

ASTR 390 ASTROPHYSICS: GALAXIES AND COSMOLOGY (3)

Lecture, 3 hours. A quantitative study of: the nature of galaxies, their formation and evolution; the extragalactic distance scale; the structure of the Universe; active galaxies; cosmology and the early Universe. Prerequisites: PHYS 314 and MATH 211.

ASTR 396 SELECTED TOPICS IN ASTRONOMY (1-3)

Lecture, 1-3 hours. A course of lectures on a single topic or set of related topics not ordinarily covered in the Astronomy curriculum. The course may be repeated for credit with a different topic. Prerequisite: consent of instructor.

ASTR 482 ADVANCED OBSERVATIONAL ASTRONOMY (2)

Lecture, 1 hour; laboratory, 3 hours. A study of advanced observing techniques including imaging and spectroscopy. Emphasis on the use of telescopes, instrumentation, and data processing including photometry and astrometry. Discussion of techniques across the electromagnetic spectrum. Statistical treatment of data and error analysis. Prerequisites: ASTR 231, or PHYS 214 or PHYS 210B, or consent of instructor.

ASTR 492 INSTRUCTIONAL DESIGN PROJECT (2)

A directed project to develop at least one laboratory experiment and/or classroom activity that teaches basic concepts in undergraduate Astronomy. Both written and oral presentations (including a demonstration of the experiment or activity) will be required. Prerequisites: PHYS 214 and 216 or PHYS 210B and 209B; ASTR 231. Course may be repeated for credit.

ASTR 495 SPECIAL STUDIES (1-4)

The Department of Physics and Astronomy encourages independent study and considers it to be an educational undertaking. Students wishing to enroll for special studies are required to submit to their supervising faculty members proposals which outline their projects and exhibit specific plans for their successful completion. May be repeated for credit up to 8 units.

ASTR 497 UNDERGRADUATE RESEARCH IN ASTRONOMY (2)

Supervised research in an area of astronomy that is currently under investigation by one or more members of the Physics and Astronomy Department's faculty. This course may be repeated for up to 6 units of credit. Prerequisites: junior-standing and consent of instructor.

Biology (BIOL)

BIOL 110 BIOLOGICAL INQUIRY (4)

Lecture, 3 hours; laboratory, 3 hours. A factual and conceptual exploration of the living world through presentation, student inquiry, and laboratory exercises. Topics include the bases of life; organization of living systems, from molecules to ecosystems, and their interactions; and genetics, evolution, and ecology. Satisfies GE, Area B2 and the GE laboratory science requirement. Not applicable to the Biology major.

BIOL 115 INTRODUCTION TO BIOLOGY (3)

Lecture, 3 hours. The unifying concepts of biology. Topics include the chemical and physical basis of life; cellular structure and function; molecular and Mendelian genetics; reproduction, development, structure, and function of representative plants and animals; and evolution and ecology. Satisfies GE, Area B2. Not applicable to the Biology major.

BIOL 130 INTRODUCTORY CELL BIOLOGY AND GENETICS (4)

Lecture, 3 hours; laboratory 3 hours. One of two courses in the lower-division series required of biology majors. Provides an introduction to structure, molecular processes and physiology of cells, as well as mechanisms of inheritance and evolution. Satisfies GE, category B2 and GE lab requirement. Concurrent enrollment in CHEM 115A is recommended.

BIOL 131 BIOLOGICAL DIVERSITY AND ECOLOGY (4)

Lecture, 3 hours; laboratory 3 hours. One of two courses in the lower-division series required for biology majors. Introduces the extraordinary diversity of life, evolutionary relationships between groups of organisms, and principles of ecology. Satisfies GE category B2 and GE lab requirement. Completion of BIOL 130 is recommended.

BIOL 220 HUMAN ANATOMY (4)

Lecture, 3 hours; laboratory, 3 hours. Survey of the body systems. Designed for pursuing careers in the allied health professions. Satisfies GE, Area B3 and the GE laboratory requirement. Prerequisite: BIOL 110 or BIOL 115 or BIOL 130 and 131.

BIOL 224 HUMAN PHYSIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. An integrated examination of the human body as an efficient system maintained by a complex of interacting, homeostatic mechanisms. Includes fundamental principles of function of major organ systems. Designed for those pursuing careers in the allied health professions. Satisfies GE Area B3 and the GE laboratory requirement. Prerequisites: BIOL 110 or BIOL 115 or BIOL 130 and 131 and CHEM 115A/B or CHEM 125A/B or CHEM 110 or CHEM 105 required.

