BIOLOGY (BIOL)

The Biology Program provides a comprehensive educational experience consistent with the liberal arts philosophy of the University. The contemporary curriculum includes hands-on learning through laboratory and field experience. Small classes and low student-to-faculty ratios allow meaningful interaction between biology students and faculty, both in and out of the classroom. Professors advise students' academic scheduling and career options. Students are encouraged to conduct research projects with faculty and to participate in internships with private entities and local agencies.

Biology majors receive broad training in the life sciences leading to a variety of careers. Our graduates pursue entry-level careers in biological research, education, and applied sciences such as wildlife biology, fisheries, and forestry. The Biology Major prepares graduates to succeed in graduate school and professional schools in disciplines such as medicine, dentistry, veterinary medicine, physical therapy, ecology, and wildlife biology. The Program's flexibility allows students to specialize in areas of their interest.

Eight emphases culminating in Bachelor of Science degrees are offered: Fisheries and Aquatic Ecology, Wildlife and Conservation Biology, Environmental Biology and Ecology, Pre-Medicine/Cell and Molecular Biology, Pre-Nursing, Pre-Physical Therapy, Secondary (Education) Licensure, and General Biology. Three 5-year accelerated sequence program emphases culminating in Bachelor of Science and Masters degrees are offered: Ecology, Ecology and Environmental Management, and Health Sciences. All majors receive training in fundamental biological principles and in supporting sciences appropriate for each emphasis.

The Fisheries and Aquatic Ecology Emphasis is recommended for students seeking careers associated with the management and/ or conservation of fisheries and aquatic natural resources. Successful completion of this emphasis qualifies students for certification as an Associate Fisheries Professional as recognized by the American Fisheries Society (with a separate application to the American Fisheries Society upon graduation). Students graduating with this emphasis may choose to continue their education in graduate programs, gain entry-level positions with tribal, state, or federal natural resource agencies, or attain employment with non-profit conservation organizations, or environmental consulting firms.

The Wildlife and Conservation Biology Emphasis is recommended for students interested in a career in wildlife ecology or management or in conservation biology. Students graduating with this emphasis may continue their education in graduate programs, obtain entry level positions with state and federal natural resources agencies, work for non-profit conservation organizations, or obtain employment with environmental consulting firms. Students may choose to take all the courses required to meet the educational component for certification through The Wildlife Society.

The Environmental Biology and Ecology Emphasis is recommended for students with career interests in environmental biology including ecology, environmental science, and natural resource management. Students with this emphasis may continue in graduate programs in ecological research.

The Pre-Medicine/Cell and Molecular Biology Emphasis is recommended for students pursuing careers in biotechnology, graduate programs in laboratory biology, and professional school in most health fields, including medicine, veterinary medicine, dentistry, pharmacy, and physician assistantships. Because the admission requirements of these different schools vary greatly, students must consult with their advisors to design a curriculum that meets their professional interests.

The Pre-Nursing Emphasis is designed for students planning to enter professional programs in nursing, medical technology, chiropractics, optometry, physical therapy, and public health. Because the admission requirements of these schools vary greatly, students must consult with their advisors to design a curriculum that meets their professional interests.

The Pre-Physical Therapy Emphasis is designed primarily for students planning to enter a professional program in physical therapy. Pursuit of this emphasis may also prove beneficial for students interested in occupational therapy or sports medicine. Since the admission requirements of healthcare-related professional programs vary greatly, students must consult with their advisors to design a curriculum that meets their long-term goals.

The Secondary Licensure Emphasis qualifies students for the State of Colorado License in Secondary Science Education.

The General Biology Emphasis is our most flexible major. Students pursuing this emphasis work closely with their academic advisor to select from a variety of upper division elective courses and supporting science courses to create a self-designed major in areas such as botany, zoology, molecular ecology, and integrative biology. This emphasis allows students to integrate the study of structure and function at all levels of biological organization from molecules to ecosystems and across all branches of the tree of life.

The Ecology Emphasis allows students to complete the B.S. in Biology and the Master of Science in Ecology in five years. Students graduating with this emphasis are prepared for professional careers in federal and state natural resource agencies and related organizations and businesses.

The Ecology and Environmental Management Emphasis allows students to complete the B.S. in Biology and the Master in Environmental Management (MEM) in five years. Students graduating with this emphasis are prepared for environmental jobs and to assume constructive roles in local, national, and global communities.

The Health Sciences Emphasis allows students to complete the B.S. in Biology and the Master of Science in High Altitude Exercise Physiology (HAEP) in five years. Students graduating with this emphasis gain more hands-on patient experience, preparing them to enter professional programs in various health fields.

