

Biology (BIOL)

Courses

BIOL 1001. FYE: Biological Sciences. 1 Hour.

A First Year Experience course created to help students succeed in the biology major, and assist new freshmen and returning students to make a successful transition to being a college student. The primary objective of this course is to provide students with the resources they will need to succeed in their college careers, particularly in the biology major. Multiple listed with all other sections of First Year Experience (all 1001 courses, ENGR 1000). Students may only take one FYE course for credit. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Know about and where to locate important resources provided by Dixie to help students academically and personally. 2. Know proper techniques to enhance their studies through, note taking skills, test taking skills, group study and establish effective study habits. 3. Know ways to best manage time and money. 4. Set and achieve Goals. 5. Plan out their academic career and be comfortable speaking with advisors and professors. 6. Know different career paths offered when obtaining a degree from the biology program. 7. Understand the required and suggestive courses and activities need to obtain a degree in biology program and their post grad plans. FA.

BIOL 1010. General Biology (LS). 3 Hours.

Fulfills General Education Life Sciences requirement. Not for science majors, this course focuses on general principles of Biology, including cell theory, genetics, evolution, and interrelationships of living things, using a variety of teaching methods including lecture/discussion, laboratory, overheads, videos, quizzes and exams. Recommended corequisite: BIOL 1015. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including hypothesis, experimental controls, and experimental design. 2. Describe concepts related to cell theory, the genetic basis for life, and the diversity of life, evolution, and ecology. 3. Apply biological concepts to solve real-world scientific problems. 4. Discuss how science is incorporated into daily life and identify ways to engage in the public discussion of biological issues. FA, SP, SU.

BIOL 1010D. General Biology (LS). 4 Hours.

Fulfills General Education Life Sciences requirement. Not for science majors, this course focuses on general principles of Biology, including cell theory, genetics, evolution, and interrelationships of living things, using a variety of teaching methods including lecture/discussion, laboratory, overheads, videos, quizzes and exams. This class is specifically designed for students who may not be prepared to take BIOL 1010. Recommended corequisite: BIOL 1015. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including hypothesis, experimental controls, and experimental design. 2. Describe concepts related to cell theory, the genetic basis for life, and the diversity of life, evolution, and ecology. 3. Apply biological concepts to solve real-world scientific problems. 4. Discuss how science is incorporated into daily life and identify ways to engage in the public discussion of biological issues. FA, SP.

BIOL 1010S. General Biology (LS). 3 Hours.

Fulfills General Education Life Sciences requirement. Not for science majors, this course focuses on general principles of Biology, including cell theory, genetics, evolution, and interrelationships of living things, using a variety of teaching methods including lecture/discussion, laboratory, overheads, videos, quizzes and exams. Recommended corequisite: BIOL 1015. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. This course was selected to participate in Dixie State University's Supplemental Instruction (SI) Program. This course adds one weekly class SI session but does not increase credit hours. SI is a series of weekly review sessions, led by peer SI leaders and designed to help students succeed in their academic pursuits. SI is provided for students who want to improve their understanding of course material and improve their grades. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including hypothesis, experimental controls, and experimental design. 2. Describe concepts related to cell theory, the genetic basis for life, and the diversity of life, evolution, and ecology. 3. Apply biological concepts to solve real-world scientific problems. 4. Discuss how science is incorporated into daily life and identify ways to engage in the public discussion of biological issues. FA, SP.

BIOL 1015. General Biology Lab (LAB). 1 Hour.

Lab course designed recommended but not required to accompany BIOL 1010. Students will have hands-on experience in a laboratory setting, including the use of microscopes, measurement and simple data analysis, observations of osmosis and diffusion, and other group activities in order to appreciate the true essence of science and the scientific process of acquiring knowledge through inquiry. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Use the scientific method to observe problems, ask questions, make predictions, formulate testable hypotheses, create experiments, and formulate reasonable conclusions. 2. Use a microscope to view and diagram cells and whole organisms, osmosis and diffusion, and the movement of chromosomes. 3. Diagram molecules, and perform experiments that demonstrate some of the functions of photosynthesis and cellular respiration. 4. Calculate simple statistics to determine the patterns of inheritance in Mendelian genetics. 5. Discuss the history and methods of classification, evolution, and ecological principles. Course fee required. Corequisite: BIOL 1010. FA, SP.

BIOL 1200. Human Biology (LS). 3 Hours.

Fulfills General Education Life Sciences requirement. Covers basic anatomy and physiology of humans for pre-health science majors. Focuses on the general structure and function of the human body including tissues, organs, and systems. Through lecture, videos, models, quizzes, and tests, students become familiar with how the human body functions. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Explain the process and methods of science, including asking testable questions, using inductive and deductive reasoning in forming hypotheses and in making reliable predictions. 2. Explain and apply major concepts of life organisms including: the chemistry of life, the cell, the genetic basis of life, and human evolution. 3. Describe the function and processes of the major body systems including: cardiovascular, immune, digestive, urinary, muscular, skeletal, nervous, endocrine, and reproduction, as well as the coordination between systems in maintaining body homeostasis.

BIOL 1300. Evolution & Ecology. 1 Hour.

Focuses on the fundamental principles of evolution and ecology. Evolution is emphasized as a unifying theme for all of Biology, as an explanation for both the unity and diversity of life. Students will learn how ecology provides the environmental context for adaptive evolution, as well as how our understanding of environmental processes relates to modern-day environmental concerns. Fulfills General Education Life Sciences and Laboratory Sciences requirements if these classes are also completed: BIOL 2320, BIOL 2325, BIOL 2420, BIOL 2425. Offered based on sufficient student need.

BIOL 1610. Principles of Biology I (LS). 4 Hours.

Fulfills General Education Life Sciences requirement. Introductory course required of all Biology majors, including pre-health science, pre-nursing, pre-veterinary, pre-medical, pre-dental, and other pre-professional students. Emphasizes the scientific method; cell processes, including basic chemistry, cellular level structure, and function; and the principles of inheritance, evolution and ecology. Fulfills prerequisite to most other Biology courses. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including asking testable questions, forming hypotheses, and using experimental design to evaluate hypotheses. 2. Describe and apply concepts related to the chemistry of life, cell theory, the genetic basis for life, evolution, and ecology. 3. Apply information literacy skills including effectively locating, evaluating, and communicating scientific information. Corequisite: BIOL 1615. FA, SP, SU.

BIOL 1610A. Honors Prin of Biology I. 4 Hours.

Honors Course. Fulfills General Education Life Sciences requirement. Introductory course required of all Biology majors, including pre-dental, pre-veterinary, pre-medical, and other pre-professional students. Emphasizes the scientific method; cell processes, including basic chemistry, cellular level structure, and function; and the principles of inheritance, evolution and ecology. Honors designation indicates greater student interaction, inquiry driven classes, and critical evaluations of mass media and scientific publications. Fulfills prerequisite to most other Biology courses. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including asking testable questions, forming hypothesis, and using experimental design to evaluate hypotheses. 2. Describe and apply concepts related to the chemistry of life, cell theory, the genetic basis for life, evolution, and ecology. 3. Demonstrate information literacy skills including effectively locating, evaluating, applying, and communicating scientific information. Prerequisites: Admission to the DSU Honors Program OR program director permission. Corequisite: BIOL 1615A.

BIOL 1610S. Principles of Biology I (LS). 4 Hours.

Fulfills General Education Life Sciences requirement. Introductory course required of all Biology majors, including pre-health science, pre-nursing, pre-veterinary, pre-medical, pre-dental, and other pre-professional students. Emphasizes the scientific method; cell processes, including basic chemistry, cellular level structure, and function; and the principles of inheritance, evolution and ecology. Fulfills prerequisite to most other Biology courses. This course was selected to participate in Dixie State University's Supplemental Instruction (SI) Program. This course adds one weekly class SI session but does not increase credit hours. SI is a series of weekly review sessions, led by peer SI leaders and designed to help students succeed in their academic pursuits. SI is provided for students who want to improve their understanding of course material and improve their grades. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including asking testable questions, forming hypotheses, and using experimental design to evaluate hypotheses. 2. Describe and apply concepts related to the chemistry of life, cell theory, the genetic basis for life, evolution, and ecology. 3. Apply information literacy skills including effectively locating, evaluating, and communicating scientific information. Corequisite: BIOL 1615. FA, SP.