BIOL 240 GENERAL MICROBIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. An introduction to the organization and characteristics of microorganisms, including bacteria, fungi, protists, and viruses. Topics include their role in agriculture, industry, and disease processes. Prerequisites: BIOL 110 or 115 or BIOL 130 and 131, and CHEM 115AB or CHEM 105.

BIOL 308 ENVIRONMENTAL TOXICOLOGY (3)

Lecture, 3 hours. Information needed to formulate a philosophy of chemical use: the nature of the interaction of toxicants and living organisms; categories of toxicological activity; toxicological evaluation and environmental monitoring; and governmental regulations and procedures. Satisfies GE Area B3. Prerequisite: BIOL 110, 115, or 130 and 131. Teaching mode face-to-face, online, or hybrid.

BIOL 309 BIOLOGY OF CANCER (3)

Lecture, 3 hours. Biological, clinical, environmental, and psychosocial aspects of cancer explored through the perspectives of medical researchers, physicians, patients, and health educators. This lecture series is intended for students of all majors, for those in the health professions, and for the general public. It is designed so that everyone (regardless of scientific background) will benefit. Satisfies GE Area B3. Prerequisite: BIOL 110 or BIOL 115, or BIOL 130 and 131.

BIOL 311 SEXUALLY TRANSMITTED DISEASES (3)

Lecture, 3 hours. Biological, environmental, societal, and psychosocial aspects of sexually transmitted diseases. Satisfies GE Area B3. Prerequisite: BIOL 110 or BIOL 115, or BIOL 130 and 131.

BIOL 312 BIOLOGICAL OCEANOGRAPHY (3)

Lecture, 3 hours. An introduction to the world's oceans with emphasis on the way in which their physical properties support life. Satisfies GE category B3. Prerequisite: BIOL 110 or BIOL 115, or BIOL 130 and 131.

BIOL 314 FIELD BIOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. A course emphasizing plant and animal communities of Northern California. Satisfies GE Area B3 and GE laboratory requirement. Prerequisite: BIOL 110 or BIOL 115, or BIOL 130 and 131.

BIOL 318 BIOLOGY OF AGING (3)

Lecture 3 hours. Examines the biological processes occurring in a cumulative fashion in the course of human senescence, including the medicinal and social consequences. Satisfies GE Area E. Prerequisite: BIOL 110, 115, or 130 and 131 required. Face to face and hybrid teaching mode.

BIOL 320 ECOLOGY AND EVOLUTION - AN INTEGRATED APPROACH (4)

Lecture, 3 hours; discussion, 1 hour. An integrated overview of ecological and evolutionary processes focusing on the origins and functioning of biodiversity from genes to ecosystems. Discussions complement lectures with quantitative and written exercises to strengthen knowledge and understanding. One of a two-semester sequence satisfying the upper division core in the Biology major. Prerequisites: BIOL 130 and 131.

BIOL 321 MOLECULAR BIOLOGY, CELL BIOLOGY & PHYSIOLOGY (4)

Lecture, 3 hours; Discussion, 1 hour. An integrated overview of the key principles of molecular biology, cell biology and organismal physiology with an emphasis on regulatory mechanisms. Discussions complement lectures with quantitative and written exercises to strengthen knowledge and understanding of concepts covered in lecture. Second of a two-semester sequence satisfying the upper division core in the Biology major. Prerequisites: All majors except BIOCHEM: BIOL 130 and 131, MATH 161 or 165, CHEM 115A or CHEM 125A and completion or concurrent enrollment in CHEM 115B or CHEM 125B. BIOCHEM majors: BIOL 130, MATH 161 or 165, CHEM 115A or CHEM 125A and completion or concurrent enrollment in CHEM 115B or CHEM 125B.

BIOL 322 INVERTEBRATE BIOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. Exploration of the systematics, functional morphology, behavior, and ecology of invertebrates. Prerequisite: BIOL 130 and 131 required.

BIOL 323 ENTOMOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. A comprehensive foundation in the biology of insects, with emphasis on ecology, behavior, evolution, and systematics. Emphasis on the diagnostic features of insects and their major orders. Prerequisite: BIOL 130 and 131.

BIOL 324 BIOLOGY OF MARINE MAMMALS (3)

Introduction to the biology of marine mammals, emphasizing evolutionary history, physiology, behavior, ecology, and conservation, with a focus on various factors that influence foraging and reproductive strategies, as well as on the evolution of social systems. Prerequisites: completion of BIOL 130 and 131.

