

# BIOLOGY

The biology degree allows students to explore biological topics that span the breadth of biology. A diverse selection of courses enable students to obtain a very broad expertise or to follow a specialized area of the discipline. The biology major prepares students for a wide range of career choices.

## Other Information

All coursework taken for the Biology major or minor must be completed with a grade of "C-" or better.

## Double Majors

For a double major in **Biology and Biotechnology**, beyond BIOL 1450, BIOL 1750, BIOL 2140 and BIOL 3020, no other biology courses may count for both majors.

For a double major in **Biology and Environmental Studies–Life Sciences**, students may not count the same 3000-4000 level Biology courses towards both majors. Double majors are required to take a minimum of 5 additional upper division BIOL courses that are not part of the other major. These courses must be approved by the advisor and at least three of these must be lab courses. BIOL 3150 may not count as part of these upper division courses.

For a double major in **Biology and Psychology or Biology and Neuroscience**, beyond the required fundamentals courses, students cannot use a 3000/4000 level course to count toward both majors.

For a major in **Biology and a minor in Psychology**, with the exception of PSYC 3130, students cannot use a 3000/4000 level course to count toward both programs.

For a major in **Neuroscience and a minor in Biology**, students cannot use a 3000/4000 level course to count toward both programs.

## Residency Requirement for Biology Majors

To fulfill degree requirements, upper level courses with labs need to be taken at UNO.

## Writing in the Discipline

All students are required to take a writing in the discipline course within their major. For the biology major, the writing in the discipline requirement can be fulfilled by completing a sequence of approved biology courses at UNO that incorporate discipline specific writing as part of their requirements. To satisfy the requirement for the writing in the discipline course students must complete BIOL 1450 and BIOL 1750, two courses from BIOL 2140, BIOL 3020 and BIOL 3340 and two additional 3000/4000 level courses that are approved as meeting the writing requirement by the Department of Biology. Only courses taken at UNO and after January 1, 2010 can be applied to this requirement. Students not meeting the writing requirement through this sequence of courses will fulfill the writing requirement by completing BIOL 3150 or another college-approved advanced writing course.

## Contact

114 Allwine Hall  
402.554.2641

**Website** (<http://www.unomaha.edu/college-of-arts-and-sciences/biology>)

## Degrees Offered

Students may choose to pursue a Bachelor of Arts in Biology or a Bachelor of Science in Biology. Each degree option requires 36-45 credits of biology courses of which 18 credits must be 3000-4000 level courses.

- Biology, Bachelor of Arts (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/biology/biology-ba>)
- Biology, Bachelor of Science (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/biology/biology-bs>)
- Biology, Bachelor of Science with a Concentration in Education (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/biology/concentration-education>)

## Minors Offered

- Biology Minor (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/biology/biology-minor>)

### BIOL 1020 PRINCIPLES OF BIOLOGY (4 credits)

Principles of Biology introduces fundamental concepts at all levels of organization in biology. The laboratory emphasizes inquiry-based and problem-oriented approaches to these concepts. Must enroll in one laboratory. Usually offered Fall, Spring, Summer.

**Prerequisite(s)/Corequisite(s):** ENGL1150 placement by the English Placement and Proficiency Exam (EPPE), grade of C- or better in English 1050 or 1100, ACT English subscore of 20 or higher, or permission of the department.

**Distribution:** Natural/Physical Sci General Education lecture&lab

### BIOL 1030 BIOLOGY OF HUMAN DISEASES (2 credits)

A course on the general principles of human disease. Concepts include an introduction to immunity, heredity, cancer, and infectious disease. Diseases of all major organ systems will be discussed, including the cardiovascular, blood, respiratory, urinary, gastrointestinal, reproductive, endocrine, nervous, immune, and musculoskeletal systems. Sections will cover the most common diseases in organ systems, including the overall pathology, diagnosis, and treatment of diseases that occur in these systems. The course is intended as a science course for non-science majors - for example those who may be involved in the business aspects of the health care industry.

**Prerequisite(s)/Corequisite(s):** Prerequisites are high school biology and chemistry.

### BIOL 1060 INTRODUCTION TO MEDICAL CAREERS & ETHICS (2 credits)

A general overview of modern healthcare professions, plus foundational career concepts which include vocational discernment, undergraduate preparation, healthcare ethics, HIPAA certification, challenges and opportunities in healthcare, and evidence-based medicine. An exploration of various careers in healthcare is included. Intended as a preparatory healthcare professional course. Usually offered during the Fall, Spring, and Summer semesters.

### BIOL 1160 TERMINOLOGY OF HUMAN HEALTH & DISEASE (2 credits)

This completely online course is designed to help students learn clinical terminology in relation to human health and disease. The course will cover root words, terms, and phrases relating to human anatomy, disease conditions, and clinical procedures. The course will also serve as a survey of human diseases across all major organ systems, and common procedural diagnostics and treatments.

### BIOL 1330 ENVIRONMENTAL BIOLOGY (3 credits)

This course is a study of human ecology with emphasis on the effects of human populations on the earth's resources and on the environment. Usually offered Fall, Spring, Summer.

**Distribution:** Natural/Physical Science General Education course

### BIOL 1350 SCIENCE OF FOOD (3 credits)

A basic and applied science, general education course emphasizing scientific concepts in biology, chemistry and physics using food as a model. Students will study food from its chemical and nutritional perspectives and the fate of food from production to consumption. (Cross-listed with FSCI 1310).

**Distribution:** Natural/Physical Science General Education course

**BIOL 1450 BIOLOGY I (5 credits)**

First semester of a two semester series on the general principles of biology. Concepts including the chemical and physical basis of living systems, cell structure and function, energy and metabolism, genetics and molecular genetics, and evolution of biological diversity will be presented. Laboratory will provide inquiries into these same topics. Intended as the first course for Biology majors. Must enroll in one lab section. Usually offered Fall, Spring and Summer.

