

Biological Sciences

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Department Chair

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Program Description

The Dixie State University Biology program introduces students to an integrated perspective of study allowing them to consider the many facets of living systems. From its intricate molecular machinations, to the function and form of organisms, and to the complexities of ecological communities, students gain an understanding of life through the entire spectrum of its properties.

Students are provided the opportunity to learn through traditional coursework, extensive laboratory experience, and student-driven research projects. Advanced laboratories for molecular and microbiology experiments, a controlled desert garden and greenhouse facility, a marine reef aquarium, and extensive fieldwork in the unique ecosystems of the surrounding areas are some of the resources utilized for scientific study.

The Bachelor of Science in Biology degree at DSU is designed to provide students with a firm foundation and understanding of the unifying concepts of Biology, including those at the molecular, cellular, and ecosystem levels. It is also essential that biology students develop a strong background in the areas of Chemistry, Physics, and Math because the comprehension and mastery of biological concepts is contingent upon the integration of these other sciences.

All Biological Sciences students will complete a set of core courses focusing on general Biology, genetics, ecology, evolution, cellular and molecular biology, scientific writing, and data analysis. These core areas are intended to prepare an underlying support for further study in Biology. Upon completion of the core, students may select other upper-division Biology courses that allow them to explore and develop in one or more areas (zoology, botany, microbiology, ecological, or molecular) of their choosing.

The versatility of the Biology degree prepares successful undergraduate Biology majors to enter professional programs in medicine, dentistry, and veterinary medicine, as well as other professional programs and graduate schools. Graduates of the Biology program may also opt for governmental or private-sector careers in such fields as natural resource management, environmental research, health care, the biomedical industry, independent laboratory research, or science teaching.

The Bachelor of Science Biology, Secondary Education and the Bachelor of Science in Biology with Integrated Science, Secondary Education degrees at Dixie State University prepare students to become Biology teachers at the secondary level. Students who complete the Biology Education program will be recommended to the Utah State Office of Education for licensure to teach biology at the secondary education level (grades 7-12). The Biology with Integrated Science option prepares students to become middle level Science teachers. In addition to fulfilling the General Education requirements of Dixie State University, students will complete a set of core courses in the sciences plus 39 credits of Secondary Education courses taught through the Education Department that will satisfy the State of Utah requirements for secondary teachers. Students will also be required to take the appropriate PRAXIS II exam(s) for secondary licensure.

Students are strongly encouraged to meet with an advisor in the Biological Sciences Department each semester to outline their programs of study and course sequences.

Course Prefix

- BIOL

Degrees and Certificates

- Bachelor of Science in Bioinformatics (catalog.dixie.edu/programs/biology/bachelor_of_science_in_bioinformatics)
- Bachelor of Science in Biology (catalog.dixie.edu/programs/biology/bachelor_of_science_in_biology)
- Bachelor of Science in Biology - Biological Sciences Emphasis (catalog.dixie.edu/programs/biology/bs_in_biology_biological_sciences_emphasis)
- Bachelor of Science in Biology - Biomedical Sciences Emphasis (catalog.dixie.edu/programs/biology/bs_in_biology_biomedical_emphasis/#text)
- Bachelor of Science in Biology - Natural Sciences Emphasis (catalog.dixie.edu/programs/biology/bs_in_biology_natural_sciences_emphasis)

- Bachelor of Science in Biology - Biology Education Emphasis (catalog.dixie.edu/programs/biology/bachelor_of_science_in_biology_secondary_education)
- Bachelor of Science in Biology with Integrated Science - Biology Education Emphasis (catalog.dixie.edu/programs/biology/bachelor_of_science_in_biology_with_integrated_science_secondary_education)
- Bachelor of Arts/Science in Integrated Studies - Biology Emphasis (catalog.dixie.edu/programs/interdisciplinaryartsandsciences/bachelor_of_science_bachelor_of_arts_in_integrated_studies__biology_emphasis)
- Minor in Biology (catalog.dixie.edu/programs/biology/minor_in_biology)
- Minor in Biology Education (catalog.dixie.edu/programs/biology/minor_in_biology_education)

Admission Process & Requirements

1. Completion of the following courses

BIOL 1610 & BIOL 1615	Principles of Biology I and Principles of Biology I Lab	5
BIOL 1620 & BIOL 1625	Principles of Biology II and Principles of Biology II Lab	5
CHEM 1210 & CHEM 1215	Principles of Chemistry I and Principles of Chemistry I Lab	5
CHEM 1220 & CHEM 1225	Principles of Chemistry II and Principles of Chemistry II Lab	5
BIOL 3010 or BIOL 3030	Evolution Principles of Genetics	3

2. An overall GPA of 2.7 or higher

3. Complete Application (includes Personal Statement)

Incoming freshman & current students, who don't meet admission requirements, interested in pursuing biology, will be matriculated as Pre-Biology Majors.

