Doctoral Degree

The Department of Biology offers the Ph.D. degree in Evolution, Ecology, and Organismal Biology. In addition to the general requirements of the Graduate Division, students intending to become candidates for the Ph.D. degree in Evolution, Ecology, and Organismal Biology must complete the following.

Course Work Course requirements are determined in consideration of the requirements of the student's area of specialization. Selection of specific courses is done by the guidance committee in consultation with the student.

All students are required to take EEOB 400, at least one of EEOB 210, EEOB 216 or EEOB 217 and at least one other four-unit graduate level course from an approved list. Students also are required to take two current research topics courses (Biol 252 or another disciplinary colloquium and EEOB 265) for a minimum of 5 quarters prior to advancement to candidacy and 12 quarters prior to completion of the doctoral degree.

Professional Development One unit of coursework in professional development, which is satisfied by EEOB 400.

Written and Oral Qualifying Examinations Students must pass a written examination in their specialized field of interest not later than the end of the second year of residence. Written Qualifying Examinations must be completed by the eighth week of the sixth quarter in residence. Upon successful completion of the Written Qualifying Examination, an Oral Qualifying Examination is administered wherein students defend a proposal detailing the rationale, specific aims, and approaches to be undertaken for their proposed dissertation research.

Dissertation Candidates may be required to successfully defend their dissertation research in a public oral presentation.

Teaching Requirement Students must have at least one year of approved teaching experience.

Normative Time to Degree 18 quarters

Master’s Degree

The Department of Biology offers the M.S. degree in Evolution, Ecology, and Organismal Biology, with specializations in Evolutionary Biology, Ecology, and Physiology & Biophysics. To qualify for the M.S. degree in Evolution, Ecology, and Organismal Biology, candidates must meet the requirements of the Department of Biology.

These requirements are as follows:

Plan 1 (Thesis) Thirty-six (36) quarter units of approved courses in the 100 or 200 series, of which at least 24 units must be in the 200 series courses in the biological sciences. Not more than 12 units of EEOB 299 may be applied to the degree. A minimum of 12 units of course work other than courses in the 290 series must be completed in fulfillment of the requirement for 24 units of graduate courses. Students must present an acceptable thesis and undergo a final oral examination in defense of the thesis.

Lower-Division Courses

BIOL 002 Cellular Basis of Life (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): none. An introduction to the fundamentals of life processes at the cellular level. Topics include cell structure, chemical composition, metabolism, reproduction, genetics, and development with emphasis on humans. Not recommended for natural science majors. Either BIOL 002 or BIOL 003 may be taken as a breadth requirement in biology; together they provide a general introduction to the field of biology. Credit is not awarded for BIOL 002 if it has already been awarded for BIOL 005A, BIOL 05LA or BIOL 020.

BIOL 003 Organisms in Their Environment (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): none. An introduction to the physiology, ecology, and evolution of living organisms with emphasis on humans. Not recommended for natural science majors. Either BIOL 002 or BIOL 003 may be taken as a breadth requirement in biology; together they provide a general introduction to the field of biology. Credit is not allowed for both BIOL 003 and BIOL 005B.

BIOL 005A Introduction to Cell and Molecular Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 05LA (may be taken concurrently) or BIOL 020 (may be taken concurrently) with grades of “C-” or better, or CHEM 010LA with grades of “C-” or better or CHEM 01HA and CHEM 1H1A with grades of “C-” or better, consent of instructor is required for students repeating the course. An intensive course designed to prepare for upper-division courses in cell and molecular biology. Covers biochemical, structural, metabolic, and genetic aspects of cells. Required for Biology majors; recommended for science majors desiring an introduction to biology. Credit is not awarded for BIOL 005A if it has already been awarded for BIOL 002.

BIOL 005B Introduction to Organismal Biology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A and BIOL 05LA or BIOL 020 with grades of “C-” or better, or CHEM 010LA with grades of “C-” or better, or CHEM 01HA, CHEM 01LB or CHEM 01HB; consent of instructor is required for students repeating the course. An intensive course designed to prepare for upper-division courses in organismal biology. Covers developmental biology, physiology, and regulation at the level of the organism. Required for Biology majors; recommended for science majors desiring an introduction to biology. Credit is awarded for only one of BIOL 003 or BIOL 005B.

