

BIOLOGY (BIOL)

BIOL 000 | TOPICS

Units: 1-4

BIOL 110 | LIFE SCIENCE FOR EDUCATORS

Units: 3

Non-Core Attributes: Life Science-Pre F17 CORE

A one-semester course in the general concepts of biology tailored for the liberal studies major. The course is designed to meet the subject matter requirement in life science for the Multiple Subject Teaching Credential. Topics covered include an overview of the scientific method, biochemical molecules, cell structure and function, anatomy and physiology of animals and plants, genetics, evolution, and ecology. Field trips and laboratory assignments will provide experience with selected biological principles and practices. Students majoring in liberal studies cannot take this course pass/fail. Two hours of lecture and one laboratory weekly.

BIOL 111 | SURVEY OF BIOLOGY WITH LAB

Units: 3-4

Non-Core Attributes: Lab

A one-semester course in the general concepts of biology providing the non-major with an overview of the living world and the principles of life processes. BIOL 101 is lecture only, 111 is two hours of lecture per week and one laboratory every other week.

BIOL 112 | ECOLOGY AND ENVIRONMENTAL BIOLOGY WITH LAB

Units: 4 Repeatability: No

Core Attributes: Science/Tech Inquiry area

Non-Core Attributes: Lab

Investigation of the natural environment and the relationship of its biotic and abiotic components. Topics will include the ecosystem concept, population growth and regulation, and our modification of the environment. Laboratory will include field trips, including a possible overnight trip to the desert.

BIOL 113 | PLANTS AND PEOPLE

Units: 4 Repeatability: No

Core Attributes: First Yr Integration (LC Only), Science/Tech Inquiry area

What are the major ways that plants and plant products contribute to human life and how have humans modified plants and their environments? Biology 113, Plants and People, is a one-semester course (Science and Technological Inquiry Core Area) that endeavors to answer these questions. It is about humans and their knowledge, uses, and abuses of plants. The biology of plants is considered from a scientific viewpoint; drawing on topics of anatomy, morphology, physiology, ecology, evolution, taxonomy, and biotechnology. The basis of this course is science literacy, defined as citizen-level fluency for comprehending the process through which science's way of knowing brings understanding of the natural world. 4 units: 3 hours of lecture and one 4-hour lab, weekly.

BIOL 114 | TOPICS IN HUMAN BIOLOGY WITH LAB

Units: 3

Non-Core Attributes: Life Science-Pre F17 CORE

This is a course in general biology with a human emphasis for non-majors. The general principles of evolution, genetics, biochemistry, and physiology are illustrated by reference to normal and abnormal human body function. Behavioral biology and ecology are also treated from a primarily human viewpoint. 104 is lecture only, 114 is two hours of lecture per week and one laboratory every other week.

BIOL 115 | PHYSIOLOGY OF EXERCISE WITH LAB

Units: 4

Non-Core Attributes: Life Science-Pre F17 CORE

A study of human physiology and how the body accommodates physical exercise. Training procedures, health, and importance of nutrition and ergogenic aids are emphasized. PHYS 105 is lecture only for 3 units, 115 is three hours of lecture and one laboratory weekly.

BIOL 116 | EARTH AND LIFE SCIENCE FOR EDUCATORS

Units: 3

A laboratory/lecture/discussion class in the general concepts of earth science and life science for Liberal Studies majors. The course topics are selected to satisfy the earth and life science specifications for the science content standards for California Public Schools and the Multiple Subject Teaching Credential. Laboratory activities and field trips will provide experience with selected principles and relate them to suggested teaching practice at the K-8 grade level. Two two-hour laboratory sessions per week. Spring semester.

BIOL 117 | INTEGRATING INDIGENOUS AND WESTERN SCIENCE

Units: 4 Repeatability: No

Core Attributes: Science/Tech Inquiry area, Domestic Diversity level 1

Non-Core Attributes: Community Engagement, Lab

Biology 117, Integrating Indigenous and Western Science, is a one-semester course that meets Science and Technological Inquiry (STI) and Diversity Inclusion & Social Justice I (DISJ) core areas. General biological concepts are considered from a western scientific viewpoint, while concurrently engaging Indigenous ways of being in relationship with the natural world. The course includes a service-learning component with Community Partners. 4 units: 3 hours of lecture and one 4-hour lab, weekly.