Student may apply for admission when course & GPA requirements are complete or during the semester they will finish said course requirements. Students applying during the semester they are finishing course requirements can receive tentative admission. Full admission will be granted pending the students meets course & GPA requirements at the conclusion of the semester.

Prospective Biology Majors who meet the requirements must set an appointment with the biology advisor and bring completed application form. Once the application is verified, the student will be matriculated under the desired B.S Biology Emphasis.

Students, who don't meet the application requirements, may go through an appeal process. The Biology Department Chair, Biology Advisor and select Biology Faculty will hear all admission appeals.

All upper-division biology courses except BIOL 3010, BIOL 3030, BIOL 3040/45 and BIOL 3000R, will be closed to students except those matriculated in a **B.S Biology Emphasis, Biology Minor, or Integrated Studies with a Biology Emphasis.***

*** Except for Upper-division biology courses used in the Allied Health degrees and B.S Chemistry.**

Biology Career Information

Career Strategies

In addition to the required coursework, students can do the following to enhance their career opportunities:

- Develop excellent laboratory skills
- Take additional computer science and math courses to increase analytical skills
- Develop strong oral and written communication skills
- Maintain a high grade point average
- Gain related experience through part-time jobs, internships, or volunteer research
- Learn federal and state job application processes

Career Opportunities *

This major prepares you for a multitude of employment possibilities including graduate schools and careers in biomedicine and research, allied health, private industry, and education. Many pre-medicine, pre-dentistry and pre-veterinary science majors enroll in biology as their undergraduate major. Job opportunities in the biological sciences are as diverse as the science itself.

A Biology degree prepares students for graduate or professional training in the biomedical sciences or employment in research, industry, or governmental agencies.

Job Outlook *

Employment of Biological scientists is projected to grow 14-16% between 2010 and 2020, which is about average for all occupations.

Salary Range *

Earning potential varies by industry. The median annual salary for a bachelor's degree graduate in the Biological Sciences is about \$39,020, which is 20% above the average for all occupations. Those who earn advanced degrees in areas such as microbiology, genetics, botany, or bio-technology can expect to more than double entry level salaries of baccalaureate graduates.

Biology Educational Career Information

Career Strategies

In addition to the required coursework, students can do the following to enhance their career opportunities:

- Develop excellent laboratory skills
- Take additional computer science and math courses
- Develop strong oral and written communication skills
- Maintain a high grade point average
- Gain related experience through part-time jobs, internships or volunteer research
- Be well-prepared for student teaching experience

Career Opportunities *

Teaching is a very rewarding and noble profession, and most teachers find their jobs fulfilling, especially for those who love what they teach and enjoy working with young people. Current employment opportunities for graduates from Biology Education programs are strong, particularly for those who also have a chemistry endorsement or integrated science endorsement.

Job Outlook *

The demand for secondary science teachers will continue at a growth rate of 15-17% until 2020. Population growth and a need to replace retiring biology teachers will contribute to a steady demand, which is highest in rural areas and low-income communities.

Salary Range *

The median salary for a middle or high school teacher is \$51,960 to \$53,230, with an average starting salary of about \$33,000 in Utah (all are 9-month contracts). Many schools report difficulty in filling teaching positions in math and science, so teachers in those subjects should have better job prospects, and steady salary increases can be obtained by furthering one's education.

* Information from the Occupational Outlook Handbook, 2012

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. 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. FA, SP, SU.

BIOL 1015. General Biology 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. Lab fee required. Corequisite: BIOL 1010. FA, SP.

BIOL 1100. General Botany (LS). 3 Hours.