BIOL 005C Introductory Evolution and Ecology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B (or BIOL 002 and BIOL 003 for non-Biology majors) with grades of “C-” or better, or BIOL 05LA with a grade of “C-” or better or equivalent; consent of instructor is required for students repeating the course. An intensive introduction to the subjects of evolution and ecology. Covers population dynamics, community ecology, population genetics, and evolutionary theory. Recommended for science majors desiring an introduction to biology. Students who take equivalent first-year biology at another institution may enter directly into BIOL 005C without critical handicap.

BIOL 010 Headlines in the History of Life (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): none. Evolution of life beginning with precellular life. Topics include the origin of sex; multicellularity; vertebrate classes; morphological speciations; adaptive radiations; extinction dynamics; and the biology of dinosaurs. Cross-listed with GEO 003.

BIOL 020 Dynamic Genome (2) Lecture, laboratory, 6 hours. Prerequisite(s): CHEM 001A or CHEM 01HA, MATH 009A (may be taken concurrently); freshwater standing. Introduces computational and experimental approaches in investigating the genomes of plants and animals. Explores scientific discovery using the tools of bioinformatics and genomics. Includes participation in research projects being conducted on campus. Credit is not awarded for BIOL 020 if it has already been awarded for BIOL 002 or BIOL 05LA.

BIOL 030 Human Reproduction and Sexual Behavior (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): none. A consideration of human anatomy, physiology and behavior as related to sexual reproduction, including discussion of fertility, pregnancy, childbirth and birth control. Consideration will also be given to homosexuality, venereal diseases, sex education, sexual intercourse and response.

BIOL 034 Human Heredity and Evolution (4) Lecture, 3 hours; discussion and problem solving, 1 hour; audio-visual aids plus discussion, 1 hour. Basic human genetics and evolution, emphasizing their relationship to physical and emotional health, Political, philosophical and ethical implications of human heredity and evolution.

BIOL 040 Disease and History: From the Bubonic Plague to AIDS (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): none. This lecture course for nonscience majors will deal with the natural history of infectious diseases and how plagues have influenced the course of human history. It will cover the biology, pathology, epidemiology, and immunology of viruses, bacteria, and protozoan parasites causing smallpox, yellow fever, influenza, AIDS, syphilis, bubonic plague, tuberculosis, leprosy, malaria, and African sleeping sickness. The role of scientific inquiry in the conquest of human disease will be emphasized.

BIOL 05LA Introduction to Cell and Molecular Biology Laboratory (1) Laboratory, 3 hours. Prerequisite(s): BIOL 005A (may be taken concurrently); consent of instructor is required for students repeating the course. An introductory laboratory course in the fundamental principles of cells and techniques in cell and molecular biology. Laboratory exercises are based on the experimental foundations of the topics covered in BIOL 005A. Credit is not awarded for BIOL 05LA if it has already been awarded for BIOL 002 or BIOL 020.

Upper-Division Courses

BIOL 100 General Entomology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005B, BIOL 005C, or equivalents; or consent of instructor. Introductory study of insects, Earth’s most diverse group of animals (75 percent of animal species are insects). Lecture covers the anatomy, physiology, ecology, behavior, and diversity of insects. Laboratory focuses on insect identification. Cross-listed with ENMT 100.

BIOL 102 Introductory Genetics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B with grades of “C-” or better. An introductory course that includes classical Mendelian genetics, linkage and recombination, sex-linked traits, cytogenetics, developmental genetics, and molecular genetics. Also includes some probability theory and statistics.

BIOL 104 Foundations of Plant Biology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005C. A study of the plant world from cells to ecosystems. Examines the structure and function of organisms from the major plant groups and their role in the biosphere. The laboratory explores the unique properties of plants. Cross-listed with BPSC 104.

BIOL 105 Evolution (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C with a grade of “C-” or better, BIOL 102, CHEM 12C or CHEM 12H, MATH 009B or MATH 010B, PHYS 020C, PHYS 021C, BCH 100 or BCH 110A, one course in statistics; or consent of instructor. Covers the causal interpretation of organic diversity and adaptation. Topics include inference of evolutionary change from the fossil record and from protein and molecular patterns; microevolution and macroevolution; systematics and the species problem; and natural selection, drift, and other forces of evolution.
BIOL 105Y Evolution Online (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C with a grade of “C-” or better; BIOL 102 with a grade of “D-” or better; CHEM 112C with a grade of “D-” or better; MATH 099B with a grade of “D-” or better; PHYS 002C with a grade of “D-” or better; PHYS 02LC with a grade of “D-” or better; BCH 100 with a grade of “D-” or better or BCH 110A with a grade of “D-” or better. Covers the causal interpretation of organic diversity and adaptation. Topics include inference of evolutionary change from the fossil record and from genomic and molecular patterns; microevolution and macroevolution; systematics and the species problem; and natural selection, drift, and other forces of evolution. Credit is awarded for only one of BIOL 105 or BIOL 105Y.