BIOL 118 | PEOPLES, PLAGUES AND MICROBES

Units: 4 Repeatability: No

Core Attributes: First Yr Integration (LC Only), Science/Tech Inquiry area

An introduction to the infectious microbes that have caused major plagues throughout human history. This non-majors course will examine epidemics that have decimated populations across entire continents and consider the resulting reverberations that continue to shape modern society. Special attention will be devoted to the evolution of pathogenic microbes that cause infectious disease. The laboratory experience will train students in microscopy and aseptic techniques while providing an opportunity to apply the scientific method in a study of microorganisms.

BIOL 120 | LIFE-CHANGING BIOLOGY

Units: 4 Repeatability: No

Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area

Non-Core Attributes: Lab

Why can science be life-changing? In this course, we will explore topics in biology that can have a big impact on our lives, including COVID-19, forensics, cancer, and race. We will delve into these topics through the lens that science is an evolving process instead of a collection of facts. To put science into practice, you will also join real scientists and fellow students around the globe in search of new antibiotics for our world. Throughout the semester, we will build critical thinking skills, so you can leave this course better prepared to discern what is true for yourself while navigating the noisy world of science in the news and social media. This course satisfies the core requirement for Explorations in Scientific and Technological Inquiry (ESTI) and the core attribute of Quantitative Reasoning (CQR).

BIOL 212 | ANATOMY AND PHYSIOLOGY I**Units: 4**

A two-semester course on the fundamentals of human anatomy and physiology. The biological function and structure of the cells, tissues, and major organ systems in the body will be covered, along with basic concepts of chemistry and physics. The course will also cover the pathological conditions that are most often seen by medical personnel, and will discuss how the loss of homeostasis leads to pathology or disease. BIOL 212 is the prerequisite for BIOL 213, and this combination is intended to meet the requirements of students preparing for allied health occupations. This course will not satisfy Core Life Science requirement or requirements for a major or minor in biology. Three hours of lecture and one laboratory weekly.

BIOL 213 | ANATOMY AND PHYSIOLOGY II**Units: 4**

Prerequisites: BIOL 212

A two-semester course on the fundamentals of human anatomy and physiology. The biological function and structure of the cells, tissues, and major organ systems in the body will be covered, along with basic concepts of chemistry and physics. The course will also cover the pathological conditions that are most often seen by medical personnel, and will discuss how the loss of homeostasis leads to pathology or disease. BIOL 212 is the prerequisite for BIOL 213, and this combination is intended to meet the requirements of students preparing for allied health occupations. This course will not satisfy Core Life Science requirement or requirements for a major or minor in biology. Three hours of lecture and one laboratory weekly.

BIOL 214 | MEDICAL MICROBIOLOGY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: (BIOL 240 and BIOL 240L) or (BIOL 242 and BIOL 242L)

This course is designed to be an introduction to microbiology for students working towards health-related professions. Fundamentals of microbiology, including Bacteriology, Virology, Mycology (fungi), and Parasitology (protozoa) will be covered, with an emphasis on human pathogens. Topics will include, but are not limited to bacterial structure, physiology and metabolism, bacterial pathogenesis and virulence, normal flora of the human body, immunology, methods of diagnosing and treating infections, viruses including influenza and HIV, and epidemiology. The laboratory portion of the class will focus on aseptic technique, inoculation and maintenance of cultures, microscopy, and identifying bacteria through both culture-based and molecular methods. Does not fulfill ESTI.

BIOL 240 | BIOENERGETICS AND SYSTEMS**Units: 3 Repeatability: No****Core Attributes: First Yr Integration (LC Only), Science/Tech Inquiry area**

This one-semester course for biology majors provides an introduction to the mechanisms of energy flow within cells and between organisms and the environment. Lecture topics will include cellular respiration and photosynthesis, organismal physiology and locomotion, and ecological interactions. Concurrent registration in 240L is strongly recommended, and required for Core credit. Offered every semester.

BIOL 240L | BIOENERGETICS AND SYSTEMS LABORATORY**Units: 1 Repeatability: No****Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area**

This one-semester course for biology majors provides an introduction to the mechanisms of energy flow within cells and between organisms and the environment. The laboratory will include inquiry into the mechanisms of physiology, including testing novel hypotheses concerning bioenergetics. Concurrent registration in 240 is strongly recommended, and required for Core credit. Offered every semester.