BIOL 1615. Principles of Biology I Lab (LAB). 1 Hour.

Lab portion of BIOL 1610. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand and apply basic laboratory safety. 2. Use a compound microscope and a wide-field stereoscope. 3. Understand basic concepts in biology pertaining to scientific methods, microscopy, cell structure and function, enzymatic processes, cellular respiration, cell reproduction, Mendelian genetics, molecular genetics, natural selection, population growth, and evolutionary agents. 4. Apply proper laboratory techniques in measuring materials, making wet mount slide preparations, pipetting, preparing gels for electrophoresis and carrying out gel electrophoresis. 5. Develop and evaluate hypotheses and interpret scientific data. Course fee required. Corequisite: BIOL 1610. FA, SP, SU.

BIOL 1615A. Honors Prin. of Biology Lab. 1 Hour.

Honors course. Lab portion of BIOL 1610A. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify the scientific method, including asking testable questions, forming hypothesis, and using experimental design to evaluate hypotheses. 2. Describe and apply concepts related to the chemistry of life, cell theory, the genetic basis for life, evolution, and ecology. Demonstrate information literacy skills including effectively locating, evaluating, applying, and communicating scientific information. Course fee required. Prerequisite: Admission to the DSU Honors Program OR program director permission. Corequisite: BIOL 1610A.

BIOL 1620. Principles of Biology II. 4 Hours.

Required of all Biology majors, including pre-health science, pre-nursing, pre-veterinary, pre-medical, pre-dental, and other pre-professional students. Continues BIOL 1610; emphasizes Evolution, diversity processes, animal structure and function, plant structure and function. Prerequisite to many other Biology courses. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Explain and compare the structural and physiological diversity of viruses and bacteria. 2. Explain and compare the structural and physiological diversity of the protists. 3. Explain and compare the various life cycles and the structural and physiological diversity of fungi. 4. Explain and compare the various life cycles and the structural and physiological diversity of the plants. 5. Explain and compare the various life cycles and the structural, physiological, and evolutionary diversity of the invertebrate and vertebrate animals. Prerequisite: BIOL 1610 (Grade C or higher). Corequisite: BIOL 1625. FA, SP.

BIOL 1620A. Honors Prin of Biology II. 4 Hours.

Honors Course. Introductory course required of all Biology majors, including pre-dental, pre-veterinary, pre-medical, and other pre-professional students. Continues BIOL 1610; emphasizes evolution, diversity processes, animal structure and function, plant structure and function. Honors designation indicates greater student interaction, inquiry driven classes, and critical evaluations of mass media and scientific publications. Prerequisites: Admission to the DSU Honors Program OR Honors program director permission, and BIOL 1610 (Grade C or higher). Corequisite: BIOL 1625A. SP.

BIOL 1625. Principles of Biology II Lab. 1 Hour.

Lab portion of BIOL 1620. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Deepen understanding of the main groups of living organisms. 2. Develop clear, testable hypotheses. 3. Design proper experiments and analyze and interpret the resulting data. 4. Report experiment results through oral presentations. 5. Report experimental results through writing. Course fee required. Prerequisite: BIOL 1615 or BIOL 1615A (Grade C or higher). Corequisite: BIOL 1620. FA, SP.

BIOL 1625A. Honors Prin of Biology II Lab. 1 Hour.

Honors Lab portion of BIOL 1620A. Honors designation indicates greater student interaction and inquiry driven class. Lab fee required. Prerequisites: Admission to the DSU Honors Program OR Honors program director permission, AND (BIOL 1615 or BIOL 1615A (Grade C or higher)). Corequisite: BIOL 1620A. SP.

BIOL 2035. Principles of Genetics Laboratory. 1 Hour.

Required for all Biology degrees and programs. Exploration of the nature of genetic systems from the molecular to organismal level. Detailed investigations into heredity, information flow, chromatin architecture, gene regulation, and epigenetics as well as examination of genetics from a developmental, evolutionary, and medical perspective. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Describe and perform common techniques used in genetics research including: testcrosses, karyotyping, DNA extraction, PCR and qRT-PCR, gel electrophoresis, DNA sequencing, cloning and transformation, and gene editing. 2. Carry out the collection and interpretation of experimental data and present results in a detailed lab report. 3. Demonstrate quantitative reasoning including: dilutions, calculating molarity, probability, and the Hardy-Weinberg equation, as well as perform basic statistics using the chi-square test. 4. Perform basic bioinformatics techniques including database searches and sequence alignment. 5. Discuss the use of genetics in understanding evolution, the role of genetics in disease, and the ethics of biotechnology applications. Course fee required. FA, SP.

BIOL 2060. Principles of Microbiology. 3 Hours.

For health science, pre-pharmacy and other allied health professionals who need an understanding of microbiology. Focuses on essentials of microbiology, including disease control, nomenclature, function of immune system, pathologies, causes and cures, and laboratory methods for safely studying microorganisms. Successful completion of the course gives students an understanding of microbes and their relationship to the human system and health. The material of this course is presented in an advanced manner. Relevant background in basic biology is assumed. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Learn about the people who have made important contributions to the understanding of microbiology. 2. Learn the structure and function of prokaryotic cells. 3. Learn how prokaryotic cells survive and reproduce. 4. Learn about information exchange within and between prokaryotic cells. 5. Learn about virus structure, genetics, reproduction, and diversity. Prerequisite: BIOL 1010 or BIOL 1610 (Grade C- or higher) and CHEM 1110 or CHEM 1210 (Grade C- or higher). Corequisite: BIOL 2065. FA, SP, SU.

BIOL 2065. Principles of Microbiology Lab. 1 Hour.

Lab portion of BIOL 2060, stressing safety; sterile technique; methods of staining; preparing, culturing, and transferring microorganisms; and identification of an unknown. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Learn about the people who have made important contributions to the understanding of microbiology. 2. Learn the structure and function of prokaryotic cells. 3. Learn how prokaryotic cells survive and reproduce. 4. Learn about information exchange within and between prokaryotic cells. 5. Learn about virus structure, genetics, reproduction, and diversity. Course fee required. Prerequisite: CHEM 1115 or CHEM 1215. Corequisite: BIOL 2060. FA, SP, SU.

BIOL 2320. Human Anatomy. 3 Hours.

For students pursuing health science fields, including pre-allied health, pre-nursing, pre-physical therapy, pre-dental, pre-medical, and many others. Examines the structures of the human body, including muscles, nerves, blood supply, bones, lymph, internal organs, and reproductive anatomy. Includes lectures supplemented with laboratory examinations of cadavers and physical and virtual models. Successful completers will have advanced familiarity with the nomenclature and locations of structures in the human body. Successful completion of BIOL 1010, BIOL 1610, or equivalent recommended prior to enrolling. Recommended prerequisite: BIOL 1010, BIOL 1610, or equivalent course. Corequisite: BIOL 2325. FA, SP, SU.

BIOL 2325. Human Anatomy Lab. 2 Hours.

Lab portion of BIOL 2320. Includes cadaver study. Successful completion of BIOL 1015, BIOL 1615, or equivalent lab course recommended prior to enrolling. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Be quite familiar with structures of the human body. 2. Understand certain medically important concepts. 3. Apply knowledge of the body in future courses and/or occupations. 4. Identify structures of the human body in all regions, including muscles, with some origins and insertions, ligaments and tendons, bones with some anatomical landmarks, organ systems, circulatory routes, and certain neurological pathways of both the central and peripheral nervous system. 5. Explore and reflect on their desire and aptitude to pursue a career in the health care field. Course fee required. Corequisite: BIOL 2320. FA, SP, SU.