**Prerequisite(s)/Corequisite(s):** High school biology and chemistry. College level chemistry recommended.

**Distribution:** Natural/Physical Sci General Education lecture&lab

**BIOL 1750 BIOLOGY II (5 credits)**

Second semester of a two semester series on the general principles of biology. Introduction to the study of life, concentrating on whole organisms and their interactions with the environment. This course will focus on evolution and natural selection, biodiversity, physiologic responses to the environment, organ systems, population dynamics, community ecology, and energy and material flow through ecosystems. Laboratory will provide inquiries into these same topics. Intended as the second course for Biology majors. Must enroll in one lab section. Usually offered Fall, Spring and Summer.

**Prerequisite(s)/Corequisite(s):** Prerequisite is BIOL 1450. College level chemistry is recommended.

**BIOL 1950 ANALYZING DYNAMIC LIVING SYSTEMS (3 credits)**

A foundations course in systems/mathematical biology. The course is an introduction to the use of mathematical concepts in molecular, cellular, and higher level biological systems. Both continuous and discrete methods will be covered. Topics include classical modeling techniques as well as the more modern concepts such as chaos theory, complexity systems, discrete modeling, and neural networks and their applications to molecular, cellular, organismic, and population biology.

**BIOL 2030 INTRODUCTORY TOPICS IN BIOLOGY (1-4 credits)**

This is course is a variable credit lecture and/or laboratory course for Biology and non-Biology majors pertaining to a specific biological topic not available in the regular curriculum. Topics will be developed by individual faculty members reflecting their special interests and expertise. The course may be repeated for credit if the topic differs.

**Prerequisite(s)/Corequisite(s):** Instructor permission.

**BIOL 2060 ART AND SCIENCE OF MEDICAL DECISION-MAKING (3 credits)**

The course explores multiple facets of medical decision-making, including the perspective of the patient, the family, and the healthcare provider. Topics include basic anatomy and medical terminology, which will be used to understand decision-making in the context of the provider. Students use literature and other records to generate and critically evaluate clinical decisions. The course does not satisfy requirements for degree programs in the Department of Biology minor, BA, BS in Biology; BS in Biotechnology. (Cross-listed with MEDH 2060).

**Prerequisite(s)/Corequisite(s):** BIOL 1060 or concurrent.

**BIOL 2120 SUSTAINABLE LANDSCAPE PLANTS (4 credits)**

This course focuses on the identification of native and adapted landscape plants, including herbaceous perennials, groundcovers, vines, trees and shrubs in natural and urbanized landscapes. In addition, it covers the ecological and design contexts for the landscape roles, sustainable usage and management of identified plants in the Great Plains region. (Cross-listed with ENVN 2120)

**Prerequisite(s)/Corequisite(s):** High school biology

**Distribution:** Natural/Physical Sci General Education lecture&lab

**BIOL 2130 SUSTAINABLE LANDSCAPE PLANTS II (3 credits)**

This course requires the identification of native and adapted landscape plants, including groundcovers, vines, trees and shrubs, in natural and urbanized landscapes. In addition, it covers the sustainable usage and management of identified plants in the Great Plains region. (Cross-listed with ENVN 2130)

**Prerequisite(s)/Corequisite(s):** BIOL 2120 or ENVN 2120 is recommended.

**BIOL 2140 GENETICS (4 credits)**

This course provides students with a foundational understanding of genetics. First, students will learn to analyze patterns of Mendelian inheritance. Then, they will develop molecular explanations for these patterns and understandings of how gene genes are defined and identified. They will also learn how variations in inheritance patterns arise, using analytical and statistical tools to distinguish between variations on inheritance patterns and to analyze quantitative traits. Then, students will focus in on the nucleus to examine the structure, organization, packaging, and inheritance of chromosomes. They will consider the consequences of genetic recombination on inheritance patterns and for genetic mapping. They will zoom in even further to examine the molecular details of genetic processes: the regulation of gene expression, the basis of mutation and recombination, and the movement of transposable elements. With this background, they will consider the contributions of genome projects to genetics. Finally, students will zoom out to the level of populations and analyze the genetic structure of populations and the contribution of genetics to evolution. Usually offered Fall, Spring, Summer.

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and 1750, CHEM 1140 or 1180 or the equivalent or permission of the instructor. Must enroll in discussion.

**BIOL 2440 THE BIOLOGY OF MICROORGANISMS (4 credits)**

An introduction to the structure and properties of different types of microorganisms, the importance of microorganisms to our society and our environment, the methods used to control microorganisms, the diseases caused by microorganisms and the defenses of the human body against microorganisms including immune cells. Must enroll in one lab section. Usually offered in Fall, Spring, Summer.

**Prerequisite(s)/Corequisite(s):** High school biology and chemistry.

**BIOL 2740 HUMAN PHYSIOLOGY AND ANATOMY I (4 credits)**

Structure and function of the cell, and the nervous, skeletal, muscle systems and special senses as well as necessary aspects of chemistry, physics, embryology and histology. Usually offered Fall, Summer.

**Prerequisite(s)/Corequisite(s):** High school or college biology or zoology and high school or college chemistry. Must enroll in one lab section.

**BIOL 2840 HUMAN PHYSIOLOGY AND ANATOMY II (4 credits)**

Structure and function of the circulatory, respiratory, digestive, excretory, endocrine, reproductive systems and embryology. Usually offered Spring, Summer.

**Prerequisite(s)/Corequisite(s):** BIOL 2740 or permission of instructor. Must enroll in one lab section.

**BIOL 3020 MOLECULAR BIOLOGY OF THE CELL (3 credits)**

A study of molecular and cellular biology. Topics to be covered include gene expression and regulation, structure and function of biological macromolecules, metabolism, membrane function and transport, and cell differentiation. Usually offered Fall, Spring, Summer.

**Prerequisite(s)/Corequisite(s):** BIOL 2140 and at least one semester of general chemistry.

**BIOL 3100 INVERTEBRATE PALEONTOLOGY (3 credits)**

An introduction to the development of life through the study of the morphology, evolution and geological distribution of fossils. Must be taken concurrently with BIOL 3104 for one credit hour. (Cross-listed with GEOL 3100.)

**Prerequisite(s)/Corequisite(s):** GEOL 1180 or permission; coreq BIOL 3104.

**BIOL 3104 INVERTEBRATE PALEONTOLOGY LAB (1 credit)**

An examination of representative specimens of groups of organisms important in the fossil record and an introduction to analytical techniques in paleontology.