BIOL 242 | GENOMES AND EVOLUTION**Units: 3 Repeatability: No****Core Attributes: Science/Tech Inquiry area**

This one-semester course for biology majors provides an introduction to the mechanisms of information flow through organisms and their lineages. Lecture topics will include the use and change of hereditary information in DNA, the mechanisms of evolution, and the relationships among major groups of organisms. Concurrent registration in 242L is strongly recommended, and required for Core credit. Offered every semester.

BIOL 242L | GENOMES AND EVOLUTION LABORATORY**Units: 1 Repeatability: No****Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area**

This one-semester course for biology majors provides an introduction to the mechanisms of information flow through organisms and their lineages. The laboratory will include inquiry into the structure and function of DNA, and testing hypotheses of evolution and phylogeny. Concurrent registration in 242 is strongly recommended, and is required for Core credit. Offered every semester.

BIOL 294 | SPECIAL TOPICS IN BIOLOGY**Units: 1-4 Repeatability: Yes (Repeatable if topic differs)**

An overview and analysis of selected topics in Biology.

BIOL 300 | GENETICS**Units: 3 Repeatability: No**

Prerequisites: (BIOL 240 and BIOL 240L and BIOL 242 and BIOL 242L) and (CHEM 151 and CHEM 151L)

A general course covering the mechanisms of inheritance at the molecular, organismal, and populational levels. Elementary probability and statistical methodology appropriate for the analysis of various genetic systems are introduced. Three hours of lecture weekly.

BIOL 301 | BIOSTATISTICS**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 240 and BIOL 240L and BIOL 242 and BIOL 242L

An introduction to data analysis and statistical testing. This course will prepare students for their upper division courses and independent research by teaching them the basics of hypothesis testing and the most common statistical tests used in biology. It will also cover basic experimental design, teach students how to use modern computer software for data management, graphical presentation, and statistical tests. Three hours of lecture and one laboratory weekly.

BIOL 305 | ECOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 240 and BIOL 240L and BIOL 242 and BIOL 242L

A study of the distribution and abundance of organisms. This survey course will include a discussion of the physical environment, biogeography, and ecosystems. Community and population ecology will also be addressed, and quantitative approaches will be emphasized. Field trips may be required. Environmental and Ocean Sciences majors may substitute EOSC 301 for BIOL 305.

BIOL 309 | RESEARCH METHODS**Units: 2 Repeatability: No**

Prerequisites: BIOL 240 and BIOL 240L and BIOL 242 and BIOL 242L

Development of basic methods and skills common to all research in Biology. Topics include use of literature, hypothesis formation and hypothesis testing with statistical inference, and critical evaluation of data. Offered every semester.

BIOL 310 | EVOLUTION**Units: 3 Repeatability: No**

Prerequisites: BIOL 300 and (BIOL 305 or EOSC 301)

A study of the fundamental concepts of evolution. The nature of variation, isolation, natural selection, and speciation will be discussed. Special topics include molecular, behavioral, developmental, and human evolution. Three hours of lecture per week.

BIOL 320 | COMPARATIVE ANATOMY OF VERTEBRATES**Units: 4 Repeatability: No**

Prerequisites: BIOL 305 or EOSC 301

The evolution of vertebrates is one of the most compelling stories in comparative biology. For millions of years vertebrates have flourished in the seas and on land by employing a variety of morphological specializations for feeding, locomotion, and reproduction. Yet, all vertebrates retain similarities in their design regardless of how structural components function in different lineages and environments. This course examines the shared and transformed anatomical attributes among vertebrates in the context of function and phylogenetic history. We pursue that objective by integrating lecture discussions with laboratory observations and directions. Two hours of lecture and two laboratories weekly.

BIOL 330 | TECHNIQUES IN MOLECULAR BIOLOGY**Units: 3 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 242 and BIOL 242L

An introduction to recombinant DNA techniques including bacterial culture, transformation, nucleic acid purification, restriction analysis, DNA cloning, polymerase chain reaction, etc. Computer-based sequence analyses include database accession, BLAST, alignments, restriction analysis, gene-finding, and genomics. A cloning project generating new molecular reagents will be undertaken. One lecture and one laboratory weekly. Completion of CHEM 301 and CHEM301L is recommended.