Program Goals

- Employ scientific methods to formulate and test hypotheses, analyze results and draw valid conclusions;
- Use current instrumentation and methodologies to acquire and analyze biological data;
- Apply biological concepts to solve problems;
- Conduct independent library research of the scientific literature, write scientific papers using accepted format, and communicate effectively with peer scientists and the general public; and
- Make knowledgeable choices to satisfy personal and professional goals.

Program Requirements

The courses listed for each of the following emphases are the minimum requirements. Higher-level supporting courses may be appropriate for students pursuing certain careers. Students should consult with their advisors for proper course selections. All majors require a Capstone Course.

- Biology Comprehensive Major: Environmental Biology and Ecology Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-environmental-biology-ecology/)
- Biology Comprehensive Major: Fisheries and Aquatic Ecology Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-fisheries-aquatic-ecology/)
- Biology Comprehensive Major: General Biology Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-general-biology/)
- Biology Comprehensive Major: Pre-Medicine/Cell and Molecular Biology Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-pre-medicine-cell-molecular-biology/)
- Biology Comprehensive Major: Pre-Nursing Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-pre-nursing/)
- Biology Comprehensive Major: Pre-Physical Therapy Emphasis (https://catalog.western.edu/undergraduate/programs/biology/pre-physical-therapy/)
- Biology Comprehensive Major: Secondary Licensure Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-secondary-licensure/)
- Biology Comprehensive Major: Secondary Licensure Emphasis (with a 3+2 Master of Arts in Education) (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-secondary-licensure-3-2/)
- Biology Comprehensive Major: Wildlife and Conservation Biology Emphasis (https://catalog.western.edu/undergraduate/programs/biology/biology-comprehensive-wildlife-conservation-biology/)
- Biology Minor (https://catalog.western.edu/undergraduate/programs/biology/biology-minor/)
- Ecology and Environmental Management Emphasis (with a 3+2 Master in Environmental Management) (https://catalog.western.edu/undergraduate/programs/biology/ecology-environmental-management-master-environmental-management/)
- Ecology Emphasis (with a 3+2 Master of Science in Ecology) (https://catalog.western.edu/undergraduate/programs/biology/ecology-master-ecology/)
- Health Sciences Emphasis (with a 3+2 MS in High Altitude Exercise Physiology) (https://catalog.western.edu/undergraduate/programs/biology/haep-3-2/)

Substitutions

The following substitutions may be used to satisfy biology degree requirements: CHEM 331 Organic Chemistry I, CHEM 332 Organic Chemistry II, CHEM 334 Organic Chemistry Laboratory I, and CHEM 335 Organic Chemistry Laboratory II may be substituted for CHEM 231 Introduction to Organic Chemistry and Biochemistry and CHEM 234 Introductory Organic and Biochemistry Laboratory; PHYS 170 Principles of Physics I (GT-SC2)/PHYS 185 Laboratory Physics I (GT-SC1) and PHYS 171 Principles of Physics II (GT-SC2)/PHYS 186 Laboratory Physics II (GT-SC1) may be substituted for PHYS 140 Introductory Physics (with laboratory) (GT-SC1); PHYS 190 General Physics I (GT-SC2) and PHYS 191 General Physics II (GT-SC2) may be substituted for PHYS 170 Principles of Physics I (GT-SC2) and PHYS 171 Principles of Physics II (GT-SC2).

Capstone Course Requirement

The following courses in the Biology Major fulfill the capstone course requirement (some may be specific to the selected emphasis): BIOL 495 Senior Seminar, BIOL 496 Senior Thesis, EDUC 409 Secondary Student Teaching, orESS 601 Quantitative Research Methods.

Biology Courses

BIOL 110. Introduction to Healthcare. (1 Credit)
Students are exposed to a variety of healthcare professions (i.e. medicine, dentistry, nutrition). Various healthcare professionals will describe their field of expertise. These specialized previews into a variety of medical professions will provide students with a framework of the medical system.