**Prerequisite(s)/Corequisite(s):** GEOL 1180 or permission; coreq BIOL 3100.

**BIOL 3150 WRITING AND COMMUNICATION IN THE BIOLOGICAL SCIENCES (3 credits)**

This is a course in writing for students majoring in the biological sciences. It is designed primarily to prepare students to report results of original research in a scientific, scholarly format. Topics will include scientific literature, the organization and presentation of data in biological reports, as well as the preparation of posters and oral presentations for scientific meetings. Usually offered Fall, Spring.

**Prerequisite(s)/Corequisite(s):** Biology major, junior or senior standing, ENGL 1150 and ENGL 1160 or equivalent.

**Distribution:** Writing in the Discipline Single Course

**BIOL 3240 INTRODUCTION TO IMMUNOLOGY (3 credits)**

An introduction to the fundamentals of immunology including the immune system, the immune response, humoral and cellular immunity, and antibodies. In addition, immunoassay, immunopathology, cancer immunology, and histocompatibility will be considered. Usually offered Fall, Summer.

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750 and 2140; junior. Recommended: BIOL 2440 or CHEM 3650 or Organic Chemistry.

**BIOL 3340 ECOLOGY (4 credits)**

Study of interrelationships between organisms and their biotic and abiotic environment; includes population biology, community dynamics, biotic interactions and evolution. Usually offered Fall, Spring, Summer. (Cross-listed with BIOL 8345)

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and 1750, junior-senior. Must enroll in one lab section.

**BIOL 3500 BIOLOGICAL PRINCIPLES OF AGING (3 credits)**

The Biological Bases of Aging Course provides a survey of the primary topics in the biology of aging field for undergraduate students. This a required course for the Gerontology major. By the end of the course, students will understand major theories, biological methods, and seminal research studies in the biology of aging field. Furthermore, students will learn how to critically analyze and interpret primary research about biological aging. This course provides preparation for students considering graduate school in gerontology or biology, geriatric nursing and social work, geriatric medicine, neuroscience, psychology, and exercise science. (Cross-listed with GERO 3500, NEUR 3500)

**Prerequisite(s)/Corequisite(s):** Sophomore/Junior/Senior Standing. Not open to non-degree graduate students.

**BIOL 3530 FLORA OF THE GREAT PLAINS (4 credits)**

A study of common vascular plants found in the Great Plains region, including identification, description, and classification techniques and an introduction to the plant communities of Nebraska. Usually offered every Fall and Summer. (Cross-listed with BIOL 8535.)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750 and junior-senior. Must enroll in lab.

**Distribution:** OBIOWRT3 - Tier III Biology Writing Course

**BIOL 3630 PLANT ANATOMY AND DEVELOPMENT (4 credits)**

A study of cells, tissues and organs of vascular plants with particular emphasis on the internal structures of seed plants, their development, and structure-function relationships. Must enroll in lab. Usually offered in alternate years. (Cross-listed with BIOL 8635)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750 and junior-senior.

**BIOL 3660 INTRODUCTION TO SUSTAINABLE LANDSCAPE DESIGN (3 credits)**

This course provides an overview of graphic techniques and process for landscape design; the analysis and conceptual design of the landscape; and the exploration of the design characteristics of plants, landform, and structures through discussion, case studies and applied design development. A focus on sustainable design components and applications is included, including native and adapted plant selection, stormwater management, water conservation, efficient irrigation concepts, and practical landscape management and maintenance considerations. (Cross-listed with ENVN 3660)

**Distribution:** Humanities and Fine Arts General Education course

**BIOL 3670 INTRODUCTION TO SUSTAINABLE LANDSCAPE DESIGN LABORATORY (1 credit)**

This course covers the basic use of graphic techniques for landscape design; the analysis and process for conceptual design of the landscape; studio problems in value, texture, form and space; and the exploration of the design characteristics of plants, landform, and structures supporting sustainable landscape design and management principles. (Cross-listed with ENVN 3670)

**Prerequisite(s)/Corequisite(s):** ENVN 3660 or BIOL 3660 (prior or concurrent).

**BIOL 3730 FAUNA OF THE GREAT PLAINS (3 credits)**

A survey of the common animal groups found in the Great Plains, including their evolution, ecology, distribution and specific adaptations to the environment of the temperate North American grasslands. Must enroll in lab. Usually offered in alternate years. (Cross-listed with BIOL 8735).

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and BIOL 1750.

**BIOL 3740 HISTOLOGY (4 credits)**

Analysis of the microscopic anatomy of tissues and organs, their adaptations and functional significance. Must enroll in one lab section. Usually offered Spring semesters. (Cross-listed with BIOL 8745)

**Prerequisite(s)/Corequisite(s):** BIOL 1750 and a course in vertebrate anatomy, or 2740 or 2840, junior-senior. Must enroll in one lab section.

**BIOL 3800 ANATOMY ACADEMIC ASSISTANTSHIP PRACTICUM (1 credit)**

Assistantships for students participating in the Anatomy Academic Assistantship (AAA) program provide advanced Human Physiology and Anatomy students with the opportunity to apply their knowledge while gaining leadership and communication skills via the mentorship of current Human Physiology and Anatomy I and II students. Additionally, STEM service learning activities will be offered. This course is not intended to replace other biology courses required for degrees offered by the Department of Biology.

**Prerequisite(s)/Corequisite(s):** Students must have a cumulative GPA of 3.0 or above, a grade of B in BIOL 2740, and be accepted to the Anatomy Academic Assistantship (AAA) Practicum. Students must receive permission of instructor. Not open to non-degree graduate students.

**BIOL 3830 BIOLOGY OF PATHOGENIC MICROORGANISMS (3 credits)**

A study of the biology, epidemiology and pathogenicity of bacteria, viruses, fungi and protozoan, with emphasis on human pathogens. Usually offered in Spring semesters.