BIOL 332 | BIOCHEMISTRY II**Units: 3**

Prerequisites: CHEM 331

This course advances the fundamental concepts of macromolecules, structure/function paradigms, enzyme mechanism & activity and metabolism gained in CHEM 331. We will study metabolic homeostasis, integrating anabolic/catabolic pathways and energy flux with nutrition/nutrient intake of essential and non-essential molecules. Regulatory control through allosteric, transcriptional/translational, and post-translational mechanisms will be examined as part of maintaining metabolic homeostasis. Where relevant, disease and pathology will be used to highlight these concepts. We will study signal transduction to address the flow of information within a system. As a capstone to our indepth study of biochemistry, we will examine cross-disciplinary applications of core biochemical concepts (structure/function, homeostasis, energy flow and information flow) in the context of systems biology, chemical biology and synthetic biology.

BIOL 340 | DESERT BIOLOGY**Units: 4 Repeatability: No**

Prerequisites: BIOL 305 or EOSC 301

This course provides an introduction to the formation and climate of the local Colorado Desert and the evolution, ecology, physiological adaptations, and relationships of the organisms found there. The lab portion includes five days hiking and camping in Anza Borrego Desert State Park during Spring Break, where the floral and faunal communities of several habitat types will be studied through trapping, tracking, and experiment. Two hours of lecture and two laboratories weekly.

BIOL 342 | MICROBIOLOGY**Units: 4 Repeatability: No**

Prerequisites: BIOL 300

An introduction to the microbial world, with emphasis given to bacteria, archaea and viruses. The diversity of prokaryotes is surveyed with particular attention devoted to differences in cell physiology, energy metabolism and ecology. Interactions between humans and microbial pathogens are also examined. The laboratory stresses techniques in light microscopy and procedures used to culture and characterize microorganisms. Two hours of lecture and two laboratories weekly.

BIOL 344 | PLANT SYSTEMATICS AND EVOLUTION**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

An introduction to the study of plant diversity. The evolution and relationships of plants are examined from the perspective of geological and ecological history. Significant plant groups will be discussed, with special emphasis on the flowering plants. Field identification of plant families will be emphasized in the laboratory sessions. Three hours of lecture and one laboratory weekly.

BIOL 346 | VERTEBRATE NATURAL HISTORY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

A course in the biology of vertebrates. Although vertebrate structure, function, and development are studied, emphasis is on the behavior, evolution, and interaction of the vertebrate organism as a whole, or at the population level. Techniques of identification and study are covered in the laboratory and field. Three hours of lecture and one laboratory or field trip weekly.

BIOL 347 | AVIAN BIOLOGY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

An introduction to the biology of birds, including their evolution, physiology (particularly those areas associated with flight), vocalizations, navigation, reproduction, and ecology including conservation. The laboratory will include several field trips (including one overnight trip to the mountains and desert) for bird identification and will include a project designed by the student. Three hours of lecture and one laboratory weekly.

BIOL 348 | INSECT BIOLOGY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

An introduction to the biology of insects, including their identification, evolution, structure, function, physiology, ecology, behavior, and conservation. The course includes compilation of an extensive insect collection and an overnight field trip to the desert. Three hours of lecture and one laboratory weekly.

BIOL 350 | INVERTEBRATE ZOOLOGY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

A survey of the invertebrate animals with emphasis on evolutionary relationships among the groups as expressed by their morphology and physiology. Three hours of lecture and one laboratory weekly.

BIOL 361 | ECOLOGICAL COMMUNITIES OF SAN DIEGO COUNTY**Units: 2 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

A general survey of the ecological communities of San Diego County will acquaint students with local marine, freshwater, chaparral, and desert habitats. The course is primarily field study, and one overnight trip to the desert will be included. Identification of organisms and their ecological relationships will be stressed. One laboratory weekly.

BIOL 364 | CONSERVATION BIOLOGY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or EOSC 301

Lectures address conservation topics from historical, legal, theoretical, and practical perspectives. The laboratory includes discussions of classic and current literature, student presentations, computer simulations of biological phenomena, analysis of data, and field trips to biological preserves, habitat restoration sites, and captive breeding facilities. Three hours of lecture and one laboratory weekly.

BIOL 376 | ANIMAL DEVELOPMENT**Units: 4 Repeatability: No**

Prerequisites: BIOL 300

This course explores embryonic development emphasizing mechanisms of differential gene expression and pattern formation at a cellular, molecular, and genetic level. Vertebrate and invertebrate model organisms (e.g., *Xenopus*, *Drosophila*, *Caenorhabditis*) that illustrate common developmental mechanisms will be examined in detail. In laboratory, living embryos and prepared slides will be studied, and molecular techniques will be employed to identify genes and examine gene expression. Three hours lecture and one laboratory weekly.