BIOL 120. Studies in Biology (GT-SC2). (3 Credits)
An introduction to selected biological topics and the methods of science through an exploration of current topics such as evolution, bioethics and conservation biology. Students may only take this course once for credit. GT-SC2

BIOL 130. Environmental Biology (GT-SC2). (3 Credits)
An introduction to basic biological principles as they apply to interactions between organisms and their environment. Consideration is given to biotic and abiotic interactions, energy flow, biogeochemical cycling, population growth, biodiversity, basic cell biology, genetics, and evolution with a special emphasis on human impacts on these biological systems. This course establishes a strong foundation in applied biology from a scientific perspective. GT-SC2

BIOL 135. Environmental Biology Laboratory (GT-SC1). (1 Credit)
An experimental approach in both the field and laboratory to explore fundamental biological principles including biotic and abiotic interactions, energy flow, biogeochemical cycling, population growth, biodiversity, basic cell biology, genetics and evolution. Additional course fee applies. Prerequisite or corequisite: BIOL 130 or instructor permission. GT-SC1

BIOL 150. Biological Principles (with laboratory) (GT-SC1). (4 Credits)
An introduction to the central unifying concepts of biology including the biochemical foundations of life, cell structure and function, cell metabolism, genetics, and evolution. Laboratories introduce students to the process and methods of science through investigative experiences. This course is designed for the science major. A year of high school biology and a year of high school chemistry are highly recommended. Additional course fee applies. Prerequisites: University Entry-Level Expectations met for mathematics and English. GT-SC1

BIOL 151. Diversity and Patterns of Life (with laboratory). (4 Credits)
An overview of organismal diversity and evolution. Through a taxonomic survey, students are introduced to prokaryotic and eukaryotic diversity and evolution including microorganisms, fungi, plants, and animals. Fundamentals of evolution including the history of life, evidence for common ancestry, mechanisms of evolutionary change, and speciation are covered. Organismic structure, function, and ecology are also explored. Laboratories introduce students to the process and methods of science through investigative experiences. This course is designed for the science major. A year of high school biology and a year of high school chemistry are highly recommended. Additional course fee applies. Prerequisites: University Entry-Level Expectations met for mathematics and English. Or instructor permission.

BIOL 197. Special Topics. (1-6 Credits)

BIOL 200. Environmental and Public Health (GT-SC2). (3 Credits)
An appraisal of man's surroundings which influence his health, including an introduction to the societal structure designed to cope with health problems. Of particular benefit to those who plan to major in the social sciences or enter the field of public health. GT-SC2

BIOL 201. Introduction to Microbiology (with laboratory). (4 Credits)
A study of the basic aspects of microbiology that includes an introduction to the identification, physiology, growth and control of microbes. Laboratory exercises will emphasize aseptic, pure culture, and identification techniques. Additional course fee applies.

BIOL 220. Preparation for Healthcare. (1 Credit)
Prepares students to apply to graduate-level healthcare programs. Specifically, students will receive guidance about test preparation, selection of programs, personal statement writing, resume construction, and interviewing skills. Additionally, general topics relevant to a career in medicine (i.e. work/life balance, networking, etc.) will be discussed during the course

BIOL 250. Medical Terminology. (3 Credits)
Students will learn to clearly communicate in a medical situation using appropriate terminology.

BIOL 292. Independent Study. (1-4 Credits)

BIOL 297. Special Topics. (1-6 Credits)

BIOL 300. Basic Nutrition. (3 Credits)
An introduction to the science of human nutrition. Consideration is given to the chemical nature and functions of the major groups of nutrients, the function of the digestive system, energy metabolism and balance, weight control, and nutrition for fitness. Human nutrition during the life span is also addressed. Prerequisites: BIOL 150; and CHEM 101 or CHEM 111; or instructor permission.

BIOL 301. GENERAL ECOLOGY. (3 Credits)
An introduction to basic ecological principles and their relationships to natural systems. Human impact on the natural systems is assessed. Prerequisites: BIOL 150 and BIOL 151. Prerequisite or corequisite: ENG 103. Or instructor permission.

BIOL 302. Ecology Laboratory and Recitation. (2 Credits)
An experimental approach in both field and laboratory to explore fundamental ecological principles. Students gather and analyze data to address ecological hypotheses, learn practical ecological skills (performing field techniques, using statistical and graphical tools, and interpreting ecological software), and develop oral and written communication skills. Additional course fee applies. Prerequisites: BIOL 150, BIOL 151, and CHEM 113 or instructor permission. Prerequisite or corequisite: BIOL 301.

BIOL 310. Cell Biology. (3 Credits)
An introduction to cellular function and structure. Prerequisites: BIOL 150 and BIOL 151. Prerequisite or corequisite: CHEM 231 or CHEM 331; and ENG 103; or instructor permission.

BIOL 312. Genetics (with recitation). (4 Credits)
A course in Mendelian inheritance, linkage, chromosomal aberrations, molecular genetics, gene regulation, genetic engineering, and population genetics. Prerequisites: BIOL 150, BIOL 151; and CHEM 231 or CHEM 331; or instructor permission.