**Prerequisite(s)/Corequisite(s):** BIOL 2440 or 3240, or 2140 or the equivalent.

**BIOL 4030 SPECIAL TOPICS IN BIOLOGY (1-3 credits)**

A variable credit lecture and/or laboratory course for biology majors pertaining to a specific biological topic not available in the regular curriculum. Topics will be developed by individual faculty members reflecting their special interests and expertise. The course may be repeated for credit.

**Prerequisite(s)/Corequisite(s):** Junior-senior.

**BIOL 4040 DIRECTED READINGS IN BIOLOGY (1-3 credits)**

A faculty directed study of a biological subject through selected readings, oral reports and a final written report. May be repeated up to a total of six hours for 4040 and 4050 combined.

**Prerequisite(s)/Corequisite(s):** Junior-senior and written permission of instructor.

**BIOL 4050 SUPERVISED RESEARCH IN BIOLOGY (1-3 credits)**

Completion of a faculty supervised research project involving experimental design, data collection and analysis, and a final written report. May be repeated up to a total of six hours of BIOL 4040 and BIOL 4050 combined.

**Prerequisite(s)/Corequisite(s):** Junior-senior and written permission of instructor.

**BIOL 4100 BIOGEOGRAPHY (3 credits)**

This course is intended as an introduction to biogeography, the study of the distribution of organisms in space and time. Usually offered every year. (Cross-listed with BIOL 8106, GEOG 4100, GEOG 8106, GEOL 4100, GEOL 8106)

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and 1750 or GEOL 3100 or BIOL 3100, junior-senior.

**BIOL 4110 STATISTICS FOR BIOLOGICAL SCIENCES (4 credits)**

Introduction to statistical methods and software used to display, summarize, analyze, and interpret biological and medical data. (Cross-listed with BIOL 8116)

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and BIOL 1750 and MATH 1220, MATH 1130, or MATH 1530

**BIOL 4120 CONSERVATION BIOLOGY (3 credits)**

Study of biological diversity at the genetic, species and ecosystem levels, its values, and the factors that threaten it. We will explore the scientific basis of conservation biology and how it can be applied to the maintenance of biological diversity. Usually offered every year. (Cross-listed with BIOL 8126).

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750, 2140 and Junior-Senior in biology. Not open to non-degree graduate students.

**BIOL 4130 MOLECULAR GENETICS (4 credits)**

A lecture and lab course that explores the frontiers of molecular genetics research. Topics addressed will include DNA replication, gene function, gene expression, genetic manipulation, cloning, mutational analysis, genome sequencing, and epigenetics. Research techniques will include DNA/RNA isolation, PCR, cloning, gel electrophoresis, transgene generation, data analysis, and quantitative rtPCR. Students will get a solid grounding in scientific writing and presentations, as well as reading and assessing primary scientific literature. Lecture, discussion, and laboratory. (Cross-listed with BIOL 8136)

**Prerequisite(s)/Corequisite(s):** BIOL 2140, 3020 and CHEM 2210 or 2260; or their equivalents. Must enroll in one lab section.

**BIOL 4140 CELLULAR BIOLOGY (4 credits)**

This course is a modern study of mammalian cell function. Focus will be placed on developing skills in experimental cellular biology. Material covered will include tissue culture techniques, cell staining applications, fluorescent microscopy, determination of gene expression, and high-throughput assay design. (Cross-listed with BIOL 8146)

**Prerequisite(s)/Corequisite(s):** BIOL 2140, 3020 and CHEM 2210 or 2250. Junior or senior undergraduate standing Must enroll in laboratory section and lecture for this course. Not open to non-degree graduate students.

**BIOL 4150 CANCER BIOLOGY (3 credits)**

The etiology of cancers, differences between types of malignancies, oncogenes and genetic modifiers, treatments, susceptibility, and tumor-induced immunosuppression are discussed. This is an active course focused on inquiry-based learning and the purpose of this course is to provide students a foundation in cancer biology while applying tools learned through cell biology, genetics, and immunology courses. (Cross-listed with BIOL 8156).

**Prerequisite(s)/Corequisite(s):** BIOL 3020 and BIOL 2140.  
Recommended: BIOL 3240.

**BIOL 4180 LIMNOLOGY (4 credits)**

A study of the physical, chemical, and biotic relationships that serve to establish and maintain plant and animal communities in a freshwater environment. Usually offered in alternate years. (Cross-listed with BIOL 8186)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750, organic chemistry, and junior-senior. Must enroll in lab.

**BIOL 4210 FIRE ECOLOGY (3 credits)**

Study of fire in ecosystems including characteristics of fire, effects on flora, fauna, and the abiotic environment, and use in maintaining native ecosystems. Includes an optional 4-day fieldtrip. Usually offered in alternate years. (Cross-listed with BIOL 8216)

**Prerequisite(s)/Corequisite(s):** BIOL 3340, junior-senior.

**BIOL 4220 POPULATION BIOLOGY (4 credits)**

An examination of topics in population ecology and population genetics including selection on individuals and groups, mating systems, life history characteristics, growth and regulation of populations and population interactions. Must enroll in lab. Usually offered in alternate years. (Cross-listed with BIOL 8226)

**Prerequisite(s)/Corequisite(s):** BIOL 2140 and 3340, junior-senior.

**BIOL 4230 ORGANIC EVOLUTION (3 credits)**

The mechanisms of evolution (natural selection, gene flow, mutation and genetic drift) are explained. Evidence for and examples of micro- and macroevolution, speciation and human evolution are presented. Lecture and discussion. Usually offered every year. (Cross-listed with BIOL 8236)

**Prerequisite(s)/Corequisite(s):** BIOL 2140, junior-senior.

**BIOL 4240 MARINE BIOLOGY (3 credits)**

An introduction to the marine environment, this course explores physical conditions of the ocean including ocean chemistry, salinity, waves and currents, and tides as well as the ecology of planktonic, nektonic and benthic organisms— their communities and environments. Impacts of humans on the marine environment will also be covered. (Cross-listed with BIOL 8246)

**Prerequisite(s)/Corequisite(s):** BIOL 1750

**BIOL 4250 FIELD MARINE BIOLOGY (1 credit)**

This lab is a hands-on introduction to the marine environment using a field trip to the Gulf Coast. Students will observe first-hand examples of local marine habitats and organisms. Students will be required to take a trip to the Gulf Coast of Texas, Louisiana, Mississippi, and Alabama during Spring Break. Students will be required to provide their own basic camping and snorkeling gear. (Cross-listed with BIOL 8256)

**Prerequisite(s)/Corequisite(s):** BIOL 1750, previous or concurrent enrollment in BIOL 4240 and permission of instructor.

