

Biological Sciences (BIOL)

BIOL 100L. Non-Majors Biology Lab. 1 Credit.

Laboratory experience to introduce the application of the scientific method across a wide scale of biological topics, including molecular biology, the organism, evolution, and ecology. This lab may be taken as a co-requisite with BIOL 111, BIOL 124 or BIOL 126. Co-req: BIOL 111 or BIOL 124 or BIOL 126.

BIOL 104. Human Anatomy and Physiology Prep. 1 Credit.

This course is designed to improve the success of students when taking Human Anatomy and Physiology. The focus of the course will be to develop language literacy, visual literacy, study skills, and the understanding of science concepts that are fundamental to Human Anatomy and Physiology. Restrictions: First-year students.

BIOL 111. Concepts of Biology. 3 Credits.

Introduction to a wide range of biological topics, from the organism, ecology, and evolution to the cell, molecular biology, and genetics. For credit as a lecture/lab pair, students should take BIOL 100L as a co-requisite.

BIOL 124. Environmental Science. 3 Credits.

Ecological principles related to human cultures, resource use, and environmental alterations. For credit as a lecture/lab pair, students should take BIOL 100L as a co-requisite.

BIOL 126. Human Biology. 3 Credits.

Consideration of selected problems in human biology. For credit as a lecture/lab pair, students should take BIOL 100L as a co-requisite.

BIOL 150. General Biology I. 3 Credits.

Introduction to cellular and molecular biology, genetics, and evolution.

BIOL 150L. General Biology I Laboratory. 1 Credit.

Introduction to cellular and molecular biology, genetics, and evolution.

BIOL 151. General Biology II. 3 Credits.

An introduction to the biology of living organisms and their interactions with each other and their environments. Examples primarily involve plants and animals, but include other groups of organisms as well. Prereq: BIOL 150.

BIOL 151L. General Biology II Laboratory. 1 Credit.

An introduction to the biology of living organisms and their interactions with each other and their environments. Examples primarily involve plants and animals, but include other groups of organisms as well. Prereq: BIOL 150L.

BIOL 189. Skills for Academic Success. 1 Credit.

This course is designed to ease the transition for new students at NDSU. Students will be introduced to skills and techniques used by successful college students. Topics will include campus resources, study techniques, time management, goal setting, degree planning, and career and major orientation.

BIOL 193. Undergraduate Research. 1-5 Credits.**BIOL 194. Individual Study. 1-5 Credits.****BIOL 196. Field Experience. 1-15 Credits.****BIOL 199. Special Topics. 1-5 Credits.****BIOL 220. Human Anatomy and Physiology I. 3 Credits.**

An in-depth introduction to structure and function of human organ systems' cells, tissues, the integumentary system, the skeletal system, joints, muscle and muscular system, nervous tissue and nervous system, and the special senses. F.

BIOL 220L. Human Anatomy and Physiology I Laboratory. 1 Credit.

An in-depth introduction to structure and function of human organ systems' cells, tissues, the integumentary system, the skeletal system, joints, muscle and muscular system, nervous tissue and nervous system, and the special senses. F.

BIOL 221. Human Anatomy and Physiology II. 3 Credits.

A continuation of BIOL 220, 220L; the endocrine, cardiovascular, lymphatic, immune, respiratory, digestive, urinary, and reproductive systems and development. Prereq: BIOL 220. S.

BIOL 221L. Human Anatomy and Physiology II Laboratory. 1 Credit.

A continuation of BIOL 220, 220L; the endocrine, cardiovascular, lymphatic, immune, respiratory, digestive, urinary, and reproductive systems and development. S.

BIOL 252. Plant and Animal Diversity. 3 Credits.

An introduction to the anatomy and physiology of higher plants and animals. An integrative and comparative look at the organization and function of plants and animals. Prereq: BIOL 150 and BIOL 151.

BIOL 270. Undergraduate Research Experience: Antibiotic Drug Discovery. 3 Credits.