BIOL 313. Cell and Genetics Laboratory. (2 Credits)
An introduction to experimentation and laboratory techniques used in cell biology, microbiology, and genetics, including experimental design, data analysis, and presentation of research results. Additional course fee applies. Prerequisite or corequisite: BIOL 310 and BIOL 312; or instructor permission.

BIOL 317. Genome Analysis (with laboratory). (3 Credits)
This course introduces students to the appropriate mathematical techniques to answer questions about information contained in genetic sequences. These techniques may include dynamic programming, motif similarity, Bayesian models, hidden Markov models, principal component analysis, and clustering. Students use standard genome query tools to annotate genomic DNA. BIOL 317 and MATH 317 cannot both be taken for credit. Prerequisites: BIOL 312, BIOL 313, and MATH 213; or instructor permission.

BIOL 320. Ornithology (with laboratory and recitation). (4 Credits)
An introduction to the study of bird evolution, ecology, and conservation. This course has a strong field component providing frequent opportunities to observe birds in their native environments. Additional course fee applies. Prerequisite: BIOL 301 or instructor permission

BIOL 322. Mammalogy (with laboratory and recitation). (4 Credits)
An introduction to the study of mammal taxonomy, evolution, ecology and conservation. Additional course fee applies. Prerequisite: BIOL 301 or instructor permission.

BIOL 325. Invertebrate Zoology with Laboratory. (4 Credits)
Invertebrate Zoology is a comprehensive overview of invertebrate organisms that comprise over 98% of all animals on Earth. This course delves into various aspects of the anatomy, biodiversity, ecology, evolutionary adaptations, physiology, systematics and taxonomy of invertebrate organisms. The laboratory portion of this course has a strong field component providing ample opportunity for students to observe invertebrates in their natural habitats and gain an appreciation for the ecological roles invertebrates play in local ecosystems. Prerequisite: BIOL 151 or instructor permission.

BIOL 327. Field Entomology (with laboratory). (4 Credits)
An introduction to the world of the most diverse and abundant form of animal life on Earth through an experiential, field, and laboratory class. The course emphasizes field study, collection and preservation, identification, ecology, and natural history. Additional course fee applies. Prerequisite: BIOL 301 or instructor permission.

BIOL 342. Microbiology (with laboratory). (4 Credits)
An introduction to microbial morphology, identification, physiology, genetics, and microbiology laboratory techniques. A brief consideration is given to fungi. Additional course fee applies. Prerequisites: Biology Nucleus and BIOL 313; or instructor permission.

BIOL 352. Botany (with laboratory). (4 Credits)
Using field and laboratory experiences this course explores the diversity within the plant kingdom using a comparative approach to examine evolutionary trends and relationships.Students are introduced to the structure and function of plants through an investigation of plant cells, tissues, organs, and basic physiological processes. Economic importance, human uses, and significance of plants to society are emphasized. Additional course fee applies. Prerequisites: BIOL 150, BIOL 151, and ENG 102; or instructor permission.

BIOL 353. Rocky Mountain Flora. (3 Credits)
A field and laboratory course focusing on identification of flowering plants commonto the Western Slope of the Colorado Rocky Mountains. This course covers methods of plant collection and preservation, field identification, natural history, and ecology as well as local plants of particular human interest, including those that are medically important, edible, and poisonous. Additional course fee applies. Prerequisites: BIOL 150 and BIOL 151; or instructor permission.

BIOL 355. Spring Fungi Rocky Mountains (with laboratory). (3 Credits)
An introduction to the enigmatic kingdom of Fungi. Fungal classification, life cycles, morphology, development, symbioses, and ecological and economic significance will be explored through lecture, lab, and field experiences. Methods of fungal collection, preservation, and identification will be covered with a focus on spring and snowbank fungi of the Rocky Mountains. Prerequisites: BIOL 150 and 151; or instructor permission.

BIOL 362. EVOLUTION. (3 Credits)
This course provides a comprehensive overview of evolutionary processes, mechanisms, and analytical techniques. Topics include population genetics, conservation genetics, phylogenetic analysis, adaptation, behavioral evolution, sexual selection, and speciation. Evolutionary perspectives in human health and medicine, conservation biology, agriculture, natural resource management, biotechnology, global change, and emerging diseases are considered. Prerequisites: BIOL 312; or ENVS 350, ENVS 370, ENVS 390, and either BIOL 151 or Both BIOL 130 and BIOL 135; or instructor permission.