BIOL 377 | PHYSIOLOGY OF SPORTS**Units: 3 Repeatability: No**

Prerequisites: BIOL 300

This course will examine how the physiology of humans can be challenged by different athletic sports. The principles that underlie the functioning of each physiological system (e.g. muscle, neural, cardiovascular, respiratory, metabolism, etc) will be discussed. Students will identify a sport that truly challenges these physiological systems and will examine the primary literature regarding each system. Students will also examine the impact of training, nutrition, performance, etc. on the physiology of the athlete in a given sport. This course will also take an integrative approach by examining the response and regulation of these physiological systems from the level of the gene to the whole organism.

BIOL 416 | POPULATION BIOLOGY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: (BIOL 305 or EOSC 301) and (MATH 130 or MATH 150 or MATH 151)

The mechanisms of evolution and the dynamics of ecosystems are studied through the development of mathematical and computer models. The mathematics and computer programming experience required in this course beyond the level of MATH 130 (Survey of Calculus) will be introduced as needed. Research techniques used in investigating population phenomena are emphasized. Three hours of lecture and one laboratory weekly. Biostatistics is highly recommended. Fall semester.

BIOL 432 | ELECTRON MICROSCOPY**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 300 and (BIOL 309 or EOSC 301)

An introduction to the theory, development, and operation of the electron microscope, with emphasis on development of knowledge of cellular fine structure. The laboratory portion of the course will focus on tissue preparation, microscope operation, and evaluation and presentation of electron microscopic data. Two hours of lecture and two laboratories weekly.

BIOL 438 | ANIMAL BEHAVIORAL ECOLOGY WITH LAB**Units: 4 Repeatability: No**

Prerequisites: BIOL 300 or BIOL 305 or EOSC 300 (Can be taken Concurrently)

This course examines the evolution of animal behavior in an ecological context. Topics include economic decision making, co-evolutionary arms races, competition, aggression, biological rhythms, group living, sexual and family conflict, parental care, mating systems, cooperation, and communication. This course explores questions in behavioral ecology using basic concepts and theory, as well as model-based, comparative, and experimental approaches. The inquiry-based lab introduces methods commonly used in behavioral ecology and allows students to test their own hypotheses within the framework of prescribed field and laboratory exercises. Cross-listed as EOSC 438. Students may not receive credit for taking both BIOL 438 and BIOL 439 or for taking both BIOL 438 and PSYC 344.

BIOL 439 | ANIMAL BEHAVIORAL ECOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 300 or BIOL 305 or EOSC 300 (Can be taken Concurrently)

This course examines the evolution of animal behavior in an ecological context. Topics include economic decision making, co-evolutionary arms races, competition, aggression, biological rhythms, group living, sexual and family conflict, parental care, mating systems, cooperation, and communication. This course explores questions in behavioral ecology using basic concepts and theory, as well as model-based, comparative, and experimental approaches. Cross-listed as EOSC 439. Students may not receive credit for taking both BIOL 439 and BIOL 438 or BIOL 439 and PSYC 344.

BIOL 440 | MATHEMATICAL MODELING IN ECOLOGY**Units: 4 Repeatability: No****Core Attributes: Advanced Integration**

Prerequisites: MATH 150 and (EOSC 301 or BIOL 305)

An introduction to mathematical applications to ecology. In this integrative course, students will learn to describe ecological processes in mathematical terms and formulate different types of mathematical models relevant to ecology. In a weekly lab, students from BIOL 440/EOSC 440 and MATH 440 will work together on integrative projects and computer programming applications to mathematical ecology. Students may not receive credit for taking both BIOL 440 and EOSC 440 or BIOL 440 and MATH 440.

BIOL 444 | ECOLOGY AND EVOLUTION OF INFECTIOUS DISEASE**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 305 or BIOL 301

This course will focus on fundamental topics in the ecology and evolution of infectious disease, including epidemiological Susceptible-Infected-Recovered (SIR) type models, the basic reproductive ratio R_0 , vaccination and herd immunity, heterogeneity in host resistance, and the evolution of virulence. Examples will be taken from the primary scientific literature across human, wildlife and plant diseases. Labs will include a mix of computer-based labs working with epidemiological mathematical models; laboratory experiments using model organisms such as mosquitoes; and field labs surveying local plant and wildlife diseases. Students will also complete a semester-long project modeling an infectious disease of their choice. Experience using the software R would be helpful, but no mathematical or programming knowledge is required, and any math content will be introduced as needed.

