BIOL - BIOLOGY (BIOL)

BIOL 100 Horizons in Biology

Credits 0-1. 0-1 Lecture Hours. Introduction to the study of biology at Texas A&M University; gain knowledge of departmental and campus resources to assist and enhance the pursuit of a degree in biology, microbiology, molecular and cellular biology or zoology. **Prerequisites:** First-year and first-time-in-college freshman majoring in BIOL, MBIO, BMCB and ZOOL.

BIOL 101 Botany

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1311 and 1111, BIOL 1411) Botany. Structure, physiology and development of plants with an emphasis on seed plants. (Not open to students who have taken BIOL 111 and BIOL 112 or BIOL 113.); includes laboratory that reinforces and provides supplemental information related to the lecture topics.

BIOL 102 Neuroscience Overview

Credit 1. 1 Lecture Hour. An introductory survey of neuroscience for freshmen undergraduate students on the basic neuroscience core ideas and neurological disorders. **Cross Listing:** NRSC 101, PBSI 101 and VIBS 101.

BIOL 104 Contemporary Issues in Science - Cosmos, Earth and Humanity

Credits 3. 3 Lecture Hours. Science for citizens; interdisciplinary survey of contemporary issues in the science of our universe or cosmos, Earth and humanity, including the big bang, evolution, genetics, vaccines and drugs; future outlook on humanity, including artificial intelligence, cryptography and cybersecurity; critically analyze science presented in the news, on television and on social media; ethical implications of research. **Cross Listing:** ARSC 104 and PHYS 104.

BIOL 107 Zoology

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1313 and 1113, 1413) Zoology. Survey of animal life with respect to cell organization, genetics, evolution, diversity of invertebrates/vertebrates, anatomy/physiology, and interaction of animals with their environment; includes laboratory that reinforces and provides supplemental information related to lecture topics. (Not open to students who have taken BIOL 111 and BIOL 112 or BIOL 113).

BIOL 111 Introductory Biology I

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1306 and 1106, 1406) Introductory Biology I. First half of an introdutory two-semester survey of contemporary biology that covers the chemical basis of life, structure and biology of the cell, molecular biology and genetics; includes laboratory that reinforces and provides supplemental information related to the lecture topics; also taught at Galveston campus.

BIOL 112 Introductory Biology II

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1307 and 1107, 1407) Introductory Biology II. The second half of an introductory two-semester survey of contemporary biology that covers evolution, history of life, diversity and form and function of organisms; includes laboratory that reinforces and provides supplemental information related to the lecture topics. **Prerequisite:** BIOL 111; also taught at Galveston campus.

BIOL 113 Essentials in Biology

Credits 3. 3 Lecture Hours. (BIOL 1308, BIOL 1408) Essentials in Biology. One-semester biology for non-majors; overview of essential biological concepts and their application to real world and contemporary issues; topics include evolution, biodiversity, cellular, molecular and forensic biology, genetics and heredity to scientific literacy, human impact on the environment, genetically modified organisms and emerging diseases.

BIOL 206 Introductory Microbiology

Credits 4. 3 Lecture Hours. 4 Lab Hours. (BIOL 2320 and 2120, BIOL 2321 and 2121, BIOL 2420, BIOL 2421) Introductory Microbiology. Basic microbiology of prokaryotes and eukaryotes; main topics include morphology, physiology, genetics, taxonomy, ecology, medically important species and immunology; mandatory laboratory designed to give hands-on experience and to reinforce basic principles. **Prerequisites:** BIOL 101, BIOL 107, BIOL 111, or BIOL 113; CHEM 119. May not be used for credit by biology, molecular and cell biology, microbiology, zoology, predentistry or premedicine majors.

BIOL 213 Molecular Cell Biology

Credits 3. 3 Lecture Hours. Exploration of the molecular basis of cell structure, function and evolution; gene regulation, cell division cycle, cancer, immunity, differentiation, multicellularity and photosynthesis. **Prerequisite:** BIOL 112 and CHEM 120.

BIOL 214 Genes, Ecology and Evolution

Credits 3. 3 Lecture Hours. A genetically-based introduction to the study of ecology and evolution; emphasis on the interactions of organisms with each other and with their environment. **Prerequisite:** BIOL 112.