BIOL 106 Biology of Human Variation (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102; BIOL 105 or BIOL 108; STAT 100B (STAT 100B may be taken concurrently); or consent of instructor. A survey of variation within and among contemporary human populations arising from genetic and environmental factors. Covers single-locus and polygenic inheritance, developmental plasticity, and physiological acclimatization. Includes biogeographic and demographic influences; variation in pigmentation, stature, physiology, disease susceptibility, behavior, and IQ; and phenotypic evaluation of racial and ethnic classifications.

BIOL 107A Molecular Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 010C, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A. The structure and function of the genetic material, including DNA structure, DNA replication and recombination, the molecular mechanisms used by cells to control reproduction, growth, and responses to extracellular signals. Emphasis is on the genetic mechanisms that form the basis of the current understanding of the cell. The discussion section focuses on reading and analyzing original journal articles.

BIOL 108A Introductory Population Genetics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, CHEM 001C or CHEM 010C, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. An examination of the organization, function, and behavior of eukaryotic cells. Topics include membrane systems, protein targeting, the cytoskeleton, motility, and cell division. Emphasis is on the genetic mechanisms that form the basis of the current understanding of the cell. The discussion section focuses on reading and analyzing original journal articles.

BIOL 1101 Infectious Disease Epidemiology (4) S Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, and BIOL 005C with a grade of “C-” or better, BIOL 102 with a grade of “C-” or better, STAT 100A or equivalent (or consent of instructor) with a grade of “C-” or better. Introduces epidemiological methods used to investigate infectious diseases. Includes examples and case studies presented for a variety of human infectious diseases.

BIOL 112 Systems Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C or equivalent. Principles and philosophy of classification: phylogenetic and phenetic methods, species concepts, taxonomic characters, evolution, hierarchy of categories, and nomenclature. Cross-listed with BPSIC 112 and ENTM 112.

BIOL 113 Advanced Cell Biology: Membranes, Organelles, and the Cytoskeleton (4) Lecture, 4 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 102, CHEM 010C or CHEM 010HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics. A study of the factors influencing the genetic structure of natural populations, including biogeographic and demographic influences; variation in pigmentation, stature, physiology, disease susceptibility, behavior, and IQ; and phenotypic evaluation of racial and ethnic classifications.

BIOL 114 Advanced Cell Biology: Cellular Reproduction and Signaling (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, BIOL 102, CHEM 010C or CHEM 010HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics. Examines the genetic mechanisms that form the basis of the current understanding of the cell. The discussion section focuses on reading and analyzing original journal articles.

BIOL 116 Ecology and Conservation Biology (4) Lecture, 3 hours; discussion, 1 hour; field, 9 hours per quarter. Prerequisite(s): BIOL 005C with a grade of “C-” or better; CHEM 001C (or CHEM 010C), MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. An introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers evolutionary origins of metabolic diversity, bacterial and viral genetic mechanisms, and an introduction to microbial pathogenesis. Cross-listed with MCBL 121.

BIOL 121L Microbiology Laboratory (3) Lecture, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 121/MCBL 121 with a grade of “C-” or better. Laboratory exercises include diagnostic bacteriology, biochemistry, and epidemiology. Includes fundamental quantitative and diagnostic microbiological procedures, basic mechanisms of microbial genetic exchange, and a project examining bacterial epidemiology. Cross-listed with MCBL 121.

BIOL 1210 Introduction to Plant Pathology Laboratory (1) Laboratory, 4 hours. Prerequisite(s): BIOL 005A, BIOL 005B; concurrent enrollment in BIOL 120/MCBL 120/PLPA 120 or consent of instructor; BIOL 121/MCBL 121 and BIOL 124/MCBL 124 recommended. Covers fundamentals in the use of laboratory instruments and techniques for the detection, isolation, and identification of representative infectious agents that cause disease in plants. Cross-listed with MCBL 120 and PLPA 120.

BIOL 1212 Food Microbiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 05LA, BIOL 005B, CHEM 001C or CHEM 010C, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. Covers spoilage and preservation of food; food quality and indicator organisms; the role of microorganisms in the production of dairy goods and fermented beverages; food-borne pathogens and microbiological principles of toxins, antimicrobial and antiviral agents; extremophilic microorganisms; and molecular methods for detection of food microorganisms. Cross-listed with MCBL 122.