BIOL 325 MOLECULAR AND CELLULAR LAB TECHNIQUES (1)

Laboratory 3 hours. This lab-centered course will focus on teaching fundamental hands-on skills used in all areas of molecular and cellular lab work. In addition to practical lab skills, emphasis will be placed on quantitative aspects of lab work as well as data interpretation and scientific writing. Completion of CHEM115A and completion or concurrent enrollment in CHEM115B and BIOL 321 or consent of instructor.

BIOL 326 DINOSAURS AND MESOZOIC VERTEBRATES (3)

Lecture, 3 hours. The course will examine the rise and fall of the dinosaurs, arguably the most successful terrestrial vertebrates in the history of Earth. We will discuss their evolutionary history and place among the vertebrates, as well as look at the other animals and plants that they shared the Mesozoic world with. Prerequisites: BIOL 130 and 131.

BIOL 327 VERTEBRATE BIOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. Exploration of the systematics, behavioral ecology, biogeography, evolution, and conservation biology of fish, amphibians, reptiles, birds, and mammals. At least one weekend field trip. Prerequisite: BIOL 130 and 131; requires consent of instructor.

BIOL 328 VERTEBRATE EVOLUTIONARY MORPHOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Trends in the evolution of structure and function in the vertebrates. This course focuses on morphological adaptations at the organ system level that have enabled vertebrates to diversify and succeed in a wide range of habitats and environments. Prerequisite: BIOL 320.

BIOL 329 PLANT BIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. An overview of plant biology, with focus on structure, function, reproduction, and evolution. Emphasis is on flowering plants, but a survey of all plant and plant-like organisms, both modern and extinct, is included. Prerequisites: BIOL 130 and 131 required.

BIOL 330 PLANT TAXONOMY (4)

Lecture, 3 hours; laboratory and field, 3 hours. An introduction to the principles and practices of plant taxonomy, including approaches to classification, data analysis, and a survey of vascular plant families in the California flora. A minimum of two Saturday field trips is required. Prerequisite: BIOL 130 and 131.

BIOL 332 MARINE BIOLOGY (3)

Lecture, 3 hours. The biology of marine life is examined from an integrated and functional perspective. Near shore, open ocean, and deep sea environments will be covered. Topics include factors that affect marine ecosystems, the relationship between physical processes and biological communities, and the physiology and behavior of marine organisms. Prerequisites: BIOL 130 and 131.

BIOL 333 ECOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. A current overview of this field, with in-depth coverage of ecology at the population, community, and ecosystem level. Emphasis on diverse taxa and habitats, hypothesis testing, and data collection and analysis. Prerequisite: BIOL majors: BIOL 320 and MATH 165; ENSP/GEP Majors: ENSP 322/GEP341 and MATH 165 or ECON 217.

BIOL 335 MARINE ECOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. An overview of current topics in marine ecology and conservation with emphasis on ecology of coastal ecosystems. Extensive focus on field and laboratory research projects. Includes experimental design, data analysis, and presentation. At least three 5-hour field trips outside of scheduled class time. Prerequisite: BIOL majors: BIOL 320 and MATH 165; ENSP/GEP Majors: ENSP 322/GEP341 and MATH 165 or ECON 217.

BIOL 337 BEHAVIORAL ECOLOGY (3)

Lecture, 3 hours; laboratory and field, 3 hours. Examines the evolution and function of the behavior of animals. Explores topics such as social behavior, mating systems, reproductive strategies, foraging, and communication with emphasis on techniques for formulating and testing hypotheses. Prerequisite: BIOL 320 or ENSP 322/GEP341, and MATH 165 or ECON 217 required.

BIOL 338 ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Examines microbial ecology and diversity along with biotechnological applications of microbes in agriculture, wastewater treatment, bioremediation, and biofuel production. Satisfies the ENSP Hazardous Materials Management and Water Quality Technology core requirement. Prerequisites: BIOL 130 and 131 and CHEM 115AB, or consent of instructor.

BIOL 340 GENERAL BACTERIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. An introduction to prokaryotes covering their cell structure, metabolic diversity, interactions with other organisms, and pivotal roles in biogeochemical cycling. Laboratory projects develop skills essential for studies of bacteria. Laboratory in two 1.5 hour sessions per week. Prerequisite: BIOL 321, 325 and CHEM 335A.

BIOL 341 EVOLUTION (4)

Lecture, 3 hours; laboratory and field, 3 hours. A broad examination of the patterns and processes involved in the evolution of life on earth. Includes inquiry into the origin of life, microevolutionary processes, systematics, and large-scale evolutionary history. Prerequisite: Prerequisite: BIOL 320.