BIOL 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Problems in various phases of plant, animal and microbial science. **Prerequisites:** Freshman or sophomore classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

BIOL 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of biology. May be repeated for credit. **Prerequisite:** Approval of instructor.

BIOL 291 Research

Credits 0 to 4. 0 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. May be repeated for credit. **Prerequisites:** Freshman or sophomore classification and approval of faculty member.

BIOL 302 Careers in Biology

Credit 1. 1 Lecture Hour. Development of job search skills; utilization of career resources; self-assessment of career interests and career objectives; strategies for professional correspondence and networking; business etiquette and interviewing techniques; insight into life science career opportunities. **Prerequisites:** Junior or senior classification; department of biology majors only; or approval of instructor.

BIOL 318 Chordate Anatomy

Credits 4. 3 Lecture Hours. 3 Lab Hours. Classification, phylogeny, comparative anatomy, and biology of chordates; diversity, protochordates, vertebrate skeletons, shark and cat anatomy studied in laboratory. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 319 Integrated Human Anatomy and Physiology I

Credits 4. 3 Lecture Hours. 3 Lab Hours. Integrated approach to cellular, neural, skeletal, muscular anatomy and physiology; includes some histology, histopathology, radiology and clinical correlations. **Prerequisite:** BIOL 111 and BIOL 112, or BIOL 107.

BIOL 320 Integrated Human Anatomy and Physiology II

Credits 4. 3 Lecture Hours. 3 Lab Hours. Continuation of BIOL 319. Integrated approach to endocrine, cardiovascular, respiratory, digestive, urinary, reproductive and developmental anatomy and physiology; includes some histology, histopathology, radiology and clinical correlations. **Prerequisite:** BIOL 319 or approval of instructor.

BIOL 335 Invertebrate Zoology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Morphology, taxonomy, natual history and phylogeny of invertebrate animals, with emphasis on biodiversity; class includes both lecture and lab. Labs include study of preserved material and demonstration of living animals in aquaria and terraria. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 344 Embryology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to general and comparative embryology; molecular and cellular mechanisms of development; genetics and early development of selected invertebrates (C. elegans, Drosophila and sea urchin) and emphasis on vertebrates (frog, fish, chick and mouse). **Prerequisite:** BIOL 213 or GENE 302.

BIOL 350 Computational Genomics

Credits 3. 2 Lecture Hours. 2 Lab Hours. Hands-on approach to obtaining, organizing and analyzing genome-related data; emphasis on asking and answering biologically relevant questions by designing and performing experiments using computers; understanding biology from a computational perspective. **Prerequisite:** Junior or senior classification in life sciences, engineering, mathematics, chemistry.

BIOL 351 Fundamentals of Microbiology

Credits 4. 3 Lecture Hours. 4 Lab Hours. Introduction to modern microbiology with emphasis on prokaryotes; includes microbial cell structure, function, and physiology; genetics, evolution, and taxonomy; bacteriophage and viruses; pathogenesis and immunity; and ecology and biotechnology; includes laboratory experience with microbial growth and identification. **Prerequisites:** BIOL 112; CHEM 227, and CHEM 237 or CHEM 231; or approval of instructor; also taught at Galveston campus.

BIOL 352 Diagnostic Bacteriology

Credits 4. 2 Lecture Hours. 6 Lab Hours. Practical experience in handling, isolation and identification of pathogenic microorganisms using biochemical tests and rapid identification techniques. **Prerequisite:** BIOL 351 or approval of instructor.

BIOL 357 Ecology

Credits 3. 3 Lecture Hours. Analysis of ecosystems at organismal, population, interspecific and community levels. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 358 Ecology Laboratory

Credit 1. 3 Lab Hours. Quantitative analyses of freshwater and terrestrial ecosystems; includes data sampling and presentation of results in written and oral formats; required fieldtrips; analysis of competition and predator-prey interactions using ecological models. **Prerequisite:** BIOL 357 or concurrent enrollment; junior or senior classification.

BIOL 388 Principles of Animal Physiology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to how animals function, including basics of neurophysiology, endocrinology, muscular, cardiovascular, respiratory, ormoregulatory, and metabolic physiology; broadly comparative in scope and encompassing adaptation of physiological systems to diverse environments; the laboratory stresses techniques used for monitoring and investigating physiological mechanisms and responses to environmental changes. **Prerequisites:** BIOL 214 or CHEM 228 or approval of instructor.