BIOL 451 | BIOLOGICAL OCEANOGRAPHY**Units: 4 Repeatability: No****Core Attributes: Advanced writing competency**

Prerequisites: BIOL 309 or EOSC 301

An integrated study of marine organisms and their environments, stressing ecological, behavioral, and physiological relationships. Nearshore, deep sea, and open ocean environments will be covered. A weekend field trip may be required. Cross-listed as EOSC 451.

BIOL 462 | BIOLOGY OF FISHES**Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: (EOSC 300 (Can be taken Concurrently) and EOSC 301 (Can be taken Concurrently)) or BIOL 305

This course examines the various aspects of ichthyology encompassing the anatomy, physiology, ecology, evolution, ethology, and natural history of fishes. Lab includes techniques of identification and a general survey of fish systematics and zoogeography. Three hours of lecture and one laboratory per week. Cross-listed with EOSC 462.

BIOL 465 | MARINE MAMMALS**Units: 3 Repeatability: No**

Prerequisites: EOSC 300 (Can be taken Concurrently) or BIOL 305

An examination of the biology of whales, pinnipeds and other marine mammals. Topics will include general adaptations to a marine existence; systematics and biogeography; reproduction; diving physiology; communication and echolocation; feeding and migratory behavior; and marine mammal-human interactions. Some emphasis will be placed on species occurring in the North Pacific Ocean. Necropsies of a beach-stranded marine mammal may occur. Special projects will also be assigned. Cross-listed with EOSC 465.

BIOL 472 | PLANT PHYSIOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 300 and CHEM 151 and CHEM 152

An introduction to the basic processes occurring in vascular plants. Movement of water and solutes; photosynthesis and respiration; plant growth and development, including plant hormones and growth regulators; and plant reactions to environmental stress will be studied. Three hours of lecture weekly.

BIOL 472L | PLANT PHYSIOLOGY LAB**Units: 1 Repeatability: No**

Prerequisites: BIOL 300 and CHEM 151 and CHEM 152

Corequisites: BIOL 472

A laboratory investigation of the topics introduced in the Plant Physiology lecture. Coregistration in BIOL 472 is required.

BIOL 477 | INVERTEBRATE PHYSIOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 300

The study of key physiological systems of invertebrate organisms with an emphasis on metabolism, respiration, osmoregulation, thermal relations, membrane, and neural physiology. The function of these systems will be examined by comparing invertebrates from various taxonomic groups and diverse habitats. Three hours of lecture weekly.

BIOL 477L | INVERTEBRATE PHYSIOLOGY LAB**Units: 1 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: BIOL 300

Corequisites: BIOL 477

Laboratory-based study of several physiological systems of invertebrate organisms. Both traditional and recently developed techniques will be employed to demonstrate the functioning and integrative nature of these systems. One laboratory weekly. Concurrent registration in BIOL 477 is required. Offered every Fall semester.

BIOL 478 | VERTEBRATE PHYSIOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 300 and CHEM 301

A detailed comparative examination of life processes in animals. Particular focus will be upon energy utilization, gas transport, kidney function, and muscle function of organisms from diverse habitats. Three hours of lecture weekly.

BIOL 478L | VERTEBRATE PHYSIOLOGY LAB**Units: 1 Repeatability: No****Core Attributes: Advanced writing competency****Non-Core Attributes: Lab**

Prerequisites: BIOL 300

Corequisites: BIOL 478

An intensive exploration in a research setting of metabolic pathways, temperature acclimation, gas exchange, and ion regulation in a variety of vertebrate animals. One laboratory weekly. Concurrent registration in BIOL 478 is required. Offered every Spring semester.

BIOL 480 | CELL PHYSIOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 300 and CHEM 301

Mechanisms of cell functions are emphasized. Topics covered include: membrane structure, membrane transport, endoplasmic reticulum and Golgi functions, cell motility, energetics, mechanisms of hormone action, and control of the cell cycle. Three hours of lecture weekly.

BIOL 480L | CELL PHYSIOLOGY LAB**Units: 1 Repeatability: No****Core Attributes: Advanced writing competency****Non-Core Attributes: Lab**

Prerequisites: BIOL 300

Corequisites: BIOL 480

The laboratory exercises introduce the student to some of the modern methods used to study cell function. One laboratory weekly. Concurrent registration in BIOL 480 is required. Offered every Spring semester.