BIOL 1213 Introduction to Comparative Virology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, CHEM 001C or CHEM 010C, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. An introduction to the science of genomics and bioinformatics. Includes genome sequencing; database techniques; structural, comparative, and evolutionary genomics; and microarray analysis.

BIOL 1214 Pathogenic Microbiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 121/MCBL 121 with a grade of “C-” or better; BIOL 121/MCBL 121 with a grade of “C-” or better. An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers evolutionary origins of metabolic diversity, bacterial and viral genetic mechanisms, and an introduction to microbial pathogenesis. Cross-listed with MCBL 121.
BIOL 127 Insect Ecology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 051A, BIOL 051B, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics; or consent of instructor. Introduces principles of insect ecology with emphasis on the Arthropoda. Topics include factors governing population growth; ecological and evolutionary interactions with hosts, competitors, and natural enemies; structure of ecological communities; and adaptations to different environments. Cross-listed with ENMT 127.

BIOL 128 Immunology (3) Lecture, 3 hours, Prerequisite(s): BIOL 005C, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A. A study of humoral and cellular immunity. Topics include lymphoid systems, cells, antigens, antibodies, and T-cell function, cellular immunity, and tumor and transplantation immunology. Diseases and altered immune states associated with each topic are discussed in detail. Cross-listed with CBNS 128.

BIOL 132 Plant Anatomy (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A and BIOL 005B, BIOL 051B, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics; or consent of instructor. Functional and developmental aspects of plant cell, tissue, and organ structure. Covers all aspects of the flowering plant life cycle from germination to pollination and fruit and seed development. Cross-listed with BPS 132.

BIOL 134 Introduction to Mycology (3) Lecture, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, CHEM 001C, CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics; or consent of instructor. Introduction to the morphology, taxonomy, genetics, physiology, ecology, and economic importance of the major groups of the fungi. Cross-listed with PLPA 134.

BIOL 134L Introduction to Mycology Laboratory (1) Laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 001C, CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, or equivalent; concurrent enrollment in BIOL 134/PLPA 134L; or consent of instructor. Introduces fundamentals in the use of laboratory instruments and techniques for the isolation, cultivation, and identification of representatives of the major taxa of fungi. Cross-listed with PLPA 134L.

BIOL 138 Plant Developmental Morphology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 12C, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), PHYS 002C, PHYS 02LC, or consent of instructor. A cross-disciplinary course in the key areas of research in plant morphology and developmental biology. Emphasizes flowering plants (angiosperms). Cross-listed with BPS 138.

BIOL 143 Plant Physiology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 12C, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), or consent of instructor. An analysis of the mechanisms that cause and control behavioral reactions of insects. Emphasizes ethological and physiological knowledge concerning orientation mechanisms, communication systems, learning, and the role of the nervous system in integrating behavior in insects. Cross-listed with ENMT 162.

BIOL 153 Plant Genomics and Biotechnology Laboratory (4) F, Even Years Lecture, 1 hour; discussion, 1 hour; laboratory, 6 hours. Prerequisite(s): BCH 110C or BCH 110A; upper-division standing; consent of instructor. A study of the functional anatomy of "C." or better. A study of the functional anatomy of vertebrates including humans. Examines each organ system from a developmental and evolutionary perspective. Topics include phylogeny, the skeleton, muscles, and the nervous system. BIOL 161A, BIOL 161B, BIOL 171B, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology. Recommended for sophomores and juniors.

BIOL 161B Functional Anatomy of the Vertebrates (5) Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): BIOL 161A, CHEM 12B or CHEM 12HB, and PHYS 002B with grades of "C-" or better. A study of the functional anatomy of vertebrates, including humans. Examines each organ system from a developmental and evolutionary perspective. Topics include circulation, sense organs, the integument, and the respiratory, digestive, and urogenital systems. BIOL 161A, BIOL 161B, BIOL 171B, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology. Recommended for sophomores and juniors.

BIOL 162 Insect Behavior (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, or equivalent; concurrent enrollment in BIOL 104/BPSC 104 or BIOL 116 or ENSC 128; upper-division standing; consent of instructor. An analysis of the mechanisms that cause and control behavioral reactions of insects. Emphasizes ethological and physiological knowledge concerning orientation mechanisms, communication systems, learning, and the role of the nervous system in integrating behavior in insects. Cross-listed with ENMT 162.