**BIOL 4260 BEHAVIORAL ECOLOGY (3 credits)**

Behavioral ecology is the study of behavior from an evolutionary and ecological point of view. Through the integration of research at different organizational levels and the use of many different organisms, behavioral ecology is one of the most integrative fields in biological sciences. This course will provide an introduction to the basic concepts of behavioral ecology and the integrative approaches used in behavioral ecology. Further, the course will train students in critical reading and discussion of primary literature in writing and in an oral setting. (Cross-listed with BIOL 8266)

**Prerequisite(s)/Corequisite(s):** For BIOL 4260: BIOL 2140 Genetics and BIOL 3340 Ecology; or permission by the instructor. Not open to non-degree graduate students.

**BIOL 4270 ANIMAL BEHAVIOR (3 credits)**

Behavior of diverse animals for the understanding of the relationships between nervous integration and the behavior manifested by the organism, as well as the evolution and adaptive significance of behavior as a functional unit. Lecture only. (Cross-listed with BIOL 8276, PSYC 4270, PSYC 8276)

**Prerequisite(s)/Corequisite(s):** BIOL 1750 and PSYC 1010 or permission of instructor, junior-senior.



**BIOL 4280 ANIMAL BEHAVIOR LABORATORY (3 credits)**

Laboratory and field studies of animal behavior with an ethological emphasis. Classical laboratory experiences and independent study will be conducted. (Cross-listed with BIOL 8286, PSYC 4280, PSYC 8286)

**Prerequisite(s)/Corequisite(s):** PSYC 4270 or BIOL 4270 or PSYC 8276 or BIOL 8273

**BIOL 4290 NEUROETHOLOGY (3 credits)**

In the field of Neuroethology a major goal is to understand the neural bases of animal behaviors in a natural context. In this course students will investigate how behaviors are generated and modulated by the nervous system in organisms ranging from insects to mammals. We will explore the neural mechanisms underlying a variety of animal behaviors as they interact with their natural environment ranging from sensory perception of the world (e.g. echolocation, electrolocation), to locomotor movements (e.g. flying, swimming), to more complex behaviors (e.g. learning, memory). (Cross-listed with NEUR 4290, BIOL 8296, PSYC 8296).

**Prerequisite(s)/Corequisite(s):** NEUR 1520, NEUR 1540 and BIOL 1750; or by permission of instructor. Not open to non-degree graduate students.

**BIOL 4320 HORMONES & BEHAVIOR (3 credits)**

In this course, students will examine the interaction between hormones, chemical messengers released from endocrine glands, and behavior in both human and animal systems. Methods for studying hormonal issues on behavior will be addressed. This course will provide students in psychology, biology, and related disciplines an understanding of how hormones affect sensory processing, motor activities, and processing of information in the central nervous system. (Cross-listed with BIOL 8326, PSYC 4320, PSYC 8326)

**Prerequisite(s)/Corequisite(s):** PSYC 1010 and either BIOL 1020 or 1750. Not open to non-degree graduate students.

**BIOL 4340 ICHTHYOLOGY (4 credits)**

A study of the biology of fishes, including their evolution, anatomy, physiology, ecology, distribution, classification and identification with emphasis on North American freshwater fishes. Usually offered in alternate years. (Cross-listed with BIOL 8346)

**Prerequisite(s)/Corequisite(s):** BIOL 1750, junior-senior. Must enroll in lab.

**BIOL 4350 LICHENOLOGY (3 credits)**

Taxonomy, morphology and ecology of lichenized fungi with laboratory emphasis on identification of the local species. Other topics for discussion will include symbiosis, air pollution and lichens, chemosystematics, and modern herbarium techniques for lichens and other cryptograms. Usually offered in alternate years. (Cross-listed with BIOL 8356)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750, junior-senior. Must enroll in lab.

**BIOL 4370 PHYCOLOGY (3 credits)**

A survey of the algae dealing with their ecology, morphology, physiology, taxonomy and evolution. (Cross-listed with BIOL 8376)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750, junior-senior.

**BIOL 4380 MORPHOLOGY OF NON-VASCULAR PLANTS (4 credits)**

Structural, reproductive, ecological and evolutionary features of the major non-vascular plant groups including prokaryotes, algae, fungi, lichens, and bryophytes. Usually offered in alternate years. (Cross-listed with BIOL 8386)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750, junior-senior. Must enroll in lab.

**BIOL 4390 VASCULAR PLANT MORPHOLOGY (3 credits)**

A survey of living and fossil vascular plants with emphasis on their comparative anatomy and morphology and their evolution. Usually offered in alternate years. (Cross-listed with BIOL 8396)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, BIOL 1750 or equivalent, junior-senior. Must enroll in lab.

**BIOL 4410 WETLAND ECOLOGY AND MANAGEMENT (3 credits)**

This course will examine the principles and theory of wetland ecology with application towards wetland management and regulation. An interdisciplinary overview of physical, biological and regulatory aspects of wetlands will allow students to synthesize information from their backgrounds in geography, geology and ecology. Definitions, classifications, natural processes and functions of wetland environments will be presented. Labs concentrate on field techniques used to assess specific plant, animal, soil, and hydrological characteristics of wetlands. (Cross-listed with ENVN 4410 and BIOL 8416)

**Prerequisite(s)/Corequisite(s):** BIOL 3340 or instructor permission.

**BIOL 4420 RESTORATION ECOLOGY (3 credits)**

Restoration Ecology examines how people assist with the recovery of ecosystems that have been degraded. The course will examine the theory and application of restoration ecology through lecture, discussion, field trips, and development of a restoration management plan for a degraded ecosystem near Omaha. The course will provide information and resources used by restoration and land management professionals to plan, implement, and manage restorations. (Cross-listed with BIOL 8426, ENVN 4420)

**Prerequisite(s)/Corequisite(s):** Junior or Senior standing.

**BIOL 4430 BIOLOGY OF FUNGI (3 credits)**

A functional and developmental approach to the study of fungi. Fungal structure, growth, physiology and biotic interactions will be examined. Usually offered spring semester. (Cross-listed with BIOL 8436)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750, junior-senior.