This course is an authentic research experience for undergraduates. Students in the course will participate in a larger national research initiative aimed at discovering new antibiotics produced by soil bacteria. Prereq: BIOL 150 and BIOL 151.

BIOL 271. Wildlife Ecology and Conservation: An Undergraduate Research Course. 3 Credits.

This course is an authentic research experience for undergraduates. Students in the course will participate in collaborative research projects with their teams, each team will design its own unique project focused on the wildlife population of interest. Prereq: BIOL 150, BIOL 150L, BIOL 151, BIOL 151L.

BIOL 272. Research Experience: Learning in Biology. 3 Credits.

This course is an authentic research experience for undergraduates. Students in the course will explore the processes of learning and instruction in undergraduate biology through critical reading of literature, experimental design, data analysis, and communication of research findings. Prereq: BIOL 150, BIOL 150L, BIOL 151, BIOL 151L.

BIOL 273. Undergraduate Research Course: Genomic Analysis. 3 Credits.

This course is an authentic research experience that provides students the opportunity to learn lab and analysis techniques used in genomics research, including sequencing of prokaryotic and eukaryotic DNA, and annotation of *Drosophila* sp. DNA. Prereq: BIOL 150 and BIOL 150L and BIOL 151 and BIOL 151L.

BIOL 274. Undergraduate Research Experience: Biomedical Research Analysis. 3 Credits.

This is an authentic research experience for undergraduates. Through critical reading of the literature, students in this course will explore elements of biomedical research including the ethics of working with human subjects, experimental design of clinical studies, and statistical analysis and interpretation of results. The course will culminate with students using public databases to conduct their own biomedical analysis. Prereq: BIOL 150, BIOL 150L, BIOL 151 and BIOL 151L.

BIOL 291. Seminar. 1-3 Credits.

BIOL 292. Global Practicum: Study Abroad. 1-15 Credits.

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

BIOL 293. Undergraduate Research. 1-5 Credits.

BIOL 294. Individual Study. 1-5 Credits.

BIOL 296. Field Experience. 1-15 Credits.

BIOL 299. Special Topics. 1-5 Credits.

BIOL 315. Genetics. 3 Credits.

Study of the basis of heredity with emphasis on structure and function of DNA and Mendelian genetics. 3 lectures. Cross-listed with PLSC 315. F, S.

BIOL 315L. Genetics Laboratory. 1 Credit.

Study of the basis of heredity with emphasis on structure and function of DNA and Mendelian genetics. 1 two-hour laboratory. Cross-listed with PLSC 315L. F, S.

BIOL 359. Evolution. 3 Credits.

Discussion of the mechanisms of evolution, including population genetics, selection, speciation, adaptation, and molecular evolution. Capstone course for Botany and Biological Sciences majors. Prereq: BIOL 150, BIOL 151 and BIOL 315.

BIOL 364. General Ecology. 3 Credits.

Ecological principles associated with organism environment interactions, populations, communities, and ecosystems. Quantitative approach with examples (animal, plant, microbial) included. Prereq: BIOL 150 and BIOL 151.

BIOL 370. Cell Biology. 3 Credits.

Structure and function of cells, including cell surfaces, membranes, organelles, cytoskeleton, cell division, cell physiology, and methods used in cell studies. Prereq: BIOL 150 and BIOL 151.

BIOL 379. Global Seminar. 1-6 Credits.

NDSU instructed experience or field study in a foreign country. Conducted in English for residence credit. Pre-requisite: Prior approval by International Student and Study Abroad Services and major department. May be repeated. Standard Grading.

BIOL 391. Seminar. 1-3 Credits.

BIOL 392. Global Practicum: Study Abroad. 1-15 Credits.

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

BIOL 393. Undergraduate Research. 1-5 Credits.**BIOL 394. Individual Study. 1-5 Credits.****BIOL 396. Field Experience. 1-15 Credits.****BIOL 399. Special Topics. 1-5 Credits.****BIOL 410. Comparative Chordate Morphology. 3 Credits.**

This is a combination lecture/lab course designed to introduce you to the systematics, history, and structure of the chordates, particularly the craniates. Structural and functional similarities and differences among organs and organ systems of representative organisms as well as the use of comparative morphology as a tool to better understand the process of chordate evolution will be emphasized. Prereq: BIOL 150, BIOL 151, BIOL 252.