BIOL 2350. Fall Flora. 2 Hours.

For students interested in learning: "What kind of plant is that?" Teaches plant classification of trees and shrubs, including how to collect and identify vascular plants, primarily trees and shrubs, using manuals. Corequisite: BIOL 2355. FA.

BIOL 2355. Fall Flora Lab. 1 Hour.

Lab portion of BIOL 2350; requires frequent field trips. Lab fee required. Corequisite: BIOL 2350. FA.

BIOL 2360. Spring Flora. 2 Hours.

For students interested in learning: "What kind of plant is that?" Teaches plant classification of spring wild flowers, including how to collect and identify vascular plants, primarily wild flowers, using manuals. Corequisite: BIOL 2365. SP.

BIOL 2365. Spring Flora Lab. 1 Hour.

Lab portion of BIOL 2360; requires frequent field trips. Lab fee required. Corequisite: BIOL 2360. SP.

BIOL 2370. Economic Botany. 3 Hours.

Focuses on plants and plant products useful to humans, including fibers, forest products, tanning and dyeing material, rubber and other latex products, gums and resins, essential oils, fats and waxes, sugar, starches, and cellulose products, medicinal plants, food plants, spices, and beverage plants, and many others. Prerequisite: BIOL 1010, or BIOL 1610. Offered upon sufficient student need.

BIOL 2400. Plant Kingdom (LS, ALPP). 3 Hours.

Fulfills General Education Life Sciences requirement. Surveys the Divisions traditionally studied by botanists, including structure, reproduction, systematic, and evolution of the major prokaryotic, fungal, algal, and plant groups. This course is designated as an Active Learning Professional Practice (ALPP) course. This course allows students to explore and apply content learned in the course in a professional experience away from the classroom. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Identify, diagram, and describe the major concepts that apply to the structure and function of prokaryotic and eukaryotic cells. 2. Identify, diagram, and describe the major concepts that apply to the structure and function of the tissues, tissue systems, and organs of plants. 3. Identify, diagram, and describe the reproductive processes of the prokaryotes, algae, fungi, and plants. 4. Evaluate and assess the geologic timeline as it relates to the prokaryotes, algae, fungi, and plants. 5. Demonstrate a knowledge of the common plant families that are found in the Mojave Desert, Great Basin, and Colorado Plateau region. Corequisite: BIOL 2405. FA.

BIOL 2405. Plant Kingdom Lab (LAB, ALPP). 1 Hour.

Lab portion of BIOL 2400. This course is designated as an Active Learning Professional Practice (ALPP) course. This course allows students to explore and apply content learned in the course in a professional experience away from the classroom. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Identify, diagram, and describe the major concepts that apply to the structure and function of prokaryotic and eukaryotic cells. 2. Identify, diagram, and describe the major concepts that apply to the structure and function of the tissues, tissue systems, and organs of plants. 3. Identify, diagram, and describe the reproductive processes of the prokaryotes, algae, fungi, and plants. 4. Evaluate and assess the geologic timeline as it relates to the prokaryotes, algae, fungi, and plants. 5. Demonstrate a knowledge of the common plant families that are found in the Mojave Desert, Great Basin, and Colorado Plateau region. Course fee required. Corequisite: BIOL 2400. FA.

BIOL 2420. Human Physiology. 3 Hours.

Required for students pursuing a Biology Secondary Education degree, as well as many pre-allied health, pre-nursing, pre-dental, pre-medical, and other pre-professional programs. Examines how the body's functions are carried out utilizing a systems approach, including blood chemistry, nerve impulse transmission, kidney function, muscle contraction, and heart function. Successful completers of this intensive course will have sufficient familiarity with the details of biological functions to enable them to understand disease processes, treatment procedures, research pursuits, and evolutionary consequences of various aspects of physiology. Successful completion of BIOL 1010, BIOL 1610, or equivalent recommended prior to enrolling. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Expand biological and medical vocabulary and the importance of its use in science. 2. Understand the overall processes of the major body systems: integument, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, respiratory, digestive, reproductive and urinary. 3. Have a basic understanding of cell transport systems, communication, function and how the body systems interact to achieve homeostasis. 4. Apply knowledge gained in the course to clinical cases. Corequisites: BIOL 2425. FA, SP, SU.

BIOL 2425. Human Physiology Lab. 1 Hour.

Lab portion of BIOL 2420. Successful completion of BIOL 1015, BIOL 1615, recommended prior to enrolling. Recommended prerequisites courses: BIOL 1015, BIOL 1615 1615, or BIOL 1615A, or equivalent lab course. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand the overall processes of the major body systems: integument, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, respiratory, digestive, reproductive and urinary. 2. Explain the level of coordination between systems and factors which support homeostasis. 3. Remember biologic and medical vocabulary. 4. Apply the specific knowledge gained in the course to clinical cases. Course fee required. Corequisites: BIOL 2420. FA, SP, SU.

BIOL 2520. Human Anatomy for the Arts. 1 Hour.

Lab course emphasizing skeletal and muscular systems for dance and fine arts students. Covers basic anatomy of humans. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Identify all the bones in the skeletal system. 2. Understand bone composition, structure, development and growth. 3. Understand skeletal muscle structure and function. 4. Identify major muscles and their general functions. 5. Understand joint architect and joint movement terminology. Course fee required. FA.

BIOL 3000R. Advanced Utah Health Scholars Students. 1 Hour.

Helps prepare pre-medical, pre-dental, pre-pharmacy, pre-physician assistant, pre-optometry, pre-physical or occupational therapy, pre-veterinary, pre-nursing, pre-dental hygiene, pre-medical laboratory science, and other undergraduate health students for entry into professional schools. Includes opportunities to hear guest speakers, participate in health-related service learning projects, gain patient exposure and research opportunities, perform job shadowing and volunteer work, visit an international clinic Mexican and/or Navajo medical clinics, receive help with professional school applications, practice mock interviews, receive mentoring, one-on-one advisement/evaluation, and much more. Students must be willing to adhere to a student contract and participate in scheduled activities. Maximum 2 credits may be applied toward Bachelor of Science in Biology degree. Repeatable up to 7 credits subject to graduation and program restrictions. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Associate a civic educational component to their education; 2. Apply needed service, healthcare exposure and leadership in the community. 3. Connect service-based learning to academic studies for pre-health students. 3. Relate to speakers who will discuss a variety of career choices and current pertinent healthcare topics, trends, issues, etc. 4. Develop tools, knowledge, and opportunities to become competitive candidates for a variety of health care training programs. Prerequisite: HLOC 2000. FA, SP, SU.

BIOL 3010. Evolution. 3 Hours.

Required of all Biology majors. Focuses on evolution as a fundamental principle of Biology. Emphasizes evidence for evolution in nature; evolutionary change, including elementary population genetic analysis; evolution of major groups of life forms; natural selection and speciation and their importance in establishing the life forms on Earth. Prerequisite: BIOL 1620 (Grade C or higher). FA, SP.

BIOL 3030. Principles of Genetics. 4 Hours.

Required for all Biology degrees and programs. Exploration of the nature of genetic systems from the molecular to organismal level. Detailed investigations into heredity, information flow, chromatin architecture, gene regulation, and epigenetics as well as examination of genetics from a developmental, evolutionary, and medical perspective. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Describe the basic principles of inheritance at the molecular, cellular, organismal, and population levels. 2. Explain the basic principle of how genetic material is arranged and transmitted. 3. Describe how changes in genetic material occur and their consequences. 4. Relate population genetics to evolution. 5. Articulate the importance of genetics to societal, medical, and personal issues. Prerequisite: BIOL 1620 (Grade C or higher). FA, SP.

BIOL 3040. General Ecology. 3 Hours.