BIOL 372. Human Anatomy and Physiology I (with laboratory). (4 Credits)
An introduction to regulatory mechanisms which maintain normal body function. Specific topics include cytology, histology, integumentary system, skeletal system, muscular system, and nervous system. The course is designed for pre-nursing and exercise and sport science students. Additional course fee applies. Prerequisites: BIOL 150; CHEM 231 or CHEM 111; or instructor permission.

BIOL 373. Human Anatomy and Physiology II (with laboratory). (4 Credits)
A continuation of BIOL 372 Human Anatomy and Physiology I. Specific topics include immunology, cardiovascular system, respiratory system, digestive system, excretory system, reproductive system, and endocrine system. Additional course fee applies. Prerequisite: BIOL 372 or instructor permission.

BIOL 380. Pathophysiology. (3 Credits)
Explore pathological states that affect a variety of body systems. Coverage of pathophysiological processes will include discussion about the causes of, progression of, and possible cures for various conditions. Students will be encouraged to compare normal human anatomy and physiology with the pathological states studied. The knowledge gained during this course will aid students in future academic based tests and careers in the biomedical field. Pre-requisites: BIOL 372 & 373 OR ESS 201.

BIOL 392. Independent Study in Biology. (1-4 Credits)
A study in a specific area of biology under the direction of a faculty member. May be taken for a maximum of four credits. Graded Satisfactory/Unsatisfactory only.

BIOL 397. Special Topics. (1-10 Credits)

BIOL 398. Biology Teaching Practicum. (1 Credit)
Under faculty supervision, students participate in the development of laboratory and field experience exercises, as well as in their instruction and execution. Specifically designed for students serving as teaching assistants in Biology.May be taken for a maximum of 3 credits. Graded Satisfactory/Unsatisfactory only. Prerequisite: BIOL 150, BIOL 151, and instructor permission.

BIOL 420. Molecular Biology (with laboratory). (4 Credits)
A study of the molecular mechanisms by which cellular processes are controlled in prokaryotic and eukaryotic cells. Topics include the biochemistry of macromolecular processes, the structure of genes and chromosomes, the genetic and molecular techniques used to study gene expression, and the transcriptional and translational control of gene expression. The laboratory includes recombinant DNA techniques to manipulate the genome of a model organism. Additional course fee applies. Prerequisites: Biology Nucleus, BIOL 313, and CHEM 471; or instructor permission.

BIOL 430. Wildlife Ecology and Management (with laboratory). (4 Credits)
Principles of ecology are applied to population and habitat management towards wildlife conservation. Tools used by wildlife biologists to restore endangered species, harvest sustainable populations, reduce overpopulated species, and to monitor and study populations are emphasized. Habitat management approaches are discussed, along with human dimensions in wildlife conservation. A field component allows students to investigate wildlife populations and habitat issues in the Gunnison Basin. Additional course fee applies. Prerequisite: BIOL 301 or instructor permission. Co-requisite: BIOL 431.

BIOL 431. Wildlife Techniques Workshop. (1 Credit)
A one week intensive field course focuses on wildlife conservation issues and wildlife management techniques such as trapping and marking wildlife, radio telemetry, population monitoring, GPS and GIS, and wildlife conflict resolution. The course includes a trip outside the basin; a field trip course fee is required. This course meets the week prior to the start of the fall semester. Prerequisite: BIOL 301 or instructor permission. Co-requisite: BIOL 430.

BIOL 433. Wildlife Population Analysis. (3 Credits)
Students will learn about tools and techniques used by wildlife managers for analysis of populations, such as distance sampling, mark-recapture methods, survival analysis, home range analysis, and population modeling. Students will be introduced to quantitative techniques and learn to use computer software that will allow them to analyze wildlife populations. Prerequisites: BIOL 301 and MATH 213.

BIOL 435. Animal Behavior. (3 Credits)
An introduction to the study of animal behavior. This course emphasizes the importance of ecology and evolution in understanding animal behavior. Prerequisites: Biology Nucleus or instructor permission.

BIOL 440. Conservation Biology. (3 Credits)
This course addresses the reduction in biological diversity of the planet and suggested solutions to prevent further reduction. Integrating themes are drawn from scientific disciplines such as population genetics, ecology, evolutionary biology, botany, zoology, molecular biology, biochemistry, and wildlife management. Prerequisites: BIOL 312; or ENVS 350, ENVS 370, ENVS 390, and either BIOL 151 or both BIOL 130 and BIOL 135; or instructor permission.