BIOL 414. Plant Systematics. 3 Credits.

Plant identification, nomenclature and classification are aspects of plant systematics. Modern plant systematics uses molecular approaches in addition to visual traits such as morphology to order plants in accordance with our current understanding of evolution and the 'Tree of Life'. The course includes outdoor activities to learn plant identification as long as the weather permits. Prereq: BIOL 150 and BIOL 151.

BIOL 444. Vertebrate Histology. 3 Credits.

Study of the microscopic anatomy of vertebrate tissues and organs, especially mammals. Classification and identification of epithelium, connective, muscle, and nervous tissue types. Study of these tissues types in the context of major organ systems (circulatory, lymphoid, endocrine, integumentary, digestive, urinary, and respiratory). Prereq: BIOL 150, BIOL 151.

BIOL 450. Invertebrate Zoology. 3 Credits.

Survey of the biology, classification, and evolution of invertebrates. Emphasis on major phyla, marine, and parasitic taxa. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 650.}.

BIOL 452. Ichthyology. 3 Credits.

Biology and taxonomy of fishes. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 652.}.

BIOL 454. Herpetology. 3 Credits.

Primarily a field and laboratory course focusing on amphibians and reptiles. Students will learn about the biology, ecology, evolution, and life history of reptiles and amphibians utilizing a hands-on approach. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 654.}.

BIOL 456. Ornithology. 3 Credits.

Introduction to the biology, classification, and identification of birds, especially local forms. Early morning field trips required. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 656.}.

BIOL 458. Mammalogy. 3 Credits.

Biology and taxonomy of mammals. Prereq: BIOL 150, BIOL 151. F {Also offered for graduate credit - see BIOL 658.}.

BIOL 460. Animal Physiology. 3 Credits.

Study of the physical and chemical principles that govern cell, tissue, organ, organ system, and organismal function. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 660.}.

BIOL 461. Plant Ecology. 3 Credits.

Ecological structure, processes, and patterns observed with plant communities and populations as influenced by environmental conditions. Illustrations provided with local fieldwork. Prereq: BIOL 150, BIOL 151. Cross-listed with RNG 460. {Also offered for graduate credit - see BIOL 660.}.

BIOL 462. Physiological Ecology. 3 Credits.

Study of the physiological mechanisms underlying life-history trade-offs and constraints in an ecological and evolutionary context. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 662.}.

BIOL 463. Animal Behavior. 3 Credits.

Description of the principal behavior patterns of animals with consideration of ecological, evolutionary, and internal mechanisms. Prereq: BIOL 151, BIOL 151L.

BIOL 464. Endocrinology. 3 Credits.

Physiology and anatomy of endocrine glands; chemistry and interrelations of their secretions. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 664.}.

BIOL 465. Hormones and Behavior. 3 Credits.

Study of the organizational and activational role endocrine systems play in regulating animal behaviors. These studies will be explored within an ecological and evolutionary framework. Prereq: BIOL 150 and BIOL 151. {Also offered for graduate credit - see BIOL 665.}.

BIOL 470. Freshwater Ecology and Limnology. 3 Credits.

Freshwater ecology is the study of the relationship between freshwater organisms and their environment. Limnology is the study of inland waters, including lakes, reservoirs, rivers, streams, wetlands and groundwater. This course will provide an overview of freshwater ecology & limnology, emphasizing fundamental interactions and processes. Prereq: BIOL 150 and BIOL 151. {Also offered for graduate credit - See BIOL 670.}.

BIOL 472. Structure and Diversity of Plants and Fungi. 3 Credits.

We will focus on structure and morphology of plants and fungi, as well as explore the diversity or adaptations plants and fungi have acquired to overcome a variety of environmental and habitat challenges. Prereq: BIOL 150, BIOL 151.