Required of all Biology majors. Focuses on the nature and development of local, regional, and world communities and their relation to environmental factors controlling them. Covers organisms and their geographical distribution, inter-organismic interactions, speciation, and ecological methods of study in aquatic and terrestrial ecosystems. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Show proficiency in four principle perspectives of biology including the dynamic interaction of living systems with each other and their environments. 2. Learn to employ scientific methods to acquire, analyze and apply knowledge of biological phenomena. 3. Develop scientific literacy through extensive exposure to the primary research literature, expected to become adept at deriving information from the data presented in its various forms (e.g. graphs, charts, figures, etc.), and use appropriate scientific terminology (Reading Comprehension). 4. Produce well-written reports and/or research papers covering topics in biology which will be presented in the accepted formats of scientific research articles. (Written Communication) 5. Present scientific information covering specific topics in the biological sciences that will adequately communicate data and information in a clear and logical format. (Oral Presentations) Prerequisite: BIOL 1620 (Grade C or higher) or 1620A (Grade C or higher). Corequisite: BIOL 3045. FA, SP.

BIOL 3045. General Ecology Lab. 1 Hour.

Lab portion of BIOL 3040. Includes frequent field trips. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Learn about the natural history of deserts. 2. Learn about animal and plant adaptations to arid environments. 3. Learn to collect biological field data using plant surveys and mark-recapture techniques. 4. Learn to analyze and interpret biological field data. 5. Learn to communicate the results of field work. Course fee required. Prerequisite: BIOL 1625 or BIOL 1625A (either Grade C or higher). Corequisite: BIOL 3040. FA, SP.

BIOL 3050. Head/Neck Anatomy/Oral Anatomy, Histology, Embryology. 4 Hours.

Covers the structure and anatomical systems of head and neck. Emphasizes bones, muscles, blood supply, glandular tissue, TMJ, nervous system, lymphatic's, fascia and spaces, dental infection, the eye, the ear, and local dental anesthesia that have dental significance. Comprehensive presentation of embryonic and general histological fetal and postnatal development of tissues and structures of the head and oral cavity, including tooth development. Prerequisites: BIOL 2320 and BIOL 2325. FA (EVEN years).

BIOL 3100. Bioethics. 3 Hours.

Open to all students. An examination of the recent advancements in medicine and biological sciences in relation to basic ethical theories and traditional value systems, focusing on human reproduction, medical care, genetic engineering, humans as experimental subjects, environmental issues, and death and dying. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Describe and discuss various concepts and issues in contemporary bioethics. 2. Apply critical thinking skills in analyzing, evaluating, and making decisions regarding complex issues in bioethics. 3. Critique and debate various bioethical issues during class presentations/discussions. 4. Generate tolerance of differing and multiple viewpoints on bioethical issues. Prerequisite: BIOL 3010, BIOL 3030 (Grade C or higher).

BIOL 3110. Scientific Writing. 2 Hours.

Augments research, writing, and communication skills of science majors. On successful completion, students will be able to effectively use scientific literature databases; find, read, understand, and critically assess primary scientific literature; write in a clear, concise, scientific style that will be required in upper-level science classes, including Senior Thesis, and in graduate study or future professions. In order to enter BIOL 3110 with the needed experience in scientific writing, students are required to have completed or be currently enrolled in a Biology course that requires an original, student-designed research project and paper (Examples: BIOL 3150, BIOL 4260, BIOL 4270, BIOL 4350, BIOL 4820, BIOL 4830, or BIOL 4920) or must obtain instructor permission before enrolling. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Effectively use scientific literature databases. 2. Find, read, understand, and critically assess primary scientific literature effectively and efficiently. 3. Write in a clear, concise, scientific context for all types of communication that you will be required to do in upper-level science classes (including senior thesis) and in your professional life (e.g., research reports for publication in primary literature and for corporate distribution). Prerequisite: BIOL 3010, and BIOL 3030, and ENGL 2010 (can be taken concurrently) (All grade C or higher). SP.

BIOL 3140. Comparative Vertebrate Anatomy. 3 Hours.

Fulfills a program elective for all Biology majors. Covers the evolution of vertebrate design, surveying the tissue types that have changed to allow vertebrates to perform specific functions; emphasizing bones and muscles along with special tissues such as feathers, fur, and scales; and highlighting comparisons between groups of vertebrates to reveal different evolutionary pathways. Successful completers will clearly understand and be able to explain major evolutionary trends among vertebrates as well as specific instances where particular adaptations have allowed special functions to develop very efficiently like flying, digging, deep diving, and great running speed. Prerequisite: BIOL 3010 and BIOL 3030 (Both Grade C or higher). Corequisite: BIOL 3145. SP (even).

BIOL 3145. Comparative Vertebrate Anatomy Lab. 1 Hour.

Lab portion of BIOL 3140. Requires dissection of representative vertebrates to learn the 3-dimensional anatomy, emphasizing similarities and differences among large vertebrates and identify major anatomical features. Course fee required. Corequisite: BIOL 3140. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). SP (even).

BIOL 3150. Biostatistics and the Scientific Method. 2 Hours.

Required of students pursuing a Bachelor of Science in Biology. Includes experimental design, methods of data collection, statistical concepts, probability, testing of hypotheses, graphing techniques, estimation, discrete and continuous distributions, chi-square tests, linear regression and correlation, analysis of variance, and parametric and nonparametric tests. Successful completers will be able to identify and apply the proper statistical test(s) in the analysis of given data sets. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate the ability to reason scientifically. 2. Apply the scientific methods in problem solving and evaluating hypotheses. 3. Describe data numerically and graphically. 4. Apply the rules of probability to given situations or events. 5. Perform a variety of parametric and nonparametric tests. Prerequisites: MATH 1050, BIOL 3010, and BIOL 3030 (All grade C or higher). Corequisite: BIOL 3155. FA, SP.

BIOL 3155. Biostatistics and the Scientific Method Lab. 1 Hour.

Lab portion of BIOL 3150, designed to provide opportunities to practice and apply statistical concepts. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate the ability to reason scientifically. 2. Apply the scientific methods in problem solving and evaluating hypotheses. 3. Describe data numerically and graphically. 4. Apply the rules of probability to given situations or events. 5. Perform a variety of parametric and nonparametric tests. Course fee required. Prerequisite: BIOL 3010 and BIOL 3030 (Grade C or higher). Corequisite: BIOL 3150. FA, SP.

BIOL 3200. Invertebrate Zoology. 3 Hours.

Fulfills a program elective for all Biology majors. General study of invertebrate animal phyla including sponges, cnidarians, flatworms, roundworms, rotifers, mollusks, annelids, arthropods, echinoderms, and others, emphasizing characteristics, variations in body plans, life cycles, adaptations, and evolutionary relationships among major groups of animals. Successful completers will identify major invertebrate animal phyla and discuss evolutionary trends pertaining to them. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Describe the basic ground plan of the major higher invertebrate taxa. 2. Discuss unique features of the major higher invertebrate taxa including phylogeny, classification, anatomy, development, physiology, behavior, ecology, natural history, and biomechanics. 3. Identify major invertebrate animal phyla and discuss the diversity and evolutionary trends pertaining to them. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). Corequisite: BIOL 3205.

BIOL 3205. Invertebrate Zoology Lab. 1 Hour.

Lab portion of BIOL 3200, provides hands-on opportunities to dissect and study representatives of the various invertebrate animal phyla, including field trips. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Apply and use proper microscope and dissection techniques when manipulating and dissecting small invertebrate organisms. 2. Identify, draw/sketch, and describe anatomical structures of the invertebrate organisms dissected or observed in the lab. 3. Examine and compare anatomical structures among related invertebrate organisms observed in the laboratory. Course fee required. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). Corequisite: BIOL 3200.

BIOL 3230R. Cadaver Practicum. 2 Hours.

For students who desire more experience in human dissection. Students will be instructed in the maintenance, dissection, and demonstration of the human cadaver. Requires six hours of dissection per week. Limited enrollment course. Repeatable up to 8 credits subject to graduation restrictions. Course fee required. Prerequisites: BIOL 2320; AND BIOL 2325; AND Instructor permission. FA, SP.