BIOL 444. Colorado Ecoregions. (3 Credits)
A survey of the three main ecoregions of Colorado including the Great Plains, the Southern Rocky Mountains, and the Colorado Plateau. Students travel throughout Colorado and explore the ecology and natural history of the ecosystems by hiking, backpacking, and river rafting. Content includes an evolutionary perspective on ecosystem features and the adaptations of species characterizing each system, as well as applied issues in natural resources management. Additional course fee applies. Prerequisite: BIOL 301 or instructor permission.

BIOL 454. Developmental Biology (with laboratory). (4 Credits)
An examination of the embryology of vertebrates, stressing mammalian embryonic development and comparisons with amphibians, reptiles, and birds. Additional course fee applies. Prerequisites: Biology Nucleus and BIOL 313; or instructor permission.

BIOL 467. Biology of Fishes. (3 Credits)
A comprehensive overview of the biology and diversity of fishes. Topics that are covered include fish anatomy, behavior, biodiversity, conservation, ecology, evolution, morphology, physiology, and zoogeography. Additional topics include experimental design, data analysis and interpretation, and verbal and written professional communication. Colorado fishes will be emphasized, but other freshwater and marine fishes will also be covered. Prerequisites: BIOL 301 or instructor permission.

BIOL 468. Ichthyology Laboratory. (1 Credit)
A laboratory course focused on several aspects of the biology and diversity of fishes. Laboratory and field activities include a phylogenetic overview of fishes, as well as examining the unique morphological characteristics, ecological roles, evolutionary histories, physiological adaptations, and zoogeography of major taxonomic groups (e.g., jawless fishes, cartilaginous fishes, bony fishes, and common fish families). Laboratory and field exercises focus heavily on the local fauna, although marine and other freshwater taxa are also included. Prerequisite or corequisite: BIOL 467 or instructor permission.

BIOL 470. Fisheries Management (with laboratory). (4 Credits)
This course includes a lecture and laboratory and focuses on theory and methods associated with exploited populations of fish and other aquatic organisms. Covered topics include population growth, sustainable yields, conservation, community interactions, human impacts, and policy. Management techniques including sampling methods, monitoring, habitat assessment, and regulations will also be taught. Local fisheries will be highlighted in laboratory/field activities, and nationwide/global examples will be discussed in class. Prerequisite: BIOL 301 or instructor permission.

BIOL 474. Comparative Animal Physiology (with laboratory). (4 Credits)
An analysis of function in invertebrates and vertebrates, utilizing an environmental approach and emphasizing evolutionary trends in physiological systems. Prerequisites: Biology Nucleus; and PHYS 140, or PHYS 170 & PHYS 185, or PHYS 190 & PHYS 185; or instructor permission..

BIOL 476. Aquatic Ecology (with laboratory). (4 Credits)
A study of physical, chemical, and biological parameters of lakes and streams in the functioning of freshwater ecosystems. Additional course fee applies. Prerequisite: BIOL 301 or GEOL 320; or instructor permission.

BIOL 477. Plant Ecology (with laboratory). (3 Credits)
An introduction to plant populations and communities, including their role within terrestrial ecosystems. Additional course fee applies. Prerequisites: BIOL 301; or instructor permission.

BIOL 481. Forest Ecology (with laboratory). (4 Credits)
Ecology of forest species, communities, landscapes, and ecosystems, with a focus on the Gunnison Basin. Topics include tree physiology, species interactions, fire and disturbance, succession, forest types, climate, forest management and restoration. Labs and field trips will provide hands-on experience and practical skills in tree identification, forest mensuration, vegetation sampling, statistics and GIS. Students will develop and conduct independent/group research projects. Additional course fee applies. Prerequisites: BIOL 301, MATH 213; or instructor permission.

BIOL 492. Independent Study. (1-4 Credits)

BIOL 495. Senior Seminar. (1 Credit)
An examination of biological subdisciplines through an investigation of the primary literature. The professional practices, procedures, and standards of the subdiscipline are discussed. This course may be repeated for credit and must be taken twice to fulfill the capstone course requirement. Prerequisites: Biology Nucleus; and MATH 151 or MATH 213; or instructor permission.

BIOL 496. Senior Thesis. (2-4 Credits)
An advanced research experience resulting in a Senior Thesis, supervised by a thesis committee of three faculty members including at least one biologist. A proposal of the project must be approved by the thesis committee prior to project initiation. In addition to completing the written thesis, students must present the results of their work in a departmental seminar. This course satisfies the capstone course requirement. Prerequisites: Biology Nucleus; and MATH 151 or MATH 213; or instructor permission.