BIOL 165 Restoration Ecology (4) Lecture, 3 hours; two 1-day field trips; three half-day field trips. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, or equivalent; concurrent enrollment in BIOL 104/BPSC 104 or BIOL 116 or ENSC 100; or consent of instructor. An explanation of the mechanisms that cause and control behavioral reactions of insects. Emphasizes ethological and physiological knowledge concerning orientation mechanisms, communication systems, learning, and the role of the nervous system in integrating behavior in insects. Cross-listed with ENMT 162.

BIOL 166 Developmental Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, STAT 100B; or consent of instructor. Examines organogenesis, foraging and territoriality. BIOL 166 Laboratory in Animal Behavior (1) Lecture, 4 hours. Prerequisite(s): BIOL 160 (may be taken concurrently). Laboratory and field exercises in animal behavior. Covers topics such as foraging behavior, aggression, and territoriality.

BIOL 161A Functional Anatomy of the Vertebrates (5) Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 001C or CHEM 01HC, CHEM 12A or CHEM 12HA, MATH 099B or MATH 099H, PHYS 002A, and one course in statistics with grades of "C-" or better. A study of the functional anatomy of vertebrates including humans. Examines each organ system from a developmental and evolutionary perspective. Topics include phylogeny, the skeleton, muscles, and the nervous system. BIOL 161A, BIOL 161B, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology. Recommended for sophomores and juniors.

BIOL 159 Biology of Nematodes (3) Lecture, 2 hours; discussion and demonstration, 1 hour per week. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics. An introduction to the biology of nematodes. Topics include the morphology, physiology, development, and behavior of nematodes. Topics include Leishmania, Plasmodium, and others. Emphasizes the molecular and biochemical adaptations to parasitism. Prior knowledge of classical parasitology is not assumed. Students present original research papers during the seminar.

BIOL 161 Animal Behavior (4) Lecture, 3 hours; discussion, 1 hour per week. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 051C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 099B or MATH 099H, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics. An examination of behavior from an evolutionary and ecological perspective. Topics include the inheritance of behavior, evolution of communication and displays, migration and habitat selection, foraging ecology, mating systems, and the evolution of social behavior.
enrollment in BIOL 171L is recommended. An analysis of cell, tissue, and organ structure and function in normal and diseased conditions. Topics include the musculoskeletal system, cardiovascular and autonomic nervous systems; glands and hormones; body fluids and the kidney; digestion and absorption; and pharmacology and hematology. BIOL 161A, BIOL 161B, BIOL 171, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology.

BIOL 171L Human Anatomy and Physiology Laboratory (1) Laboratory, 3 hours. Prerequisite(s): BIOL 161A (may be taken concurrently), CHEM 12C or CHEM 12HC, MATH 009B or MATH 009B, PHYS 002C, PHYS 002C, BCH 100 or BCH 110A, one course in statistics; BIOL 161B is recommended; concurrent enrollment in BIOL 171L. Involves laboratory experiments in physiology and study of human anatomy and histology, transcription, translation, and regulation of gene expression at the cellular and organismic level. Subjects include growth, development and homeostasis, cell division, cell morphology, and behavioral phenotypes. Includes allometry and scaling, metabolism and locomotion, heat and water balance, and determination of body fluid composition.

BIOL 174 Ecological and Evolutionary Physiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 001C, CHEM 12A or CHEM 12HC, MATH 009B or MATH 009B, PHYS 002C, PHYS 002C, BCH 100 or BCH 110A, one course in statistics. Examines the interactions between organisms and their environments, emphasizing coadaptation of physiological, morphological, and behavioral phenotypes. Includes allometry and scaling, metabolism and locomotion, heat and water exchange, evolution of endothermy, artificial selection experiments, and phylogenetically based statistical methods.

BIOL 175 Comparative Animal Physiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, BIOL 161A, CHEM 001C or CHEM 001C, CHEM 12A or CHEM 12HC, MATH 009B or MATH 009B, PHYS 002C, PHYS 002C, BCH 100 or BCH 110A, STAT 100A; recommended: BIOL 151 and BIOL 161B. Topics include nutrition and energy metabolism, gas exchange, circulation, and regulation of body fluid composition.

BIOL 176 Comparative Biomechanics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C; PHYS 002C or PHYS 040C; BCH 100 or BCH 110A. Applies principles of engineering to the study of the relationship between organismal form and function. Covers examples from diverse plant and animal systems. Includes fundamental properties of solids and fluids, viscous elasticity, drag, biological pumps, locomotion, and muscle mechanics.