BIOL 3250. Cancer Biology. 2 Hours.

For Biology majors, and other interested students. Examines "Cancer," a catch-all term for hundreds of diseases that share the common feature of cells that forgo the normal regulatory systems of control and proliferate within the body. Focuses on general principles of molecular nature and cell behavior common in the disease state. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Describe the molecular, cellular, and environmental mechanisms that lead to the development of cancer. 2. Describe how cancer metastasizes and leads to high rates of mortality. 3. Understand the treatment of cancer and what cellular pathways are targeted by various treatment methods. 4. Be able to research information regarding the development and treatment of cancer and present your findings to a general audience. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). SU.

BIOL 3300. Introduction to Bioinformatics. 3 Hours.

In this course, students learn fundamental concepts and methods in bioinformatics, a field at the intersection of biology and computing. It surveys a wide range of topics including computational sequence analysis, sequence homology searching and motif finding, gene finding and genome annotation, protein structure analysis and modeling, genomics and SNP analysis, DNA microarrays and gene expression analysis, Proteomics, network/systems biology, and biological knowledge discovery. It serves a gateway course for all entry-level bioinformatics graduate students. Students should be enrolled in the graduate program of bioinformatics, or have advanced training in at least one of the following areas: computer science, applied mathematics, quantitative biomedical sciences, bioengineering, biotechnology, and biostatistics. Prerequisite: BIOL 3030 (Grade C or higher).

BIOL 3340. Plant Anatomy. 3 Hours.

Fulfills a program elective for all Biology majors. Study of the microscopic structure of the stems, leaves, roots, and reproductive structures of vascular plants with emphasis on the flowering plants. Successful completers will be able to categorize plants according to microscopic structure of tissues. Prerequisites: BIOL 1620; and BIOL 2400. Corequisite: BIOL 3345. FA (Odd years).

BIOL 3345. Plant Anatomy Lab. 1 Hour.

Lab portion of BIOL 3340. Provides experience using compound microscopy to study the features of various plant tissues such as stems, roots, leaves, and reproductive structures. Lab fee required. Prerequisites: BIOL 1625 or BIOL 1625A; and BIOL 2405. Corequisite: BIOL 3340. FA (odd).

BIOL 3360. Developmental Biology. 3 Hours.

Fulfills a program elective for students pursuing a Bachelor of Science in Biology degree. Covers major development patterns of animal embryos, stressing recent advances in the roles played by organizational genes and interactions among chemical gradients that cause tissue differentiation, and emphasizing constraints posed by developmental necessities on evolutionary change. Successful completers will be able to describe the evolution of different body plans, with similarities and differences among major animal taxa, and the crucial importance of early stages of development in the proper functioning of mature organisms. Recommended prerequisite course, BIOL 3550. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Describe the mechanisms of development at the molecular and cellular level. 2. Describe the major processes involved in the formation of organisms. 3. Successfully communicate scientific information as it pertains to developmental biology. 4. Critically evaluate and discuss scientific material. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). SU.

BIOL 3450. General Microbiology. 3 Hours.

Can be used to fulfill a core requirement for Biology majors. Emphasizes relationships between microbes and their ecosystems, and biotechnological applications including food production, spoilage and preservation, fermentation technology, agriculture, waste disposal, water lecture/discussion. Successful completion of the course gives students an understanding of the importance of microbes to biological communities. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Learn about the people who have made important contributions to the understanding of microbiology. 2. Learn the structure and function of prokaryotic cells. 3. Learn how prokaryotic cells survive and reproduce. 4. Learn about information exchange within and between prokaryotic cells. 5. Learn about virus structure, genetics, reproduction, and diversity. Prerequisites: BIOL 3010, BIOL 3030, and CHEM 2310 (Grade C or higher). Corequisite: BIOL 3455. FA.

BIOL 3455. General Microbiology Lab. 1 Hour.

Lab portion of BIOL 3450; provides basic and applied methodologies, including isolation of commercially useful strains and production and purification of industrial products. Lab fee required. Prerequisite: CHEM 2315 (Grade C or higher). Corequisite: BIOL 3450. FA.

BIOL 3470. Introduction to Immunology. 3 Hours.

For Biology majors who desire more coverage of the immune system and its response to microbes and viruses. General properties of immune responses, cells and tissues of the immune system, antibody-mediated and cell-mediated mechanisms of immunity, immunity to microbes, immunodeficiency and AIDS, autoimmune diseases, and transplantation will be discussed. Uses a variety of teaching methods including lecture/discussion, review of scientific journal articles, writing assignments, videos, quizzes, and exams. Successful completion of the course gives students a better understanding of the importance of the immune system to overall health and wellness of humans and other mammalian systems. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Expand knowledge of the cells and tissues of the immune system, and the chemical interactions among them. 2. Understand the differences and complimentary roles of the innate and acquired immune systems. 3. Evaluate historical advances and current problems in the field of immunology. 4. Apply knowledge gained in scientific communication. Prerequisites: BIOL 3010 and BIOL 3040 and CHEM 3510 (all Grade C or higher).

BIOL 3550. Eukaryotic Cell Biology. 3 Hours.

Can be used to fulfill a core requirement for Biology majors. Incorporating biochemistry and molecular biology, provides a solid background in cell biology, a dynamic area of study in Biology that merges studies of cell structure and cell function. Includes the basics of cell structure, function, metabolism, signaling, and communication, using textbook material and primary literature sources. Successful completers will be prepared for further study in histology, pathophysiology, and developmental biology. Inclusive Access Course Material fees may apply, see Fees tab under each course section for details. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Remember the internal organization of the structure of the cell, the cell cycle, the role of stem cells engineering, the techniques for visualizing cells. 2. Understand the relationship between internal elements of the cell in relation to the outside environment, the cell transformation process that leads to manifestation of cancer. 3. Identify the nature of cellular dysfunction(s) in a given case scenario including causes of diseases. 4. Formulating hypotheses based on the function of proteins, enzymes, messengers. 5. Assessing and concluding best techniques to study cellular conditions, alterations of cellular mechanisms, impact of cellular behaviors and diseases. Prerequisites: BIOL 3010, BIOL 3030; and CHEM 2310 (Grade C or higher). Corequisite: BIOL 3555. FA.

BIOL 3555. Eukaryotic Cell Biology Lab. 1 Hour.

Lab portion of BIOL 3550, introducing modern cell biology techniques. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Remember the internal organization of the structure of the cell, the cell cycle, the role of stem cells engineering, the techniques for visualizing cells. 2. Understand the relationship between internal elements of the cell in relation to the outside environment, the cell transformation process that leads to manifestation of cancer. 3. Identify the nature of cellular dysfunction(s) in a given case scenario including causes of diseases. 4. Formulate hypotheses based on the function of proteins, enzymes, messengers. 5. Assess and conclude best techniques to study cellular conditions, alterations of cellular mechanisms, impact of cellular behaviors and diseases. Course fee required. Prerequisite: CHEM 2315 (Grade C or higher). Corequisite: BIOL 3550. FA.

BIOL 3700. Advanced Medical Terminology. 2 Hours.

Strongly recommended for students entering pre-professional programs including pre-medicine, pre-dental, pre-veterinary, pre-chiropractic, pre-physician assistant; very useful for biology majors; open to all students. Emphasizes word roots, suffixes, and prefixes of both Greek and Latin origin, medical abbreviations, as well as proper pronunciation and spelling of medical terms. Medical case studies and narratives will be analyzed. Material is organized according to body systems, some basic anatomy and physiology is included along with pathologic terminology, laboratory tests, and clinical procedures. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Analyze and understand simple to advanced medical terms, alone and in the context of applying them to medical case studies, reports, and medical narratives. 2. Develop facility in the correct spelling and pronunciation of medical terms. 3. Learn and understand commonly used medical abbreviations. 4. Associate medical terms with the proper body systems, laboratory tests, and clinical procedures. 5. Describe symptoms and manifestations of some medical conditions. FA (odd).

