

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, PHYS 209B and 210B, and MATH 161; 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.

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 121 DIVERSITY, STRUCTURE, AND FUNCTION (4)

Lecture, 3 hours; laboratory, 3 hours. First in three-semester series required for biology majors. Introduces the extraordinary diversity of life and evolutionary relationships between groups of organisms, and compares body plans. Satisfies GE Area B2 or B3.

BIOL 122 GENETICS, EVOLUTION, AND ECOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Second in three-semester series required for biology majors. Introduces mechanisms of inheritance, evolution, and ecology. Recent advances in understanding processes underlying ecological and evolutionary relationships will be emphasized. Satisfies GE Area B2 or B3. May be taken before BIOL 121.

BIOL 123 MOLECULAR AND CELL BIOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Third in three-semester series required for Biology majors. Introduction to cell and molecular biology, with emphasis on molecular processes, cellular physiology, and regulatory mechanisms. For Biology majors, satisfies GE Area B2 or B3. Prerequisites: BIOL 121 and 122 or 121 and 130A or consent of instructor, and CHEM 115AB or 125A. Concurrent or prior enrollment in CHEM 335A 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 115, or 121/122 or 130A.

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 115 or 121/122 or 130A; and CHEM 115AB or 105.

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, and CHEM 115AB or 105.

BIOL 307 HUMAN NUTRITION (3)

Lecture, 3 hours. Concepts of modern nutrition, including some discussion of principal nutritional problems and modern food processing methods. Prerequisites: BIOL 110, 115, or BIOL 121 and 122; and one course in beginning chemistry.

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 121 and 122.

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, 115, or 121 and 122.

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, 115, or 121 and 122.

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 Area B3. Prerequisite: BIOL 110, 115 or 121 and 122.

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 115 or 121 and 122.

BIOL 315 PLANTS AND CIVILIZATION (3)

Lecture, 3 hours; field trips. Historical and evolutionary interrelationships between humans and domesticated plants, including the origins of agriculture and its development. Satisfies GE Area B3. Prerequisite: BIOL 110, 115 or 121 and 122.

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 medical and social consequences. Satisfies GE Area E. Prerequisite: BIOL 110, 115, or 121 and 122.

BIOL 322 INVERTEBRATE BIOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. Exploration of the systematics, functional morphology, behavior, and ecology of invertebrates. Prerequisites: BIOL 121 and 122.

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. Prerequisites: BIOL 121/122 or 121/130A.

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. Prerequisites: BIOL 121/122 or 121/130A; 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. Prerequisites: BIOL 121/122 or 121/130A.

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 121 and 122.

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. Prerequisites: BIOL 121 and 122.

BIOL 331 AQUATIC BOTANY (4)

Lecture, 3 hours; laboratory and field, 3 hours. An overview of the ecology, evolution, physiology, conservation, and practical uses of marine, estuarine, and freshwater plants and algae. Required field trips may be scheduled outside of scheduled class time. Prerequisites: BIOL 121 and 122.

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. Prerequisites: BIOL 121 and 122 and MATH 165.

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. Prerequisites: BIOL 121/122 or 121/130A and MATH 165.

BIOL 337 BEHAVIORAL ECOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. Examines how the behavior of animals functions to optimize their fitness. Explores such topics as foraging, altruism, breeding systems, sexual selection, deceit, communication systems, and aggression with emphasis on techniques for formulating and testing hypotheses. Prerequisites: BIOL 121 and 122.

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 121/122 or 121/130A 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. Prerequisites: BIOL 123 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: BIOL 123.

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. Prerequisites: BIOL 123 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. Prerequisites: BIOL 123 and CHEM 335A.

BIOL 346 INTRODUCTION TO BIOINFORMATICS (4)

3 Lecture, 2 hours; laboratory, 6 hours. Principles and techniques of accessing biomolecular databases and analyzing retrieved sequences of nucleic acids and proteins. Statistical tools, sequence alignments, pattern mapping, structural modeling, and phylogenetics will be explored. Examples will be selected from plants, animals, fungi, protists, bacteria, and viruses. Laboratory will involve computer exercises, projects, discussions, and student presentations. Prerequisite: BIOL 123 or consent of instructor.

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 123.

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 123.

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. Prerequisite: BIOL 121, 122 & 123.

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 121, 122 & 123 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 121 and 122.

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 and graduate students 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. A total of 4 units may apply to the Biology minor. 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 465 ORNITHOLOGY (4)

Lecture, 2 hours; laboratory and field, 6 hours. Avian classification, anatomy, and life histories, including such topics as molts, distribution, migration, and breeding habits. Prerequisite: BIOL 327 or 328.