BIOL 475. Conservation Biology. 3 Credits.

Integrative approach to the study and conservation of biodiversity. Application of principles from various sub-disciplines of the biological and social sciences to current conservation problems. Prereq: BIOL 150, BIOL 151. {Also offered for graduate credit - see BIOL 675.}

BIOL 476. Wildlife Ecology and Management. 3 Credits.

Application of ecological principles to management of game and non-game wildlife populations. Prereq: BIOL 150 and BIOL 151. {Also offered for graduate credit - see BIOL 676.}

BIOL 477. Wildlife and Fisheries Management Techniques. 3 Credits.

Students will learn techniques used in the study and management of fish and wildlife populations. Students will design an independent field research project to be executed during a field trip (typically 2-4 days in length). Prereq: BIOL 150 and BIOL 151. {Also offered for graduate credit - see BIOL 677.}

BIOL 479. Biomedical Genetics and Genomics. 3 Credits.

This course will cover the diagnoses, clinical presentations, prevention and treatments of hereditary diseases (Mendelian and complex); the ever-increasing roles that genetics and genomics have in advancing medicine (including personalized medicine). Prereq: BIOL 150, BIOL 151 and BIOL 315 or PLSC 315. {Also available for graduate credit - see BIOL 679.}

BIOL 480. Ecotoxicology. 3 Credits.

Ecotoxicology, the behavior of pollutants in and effects on ecosystems; top-down and bottom-up approaches for assessment/prediction of effects on populations, communities and ecosystems; ecotoxicological testing at single/multi-species levels; biomarkers; passive/active biomonitoring. Prereq: BIOL 151 and BIOL 151L. {Also offered for graduate credit - see BIOL 680.}

BIOL 481. Wetland Science. 3 Credits.

Definition of wetlands, biogeochemistry, ecophysiology and adaptations to wetland conditions in plants and animals, biodiversity and productivity, wetland ecology, applications of wetlands for treatment of wastewater and other forms of bioremediation. Prereq: BIOL 151, BIOL 151L. {Also offered for graduate credit - see BIOL 681.}

BIOL 482. Developmental Biology. 3 Credits.

Analysis of the processes of development, with an emphasis on animal development. Topics range from classical embryology to the cellular and molecular basis of development. Prereq: BIOL 150 and BIOL 151. {Also offered for graduate credit - see BIOL 682.}

BIOL 483. Cellular Mechanisms of Diseases. 3 Credits.

This course will be focused on the cellular and molecular bases of selected diseases and some non-human animal diseases. Key cellular pathways/processes and molecular mechanisms that, when altered/disrupted, result in pathological changes/conditions will be discussed from scientific (e.g., functions, regulation and structures of cells, proteins and organs) and medical (e.g., clinical presentation, diagnostic and treatment) perspectives. Prereq: BIOL 150, BIOL 151, BIOL 315 or PLSC 315, BIOL 370. {Also offered for graduate credit - See BIOL 683.}

BIOL 491. Seminar. 1-5 Credits.

BIOL 492. Global Practicum: Study Abroad. 1-15 Credits.

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

BIOL 493. Undergraduate Research. 1-5 Credits.

BIOL 494. Individual Study. 1-5 Credits.

BIOL 496. Field Experience. 1-15 Credits.

BIOL 499. Special Topics. 1-5 Credits.

BIOL 650. Invertebrate Zoology. 3 Credits.

Survey of the biology, classification, and evolution of invertebrates. Emphasis on major phyla, marine, and parasitic taxa. {Also offered for undergraduate credit - see BIOL 450.}

BIOL 652. Ichthyology. 3 Credits.

Biology and taxonomy of fishes. {Also offered for undergraduate credit - see BIOL 452.}

BIOL 654. Herpetology. 3 Credits.