BIOL 4040. Medical Ecology. 1 Hour.

Medical Ecology includes those aspects of the environment that have a direct bearing on human health. The environments and habits of people affect their risk of disease and well-being. The concept of ecosystem functions and services helps to describe global processes that contribute to our health, helping to cleanse the air we breathe, the water we drink, and the food we eat. Environmental degradation often leads to alterations in these aspects, leading to various states of ill health. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand basic epidemiological concepts. 2. Demonstrate a familiarity with a variety of infectious diseases. 3. Understand the relationship between urbanization and emerging infectious disease. 4. Understand the role of vaccines and immunization in community health. 5. Be able to explain the relationship between climate change and infectious diseases 6. Understand basic atmospheric science and the effect of the atmosphere on health. 7. Be able to explain basic hydrology and the effect of water quality on health. 8. Be able to explain the impact of farming on the local environment and food safety. Prerequisite: BIOL 1620 (Grade C or higher).

BIOL 4190. Mammalian Histology. 3 Hours.

Fulfills a program elective for Biology majors who desire a basic understanding of the structural organization of cells, tissues, and organ systems at the microscopic level, focusing on the characteristics of individual cell types within each tissue type as well as how the cells and tissues are organized to form organs, while emphasizing the dynamic relationships between structure and function. Prerequisite: BIOL 3010, BIOL 3030 & BIOL 3040 (All Grade C or higher). Corequisite: BIOL 4195. SP.

BIOL 4195. Mammalian Histology Lab. 1 Hour.

Lab portion of BIOL 4190. Lab fee required. Prerequisite: BIOL3010, BIOL 3020, BIOL 3040, BIOL 3045 (Grade C or higher). Corequisite: BIOL 4190. SP.

BIOL 4200. Plant Taxonomy (ALPP). 2 Hours.

Fulfills a program elective for Biology majors who desire experience in plant systematics. Focuses on the collecting of plants and systems of classification. Successful completers will identify plants in the field using diagnostic techniques including the use of dichotomous keys. This course is designated as an Active Learning Professional Practice (ALPP) course. This course allows students to explore and apply content learned in the course in a professional experience away from the classroom. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate a knowledge of, and use the terminology and nomenclature necessary for, the identification of vascular plants. 2. Identify, diagram, and describe the organs and reproductive structures of vascular plants. 3. Evaluate, identify, and classify vascular plants based on physical characteristics. 4. Use dichotomous keys and other literature in the identification of vascular plants, in the lab, and in the field. 5. Demonstrate a knowledge of the common plant families that are found in the Mojave Desert, Great Basin, and Colorado Plateau region. Prerequisites: BIOL 1610 or BIOL 1610A; and BIOL 2400. Corequisite: BIOL 4205. SP.

BIOL 4205. Plant Taxonomy Lab (ALPP). 2 Hours.

Lab portion of BIOL 4200 designed so students gain hands on experience collecting and classifying plants through field trips, plant dissection, study of herbarium samples, microscopy, and the use of dichotomous keys. Field trips and plant collection required. This course is designated as an Active Learning Professional Practice (ALPP) course. This course allows students to explore and apply content learned in the course in a professional experience away from the classroom. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate a knowledge of, and use the terminology and nomenclature necessary for, the identification of vascular plants. 2. Identify, diagram, and describe the organs and reproductive structures of vascular plants. 3. Evaluate, identify, and classify vascular plants based on physical characteristics. 4. Use dichotomous keys and other literature in the identification of vascular plants, in the lab, and in the field. 5. Demonstrate a knowledge of the common plant families that are found in the Mojave Desert, Great Basin, and Colorado Plateau region. Course fee required. Prerequisites: BIOL 1615 or BIOL 1615A; and BIOL 2405. Corequisite: BIOL 4200. SP (even).

BIOL 4235. General Parasitology Lab. 1 Hour.

Lab portion of BIOL 4230, emphasizing morphology and identification of representative groups of parasites and diagnostic techniques of parasitic disease. Lab fee required. Prerequisite: BIOL 3010 and BIOL 3030 (Grade C or higher). Corequisite: BIOL 4230.

BIOL 4240. Virology. 3 Hours.

Examines the fundamentals of virology. Covers viral structure, biochemistry, genomics, viral multiplication cycles, and techniques used in virus studies. Examines bacteriophage, plant, and animal viruses. Recommended prerequisites BIOL 3450 and BIOL 3455 OR BIOL 3550 and BIOL 3555 (Both grade C or higher). ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand replication cycle for positive/negative and double/single stranded viruses. 2. Understand host defenses to viral infection. 3. Understand viral strategies for overcoming host defenses. 4. Understand how viruses impact the environment. 5. Understand viruses' role in research. 6. Understand viruses' role in cancer. Prerequisites: BIOL 3010, BIOL 3030, CHEM 2310, and CHEM 2315 (All grade C or higher). Corequisite: BIOL 4245. FA.

BIOL 4245. Virology Lab. 1 Hour.

Introduces students to fundamentals of viral-based laboratory techniques and protocols. Covers eukaryotic cell culture, biochemistry, genomics, viral life cycles, and techniques used in virus studies. Utilize bacteriophage, plant, and animal viruses. Recommended prerequisites, BIOL 3455 and BIOL 3555. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Learn aseptic technique for working with viruses. 2. Learn methods for culturing and studying bacteriophage. 3. Learn cell culture techniques for HeLa cells and Sf9 cells. 4. Learn techniques for enumeration and identification of cultured viruses. 5. Learn techniques for storing and maintaining virus cultures. Course fee required. Prerequisites: BIOL 3010, BIOL 3030, CHEM 2310, and CHEM 2315 (All grade C or higher). Corequisite: BIOL 4240. FA.

BIOL 4260. Herpetology. 2 Hours.

Fulfills a program elective for Biology majors. Covers the biology of amphibians and reptiles including evolutionary history, functional morphology, physiological ecology, biogeography, reproductive, and population ecology. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Discuss the biology of amphibians and reptiles. 2. Synthesize and present scientific information orally. 3. Appraise and critique scientific literature. 4. Evaluate scientific information in writing. 5. Evaluate sources of scientific information. Prerequisite: BIOL 3040 and BIOL 3045 (Grade C or higher). Corequisite: BIOL 4265. FA (odd).

BIOL 4265. Herpetology Lab. 1 Hour.

Lab portion of BIOL 4260, covering systematics, natural history, and collecting/sampling techniques. Field trips required. Lab fee required. Prerequisites: BIOL 3040 and BIOL 3045 (Grade C or higher). Corequisite: BIOL 4260. FA (odd).

BIOL 4270. Ichthyology. 2 Hours.

Fulfills a program elective for Biology majors. Covers the biology of fishes, including evolutionary history, functional morphology, physiological ecology, and biogeography, with an emphasis on Utah species. Successful completers will be able to identify various fishes, especially those found locally. Offered upon sufficient student need. Prerequisite: BIOL 3040 and BIOL 3045 (Grade C or higher). Corequisite: BIOL 4275. FA (even).

BIOL 4275. Ichthyology Lab. 1 Hour.

Lab portion of BIOL 4270, covering identification, systematic and natural history. Field trips required. Lab fee required. Offered upon sufficient student need. Prerequisite: BIOL 3040 and BIOL 3045 (Grade C or higher). Corequisite: BIOL 4270. FA (even).

BIOL 4280. Marine Biology. 3 Hours.

For students in the physical and biological sciences, covers global oceans with an introduction to oceanography and ocean processes; major marine ecosystems, with an emphasis on the Pacific Coast of California; marine ecology, emphasizing energy flow, populations and community structure and formation; and human impacts on the seas by considering positive and negative human activities that alter or enhance marine resources and environments. Field trip required. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand the biology of marine organisms. 2. Synthesize scientific information on marine organisms and present it orally. 3. Appraise and critique scientific literature on marine organisms. 4. Evaluate and synthesize scientific information on marine organisms in writing. 5. Evaluate sources of scientific information. Course fee required. Prerequisite: BIOL 3010, BIOL 3030, BIOL 3040 & BIOL 3045 (All grade C or higher). SP.