BIOL 342 MOLECULAR GENETICS (4)

Lecture, 3 hours; laboratory, 3 hours. Gene structure and function at the level of DNA, RNA, and protein interactions. Emphasis on molecular analytical techniques used for genetic analysis in a diversity of prokaryotic and eukaryotic organisms. Prerequisite: BIOL 321, 325 and CHEM 335A.

BIOL 344 CELL BIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. An introduction to structural and molecular organization of eukaryotic cells and tissues. Specific topics will represent the central core of cell biology and are concerned mainly with those properties that are common to most eukaryotic cells. Prerequisite: BIOL 321, 325 and CHEM 335A .

BIOL 347 ENVIRONMENTAL PHYSIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Course examines the adaptations and physiological responses that allow animals to live under widely different environmental conditions. Laboratory and field exercises will utilize modern techniques of physiological measurement to examine adaptive strategies among and between species in different environmental conditions. Prerequisite: BIOL 320 and 321.

BIOL 348 PLANT PHYSIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Concepts and principles of plant function. The following areas are investigated in detail: photosynthesis, water relations, mineral nutrition, and plant growth regulation. Prerequisite: BIOL 320, 321 and 325.

BIOL 349 ANIMAL PHYSIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Principles and concepts of animal function, with emphasis on cellular and biochemical/molecular bases of physiological activities in tissues and organ systems, environmental adaptations, and comparative homeostatic mechanisms. Prerequisites: All majors except BIOCHEM: BIOL 320 and 321. BIOCHEM majors: BIOL 321

BIOL 350 PLANT PHYSIOLOGICAL ECOLOGY (4)

Lecture, 3 hours; laboratory 3 hours. Investigation of the physiological processes of plants that contribute to understanding their ecological distribution and evolutionary success. Examination of environmental effects on survival within the context of climate change, conservation biology, etc. Prerequisites: BIOL 130 and 131, and completion or concurrent enrollment in BIOL 321.

BIOL 383 VIROLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. The study of viruses: their characteristics, classification, genetics, and host-parasite interactions. Emphasis will be placed on the molecular mechanisms viruses use to replicate and how this can affect the host. Prerequisites: BIOL 321, 325 and CHEM 335A.

BIOL 385 CONTEMPORARY ISSUES IN BIOLOGY (3)

Lecture, 3 hours. Selected topics related to the quality of life and the search for perspectives on the future. Satisfies GE Area B3 (Specific Emphasis in Natural Sciences). Prerequisite: BIOL 110, 115, or BIOL 130 and 131.

BIOL 390 BIOLOGY COLLOQUIUM (1)

Lecture, 1 hour. Presentations by visiting scholars, departmental faculty, and master's degree candidates on current research and contemporary issues in biology. May be repeated for credit. All majors are encouraged to enroll each semester, although no more than 2 units are applicable to the Biology major. Cr/NC grading.

BIOL 393 INDEPENDENT STUDY IN BIOLOGY (1-3)

Opportunity for independent research or special projects under the supervision of a Biology faculty member, for developing competency in biological research methods. May be repeated for up to a total of 4 units. Prerequisite: approved petition to enroll.

BIOL 398 NON-MAJORS TEACHING PRACTICUM (1-3)

Application of prior knowledge towards supervised instructional experience in biology courses. Intended for professional growth and lifelong learning for non-major undergraduates in biology. Can be taken in the Cr/NC grading mode only. May be repeated for up to a total of 4 units. Prerequisites: prior completion of the course for which instructional assistance is to be provided, with a grade of B or better, consent of the instructor, and an approved petition to enroll.

BIOL 463 HERPETOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. Classification, functional and evolutionary morphology, environmental physiology, and ecology of reptiles and amphibians. Includes at least one weekend field trip. Prerequisite: BIOL 327 or 328.

BIOL 472 DEVELOPMENTAL BIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Patterns of animal development. This course is designed to provide students with a comprehensive appreciation of the developmental process, presenting detailed descriptions of developmental mechanisms along with a conceptual framework for understanding how development occurs. Prerequisites: BIOL 321 and CHEM 335A.

BIOL 480 IMMUNOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. The cellular and molecular basis of the immune response; topics include innate and adaptive immunity, hypersensitivity, autoimmunity, and cancer immunology. Prerequisites: BIOL 342 or BIOL 344 or BIOL 383 or BIOL 472 and CHEM 335A.

BIOL 485 BIOMETRY (4)

Lecture, 3 hours; laboratory, 3 hours. Introduces students to quantitative analysis of biological data. The nature of biological data, principles of experimental design, and essential statistical tools used by biologists to analyze their results. Examples used in the course will be drawn from physiology, ecology, evolution, and medicine. Laboratory sections will involve computer exercises, discussions, and student presentations. Prerequisite: BIOL 320 and MATH 165 or BIOL 130 and 131 and MATH 165.

