

ECOLOGY & EVOLUTIONARY BIOLOGY (E&EB)

*** 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 first-years and sophomores. Prerequisite: high school biology. SC

E&EB 210a / S&DS 101a, Introduction to Statistics: Life Sciences Jonathan Reuning-Scherer

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 Staff

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 o Course cr

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 o Course cr

E&EB 225b, Evolutionary Biology Staff

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 o Course cr

E&EB 228b, Ecology and Evolution of Infectious Diseases Paul Turner and Vanessa Ezenwa

Overview of the ecology and evolution of pathogens (bacteria, viruses, protozoa) and their impact on host populations. Topics include theoretical concepts, ecological and evolutionary dynamics, molecular biology, and epidemiology of ancient and emerging diseases. Prerequisite: BIOL 104 or permission of instructor. 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
o Course cr

E&EB 255a, Invertebrates Casey Dunn
An overview of animal diversity that explores themes including animal phylogenetics (evolutionary relationships), comparative studies of evolutionary patterns across species, organism structure and function, and the interaction of organisms with their environments. Most animal lineages are marine invertebrates, so marine invertebrates are the focus of most of the course. E&EB 256L is not required to enroll in the lecture. SC

E&EB 256La, Laboratory for Invertebrates Casey Dunn
The study of invertebrate anatomy and diversity in a laboratory and field setting. Activities will include will examine live animals and museum specimens, as well as local field trips. Some field trips will fall on weekends. This lab must be taken concurrently with the lecture E&EB 255. 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 290b, Comparative Developmental Anatomy of Vertebrates Joshua Moyer
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 Joshua Moyer
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 Joshua Moyer
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, 102, 103, 104, and CHEM 161, or permission of the instructor. SC

E&EB 320b, Community Ecology David Vasseur

This course covers core questions in community ecology related to species interactions, species coexistence theory, species-environment interactions, the consequences of biological diversity, spatial ecology, food webs, and eco-evolutionary interactions.

Lectures emphasize the theoretical and conceptual foundations of these topics and incorporate the empirical and experimental evidence supporting and confronting contemporary views. Prerequisites: E&EB 220 or EVST 223, or with permission of instructor. SC

E&EB 322a, Evolutionary Genetics Jennifer Coughlan

Genetic variation is the currency by which natural selection is translated into evolutionary change. In this course we dissect patterns of genetic variation using an evolutionary mindset to ultimately understand what shapes genetic variation in nature and the potential for species to adapt to new and changing environments. This class unites two foundational fields of evolutionary genetics; quantitative genetics (the study of the genetic basis of complex traits) and population genetics (the study of gene variant frequencies across time and space), with an ultimate goal of understanding evolutionary change in nature. Although this course is lecture based, there is much opportunity for hands-on learning. Students use real-life and simulated genetic data to map the genetic basis of traits and investigate the evolutionary forces responsible for shaping genetic variation in nature. We also discuss how quantitative and population genetics theory are applied to the modern genomic era, particularly in the context of detecting genomic signatures of adaptation. Lastly, we discuss the application of evolutionary genetics to human populations, including the usefulness and missteps of these applications for science and society. Prerequisite: E&EB 225, Evolutionary Biology. SC

* **E&EB 335a / HLTH 250a, Evolution and Medicine** Brandon Ogbunu

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 375a, Topics in Vertebrate Ecomorphology Joshua Moyer

Ecomorphology is a field that bridges ecology and evolutionary biology. Researchers studying organisms' ecomorphology ask questions like, "What does the morphology of an organism tell us about its relationship with its environment" and "How are correlations between morphology and ecology influenced by behavior?" The answers to questions like these inform evolutionary hypotheses based on natural selection and help to explain the amazing diversity of life forms that surround us. In this course, we explore the links between organismal form, function, ecology, and evolution using a series of readings and guided discussions. Students also learn many of the fundamentals associated with crafting and revising publishable scientific writing—a must for those seeking research-based graduate education in the sciences. By the end of the semester, students refine their critical thinking and scientific writing skills, and they

have a newfound awareness of one of the most integrative and fascinating branches of vertebrate biology. Prerequisites: BIOL 101, 102, 103, and 104 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 o Course cr

* **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 476b, 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 496b, 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