BIOL 4300. Molecular Biology. 3 Hours.

The objective of this course is to help students develop a thorough understanding of the fundamentals of modern molecular biology from the standpoint of recognized molecular mechanisms for controlling basic processes in a cell, and also from an applied standpoint for using molecular biology as a tool in the laboratory. The course will take an in-depth look at traditional subjects, like manipulation of nucleic acids, the polymerase chain reaction, recombinant vectors, DNA replication, mutation and repair. It will also address some rapidly evolving fields including next-generation sequencing, microarrays, processing of RNA, microRNA and proteomics. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand the evolution of the science of Molecular Biology from 1953 to present. 2. Understand the technical terminology associated to Molecular Biology. 3. Apply, analyze, and evaluate Molecular Biology techniques and the corresponding outcomes. Prerequisites: BIOL 3030 (Grade C or higher). Corequisite: BIOL 4305. SP.

BIOL 4305. Molecular Biology Laboratory. 1 Hour.

The laboratory component of BIOL 4300. It reinforces basic laboratory skills and techniques in molecular biology and introduces students to advanced techniques. Students will learn principles and practice of nucleic acid purification (plasmid and genomic DNA, RNA), DNA restriction digestion and analysis, polymerase chain reaction (PCR), and more. Students will also learn the technical applications of polymerases, modifying enzymes, restriction enzymes and the different DNA cloning vectors. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand the evolution of the science of Molecular Biology from 1953 to present. 2. Understand the technical terminology associated to Molecular Biology. 3. Apply, analyze, and evaluate Molecular Biology techniques and the corresponding outcomes. Course fee required. Prerequisite: BIOL 3030 (Grade C or higher). Corequisite: BIOL 4300. SP.

BIOL 4310. Advanced Bioinformatics. 3 Hours.

Builds on topics covered in BIOL 3300. Analyze and interpret large biological data sets. Genome- and transcriptome-based quantitative methods. Data management techniques. Exercises in evaluating research studies and in developing computational methods for research. Semester project. Prerequisite: BIOL 3300 (Grade C or higher).

BIOL 4350. Animal Behavior. 3 Hours.

Fulfills a program elective for all Biology majors. Covers the definition of behavior and how it is measured, the evolution and genetics of behaviors, and the wide spectrum of behaviors demonstrated by animals that help them survive and reproduce. Successful completers will be able to explain the many aspects of animal behavior, why those behaviors exist, and some specific examples of current research in each area of behavior. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). Corequisite: BIOL 4355. SP (odd).

BIOL 4355. Animal Behavior Lab. 1 Hour.

Lab portion of BIOL 4350. Students will learn how behavior can be measured based on a clear definition of what behavior involves and will be shown the various techniques used by researchers to study behavior, in both field and laboratory settings, and the proper design of such studies. Students will design and carry out their own research projects on a particular behavior and write up the results of their study in journal article format. Successful completion will help students to create a simple research study of animal behavior in the field or in a laboratory setting, and can explain strengths and weaknesses of each. Lab fee required. Prerequisites: BIOL 3010 and BIOL 3030 (Grade C or higher). Corequisite: BIOL 4350. SP (odd).

BIOL 4380. Ornithology. 2 Hours.

Fulfills a program elective for all Biology majors, covers the biology of birds including their origin, evolution, structure, habits, adaptations, distribution, and classification. Successful completers will identify various birds, especially those found locally, and to discuss evolutionary and ecological relationships among them. Prerequisite: BIOL 3010, BIOL 3030 & BIOL 3040 (All grade C or higher). Corequisite: BIOL 4385. SP (Odd years).

BIOL 4385. Ornithology Lab. 1 Hour.

Lab portion of BIOL 4380. Field trips required. Lab fee required. Prerequisite: BIOL 3045 (Grade C or higher). Corequisite: BIOL 4380. SP (odd).

BIOL 4400. Pathophysiology. 3 Hours.

Review of homeostasis pathways that maintain normal physiology of organ systems, with an emphasis on the disruption of these homeostatic pathways that result in disease. Pathophysiology fulfills a program elective for students pursuing a Bachelor of Science in Biology degree. ****COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Understand (in detail) the physiological systems associated with defense and healing. 2. Understand (in detail) the processes and effects of disrupted physiology. 3. Demonstrate a thorough understanding of the functioning of major body processes. 4. Demonstrate a basic understanding of how different vertebrate taxa accomplish the functions of organ systems in different ways and in different environments. Prerequisites: BIOL 2320; AND BIOL 2325; AND BIOL 2420; AND BIOL 2425 (Grade C or higher). FA.

BIOL 4411. Mammalogy. 3 Hours.

Fulfills a program elective for all Biology majors. Covers the unique adaptations and life histories of mammals, and surveys each order of mammal, describing evolution (where known), natural histories, and geographical ranges of representatives of that order. Successful completers will be able to describe what makes a mammal, its evolution, the adaptations that enabled mammals to dominate the earth for the last 65 million years, and current problems facing many mammals as well as possible solutions to those problems. Completion of BIOL 3140/3145 Comparative Vertebrate Anatomy/Lab is recommended before enrolling in this course. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Show proficiency in five principle perspectives of biology including the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms; the dynamic interaction of living systems with each other and their environments; and the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life. 2. Develop a critical skepticism of ideas and information while maintaining receptivity to potential alternative predications. 3. Produce well-written reports and/or research papers covering topics in biology which will be presented in the accepted formats of scientific research articles. Corequisite: BIOL 4415. FA.

BIOL 4415. Mammalogy Lab. 1 Hour.

Lab portion of BIOL 4411, includes training to skin and stuff representative mammals collected by instructors, review of skins and skeletons for identification, and in articulation of mammalian skeletons for display, as well as observation of mammals and their signs in the wild. Successful completers will obtain a strong background of general knowledge about mammals, and specific knowledge of representatives of each taxon, especially local species and those of economic importance. Lab fee required. Prerequisite: BIOL 3045 (Grade C or higher). Corequisite: BIOL 4411. FA (even).

BIOL 4440. General Entomology. 3 Hours.

Fulfills a program elective for all Biology majors. Includes study of the structure, development, classification, and life histories of insects, as well as ecological, economic, and management considerations. Successful completers will be able to identify common insects and discuss the economic and ecological impacts of insects. Prerequisite: BIOL 3150 (Grade C or higher). Corequisite: BIOL 4445. Offered upon sufficient student need.

BIOL 4445. General Entomology Lab. 1 Hour.

Lab portion of BIOL 4440. Lab fee required. Prerequisite: BIOL 3155 (Grade C or higher). Corequisite: BIOL 4440. Offered upon sufficient student need.

BIOL 4460. Plant Ecology. 2 Hours.

Fulfills a program elective for all Biology majors. Emphasizes limiting factors on plant growth and distribution; adaptations and responses at the individual, population, and community levels; species distributions along environmental gradients; and community structure and analysis. Successful completers will be able to identify possible factors limiting plant growth and distributions in certain areas. Offered on sufficient student demand. Prerequisite: BIOL 3150 (Grade C or higher). Corequisite: BIOL 4465.

BIOL 4465. Plant Ecology Lab. 1 Hour.

Laboratory portion of BIOL 4460. Includes data collection on required field trips, learning to analyze data sets, and review current scientific journal articles related to plant ecology. Lab fee required. Prerequisite: BIOL 3155 (Grade C or higher). Corequisite: BIOL 4460. FA (odd).

BIOL 4500. Comparative Vertebrate Physiology. 3 Hours.