BIOL 468 MAMMALOLOGY (4)

Lecture, 3 hours; laboratory and field, 3 hours. Characteristics, classification, physiological ecology, habitats, behavior, reproduction, distribution, and evolution of mammals. 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 121, 122, 123 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: one core course from the Molecular and Cell Biology core area.

BIOL 481 MEDICAL MICROBIOLOGY (5)

Lecture, 3 hours; laboratory, 6 hours. Mechanisms of infectious diseases caused by bacteria and fungi, host-parasite interactions in the disease process, therapeutic modalities, and infection control. Laboratory techniques for the cultivation, isolation, and identification of pathogenic bacteria and fungi. Emphasis is on methods and procedures currently utilized in diagnostic laboratories. Prerequisite: BIOL 343 or BIOL 340.

BIOL 484 HEMATOLOGY (4)

Lecture, 3 hours; laboratory, 3 hours. Blood: the normal and abnormal structure and function of red cells, white cells, and hemostatic mechanisms. Prerequisite: BIOL 347 or BIOL 349.

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. Prerequisites: BIOL 123 and MATH 165.

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: senior-level standing in the major with a cumulative GPA of 2.5, 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.

BIOL 496 SENIOR RESEARCH (2)

Experimental or observational research for the B.S. Degree conducted under the guidance of one or more of the Biology faculty. A written report and an oral presentation of results in a public forum are required. Prerequisites: BIOL 494, senior-standing in the major.

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.

BIOL 498 BIOLOGY PRACTICUM (1-4)

Application of previously studied theory through supervised instructional work experience in biology. Intended for professional growth for undergraduates. Enrollees are required to write an evaluation of their course experience. 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 511 CONSERVATION GENETICS (2)

Lecture, 1 hour; discussion, 1 hour. An examination of the scientific approaches applied to species conservation. Although molecular genetic approaches will be emphasized, a variety of other approaches will also be considered (e.g. captive breeding, population viability analysis, and translocation). Prerequisite: consent of instructor.

BIOL 512 CONSERVATION ECOLOGY (2)

Lecture, 1 hour; discussion, 1 hour. A seminar format with occasional lectures. An advanced exploration of current topics in the rapidly expanding field of conservation ecology. Specific topics considered will vary from semester to semester, depending on student interests. However, topics will commonly include habitat fragmentation and loss, global climate change metapopulation dynamics, biological invasions, restoration ecology, and design and management of preserves. Prerequisite: BIOL 333.

BIOL 513 SPECIATION (2)

Lecture, 1 hour; discussion, 1 hour. Examination of the theoretical and empirical approaches to defining species and a detailed survey of speciation modes and mechanisms. Lectures provide a framework for student-led discussion of specific topics and case studies. Prerequisite: consent of instructor.

BIOL 515 MACROEVOLUTION (2)

Lecture, 1 hour; discussion, 1 hour. A seminar format with occasional lectures. A topical and historical overview of the major macroevolutionary transitions that have occurred during the history of life. Particular attention will be given to broad patterns of change over time at higher levels of structural/organismic organization. Prerequisite: consent of instructor.

BIOL 516 BIOENERGETICS (2)

Lecture, 1 hour; discussion, 1 hour. A seminar format with occasional lectures. An in-depth examination of energy flow through living organisms at all levels of biological organization, from molecules to populations. Topics may include cellular metabolism, animal energetics, thermoregulation, fasting physiology, locomotion, foraging energetics, reproductive energetics, life history theory, community energetics, and population energetics. Prerequisite: consent of instructor.

BIOL 518 BIOTECHNOLOGY (2)

Lecture, 1 hour; discussion, 1 hour. A seminar format with occasional lectures. The field of biotechnology is moving at a rapid pace, and many of the molecular and biochemical techniques are being applied to a wide variety of biological disciplines. Topics include: structure-based approach to drug design, expressing recombinant proteins, DNA vaccines, and toxicity screening. Prerequisite: consent of instructor.

BIOL 544 ADVANCED CELL BIOLOGY (4)

Development and applications of major concepts in modern cell biology. Specific topics will include membrane structure and properties, metabolic pathways and physiology of energy conversion, cell signaling and principles of intercellular communication, and cell-cycle dynamics and macromolecular regulation of cell division. Prerequisites: BIOL 344.

BIOL 545 RECOMBINANT DNA LAB (4)

Laboratory, 9 hours; discussion, 1 hour. Techniques for the manipulation of DNA through gene cloning applicable in the study of all biological processes. Prerequisites: BIOL 342 or 344 and either BIOL 340 or CHEM 445.

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.