BIOL 178 Hormones and Behavior (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12A or CHEM 12HC, MATH 009B or MATH 09HB, PHYS 002C, PHYS 002LC, BCH 100 or BCH 110A, one course in statistics. An examination of the interactions between hormones and behavior in animals, including humans. Provides an overview of endocrine physiology, and examines the roles of hormones in sexual differentiation, sex differences in behavior, sexual behavior, parent behavior, affiliation, aggression, stress, and mood.

BIOL 190 Special Studies (1-4) Individual study, 3-12 hours. Prerequisite(s): instructor of consent of instructor and departamental chairperson. To be taken as a means of meeting special curricular needs. Grade basis to be selected in consultation with the instructor and departamental chairperson. Course is repeatable.

BIOL 191 Seminar in Biology (2-4 Seminar, 2-4 hours. Prerequisite(s): instructor of consent of instructor. A critical study of selected topics in biology. Course is repeatable.

BIOL 194 Independent Reading (1-4) Consultation, 1-4 hours. Prerequisite(s): junior or senior standing and consent of instructor. Independent study under faculty supervision. Graded Satisfactory (S) or No Credit (NC). Course is repeatable to a maximum of 4 units.

BIOL 197 Introduction to Research (1-2) Consultation, 1-2 hours. Prerequisite(s): sophomore, junior or senior standing and consent of instructor and departamental chairperson. Reading, planning and preliminary laboratory work to develop a research project suitable for BIOL 199, Junior/Senior Research. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

BIOL 199 Junior/Senior Research (1-4) Laboratory, 1-4 hours. Prerequisite(s): junior or senior standing, a minimum GPA of 3.0 and consent of instructor and departamental chairperson. Special problems and research in biology performed under the supervision of members of the faculty of the Department of Biology. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

Graduate Courses

BIOL 200 Cell Biology (4) Lecture, 3 hours; seminar, 1 hour. Prerequisite(s): BCH 110A or BCH 110B or equivalent (may be taken concurrently); BIOL 102 or equivalent; BIOL 113 or BIOL 114 or CBNS 101 or equivalent. Structure and function of eukaryotic cells and their components with emphasis on the key experiments that provide the foundation for our current knowledge. Covers topics such as cell membranes, intracellular trafficking, cell-to-cell interactions, motility, and the cytoskeleton. Cross-listed with CMDB 200.

BIOL 201 Molecular Biology (4) Lecture, 3 hours; seminar, 1 hour. Prerequisite(s): BCH 110A or BCH 110B or equivalent (may be taken concurrently); BCH 102 or equivalent; BIOL 107A or equivalent. Covers the structure and inheritance of genetic material, the regulation of gene expression at the cellular and molecular level including molecular mechanisms for regulation of gene expression, and regulation at the level of messenger RNA stability, processing, editing and translation, methods for gene mapping, and positional cloning. Cross-listed with CMDB 201.

BIOL 203 Cellular Biophysics (3) Lecture, 3 hours. Prerequisite(s): BIOL 200/CMDB 200; BIOL 201/ CMDB 201; CHEM 109 or equivalent; or consent of instructor. Biophysical principles that determine cellular structure and function including electrical gradients, transport, macromolecular interactions, and genetic recombination. Illustrative examples are used to highlight the importance of these principles in modern cell biology and physiology.

BIOL 221 Microbial Genetics (4) W Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 110C or BIOL 107A; BIOL 102. In-depth coverage of the genetics of microorganisms. Emphasis is placed on data and the foundation of modern techniques using viruses, archaea, prokaryotes, and eukaryotes. Includes genome sequences and organization, plasmids and other vectors, and mutation and genetic screens. Also covers transposable elements, recombination, and regulation of gene expression, development, and pathogenesis. Cross-listed with MCBL 221 and PLPA 226.

BIOL 250 Special Topics in Biology (1-2) Seminar, 1-2 hours. Prerequisite(s): graduate standing and consent of instructor. Oral presentations and intensive small-group discussion of selected topics in the area of special competence of each staff member. Course content will emphasize recent advances in the special topic area and will vary accordingly. Graded Satisfactory (S) or No Credit (NC). May be repeated for credit.

BIOL 252 General Colloquium in Biology (1) Seminar, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing. Oral reports by visiting scholars on current biological research. Graded Satisfactory (S) or No Credit (NC). May be repeated for credit.