Fulfills a physiology elective for students pursuing a Bachelor of Science in Biology degree. Covers physiological adaptations of vertebrates, including general functions of each organ system and enlightening examples of specific adaptations in those systems in certain taxa. Successful completers will demonstrate a thorough, broad understanding of how vertebrate organisms accomplish the necessary tasks of regulating the internal environment in a variety of ways. Prerequisites: BIOL 3010, BIOL 3030 and CHEM 1220 (Grade C or higher). Corequisite: BIOL 4505. FA.

BIOL 4505. Comparative Vertebrate Physiology Lab. 1 Hour.

Lab portion of BIOL 4500. Lab fee required. Prerequisite: CHEM 1225 (Grade C or higher). Corequisite: BIOL 4500. FA.

BIOL 4520. Psychobiology. 3 Hours.

Psychobiology is a senior-level course with a laboratory component. Nerve cell conduction, neurotransmission, and neuroanatomy are investigated in the context of human cognition and behavior through lecture, discussion, neural simulation, and lab dissection. A research-based approach is used throughout the course, and students complete research projects in lab using neural simulation software. Ethical issues in brain research are integrated into discussions when relevant. Dual listed with PSY 4520. Students may only take one course for credit. Co-requisite: PSY 4525 or BIOL 4525. Prerequisites: PSY 3710 OR BIOL 2420 (either Grade C or higher); AND PSY 3000 OR BIOL 3150 (either Grade C or higher); AND Psychology major, Biology major, or Integrated Studies major with Psychology or Biology emphasis. SP (Even).

BIOL 4525. Psychobiology Lab. 1 Hour.

Lab portion of PSY 4520 / BIOL 4520. Lab fee required. Dual listed with PSY 4525. Students may only take one course for credit. Prerequisites: PSY 3710 OR BIOL 2420 (either Grade C or higher); AND PSY 3000 OR BIOL 3150 (either Grade C or higher); AND Psychology major, Biology major, or Integrated Studies major with Psychology or Biology emphasis. Corequisites: PSY 4520 or BIOL 4520. SP (even).

BIOL 4600. Plant Physiology. 3 Hours.

Fulfills a physiology elective for students pursuing a Bachelor of Science in Biology degree who desire more coverage of botany topics. Emphasizes physical and chemical basis of plant life relative to absorption, transpiration, manufacture of foods, growth, and reproduction. Successful completers will have an understanding of the interaction between the structure and function of plants. Prerequisites: BIOL 3010, BIOL 3030; and CHEM 1220 (Grade C or higher). Corequisite: BIOL 4605. SP.

BIOL 4605. Plant Physiology Lab. 1 Hour.

Lab portion of BIOL 4600, providing hands-on activities involving observation and measurement of various plant functions and requiring students to collect and summarize data in reports. Lab fee required. Prerequisite: CHEM 1225 (Grade C or higher). Corequisite: BIOL 4600. SP.

BIOL 4810R. Independent Research I. 1-4 Hours.

Individual areas of study will be assigned to students based on preparation and interest. Students will be expected to write a paper (using supporting scientific sources) related to the problem studied. No more than 4 credits in any combination of internship, independent research, independent study, and senior thesis can count toward Biology degree requirements. Variable credit: 1.0 - 4.0. Repeatable up to 4 credits subject to graduation and program restrictions. Prerequisites: BIOL 3110 (can be concurrently enrolled); AND Advanced standing; AND ENGL 2010; AND Instructor permission. FA.

BIOL 4820R. Independent Research II. 1-4 Hours.

Individual areas of study will be assigned to students based on preparation and interest. Students will be expected to write a paper (using supporting scientific sources) related to the problem studied. No more than 4 credits in any combination of internship, independent research, independent study, and senior thesis can count toward Biology degree requirements. Variable credit: 1 - 4. Repeatable up to 4 credits subject to graduation and program restrictions. Prerequisites: BIOL 3110 (can be concurrently enrolled); AND Advanced standing; AND ENGL 2010; AND Instructor permission. SP.

BIOL 4830R. Independent Research III. 1-4 Hours.

Individual areas of study will be assigned to students based on preparation and interest. Students will be expected to write a paper (using supporting scientific sources) related to the problem studied. No more than 4 credits in any combination of internship, independent research, independent study, and senior thesis can count toward Biology degree requirements. Prerequisites: BIOL 3110 (can be concurrently enrolled); AND Advanced standing; AND ENGL 2010; AND Instructor permission. Variable credit: 1 - 4. Repeatable up to 4 credits subject to graduation and program restrictions. SU.

BIOL 4890R. Life Science Internship I. 1-8 Hours.

For students who are granted and accept an internship with an approved employer, or a governmental, non-profit, or private agency, that provides an extensive learning experience in the field of biology. Students must be supervised by an agency representative and a faculty advisor. Written contracts of expectations and terms and permission of the Biology Department Chair are required. No more than 4 credits in any combination of internship, independent research, independent study, and senior thesis can count toward Biology degree requirements. Variable credit: 1.0 - 8.0. Repeatable up to 8 credits subject to graduation and program restrictions. Prerequisites: Advanced standing; and Instructor permission. Offered based upon sufficient student need.

BIOL 4891. Life Science Internship II. 1-8 Hours.

For students who are granted and accept an internship with an approved employer, or a governmental, non-profit, or private agency, that provides an extensive learning experience in the field of biology. Students must be supervised by an agency representative and a faculty advisor. Written contracts of expectations and terms and permission of the Biology Department Chair are required. No more than 4 credits in any combination of internship, independent research, independent study, and senior thesis can count toward Biology degree requirements. Variable credit: 1.0 - 8.0. Repeatable up to 8 credits subject to graduation and program restrictions. Prerequisites: Advanced standing; and Instructor permission. Offered based upon sufficient student need.

BIOL 4910. Senior Seminar I. 1 Hour.

Senior Seminar I is required of students pursuing a Bachelor of Science in Biology degree. Topics and themes will vary. Each student will be expected to lead the class in a current research and literature in the general fields of biological science for one week and submit a synthesis paper on a selected topic. Limited enrollment course. Course fee required. Prerequisites: ENGL 2010 and Advanced Standing in the Biology Program. FA.

BIOL 4920. Senior Seminar II. 1 Hour.

Required of students pursuing a Bachelor of Science in Biology degree. This is a Senior Seminar course in which topics and themes will vary. Each student will be expected to lead the class in a current research and literature in the general fields of biological science for one week and submit a synthesis paper on a selected topic. Limited enrollment course. Course fee required. Prerequisites: ENGL 2010, AND Advanced Standing in the Biology Program. SP.

BIOL 4930R. Senior Thesis. 1-4 Hours.

For Biology majors who wish to write a scientific paper of publishable quality that details an extended individual research project planned and carried out by the student under faculty supervision, approved by a committee of at least two faculty members and the department chair. Usually, a semester or two of independent research (BIOL 4810, BIOL 4820, and/or BIOL 4830) will precede registration for the senior thesis. Students will be expected to present oral and written reports of experimental results. Final draft of the thesis will be due two weeks before the beginning of final exams. No more than 4 credits in any combination of internship, independent research, independent study, and senior thesis can count toward Biology degree requirements. Permission of the Biology Department Chair is required. Variable credit: 1 - 4. Repeatable up to 4 credits subject to graduation and program restrictions. Prerequisites: BIOL 3110 (can be concurrently enrolled), and Senior standing; and Instructor permission. Offered based upon sufficient student need.

BIOL 4990. Seminar in Biology. 0.5-3 Hours.

For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, students request some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This seminar course provides a variable-credit context for these purposes. As requirements, this seminar course must first be pre-approved by the department chair; second, it must provide at least nine contact hours of lab or lecture for each credit hour offered; and third, it must include some academic project or paper (i.e., credit is not given for attendance alone). This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other non-traditional instruction methods. Note that this course is an elective and does not fulfill general education or program requirements. Variable credit: 1.0 - 3.0. Repeatable as topics vary. Prerequisite: Instructor permission. Offered based upon sufficient student need.