BIOL 497. Special topics. (1-6 Credits)

BIOL 499. Internship In Biology. (1-6 Credits)

BIOL 606. Ecological Research Methods. (3 Credits)
A field- and lab-based course that builds on the capacity for students to conceptualize and complete ecological research projects. Students identify ecological questions and develop research to address them. Scientific communication to varied stakeholders is emphasized throughout. Prerequisite: acceptance to the MS or MEM program.

BIOL 613. Advanced Ecological Analysis. (3 Credits)
Students gain knowledge and experience in advanced statistical analysis and simulation modeling using ecological data. Specific topics include linear and generalized linear models, mixed-effects models, general additive models, multivariate analysis, spatial analysis, and simulation models. Emphasis is placed on working with data, writing and commenting scripts, and use of a wide range of internet resources for the R language and environment. Prerequisites: admission to the MEM or MS programs.

BIOL 620. Ornithology. (4 Credits)
A graduate-level survey of bird evolution, ecology, and conservation. This course has a strong field component providing frequent opportunities to identify, observe, and conduct research on birds in their native environments. Prerequisite: acceptance to MS or MEM program.

BIOL 622. Mammalogy. (4 Credits)
An advanced overview of the current science of mammal taxonomy, evolution, ecology and conservation. Prerequisite: acceptance to MS or MEM program.

BIOL 625. Invertebrate Zoology with laboratory. (4 Credits)
Invertebrate Zoology is a comprehensive overview of invertebrate organisms that comprise over 98% of all animals on Earth. This course delves into various aspects of the anatomy, biodiversity, ecology, evolutionary adaptations, physiology, systematics and taxonomy of invertebrate organisms. The laboratory portion of this course has a strong field component providing ample opportunity for students to observe invertebrates in their natural habitats and gain an appreciation for the ecological roles invertebrates play in local ecosystems. Prerequisite: Graduate Student Status.

BIOL 627. Field Entomology. (4 Credits)
A detailed examination of the most diverse and abundant form of animal life on Earth through field and laboratory research. The course emphasizes field study, collection and preservation, identification, ecology, and natural history. Students develop familiarity with current scientific literature and complete a written research paper following peer-reviewed journal formatting. Prerequisite: acceptance to MS or MEM program.

BIOL 630. Wildlife Ecology and Management. (4 Credits)
Principles of ecology are applied to population and habitat management towards wildlife conservation. Tools used by wildlife biologists to restore endangered species, harvest sustainable populations, reduce overpopulated species, and to monitor and study populations are emphasized. Habitat management approaches are examined, along with human dimensions in wildlife conservation. Students will conduct field study to investigate populations and habitat issues, and develop best management practices for wildlife in the Gunnison Basin. Prerequisite: Admission to MS or MEM program. Co-requisite: BIOL 631.

BIOL 631. WILDLIFE TECHNIQUES WORKSHOP. (1 Credit)
A one week intensive field course focuses on wildlife conservation issues and wildlife management techniques such as trapping and marking wildlife, radio telemetry, population monitoring, GPS and GIS, and wildlife conflict resolution. The course includes a trip outside the basin; a field trip course fee is required. This course meets the week prior to the start of the fall semester. Prerequisite: Admission to MS or MEM program, instructor permission. Co-requisite: BIOL 630.

BIOL 633. Wildlife Population Analysis. (3 Credits)
Students learn about tools and techniques used by wildlife managers for analysis of populations, such as distance sampling, mark-recapture methods, survival analysis, home range analysis, and population modeling. Students are introduced to quantitative techniques and learn to use computer software that allows them to analyze wildlife populations. Prerequisites: admission to the MEM or MS programs.

BIOL 640. Conservation Biology. (3 Credits)
Conservation Biology is an applied science that addresses the reduction in biological diversity of the planet and suggests solutions to prevent further reduction. Conservation biology serves as an integrating link in biology drawing from scientific disciplines such as population genetics, ecology, evolutionary biology, botany, zoology, molecular biology, biochemistry and wildlife management. Prerequisite: acceptance to MS or MEM program.

BIOL 652. Botany. (4 Credits)
Using field and laboratory experiences this graduate level course explores the diversity within the plant kingdom using a comparative approach to examine evolutionary trends and relationships. Students are introduced to the structure and function of plants through an investigation of plant cells, tissues, organs, and basic physiological processes. Economic importance, human uses, and significance of plants to society are emphasized. Prerequisite: acceptance to MS or MEM program.