BIOL 261 Seminar in Genetics, Genomics, and Bioinformatics (1) Seminar, 1 hour. Prerequisite(s): graduate standing or consent of instructor. Oral reports by visiting scholars, faculty, and students on current research topics. Graded Satisfactory (S) or No Credit (NC). Course is repeatable. Cross-listed with BCH 261, BPSC 261, ENTM 261, GEN 261, and PLPA 261.

BIOL 281 (E-Z) Seminar in Cell Development, Structure, and Function (2) Seminar, 2 hours. Prerequisite(s): graduate standing; instructor. Lectures, discussions, and demonstrations by students, faculty, and invited scholars on selected subjects concerned with the principles of cell development, structure, and function. E. Cell Biology, F. Molecular Biology, G. Developmental Biology. Segments are repeatable. Cross-listed with CMDB 281 (E-Z).

BIOL 284 Seminar in Biology (2-4) Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Consists of lectures, discussions, and demonstrations by students, faculty, and invited scholars on selected topics concerned with the principles of biology. Course is repeatable.

BIOL 289 Special Topics in Neuroscience (2) Seminar, 2 hours. Prerequisite(s): graduate standing or consent of instructor. An interdisciplinary seminar consisting of student presentations and discussion of selected topics in neuroscience. Content and instructor(s) vary each time course is offered. Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable. Cross-listed with BCH 289, CHEM 289, ENTM 289, NRSC 289, and PSYC 289.

EEOB 210 Organismal Biology (4) Lecture, 4 hours. Prerequisite(s): At least one upper-division undergraduate course that covers the principles of biology (such as animal physiology, plant physiology, human physiology, or comparative anatomy and physiology), or consent of instructor. An interdisciplinary seminar and independent research course and independent research course that covers the principles of evolution, or a similar course, OR consent of instructor. Explores the historical development of modern ideas in organismal biology. Topics include homeostasis, scaling, energetics, structure-function relationships, control systems, and response systems. Examines recent research in the context of the classic studies.

EEOB 211 Foundations of Ecology (4) Lecture, 4 hours. Prerequisite(s): BIOL 116 and a background in analysis of the historical theory, history, and interrelationships of fundamental ecological principles through readings and discussions of classic and recent literature. Topics include quantitative, population, community, ecosystem, evolutionary, and conservation ecology.

EEOB 212 Ecological Systems in Space and Time (4) Lecture, 3 hours; field, 30 hours per quarter. Prerequisite(s): One upper-division undergraduate course in population or community ecology or paleoecology, or consent of instructor. Focuses on how ecological systems are interpreted and reconciled at the community, landscape, and paleontological scales. Addresses the role of extrinsic factors operating at each of these scales. Also examines the historical development of our understanding of ecological systems at various scales. Cross-listed with ENTM 212 and GEO 212.
EEOB 213 Behavioral Ecology (4) Lecture, 4 hours. Prerequisite(s): BIOL 160 or consent of instructor. Examines animal behavior in an evolutionary context. Traces the historical development of the study of behavior, drawing from ethology, comparative psychology, and sociobiology. Topics include evolution of sociality, sexual selection, predator-prey behavior, and parental care.

EEOB 214 Evolutionary Genetics (4) Lecture, 4 hours. Prerequisite(s): BIOL 108 or consent of instructor. Traces the historical development of modern ideas in evolutionary genetics. Focuses on the influence of Fisher, Haldane, and Wright on current views of genetic variation in natural populations, by examining recent research in the context of their classic works.

EEOB 215 Advanced Methods of Data Analysis in Evolution, Ecology, and Behavior (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): PSYC 212 or STAT 100B or equivalent. Introduces students to new methods of data analysis in the fields of evolution, ecology, and behavior. Covers theory and practical application using relevant examples. Topics include maximum likelihood, randomization, the jackknife, bootstrapping, Monte Carlo approaches, and meta-analysis.

EEOB 216 The Theory of Evolution (4) Lecture, 4 hours. Prerequisite(s): BIOL 105 or consent of instructor. Traces the historical development of modern ideas in evolutionary theory. Focuses on the influence of Darwin and the various authors of the modern synthesis on current views of macroevolution by examining recent research in the context of their classic works.

EEOB 217 Advanced Population and Community Ecology (4) Lecture, 4 hours. Prerequisite(s): One upper-division undergraduate class in population or community ecology, or consent of instructor. Traces the development of the major concepts in ecology. Focuses on the influence of pioneers in the field, historical roots of key concepts, and key controversies. Evaluates current research with reference to these historical origins.