BIOL 401 Critical Writing in Biology

Credit 1. 1 Lecture Hour. Reading scientific papers and writing short synopses of papers with a focus on learning how to think and write like a scientist; fills the current Writing Intensive "W" course requirement for biology. **Prerequisite:** BIOL 213 or CHEM 228; junior or senior classification.

BIOL 402 Communicating Biological Research to the Public

Credit 1. 1 Lecture Hour. Interpretation of scientific papers; analysis of how research findings are communicated to lay audiences; creation of synopses of research findings for the general public. **Prerequisite:** BIOL 213 or CHEM 228; junior or senior classification.

BIOL 403 Medical Narratives

Credit 1. 1 Lecture Hour. Focus on reading and analyzing brief nonfiction stories about medicine; exploration of different perspectives and experiences with illness and medicine. **Prerequisites:** BIOL 213 or CHEM 228; junior or senior classification or approval of instructor.

BIOL 405 Comparative Endocrinology

Credits 3. 3 Lecture Hours. Basic principles of endocrinology including structure and functions of hormones in vertebrates; hormonal control of growth, metabolism, osmoregulation, and reproduction; endocrine techniques and mechanism of hormone action. **Prerequisites:** BIOL 214 and CHEM 227.

BIOL 406/GENE 406 Bacterial Genetics

Credits 3. 3 Lecture Hours. A problem oriented course surveying the manipulation and mechanisms of genetic systems in bacteria; recombination, structure and regulation of bacterial genes, plasmids and phages. **Prerequisites:** BIOL 351; GENE 302. **Cross Listing:** GENE 406/ BIOL 406.

BIOL 407 Biological Clocks

Credits 3. 3 Lecture Hours. Examination of the basic mechanisms of biological timing; in depth study of clocks in model organisms and the relationship between clocks and human health and disease. **Prerequisites:** BICH 431/GENE 431, BIOL 213 or GENE 431/BICH 431.

BIOL 413 Cell Biology

Credits 3. 3 Lecture Hours. Structure, function, and biogenesis of cells and their components; interpretation of dynamic processes of cells, including protein trafficking, motility, signaling and proliferation. **Prerequisites:** BIOL 213 or GENE 302; BICH 410 or BICH 440.

BIOL 414 Developmental Biology

Credits 3. 3 Lecture Hours. Concepts of development in systems ranging from bacteriophage to the mammalian embryo; use of recombinant DNA technology and embryo engineering to unravel the relationships between growth and differentiation, morphogenesis and commitment, aging and cancer. **Prerequisite:** BIOL 213 or GENE 302; BICH 410 or BICH 440.

BIOL 423 Cell Biology Laboratory

Credits 2. 1 Lecture Hour. 3 Lab Hours. Modern methods of study of cell structure and cell function. **Prerequisites:** BICH 410 and BIOL 413, or concurrent enrollment or approval of instructor.

BIOL 428 Cellular Neuroscience

Credits 3. 3 Lecture Hours. Cell biology, molecular biology and biophysics of neurons as it pertains to their fundamental role in the physiological basis of behavior; study of how neurons create, maintain and exploit electrical signals for information coding and transmission; principles of electrical and chemical signaling between neurons, and the role of intracellular signaling for signal modulation and synaptic plasticity; exploration of a broad range of state-of-the-art molecular tools currently used to study the nervous system, and the cellular basis for many of the most common neurological disorders affecting humans as well as the strategies and therapies for their treatment. **Prerequisites:** BIOL 213 and PSYC 235, or approval of instructor. **Cross Listing:** NRSC 428/BIOL 428.

BIOL 430 Biological Imaging

Credits 4. 3 Lecture Hours. 3 Lab Hours. Still and video photography and photomicrography, computerbased digital image analysis and processing of biological images; theory and principles of light and electron microscopy including transmission and scanning electron microscopy; optical contrast methods for light microscopy including phase contrast, DIC, polarizing light and confocal laser scanning microscopy. **Prerequisite:** Junior classification or approval of instructor.

BIOL 434/NRSC 434 Regulatory and Behavioral Neuroscience

Credits 3. 3 Lecture Hours. Cell biology and biophysics of neurons; functional organization of the vertebrate nervous system; physiological basis of behavior. **Prerequisites:** BIOL 213; BIOL 319, BIOL 320, BIOL 388, BIOL 413, NRSC 235, or PSYC 235, or approval of instructor. **Cross Listing:** NRSC 434/BIOL 434.