Primarily a field and laboratory course focusing on amphibians and reptiles. Students will learn about the biology, ecology, evolution, and life history of reptiles and amphibians utilizing a hands-on approach. {Also offered for undergraduate credit - see BIOL 454.}

BIOL 656. Ornithology. 3 Credits.

Introduction to the biology, classification, and identification of birds, especially local forms. Early morning field trips required. {Also offered for undergraduate credit - see BIOL 456.}

BIOL 658. Mammalogy. 3 Credits.

Biology and taxonomy of mammals. {Also offered for undergraduate credit - see BIOL 458.}

BIOL 660. Animal Physiology. 3 Credits.

Study of the physical and chemical principles that govern cell, tissue, organ, organ system, and organismal function. {Also offered for undergraduate credit - see BIOL 460.}

BIOL 661. Plant Ecology. 3 Credits.

Ecological structure, processes, and patterns observed with plant communities and populations as influenced by environmental conditions. Illustrations provided with local fieldwork. Cross-listed with RNG 660. {Also offered for undergraduate credit - see BIOL 461.}.

BIOL 662. Physiological Ecology. 3 Credits.

Study of the physiological mechanisms underlying life-history trade-offs and constraints in an ecological and evolutionary context. S {Also offered for undergraduate credit - see BIOL 462.}.

BIOL 664. Endocrinology. 3 Credits.

Physiology and anatomy of endocrine glands; chemistry and interrelations of their secretions. {Also offered for undergraduate credit - see BIOL 464.}.

BIOL 665. Hormones and Behavior. 3 Credits.

Study of the organizational and activational role endocrine systems play in regulating animal behaviors. These studies will be explored within an ecological and evolutionary framework. {Also offered for undergraduate credit - see BIOL 465.}.

BIOL 675. Conservation Biology. 3 Credits.

Integrative approach to the study and conservation of biodiversity. Application of principles from various sub-disciplines of the biological and social sciences to current conservation problems. {Also offered for undergraduate credit - see BIOL 475.}.

BIOL 676. Wildlife Ecology and Management. 3 Credits.

Application of ecological principles to management of game and non-game wildlife populations. {Also offered for undergraduate credit - see BIOL 476.}.

BIOL 677. Wildlife and Fisheries Management Techniques. 3 Credits.

Students will learn techniques used in the study and management of fish and wildlife populations. Students will design an independent field research project to be executed during a field trip (typically 2-4 days in length). {Also offered for undergraduate credit - see BIOL 477.}.

BIOL 679. Biomedical Genetics and Genomics. 3 Credits.

This course will cover the diagnoses, clinical presentations, prevention and treatments of hereditary diseases (Mendelian and complex); the ever-increasing roles that genetics and genomics have in advancing medicine (including personalized medicine). {Also available for undergraduate credit - see BIOL 479.}.

BIOL 680. Ecotoxicology. 3 Credits.

Ecotoxicology, the behavior of pollutants in and effects on ecosystems; top-down and bottom-up approaches for assessment/prediction of effects on populations, communities and ecosystems; ecotoxicological testing at single/multi-species levels; biomarkers; passive/active biomonitoring. {Also offered for undergraduate credit - see BIOL 480.}.

BIOL 681. Wetland Science. 3 Credits.

Definition of wetlands, biogeochemistry, ecophysiology and adaptations to wetland conditions in plants and animals, biodiversity and productivity, wetland ecology, applications of wetlands for treatment of wastewater and other forms of bioremediation. {Also offered for undergraduate credit - see BIOL 481.}.

BIOL 682. Developmental Biology. 3 Credits.

Analysis of the processes of development, with an emphasis on animal development. Topics range from classical embryology to the cellular and molecular basis of development. {Also offered for undergraduate credit - see BIOL 482.}.

BIOL 683. Cellular Mechanisms of Disease. 3 Credits.

This course will be focused on the cellular and molecular bases of selected diseases and some non-human animal diseases. Key cellular pathways/processes and molecular mechanisms that, when altered/disrupted, result in pathological changes/conditions will be discussed from scientific (e.g., functions, regulation and structures of cells, proteins and organs) and medical (e.g., clinical presentation, diagnostic and treatment) perspectives. {Also offered for undergraduate credit. See BIOL 483.}.