EEOB 219 Theory of Systematics (4) Lecture, 4 hours. Prerequisite(s): BIOL 112/BPSC 112/ENTM 112 or equivalent or consent of instructor. Examines topics developed around a series of classical and recent papers on the principles, philosophy, and methodology of modern systematics and phylogenetic methods. Cross-listed with ENTM 219 and GEO 219.

EEOB 220 Evolutionary Physiology (4) S, Even Years Lecture, 4 hours. Prerequisite(s): an upper-division course in evolution and animal physiology or behavior, an upper-division course in statistics that covers analysis of variance or other statistical test, or consent of instructor. Covers evolutionary approaches to the study of animal physiology. Includes organismal and organ-system physiology; biomechanics and locomotor mechanisms; cell physiology; the development of physiological systems; and behavioral neuroscience.

EEOB 230 Analysis of Ecological Communities (5) Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): PSYC 212 or STAT 231B or equivalent, or consent of instructor. Covers multivariate analysis and its application to the interpretation of ecological community data. Topics include multiple and partial correlation and regression, canonical correlation, detrended and canonical correspondence analysis, multidimensional scaling, similarity indices and cluster analysis, and discriminant analysis.

EEOB 265 Advances in Population and Evolutionary Biology (1 or 2) Seminar, 1 hour; outside research, 0-3 hours. Prerequisite(s): graduate standing or consent of instructor. Presentations by visiting scholars, faculty, and students on current research topics in population and evolutionary biology. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

EEOB 282 Seminar in Genetics and Evolution (2-4) Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Presentations by students, faculty, and invited scholars on selected topics concerned with the principles of genetics and evolution. Course is repeatable.

EEOB 283 Seminar in Organismal Biology (1-4) Seminar, 1-4 hours. Prerequisite(s): graduate standing; consent of instructor. Presentations by students, faculty, and invited scholars on selected topics concerned with the principles of organismal biology, including physiology, behavior, morphology, biomechanics, and related topics. Course is repeatable to a maximum of 18 units.

EEOB 290 Directed Studies (1-6) Individual study, 3-18 hours. Prerequisite(s): graduate standing; consent of instructor and graduate advisor. Individual studies on specially selected topics in evolution, ecology, and organismal biology under the direction of a faculty member. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

EEOB 291 Individual Study in Coordinated Areas (1-6) Individual study, 3-18 hours. Prerequisite(s): graduate standing. Provides a program of study designed to advise and assist candidates who are preparing for examinations. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

EEOB 292 Concurrent Analytical Studies in Evolution, Ecology, and Organismal Biology (2-4) Outside research, 6-12 hours. Prerequisite(s): graduate standing; consent of instructor. Elected concurrently with an appropriate undergraduate course but on an individual basis. Devoted to one or more graduate papers based on research or criticism related to the course. Faculty guidance and evaluation provided throughout the quarter. Course is repeatable.

EEOB 297 Directed Research (1-6) Outside research, 3-18 hours. Prerequisite(s): graduate standing; consent of instructor. Directed research in evolution, ecology, and organismal biology. Experimental studies on specially selected topics under the direction of a faculty member. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

EEOB 299 Research for the Thesis or Dissertation (1-12) Outside research, 3-36 hours. Prerequisite(s): graduate standing; consent of instructor. Original research in an area selected for the advanced degree. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

Professional Courses

BIOL 301 Teaching of Biology at the College Level (1) Seminar, 1 hour. Prerequisite(s): graduate standing. A program of weekly meetings and individual formative evaluations required of new Biology Teaching Assistants. Covers instructional methods and classroom section activities most suitable for teaching Biology. Conducted by the TA Development Program. Graded Satisfactory (S) or No Credit (NC).

BIOL 303 Philosophy and Pedagogy of Teaching Undergraduate Life Sciences (3) Lecture, 1 hour; laboratory, 3 hours; workshop, 1 hour. Prerequisite(s): graduate standing in life sciences. Explores the opportunities and challenges associated with developing an undergraduate course in the life sciences. Emphasizes determining how students learn, as well as exploring contemporary instruction methods that foster student engagement in the classroom. Graded Satisfactory (S) or No Credit (NC). Cross-listed with ENTM 303.

BIOL 400 Introduction to Graduate Study in Biology (2) Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing; consent of instructor. Introduces opportunities and requirements for successful graduate study. Emphasis is placed on effective strategies for developing and implementing a program of professional development and graduate research. Graded Satisfactory (S) or No Credit (NC).