BIOL 435 Laboratory for Regulatory and Behavioral Neuroscience

Credit 1. 3 Lab Hours. Study of modern methods and tools used to investigate nervous system structure and function. **Prerequisite:** BIOL 213; BIOL 319, BIOL 320, BIOL 388, BIOL 413, BIOL 428, BIOL 434/NRSC 434, NRSC 235, NRSC 335, NRSC 428/BIOL 428, NRSC 434/BIOL 434, or PBSI 235, or approval of instructor.

BIOL 437 Molecular and Human Medical Mycology

Credits 3. 3 Lecture Hours. Principles of fungal pathogenesis, diagnosis and antifungal therapies, and relevant genetic and molecular tools for studying human pathogens and drug delivery. **Prerequisites:** BIOL 351; junior or senior classification; or approval of instructor.

BIOL 438 Bacterial Physiology

Credits 3. 3 Lecture Hours. Structure and function of prokaryotic cells, with emphasis on evolutionary adaptations to different environmental, developmental, and pathogenic selections pressures; formation of teamsa and preparation of presentations on specific topics in microbiology. **Prerequisites:** BIOL 351; BIOL 406/GENE 406 or concurrent enrollment; BICH 410, BICH 431/GENE 431 and GENE 302 strongly recommended.

BIOL 440 Marine Biology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to biology of common organisms inhabiting bays, beaches and near-shore oceanic waters with special reference to Gulf of Mexico biota; emphasis on classification, distribution, history, ecology, physiology, mutualism, predation, major community types and economic aspects of marine organisms. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 443 Early Stages of Animal Evolution

Credits 3. 2 Lecture Hours. 2 Lab Hours. Analysis of the earliest stages of animal evolution by integrating various scientific fields such as genomics, paleontology, metabolism, morphology, environment, development and behavior; includes hands-on exploration of fossils and modern animals to understand how evolution shaped our world. **Prerequisites:** BIOL 214; junior or senior classification.

BIOL 444/NRSC 444 Neural Development

Credits 3. 3 Lecture Hours. Cellular and molecular mechanisms of nervous system development including neural induction and the basis of complex behaviors; use of a wide range of model organisms with a specific emphasis on vertebrate nervous system development. **Prerequisites:** BIOL 213, BIOL 319, BIOL 320, BIOL 413, BIOL 388, NRSC 235 or PSYC 235. **Cross Listing:** NRSC 444.

BIOL 445 Biology of Viruses

Credits 3. 3 Lecture Hours. Structure, composition and life cycles of viruses; methods used to study viruses; their interaction with host cells; mechanisms of pathogenicity and cellular transformation; responses of the host to viral infection, and vaccine applications; in-depth study of the life cycles of the major classes of viruses and discussion of emerging viruses. **Prerequisite:** BIOL 213 or BIOL 351 or approval of instructor.

BIOL 450/BICH 450 Genomics

Credits 4. 3 Lecture Hours. 3 Lab Hours. The study of genomic data includes consideration of the logic behind the most important genomic approaches, as well as their capabilities and limitations in investigating biological processes; the science of accessing and manipulating genomic data; and practical applications, including development of an hypotheses-driven datamining experiment. **Prerequisites:** BIOL 213, GENE 301 or GENE 302, BICH 431/GENE 431 or GENE 431/BICH 431, or BIOL 351; junior or senior classification or approval of instructor. **Cross Listing:** BICH 450/BIOL 450.

BIOL 451 Bioinformatics

Credits 3. 3 Lecture Hours. Bioinformatics tools applicable to eukaryotic organisms; theoretical background of computational algorithms, with an emphasis on application of computational tools related to modern molecular biological research. **Prerequisite:** BIOL 213, GENE 301, or GENE 302, or BIMS 320/GENE 320 or GENE 320/BIMS 320; junior or senior classification, or approval of instructor.

BIOL 454 Immunology

Credits 3. 3 Lecture Hours. Introduction to basic immunological concepts and principles of serology. **Prerequisite:** BIOL 351 or equivalent or approval of instructor.