BIOL 692. Global Practicum: Study Abroad. 1-15 Credits.

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

BIOL 695. Field Experience. 1-15 Credits.**BIOL 696. Special Topics. 1-5 Credits.****BIOL 790. Graduate Seminar. 1-3 Credits.****BIOL 791. Temporary/Trial Topics. 1-5 Credits.****BIOL 793. Individual Study/Tutorial. 1-5 Credits.****BIOL 794. Practicum/Internship. 1-10 Credits.****BIOL 795. Field Experience. 1-15 Credits.****BIOL 796. Special Topics. 1-5 Credits.****BIOL 797. Master's Paper. 1-3 Credits.**

Literature review, research, and preparation for paper required for the comprehensive study option. Graded S or U.

BIOL 798. Master's Thesis. 1-10 Credits.

BIOL 820. Advanced Cell Biology. 3 Credits.

In-depth survey of cell biology, including studies of membranes, secretion cytoskeleton, cellular movement organelles, and gene regulation.

BIOL 825. Biology of Aging. 3 Credits.

This course will take an integrative approach to understanding the biology of aging. We will examine both the evolutionary causes and underlying mechanisms of aging in diverse organisms including humans.

BIOL 842. Quantitative Biology. 3 Credits.

Philosophy and techniques for collecting, handling, and interpreting research data in the biological sciences. S.

BIOL 850. Advanced Ecology. 3 Credits.

This course covers classical ecological literature and current literature focusing on ecological research philosophy and techniques. An overview/introduction of a variety of statistical methods for analyzing ecological data is covered.

BIOL 851. Advanced Conservation Biology. 3 Credits.

This class will cover recent developments in the field of conservation biology, with a specific focus on recent literature. Areas of focus will include Evolutionary Conservation and Conservation Genetics.

BIOL 859. Evolution. 3 Credits.

Evolution is the process by which species change over time through descent with modification. This course will focus on understanding the different applications of evolutionary theory to current issues in the biological sciences.

BIOL 860. Evolutionary Ecology. 3 Credits.

Lecture-discussion course on recent developments in evolutionary theory and their implications in the study of animal adaptation, ecology, and behavior.

BIOL 862. Environment and Adaptation. 3 Credits.

Environmental factors and responses evidenced with life-history patterns, genetic variation, population dynamics, species-interactions, and physiological processes.

BIOL 865. Biological Rhythms. 3 Credits.

This course will provide a greater understanding of the nature of endogenous time keeping ("clocks") and will investigate A) the biological mechanisms by which these 'clocks' interface with the environment, both biotic (e.g. social behavioral) and abiotic, to B) enable adaptive responses. This class will focus almost exclusively on vertebrates, but may include classic examples and insights gained from plants and invertebrates.

BIOL 866. Advanced Animal Behavior. 3 Credits.

This course investigates current concepts and research areas in animal behavior, with a focus on topics that lie at the interface between animal behavior, ecology and evolution.

BIOL 876. Population Dynamics. 3 Credits.

Principles and mechanics of animal population dynamics. Prereq: an interest in working with numbers.

BIOL 877. Analysis of Population and Demographic Data. 3 Credits.

Contemporary maximum likelihood approaches to estimating abundance, survival, reproduction, and dispersal in free-living populations. Goodness-of-fit and information theory applied to population model selection. Examples from a variety of real populations. Prereq: BIOL 876, STAT 660 or STAT 661, ENT 842.

BIOL 884. Biological Research Principles. 3 Credits.

Discussion, analysis of published research papers, lectures on selected topics, and student research proposal. Prereq: STAT 725.

BIOL 892. Graduate Teaching Experience. 1-6 Credits.

BIOL 893. Individual Study/Tutorial. 1-5 Credits.

BIOL 895. Field Experience. 1-15 Credits.

BIOL 899. Doctoral Dissertation. 1-15 Credits.