**BIOL 4440 PLANT PHYSIOLOGY (4 credits)**

A study of plant processes and functions with emphasis on photosynthesis, growth and development, metabolism and mineral nutrition. (Cross-listed with BIOL 8446)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, BIOL 1750, and CHEM 2210 or CHEM 2250; or permission of instructor.

**BIOL 4450 VIROLOGY (3 credits)**

A comprehensive course about viruses. The course will address principles of viral infection, virus-host interaction, viral evolution and viral disease processes. Cellular and molecular aspects of viral infection will be the primary focus. This will include examination of viral particles, viral multiplication cycles, regulation of gene expression, viral assembly and viral escape. Viral immunology, viral defenses, viral vaccines and antiviral compounds will also be addressed. Emerging viruses and current viral topics will be a major part of the course. Usually offered in Fall semester. (Cross-listed with BIOL 8456)

**Prerequisite(s)/Corequisite(s):** Prerequisites are CHEM 2260 and 2274 or CHEM 2210 and 2214, BIOL 3020 and 2140. Recommended: Biochemistry.

**BIOL 4454 VIROLOGY LABORATORY (1 credit)**

A laboratory to accompany virology lecture. This course enables students to work with viruses in the laboratory and to conduct experiments using viral systems. Experimental design, data gathering, data analysis and manuscript writing will be integral parts of the course. The experiments include host cell characterization, viral infection, virus purification from infected cells, viral genome isolation and viral transfection. Sequence analysis and sequence comparison will also be introduced. Laboratory exercises will emphasize fundamental molecular biology techniques and instrumentation. Usually offered in Fall semester. (Cross-listed with BIOL 8454)

**Prerequisite(s)/Corequisite(s):** Biology 4450 - Virology is a prerequisite or co-requisite.

**BIOL 4490 MEDICINAL USES OF PLANTS (3 credits)**

A scientific study of the biochemical properties and physiological effects of medicinal plants, including their historical uses, current applications to varying systems of the human body, and pathways by which today's potent drugs have transitioned from wild flora. Usually offered Fall semesters of even-numbered years. (Cross-listed with BIOL 8496)

**Prerequisite(s)/Corequisite(s):** BIOL 1450, 1750 and junior-senior.

**BIOL 4540 PRINCIPLES OF SYSTEMATICS (3 credits)**

A thorough study of phylogenetics, including tree inference techniques, proper interpretation of evolutionary relationships and character evolution, and applications to investigations in various fields of study. Usually offered in fall semesters of odd-numbered years.

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and 1750, junior-senior.

**BIOL 4550 BIOTECHNOLOGY INTERNSHIP (3 credits)**

Practical laboratory experience for students in the bachelor's of science program in biotechnology. In consultation with the biotechnology adviser and principal investigators, students will select a research laboratory where they will carry out an independent investigation for one semester. Most placements will be at UNMC or UNO. Recommended: Biochemistry. Usually offered Fall, Spring, Summer.

**Prerequisite(s)/Corequisite(s):** Biotechnology major and at least one 4000 level BIOL laboratory course.

**BIOL 4560 BIOINFORMATICS INTERNSHIP (1-3 credits)**

This course is a practical experience for students in the Bachelor of Science program in Bioinformatics. In consultation with the bioinformatics adviser and principal investigators, students will select a research laboratory and conduct an independent research project in bioinformatics for one or two semesters. Students will write a report describing their research methods, project implementation, and results. The course is limited to Bioinformatics majors and does not satisfy any requirements for other programs in the Department of Biology.

**Prerequisite(s)/Corequisite(s):** BIOL 2140 Genetics, BIOI 3500 Advanced Bioinformatics Programming, and Permission of Instructor. The course is for students in the Bachelor of Science program in Bioinformatics. Not open to non-degree graduate students.

**BIOL 4570 PALEOBOTANY (4 credits)**

A comprehensive study of the biology and evolution of plants through geologic time, including fossil plant structure, function and paleoecology. (Cross-listed with BIOL 8576)

**Prerequisite(s)/Corequisite(s):** BIOL 1450 and 1750. Must enroll in lab.

**BIOL 4600 GIS APPLICATIONS FOR ENVIRONMENTAL SCIENCE (1 credit)**

This course introduces the use of geographic information systems (GIS) and other geospatial tools for work in the fields of environmental science, ecology, and natural resource management. The course will develop a working knowledge of the common software and hardware tools used by ecologists through hands-on projects. (Cross-listed with BIOL 8606, ENVN 4600)

**Prerequisite(s)/Corequisite(s):** BIOL 3340 or permission of instructor.

**BIOL 4610 ENVIRONMENTAL MONITORING AND ASSESSMENT (3 credits)**

An interdisciplinary approach to techniques for the design and implementation of environmental inventory and monitoring schemes used to evaluate natural resources. Students work as teams to synthesize information from their backgrounds in geography, geology and ecology to evaluate the impacts of human actions on environmental quality following the framework for environmental assessments provided by the National Environmental Policy Act. Course is organized to accommodate variable needs of students with different backgrounds and career choices. Usually offered every year. Cross-listed with ENVN 4610, GEOG 4610, GEOG 8616, GEOL 4610, GEOL 8616.

**Prerequisite(s)/Corequisite(s):** Permission of instructor.

**BIOL 4640 MICROBIAL PHYSIOLOGY (4 credits)**

Examination of physiological diversity found among microorganisms with an emphasis on experimental procedures and practical applications. Lecture and laboratory. Usually offered Fall semesters. (Cross-listed with BIOL 8646)

**Prerequisite(s)/Corequisite(s):** BIOL 3020. Must enroll in one lab section.

**BIOL 4650 BIOCHEMISTRY I (3 credits)**

A comprehensive introduction to biochemistry emphasizing: structure-function relationships for proteins, carbohydrates, lipids, and nucleic acids; protein purification; enzyme kinetics and mechanisms; membranes and membrane transport; carbohydrate metabolism including glycolysis, the citric acid cycle and oxidative phosphorylation; and important applications of thermodynamics and the properties of water to living systems. (Fall) (Cross-listed with BIOL 8656, CHEM 4650, CHEM 8656).