Fulfills General Education Life Sciences requirement. Introductory course in botany. Emphasizes the scientific method; cell processes including basic chemistry, cellular level structure and function; principles of inheritance; photosynthesis; evolution and ecology; history and methods of taxonomy focusing on the plant kingdom. Corequisite: BIOL 1105. FA.

BIOL 1105. General Botany Lab. 1 Hour.

Lab portion of BIOL 1100. Lab fee required. Corequisite: BIOL 1100. FA.

BIOL 1200. Human Biology. 3 Hours.

Covers basic anatomy and physiology of humans for non-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. Prerequisite: BIOL 1010 or BIOL 1610. FA.

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. 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. Corequisite: BIOL 1615. FA, SP, SU.

BIOL 1615. Principles of Biology I Lab. 1 Hour.

Lab portion of BIOL 1610. Lab fee required. Corequisite: BIOL 1610. FA, SP, SU.

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

Honors course. Lab portion of BIOL 1610A. Lab fee required. Prerequisite: Admission to the DSU Honors Program OR program director permission. Corequisite: BIOL 1610A. FA.

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. 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. Lab 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 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 of basic biology is assumed. 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. Lab 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. Lab fee required. Recommended prerequisite: BIOL 1015, BIOL 1615, or equivalent lab course. 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. 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. Corequisite: BIOL 2405. FA.

BIOL 2405. Plant Kingdom Lab. 1 Hour.

Lab portion of BIOL 2400. Lab 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. Recommended prerequisite: BIOL 1010, BIOL 1610, or equivalent course. Corequisite: BIOL 2425. FA, SP, SU.

BIOL 2425. Human Physiology Lab. 1 Hour.

Lab portion of BIOL 2420. Lab fee required. Successful completion of BIOL 1015, BIOL 1615, recommended prior to enrolling. Recommended prerequisite: BIOL 1015, BIOL 1615, or equivalent lab course. Corequisite: BIOL 2420. FA, SP, SU.

BIOL 3000R. Rural Health Scholars. 1 Hour.

Helps prepare pre-dental, pre-pharmacy, pre-physician assistant, pre-optometry, 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 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. Course is graded pass/fail. Repeatable up to 8 credits subject to graduation and program restrictions. Course fee required. FA, SP.

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 (either 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. 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. Prerequisite: BIOL 1620 (either 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. Lab 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. 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. Prerequisite: BIOL 3010 and BIOL 3030 (Grade C or higher), and ENGL 2010 (can be taken concurrently). FA, 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, BIOL 3030 & BIOL 3040 (all Grade C or higher). Corequisite: BIOL 3145. SP (Even years).

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. 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. Lab 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. 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. Lab 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. 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. Prerequisite: 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 years).

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: BIOL 3550. 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. 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 3460. Biology of Infectious Disease. 3 Hours.

For Biology majors. Provides a modern view of bacterial and viral diseases in order to build a foundation for more advanced studies in microbiology, microbial pathogenesis, and immunology. The agents of infectious diseases demonstrate excellent examples of natural selection. The various adaptations of the pathogen and defenses of the host illustrate some of the most amazing mechanisms in biology. Covers characteristics of microbes, corresponding defense mechanisms evolved by hosts of these microbes, and mechanisms of pathogenesis during infection. Molecular, cellular, and physiological concepts will be developed through use of both clinical and epidemiological pictures of selected diseases. Successful completers will have an understanding of the importance of microbes to biological communities and how evolution has impacted and continues to influence aspects of disease transmission and control. On hiatus. Prerequisites: BIOL 3010 and BIOL 3030 (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. 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. Lab fee required. Prerequisite: CHEM 2315 (Grade C or higher). Corequisite: BIOL 3550. FA.

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. 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. 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. Prerequisites: BIOL 1610; and BIOL 2400. Corequisite: BIOL 4205. SP (Even years).

BIOL 4205. Plant Taxonomy Lab. 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. Lab fee required. Prerequisites: BIOL1615 or BIOL 1615A; and BIOL 2405. Corequisite: BIOL 4200. SP (Even years).

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. SP.

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). 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 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. 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 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. 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. Lab 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.

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 years).

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. 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. Recommended prerequisites: BIOL 3140 and BIOL 3145. Prerequisite: BIOL 3010, BIOL 3030 & BIOL 3040 (All grade C or higher). Corequisite: BIOL 4415. FA (Even years).

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 years).

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 years).

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. Corequisite(s): 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.