BIOL 490 RESEARCH EXPERIENCE IN BIOLOGY (3)

Lecture, 1 hour; laboratory/field, 6 hours. An intensive course designed to provide students training and experience in biological research on topics within faculty area of expertise. Throughout the semester, students will address research questions and generate new knowledge through scientific literature review, hypothesis development, experimental design, data generation and analysis, and presentation of results in scientific format. Prerequisites: Upper division standing in biology and consent of instructor.

BIOL 494 INDEPENDENT RESEARCH (1-3)

Directed study, under the guidance of a Biology faculty member, to design and conduct a research project in biology, including readings in the primary literature and application of information from relevant upper-division course work. Results must be given in a written report or presented in a public forum. May be repeated for up to a total of 4 units. Prerequisites: upper division standing in the major and approved petition to enroll.

BIOL 495 SPECIAL STUDIES (1-4)

Investigations to meet an advanced specialized study need beyond the department curriculum. The project should be planned and described in written form with consent of the faculty sponsor. Prerequisites: majors or minors in Biology, upper-division standing with a cumulative GPA of 3.0, and approved petition to enroll. May be repeated for credit up to 8 units.

BIOL 496A HONORS THESIS I (1-2)

Experimental or observational research for the B.S. degree conducted under the supervision of one or more of the biology faculty members. Prerequisites: senior-standing in the major with a minimum GPA of 3.0 and an approved application.

BIOL 496B HONORS THESIS II (2-3)

Completion of research for the B.S. degree conducted under the supervision of one or more biology faculty members. A research paper summarizing the results is required. Prerequisites: senior-standing in the major and completion of BIOL 496A.

BIOL 497 SELECTED TOPICS (1-4)

Intensive study of biological topics, which will vary from semester to semester. May be repeated for credit and may be applicable to the requirements for a major in Biology. Prerequisite: BIOL 130 and 131 or consent of instructor.

BIOL 498 BIOLOGY PRACTICUM (1-4)

Application of previously studied theory through supervised instructional work experience in biology courses. Intended for professional growth and lifelong growth for undergraduates. Enrollees are required to write an evaluation of their course experience. Can be taken in Cr/NC grading mode only. May be repeated for up to a total of 4 units. Prerequisites: upper division standing in Biology, consent of the instructor in whose course the student will be working, and an approved petition to enroll.

BIOL 499 INTERNSHIP IN BIOLOGY (1-4)

Work that provides training in the use of biological skills in the community. Requires written agreement by students, faculty sponsor, on-the-job supervisor, and field experience coordinators; please see department office for details. May be repeated for up to 7 units of credit; 3 hours per week for each unit. Cr/NC grading only.

BIOL 500S GRADUATE SEMINAR (1-2)

Advanced seminars exploring diverse topics in biological sciences. Topics vary from semester to semester, depending on faculty interest and expertise. This course may be repeated for credit.

BIOL 510 SELECTED TOPICS IN BIOLOGY (2-4)

Intensive study of biological topics, which will vary from semester to semester. Prerequisites: adequate undergraduate preparation in the topic under consideration and graduate or last-semester-senior standing with consent of instructor.

BIOL 578 PROJECT CONTINUATION (1-3)

Designed for students working on their thesis or master's project but who have otherwise completed all graduate coursework toward their degree. This course cannot be applied toward the minimum number of units needed for completion of the master's degree. Prerequisite: permission of the graduate coordinator. Cr/NC grading only.

BIOL 590 BIOLOGY COLLOQUIUM (1)

Lecture, 1 hour. A series of lectures by faculty, master's degree candidates, and invited guests on current research and contemporary issues in biology. All graduate students are encouraged to enroll each semester, although no more than 2 units are applicable to the M.S. degree. Cr/NC grading only.

BIOL 595 SPECIAL STUDIES IN BIOLOGY (1-3)

Investigations to meet highly specialized needs and to explore possible thesis topics. Project should be planned and described in writing with consent of faculty sponsor. Prerequisite: approved petition to enroll.

BIOL 598 GRADUATE PRACTICUM (1-4)

Application of previously studied theory to development and delivery of new instructional materials. Intended to provide professional growth for graduate students. Enrollees are required to write an evaluation of their course experience. Prerequisites: graduate standing in Biology, consent of the instructor in whose course the student will be working, and an approved petition to enroll.

BIOL 599 M.S. THESIS (1-3)

Original investigation based on laboratory or field research that meets the department and University standards. Prerequisites: admission to classified standing and advancement to candidacy.