**Prerequisite(s)/Corequisite(s):** CHEM 2260 and CHEM 2274; and either CHEM 2400 or BIOL 3020, all with a C- or better. Other comparable courses taken at accredited colleges or universities are acceptable. BIOL 4654 must be taken concurrently.

**BIOL 4654 BIOCHEMISTRY I LABORATORY (1 credit)**

A laboratory course to help integrate the concepts learned in biochemistry lecture with the development of biochemical laboratory skills including experimental design, data analysis, presentation of results and communication of scientific information, with a focus on formal instruction in journal-style writing and notebook skills. There is an emphasis on protein properties, including enzyme activity. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. (Fall) (Cross-listed with BIOL 8654, CHEM 4654, CHEM 8654).

**Prerequisite(s)/Corequisite(s):** CHEM 2260 and CHEM 2274; and either CHEM 2400 or BIOL 3020, all with a C- or better. BIOL 4650 must be taken concurrently with BIOL 4654. CHEM 4650 must be taken concurrently with CHEM 4654.

**Distribution:** Writing in the Discipline Sequenced Course

**BIOL 4660 BIOCHEMISTRY II (3 credits)**

A continuation of the study of the structure and function of biomolecules and biochemical reactions with an emphasis on metabolism of carbohydrates, lipids, amino acids and nucleotides, and the chemistry of signal transduction and genetic information transfer. (Spring) (Cross-listed with BIOL 8666, CHEM 4660, CHEM 8666).

**Prerequisite(s)/Corequisite(s):** CHEM 4650 and CHEM 4654 or BIOL 4650 and BIOL 4654. BIOL 4664 must be taken concurrently.

**BIOL 4664 BIOCHEMISTRY II LABORATORY (1 credit)**

A laboratory course to help integrate the concepts learned in Biochemistry II lecture with the development of biochemical laboratory skills, to gain practical experience in experimental design, data analysis, presentation of results and communication of scientific information, with a focus on formal instruction in journal-style writing and notebook skills. There is an emphasis on nucleic acid properties. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. (Spring) (Cross-listed with BIOL 8664, CHEM 4664, CHEM 8664).

**Prerequisite(s)/Corequisite(s):** CHEM 4650 and CHEM 4654 or BIOL 4650 and BIOL 4654 with a C- or better. BIOL 4660 must be taken concurrently with BIOL 4664. CHEM 4660 must be taken concurrently with CHEM 4664.

**Distribution:** Writing in the Discipline Sequenced Course

**BIOL 4710 TOXICOLOGY (3 credits)**

An overview of the fundamentals of toxicology. Concepts include the dose-response relationship, absorption, distribution and excretion of toxicants, and the biotransformation of xenobiotics. Emphasis will be given to metals, pesticides, pharmaceutical compounds, chemical carcinogenesis and endocrine disruption. Usually offered Fall. (Cross-listed with BIOL 8716)

**Prerequisite(s)/Corequisite(s):** CHEM 2210 or 2260 and BIOL 1750, BIOL 3020 or equivalent.

**BIOL 4730 VERTEBRATE ENDOCRINOLOGY (3 credits)**

An overview of the fundamentals of vertebrate endocrinology. Concepts include: the mammalian hypothalamus-pituitary system, the endocrinology of mammalian reproduction, the mammalian adrenal glands, endocrine disruption, endocrinology and metabolism. (Cross-listed with BIOL 8736)

**Prerequisite(s)/Corequisite(s):** CHEM 2250, BIOL 1750, BIOL 3020 or equivalent.

**BIOL 4740 ANIMAL PHYSIOLOGY (3 credits)**

An overview of the fundamentals of animal physiology. Concepts include: the physiology of nerve and muscle function, endocrine function, cardiovascular and respiratory function, oxygen and carbon dioxide delivery by the blood, and osmoregulation and excretion. The course is comparative in nature, including examples from humans, mammals, vertebrates and invertebrate animals. Usually offered Spring. (Cross-listed with BIOL 8746).

**Prerequisite(s)/Corequisite(s):** BIOL 1450, BIOL 1750, and BIOL 2140 or permission of the instructor.

**BIOL 4760 GENOME TECHNOLOGY AND ANALYSIS (3 credits)**

This course will introduce the latest genome sequencing technologies and their broad applications in biology and medicine. Students will learn how genome sequencing is conducted by different platforms and obtain practical experience of how to use bioinformatics tools for genome analysis. Students are expected to be able to perform sequence analysis efficiently and interpret the results properly. (Cross-listed with BIOL 8766)

**Prerequisite(s)/Corequisite(s):** BIOL2140 Genetics; or Permission of instructor

**BIOL 4780 VERTEBRATE ZOOLOGY (4 credits)**

A study of the general biology of the subphylum vertebrata including the morphology, anatomy, physiology and ecology of vertebrate representatives. (Cross-listed with BIOL 8786)

**Prerequisite(s)/Corequisite(s):** BIOL 1750, junior-senior.

**BIOL 4790 MAMMALOLOGY (4 credits)**

The biology of mammals, including their evolution, functional morphology, physiology, ecology, zoogeography, behavior, classification and identification, with emphasis on North American groups. Field trips. Usually offered in alternate years. (Cross-listed with BIOL 8796)

**Prerequisite(s)/Corequisite(s):** BIOL 1750, junior or senior standing. Must enroll in lab.

**BIOL 4800 INTERNSHIP IN ENVIRONMENTAL MANAGEMENT AND PLANNING (1-3 credits)**

Internship providing practical experience working with environmental organizations or government agencies for students interested in careers in environmental science and related fields. A proposed internship must be approved by the Environmental Studies Program prior to enrolling. Usually offered Fall, Spring, Summer. (Cross-listed with ENVN 4800)