BIOL 455 Laboratory in Immunology

Credits 2. 6 Lab Hours. Practical application of serological principles which include precipitation, agglutination and blood banking principles; techniques in tissue culture and hybridoma technology also included. **Prerequisite:** BIOL 454 or registration therein.

BIOL 456 Medical Microbiology

Credits 3. 3 Lecture Hours. Microbiology, epidemiology and pathology of human pathogens with an emphasis on bacterial agents. **Prerequisite:** BIOL 351 or approval of instructor.

BIOL 461 Antimicrobial Agents

Credit 1. 1 Lecture Hour. Understanding of antimicrobial agents, limitations of use, biosynthesis and regulation, and challenges in development as new therapeutics. **Prerequisites:** BICH 410 or BICH 440 and BIOL 351 or VTPB 405.

BIOL 466 Principles of Evolution

Credits 3. 3 Lecture Hours. Evolutionary patterns, mechanisms and processes at the organismal, chromosomal and molecular levels; modes of adaptation and the behavior of genes in populations. **Prerequisite:** GENE 302 or approval of instructor.

BIOL 467 Integrative Animal Behavior

Credits 3. 3 Lecture Hours. Examines how behavior contributes to survival and reproduction, and how evolutionary history and ecological circumstance interact to shape the expression of behavior; focus on integrative nature of behavior; how the interaction of evolutionary processes, mechanistic constraints, and ecological demands determine behavioral strategies. **Prerequisite:** BIOL 214, BIOL 357, BIOL 388, BIOL 405, BIOL 434/NRSC 434, or BIOL 466, or approval of instructor.

BIOL 480 Departmental Colloquium

Credit 1. 1 Lecture Hour. Attend presentations given by renowned scientists from various fields of biology; learn about new developments in science; stay abreast of current and trending research topics. **Prerequisites:** Senior classification; majors in BIOL, MICRO, BMCB and ZOOL.

BIOL 481 Seminar in Biology

Credit 1. 1 Lecture Hour. Recent advances. **Prerequisite:** Senior undergraduate majors in biology, microbiology, botany or zoology.

BIOL 484 Internship

Credits 0 to 4. 0-1 Other Hours. Directed internship in a private firm or public agency to provide research experience appropriate to the student's degree program and career objectives. May be taken two times. **Prerequisite:** Approval of internship agency and advising office.

BIOL 485 Directed Studies

Credits 1 to 12. 1 to 12 Other Hours. Problems in various phases of plant, animal and bacteriological science. **Prerequisites:** Junior classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

BIOL 487/VTPB 487 Biomedical Parasitology

Credits 4. 3 Lecture Hours. 2 Lab Hours. Helminth and protozoan parasites of medical and veterinary importance; life cycles, morphology, taxonomic classification, economic and public health aspects and current topics in parasitic diseases. **Prerequisites:** BIOL 107 or BIOL 111; junior classification or approval of instructor. **Cross Listing:** VTPB 487/ BIOL 487.

BIOL 489 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 10 Lab Hours. Selected topics in an identified area of biology. May be repeated once for credit.

BIOL 491 Research

Credits 0 to 4. 0 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. May be taken two times. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. **Prerequisite:** Approval of departmental faculty member.

BIOL 492 Biomedical Therapeutics Development

Credit 1. 1 Lecture Hour. Basic aspects of the biotechnology business; includes key aspects of biotechnology patents, the main steps in preclinical drug development and company structure and funding. **Prerequisites:** BIOL 213 or equivalent; CHEM 227 and CHEM 228.

BIOL 495 Biology Capstone: Research Communication in the Life Sciences

Credits 2. 2 Lecture Hours. Culmination of capstone research experience; formalization of research results in written and oral forms; introduction to primary genres or scientific writing; apply principles of rhetoric and composition to diverse methods of professional communication. **Prerequisite:** BIOL 452, BICH 464/GENE 464, BIOL 400, BIOL 493 or BIOL 491 or approval of instructor.

BIOL 496 Ethics in Biological Research

Credit 1. 1 Lecture Hour. Fraud in science, how to recognize it, and how to avoid committing fraud; includes the basis of ethics and plagiarism, negotiation techniques and conflict management, the regulations and ethics covering animal and human experiments, record-keeping, data management and peer review. **Prerequisite:** BIOL 491, NRSC 491, BICH 491, GENE 491, BIMS 491, CHEM 491, BIOL 351, or BICH 410, or approval of instructor.