models using observations. Topics include cellular automata, bifurcation theory, deterministic chaos, self-organized criticality, renormalization, and inverse theory. Prerequisite: PHYS 301, MATH 247, or equivalent. QR, SC

E&EB 464a or b / ANTH 464a or b / ARCG 464a or b, Human Osteology  Eric Sargis
A lecture and laboratory course focusing on the characteristics of the human skeleton and its use in studies of functional morphology, paleodemography, and paleopathology. Laboratories familiarize students with skeletal parts; lectures focus on the nature of bone tissue, its biomechanical modification, sexing, aging, and interpretation of lesions. SC, SO

* E&EB 469a or b, Tutorial  Marta Wells
Individual or small-group study for qualified students who wish to investigate an area of ecology or evolutionary biology not presently covered by regular courses. A student must be sponsored by a faculty member who sets requirements and meets weekly with the student. One or more written examinations and/or a term paper are required. To register, the student must submit a written plan of study approved by the faculty instructor to the director of undergraduate studies. Students are encouraged to apply during the term preceding the tutorial. Proposals must be submitted no later than the first day of the second week of the term in which the student enrolls in the tutorial. The final paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment. In special cases, with approval of the director of undergraduate studies, this course may be elected for more than one term, but only one term may be counted as an elective toward the requirements of the major. Normally, faculty sponsors must be members of the EEB department.

* E&EB 470a or b, Senior Tutorial  Marta Wells
Tutorial for seniors in the B.A. degree program who elect a term of independent study to complete the senior requirement. A thesis, fifteen to twenty pages in length, is required. A student must be sponsored by a faculty member who sets requirements and meets weekly with the student. To register, the student must submit a written plan of study approved by the faculty instructor to the director of undergraduate studies. Students are encouraged to apply during the term preceding the tutorial. Proposals must be submitted no later than the first day of the second week of the term in which the student enrolls in the tutorial. The final paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment. Normally, faculty sponsors must be members of the EEB department. Enrollment limited to seniors. Fulfills the senior requirement for the B.A. degree.

* E&EB 474a or b, Research  Marta Wells
One term of original research in an area relevant to ecology or evolutionary biology. This may involve, for example, laboratory work, fieldwork, or mathematical or computer modeling. Students may also work in areas related to environmental biology such as policy, economics, or ethics. The research project may not be a review of relevant literature but must be original. In all cases students must have a faculty sponsor who oversees the research and is responsible for the rigor of the project. Students are expected to spend ten hours per week on their research projects. Using the form available from the office of undergraduate studies or from the Canvas, students must submit a research proposal that has been approved by the faculty sponsor to the director of undergraduate studies, preferably during the term preceding the research. Proposals are due no later than the first day of the second week of the term in which the student enrolls in the course. The final research paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment.

* E&EB 475a and E&EB 475b, Senior Research  Marta Wells
One term of original research in an area relevant to ecology or evolutionary biology. This may involve, for example, laboratory work, fieldwork, or mathematical or computer modeling. Students may also work in areas related to environmental biology such as policy, economics, or ethics. The research project may not be a review of relevant literature but must be original. In all cases students must have a faculty sponsor who oversees the research and is responsible for the rigor of the project. Students are expected to spend ten hours per week on their research projects. Using the form available from the office of undergraduate studies or from the Canvas, students must submit a research proposal that has been approved by the faculty sponsor to the director of undergraduate studies, preferably during the term preceding the research. Proposals are due no later than the first day of the second week of the term in which the student enrolls in the course. The final research paper is due in the hands of the director of undergraduate studies by the last day of classes in the term of enrollment. Fulfills the senior requirement for the B.S. degree. Enrollment limited to seniors.

* E&EB 495a and E&EB 495b, Intensive Senior Research  Marta Wells
One term of intensive original research during the senior year under the sponsorship of a Yale faculty member. Similar to other research courses except that a more substantial portion of a student's time and effort should be spent on the research project (a minimum average of twenty hours per week). A research proposal approved by the sponsoring faculty member must be submitted to the director of undergraduate studies; forms are available from the office of undergraduate studies. For research in the fall term, approval is encouraged during the spring term of the junior year. Proposals are due no later than the first day of the second week of the term in which the student enrolls in the course. The final research paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment. One term of intensive research fulfills a portion of the senior requirement for the B.S. degree. 2 Course cr per term

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