**Prerequisite(s)/Corequisite(s):** Permission of the Environmental Studies Program.

**BIOL 4820 INTRODUCTION TO ENVIRONMENTAL LAW & REGULATIONS (3 credits)**

Seminar on environmental law and regulations. Addresses federal regulations, implementing instructions, legal principles and requirements. The major federal environmental laws, air and water quality, solid and hazardous waste, and pollution prevention and remediation are discussed. Usually offered Fall semesters. (Cross-listed with BIOL 8826, ENVN 4820, GEOG 4820, GEOG 8826, PA 4820, PA 8826)

**Prerequisite(s)/Corequisite(s):** Junior-senior and permission.

**BIOL 4830 DEVELOPMENTAL GENETICS (2 credits)**

This course considers experimental approaches in developmental genetics and provides students with first-hand experience in laboratory techniques used in developmental genetics. (Cross-listed with BIOL 8836)

**Prerequisite(s)/Corequisite(s):** Completion of, or concurrent registration in, BIOL 4850.

**BIOL 4840 HERPETOLOGY (4 credits)**

The biology of amphibians and reptiles, including their evolution, classification, anatomy, physiology, ecology, distribution and identification, with emphasis on North American groups. Usually offered in alternate years. (Cross-listed with BIOL 8846)

**Prerequisite(s)/Corequisite(s):** BIOL 1750. Must enroll in lab.

**BIOL 4850 DEVELOPMENTAL BIOLOGY (3 credits)**

This course explores principles underlying the development of multicellular organisms, stressing the environmental, genetic, molecular, cellular, tissue, and evolutionary mechanisms of animal development. Usually offered once per year. (Cross-listed with BIOL 8856)

**Prerequisite(s)/Corequisite(s):** Prerequisites are BIOL 1450, 1750, 2140, 3020, and CHEM 3650 or BIOL 4650 or CHEM 4650 and junior-senior status.

**BIOL 4860 COMPARATIVE GENOMICS (3 credits)**

This course will introduce fundamental concepts in genomics and genome comparison. Students will learn how genomes are constructed, how they evolve, how individual genomes are unique, and what genomic knowledge means in terms of human health and medicine. (Cross-listed with BIOL 8866)

**Prerequisite(s)/Corequisite(s):** BIOL2140 Genetics; BIOL3020 Molecular Biology of the Cell; Or Permission of instructor. Not open to nondegree students.

**BIOL 4870 MOLECULAR AND CELLULAR NEUROBIOLOGY (3 credits)**

This course presents foundational topics in molecular and cellular neurobiology in the context of how the nervous system is functionally organized. Topics include: nervous system cell types and their subcellular organization; electrical properties of neurons and glia; energy metabolism and biochemistry of the brain; intra- and intercellular neuronal signaling; the regulation of gene expression in neuronal cells; synaptic plasticity; and how these are altered in disease. (Cross-listed with BIOL 8878, NEUR 4870, NEUR 8876).

**Prerequisite(s)/Corequisite(s):** NEUR 1500, or both NEUR 1520 and NEUR 1540, or BIOL 3020, or permission of instructor.

**BIOL 4880 INVERTEBRATE ZOOLOGY (4 credits)**

A comprehensive study of the invertebrate animals. (Cross-listed with BIOL 8886)

**Prerequisite(s)/Corequisite(s):** BIOL 1750.

**BIOL 4890 GENES, BRAIN, AND BEHAVIOR (3 credits)**

This course will evaluate the complex interaction between an organism's genome and neural activity pattern in the nervous system as related to behavior. In this course students will explore how changes in gene expression (allelic variants, epigenetics, differential regulation) and gene networks within neural tissue can reciprocally influence behaviors such as communication, foraging, reproduction, and cognition. (Cross-listed with NEUR 4890, BIOL 8896, PSYC 8896)

**Prerequisite(s)/Corequisite(s):** NEUR 1500 and BIOL 2140 or by permission of instructor. Not open to non-degree graduate students.

**BIOL 4920 PARASITOLOGY (4 credits)**

A look at the most common mode of life on earth. Lectures will focus on parasites of humans. Labs will examine the nature of parasitism in Nebraska's animals. Topics will include life histories, identification and diagnosis, parasitic diseases, host-parasite interactions, and parasite evolution. Must also enroll in one lab section. Usually offered alternate semesters. (Cross-listed with BIOL 8926)

**Prerequisite(s)/Corequisite(s):** BIOL 1750.

**BIOL 4940 ENTOMOLOGY (4 credits)**

The study of insects, their classification, morphology, physiology, behavior, life histories, ecology and evolution. (Cross-listed with BIOL 8946)

**Prerequisite(s)/Corequisite(s):** BIOL 1750, junior-senior.

**BIOL 4950 VERTEBRATE EMBRYOLOGY AND ANATOMY (4 credits)**

Development and phylogeny of vertebrate organ systems. Dissection of major vertebrate types, and study of developmental stages from fertilized egg to adult condition. Usually offered in alternate years. (Cross-listed with BIOL 8956)

**Prerequisite(s)/Corequisite(s):** BIOL 1750. Must enroll in lab.

**BIOL 4960 ADVANCED GENETICS (3 credits)**

An in-depth consideration of topics in genetic analysis. Through reading and discussion of primary and secondary literature in genetics, students will develop a deeper understanding of genetic principles, including mutation, recombination, complementation, gene regulation, the genetic structure of populations and the genetic contributions to complex traits, and how these principles and associated methodologies, including next-generation sequencing and high throughput "-omics" approaches, can be used to gain insight into fundamental biological questions. (Cross-listed with BIOL 8966).

**Prerequisite(s)/Corequisite(s):** BIOL 2140 and BIOL 3020 and concurrent enrollment or completion of either CHEM 3650 or CHEM 4610 or CHEM 4650 or BIOL 4650, or permission of the instructor.

**BIOL 4980 ORNITHOLOGY (4 credits)**

An introduction to the general biology of birds, including their anatomy, physiology, behavior, ecology, classification and identification, with emphasis on North American groups. Usually offered in alternate years. (Cross-listed with BIOL 8986)

**Prerequisite(s)/Corequisite(s):** BIOL 1750.

**Distribution:** OBIOWRT3 - Tier III Biology Writing Course