BIOL 481 | CANCER: BIOLOGY AND SOCIOLOGICAL PERSPECTIVES**Units: 3 Repeatability: No****Core Attributes: Domestic Diversity level 2**

Prerequisites: BIOL 300

This course provides an introduction to the basic characteristics of normal vs. cancerous tissue, examining the genetic and cellular changes that occur during the progression of cancer. The course also examines the disparities in cancer progression among individuals, as it relates to socioeconomic status, race and ethnicity.

BIOL 482 | MOLECULAR BIOLOGY**Units: 3 Repeatability: No**

Prerequisites: BIOL 300 and CHEM 301

A study of the structure and function of genes, emphasizing the understanding of gene regulation at many levels. The course will examine DNA structure and mechanics of replication, repair, transcription, and translation in prokaryotes and eukaryotes. Critical experiments will be studied to examine the development of concepts in molecular biology. Other special topics may include the molecular biology of development, cancer, HIV, and whole genome analysis. Three hours of lecture weekly.

BIOL 483 | EMERGING ISSUES IN GENETICS**Units: 3 Repeatability: No**

Prerequisites: BIOL 300

This course considers the science of emerging and advancing technologies in the field of genetics and the ethical issues they raise. Current events are often incorporated. Fall semester.

BIOL 484 | IMMUNOLOGY**Units: 4 Repeatability: No**

Prerequisites: BIOL 300

A comprehensive introduction to immunology, focusing on vertebrate immunity. Topics covered include molecular and cellular components of the immune system and their regulation, long-term protection from disease, immune response to cancer, autoimmunity, hypersensitivity, immunodeficiencies, and transplants. Laboratory exercises will introduce students to immunological techniques and their applications. Three hours of lecture and one laboratory weekly.

BIOL 490 | RESEARCH PROJECT**Units: 4 Repeatability: No****Core Attributes: Advanced writing competency**

Prerequisites: BIOL 300 and BIOL 305 and BIOL 309 with a minimum grade of C-

Students work on individual research projects that apply appropriate research techniques to test hypotheses. Completion of course will require oral presentation of results.

BIOL 491 | SCIENCE IN THE PUBLIC DOMAIN**Units: 3 Repeatability: No****Core Attributes: Advanced Integration****Non-Core Attributes: Community Engagement, Undergraduate Research**

Prerequisites: BIOL 309 with a minimum grade of C-

Students will design and implement science projects that demonstrate a basic scientific concept for elementary school students in an after school program. Students explore methods of pedagogy and the role of outreach and community service learning in communicating science. Tasks include practice grant-writing, hypothesis testing and assessment.

BIOL 494 | SPECIAL TOPICS IN BIOLOGY**Units: 1-4 Repeatability: Yes (Repeatable if topic differs)**

Prerequisites: BIOL 300 or BIOL 305

An in-depth evaluation of selected topics in the biological sciences. Issues of current or historical interest are addressed. May be repeated when topic changes.

BIOL 495 | BIOLOGY CAPSTONE SEMINAR**Units: 2 Repeatability: No****Core Attributes: Oral communication competency**

Prerequisites: BIOL 490 or BIOL 491 or BIOL 496 or BIOL 498

The techniques of seminar preparation, presentation, and critique will be refined through collaboration with faculty and peers, culminating with each student presenting a public seminar on their Research Experience. Enrollment for credit is limited to seniors.

BIOL 496 | RESEARCH**Units: 1-4 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential**

Students develop and/or assist in research projects in various fields of biology working with a Biology Department faculty member. The study may involve literature searching, on and off-campus research, and attendance at seminars at other leading universities and scientific institutions. Total credit in BIOL 496 is limited to four units.

BIOL 497 | TECHNIQUES IN BIOLOGY**Units: 1-2 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential**

Training and practice in those areas of biological science of practical importance to the technician, teacher, and researcher. To include, but not be limited to: technical methodology, preparation and technique in the teaching laboratory, and routine tasks supportive to research. Total credit in BIOL 497 is limited to two units.

BIOL 498 | RESEARCH INTERNSHIP**Units: 1-3 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential, Undergraduate Research**

This course offers experience in the practical and experimental application of biological principles. Students will be involved in research projects conducted by agencies and institutions outside the university, such as state parks, zoos, and biological industries. Enrollment is arranged on an individual basis according to a student's interest and background, and is dependent on positions available and faculty approval. Total credit in BIOL 498 is limited to three units.