BIOL 653. Rocky Mountain Flora. (3 Credits)
A graduate level field and laboratory course focusing on identification of flowering plants common to the Western Slope of the Colorado Rocky Mountains. This course covers methods of plant collection and preservation, field identification, natural history, and ecology as well as local plants of particular human interest, including those that are medically important, edible, or which are poisonous. Prerequisite: acceptance to MS or MEM programs.

BIOL 662. Evolution. (3 Credits)
This graduate level course provides a comprehensive overview of evolutionary processes, mechanisms, and analytical techniques. Topics include population genetics, conservation genetics, phylogenetic analysis, adaptation, behavioral evolution, sexual selection, and speciation. Evolutionary perspectives in human health and medicine, conservation biology, agriculture, natural resource management, biotechnology, global change, and emerging diseases are considered. Prerequisite: acceptance to MEM or MS program.

BIOL 667. Biology of Fishes. (3 Credits)
This course provides a comprehensive overview of the biology and diversity of fishes. Topics that are covered include fish anatomy, behavior, biodiversity, conservation, ecology, evolution, morphology, physiology, and zoogeography. Additional topics include experimental design, data analysis and interpretation, and verbal and written professional communication. Colorado fishes will be emphasized but other freshwater and marine fishes will also be covered. Prerequisite: Graduate Student Status.

BIOL 668. Ichthyology Laboratory. (1 Credit)
This laboratory course focuses on several aspects of the biology and diversity of fishes. Laboratory and field activities include a phylogenetic overview of fishes, as well as examining the unique morphological characteristics, ecological roles, evolutionary histories, physiological adaptations, and zoogeography of major taxonomic groups (e.g., jawless fishes, cartilaginous fishes, bony fishes, and common fish families). Laboratory and field exercises focus heavily on the local fauna, although marine and other freshwater fishes are also included. Prerequisite or corequisite: BIOL 667.

BIOL 670. FISHERIES MANAGEMENT. (4 Credits)
This course includes a lecture and laboratory and focuses on theory and methods associated with exploited populations of fish and other aquatic organisms. Covered topics include population growth, sustainable yields, conservation, community interactions, human impacts, and policy. Management techniques including sampling methods, monitoring, habitat assessment, and regulations will also be taught. Local fisheries will be highlighted in laboratory/field activities, and nationwide/global examples will be discusses in class. Prerequisite: Graduate Student Status.

BIOL 676. Aquatic Ecology with lab. (4 Credits)
A study of physical, chemical, and biological parameters of lakes and streams in the functioning of freshwater ecosystems. Prerequisite: acceptance to MEM or MS program.

BIOL 681. Forest Ecology. (4 Credits)
Ecology of forest species, communities, landscapes, and ecosystems, with a focus on the southern Rocky Mountains. Topics include tree physiology, species interactions, fire and disturbance, succession, forest types, climate, forest management, and restoration. Labs and field trips provide hands-on experience and practical skills in tree identification, forest mensuration, vegetation sampling, statistics and GIS. Students gain broad familiarity with the scientific literature, develop and conduct a sophisticated independent research project, and communicate findings. Prerequisite: admission to MS or MEM program.

BIOL 690. Ecology MS Proposal Development. (3 Credits)
Students are required to develop a proposed research project in consultation with their academic advisor and present it in written and oral form to their thesis committee (composed of their advisor, another faculty member or PhD-level researcher, and an external project sponsor or reviewer). This course should be completed by the end of the spring semester of the first year to prepare students for summer research. Prerequisite: instructor permission.

BIOL 692. Independent Study. (1-6 Credits)
Independent research in ecology. Prerequisite: instructor permission.

BIOL 695. Ecology/ Conservation Thesis Research. (1-9 Credits)
Students conduct research adhering to their thesis proposal, complete a written thesis, and defend their thesis. Students must also explicitly connect the research project with relevant and real-world efforts to achieve the broader impacts of ecology and conservation science in society. This is a repeatable course. Prerequisite: BIOL 690.

BIOL 696. Fisheries/ Wildlife Thesis Research. (1-9 Credits)
Students conduct research adhering to their thesis proposal, complete a written thesis, and defend their thesis. Students must also explicitly connect the research project with relevant and real-world efforts to achieve the broader impacts of fisheries and wildlife science in society. This is a repeatable course. Prerequisite: BIOL 690.

BIOL 697. SPECIAL TOPICS IN ECOLOGY. (1-4 Credits)