

BIOLOGY (BIOL)

Courses primarily for undergraduates:

BIOL 1010: Introductory Biology

Credits: 3. Contact Hours: Lecture 3.

Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring, Summer)

BIOL 1100: Biology Major Orientation

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Student orientation to the Biology program. Introduction to degree requirements, university policies and deadlines, campus resources, academic success strategies, degree planning, and registration procedures. Community building through the Biology Education Success Teams Learning Community. Required for first-year direct from high school Biology majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BIOL 1110: Opportunities in Biology

Credits: 0.5. Contact Hours: Lecture 1.

Orientation to opportunities in Biology. Introduction to biological science disciplines, career awareness, and professional development opportunities. Required for first-year direct from high school Biology majors. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BIOL 1120: Transfer Student Orientation

Credits: Required. Contact Hours: Lecture 1.

Orientation to the Biology major for students transferring from other academic institutions. Reviews university resources, academic success strategies, degree requirements, opportunities for campus involvement, and professional development. Required for all new transfer students and recommended for major changes. Online with on-campus activities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BIOL 1130X: Exploring Possibilities in Life Sciences

(Cross-listed with GEN 1130X).

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Seminar focusing on introducing students to life science fields and careers. Explores interdisciplinary career paths and guidance on strategies for success in achieving career goals. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BIOL 1140X: Experiential Learning and Explorations in Life Sciences

(Cross-listed with GEN 1140X).

Credits: 1.

A second year experiential learning course focused on careers in life science fields. Sections offer themed learning allowing students to choose an immersive experience in an area of interest. Sections utilize hands-on engagement, field trips to on- and off-campus locations, and small group discussions with speakers working in different life science careers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BIOL 1550: Human Biology

Credits: 3. Contact Hours: Lecture 3.

A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

BIOL 1730: Environmental Biology

(Cross-listed with ENVS 1730).

Credits: 3. Contact Hours: Lecture 3.

An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

BIOL 2010: Introduction to Environmental Issues

(Cross-listed with ENSCI 2010/ ENVS 2010).

Credits: 2. Contact Hours: Lecture 2.

Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change. (Typically Offered: Fall)

BIOL 2040: Biodiversity

(Cross-listed with ENVS 2040).

Credits: 2. Contact Hours: Lecture 4.

Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course. See list of life science courses (<https://www.cals.iastate.edu/student-services/lifescience>) for additional information. (Typically Offered: Spring)

BIOL 2110: Principles of Biology I

Credits: 3. Contact Hours: Lecture 3.

Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors. (Typically Offered: Fall, Spring)

BIOL 2110L: Principles of Biology Laboratory I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2110

Laboratory to accompany 2110. (Typically Offered: Fall, Spring)

BIOL 2120: Principles of Biology II

Credits: 3. Contact Hours: Lecture 3.

Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors. HS courses in biology and chemistry necessary. Credit or enrollment in CHEM 1630 or CHEM 1770 recommended. (Typically Offered: Fall, Spring)

BIOL 2120L: Principles of Biology Laboratory II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2120

Laboratory to accompany 2120. (Typically Offered: Fall, Spring)

BIOL 2510: Biological Processes in the Environment

(Cross-listed with ENSCI 2510).

Credits: 3. Contact Hours: Lecture 3.

Principles of Biology from the level of macromolecules to the biosphere. Biological processes that affect environmental systems: including metabolism, energy pathways, biochemical reactions in cells, plant and microbial structure and function, element and water cycles. (Typically Offered: Spring)

BIOL 2550: Fundamentals of Human Anatomy

Credits: 3. Contact Hours: Lecture 3.

An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider BIOL 3510 for their anatomy background. Does not satisfy biology major requirements. HS courses in biology and chemistry necessary. Credit or enrollment in BIOL 1010 recommended. (Typically Offered: Fall)

BIOL 2550L: Fundamentals of Human Anatomy Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2550

Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 3510 for their anatomy background. Does not satisfy biology major requirements. (Typically Offered: Fall)

BIOL 2560: Fundamentals of Human Physiology

Credits: 3. Contact Hours: Lecture 3.

An introduction to human physiology, studying the function of all body systems. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic and immune, respiratory, digestive, urinary, and reproductive. Does not satisfy biology major requirements. HS courses in biology and chemistry necessary. Credit or enrollment in BIOL 1010 or BIOL 2550 recommended. (Typically Offered: Spring)

BIOL 2560L: Fundamentals of Human Physiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2560

Student-conducted experiments investigating concepts of human physiology with computer data acquisition and analysis. Interpretation of experimental results and preparation of lab reports. Does not satisfy biology major requirements. (Typically Offered: Spring)

BIOL 2570X: Bionics

Credits: 2.

Introduction to engineering design for life sciences focusing on bionics. Cross-disciplinary experiential learning projects drawing from human anatomy, physiology, mechanical, computer, and electrical engineering disciplines. Exploration of emerging technologies for human body augmentation and how these technologies can be developed for entrepreneurship projects. (Typically Offered: Fall, Spring)

BIOL 2890X: Experiences in Biodiversity Research

Credits: 2.

Designed to provide early undergraduates with practical experience in biodiversity research and demystify the path to careers in the field. Exposure to a variety of research contexts to increase experiences and engagement with biodiversity sciences; teachings on how to communicate and peer-review biodiversity science; and empowerment to seek future research opportunities. Regular cohort-building opportunities to increase student sense of belonging in biodiversity research. Includes an overnight field trip towards the end of the semester. Elective credit. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BIOL 2990X: Introduction to Undergraduate Research

(Cross-listed with GEN 2990X).

Credits: 1-2.

Prereq: Instructor Permission for Course

Identify a research opportunity on campus and conduct guided research under the supervision. (Typically Offered: Fall, Spring, Summer)

BIOL 3070: Women in Science and Engineering

(Cross-listed with WGS 3070/ WISE 3070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives.

Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements. Meets U.S. Diversity Requirement. (Typically Offered: Fall)

BIOL 3110X: Genome Editing and Engineering

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 4 times.

Hands-on experiences in molecular cloning, CRISPR/Cas9 genome editing, and imaging techniques. Novel biological and cellular processes and disease-related pathways in mammalian cell culture and other model systems will be investigated through CRISPR/Cas9-mediated mutagenesis approaches. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BIOL 3120: Ecology

(Cross-listed with AECL 3120/ ENSCI 3120).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110; (BIOL 2120 or BIOL 2510)

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats. (Typically Offered: Fall, Summer)

BIOL 3130: Principles of Genetics

(Cross-listed with GEN 3130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Graduation Restriction: Students may receive graduation credit for no more than one of the following: GEN 2600, GEN 3130 and 3130L, GEN 3200, BIOL 3130 and 3130L, and AGRON 3200. (Typically Offered: Fall, Spring, Summer)

BIOL 3130L: Genetics Laboratory

(Cross-listed with GEN 3130L).

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Credit or enrollment in BIOL 3130

Laboratory to accompany 3130. Graduation Restriction: Students may receive graduation credit for no more than one of the following: BIOL 3130 and 3130L, GEN 2600, GEN 3130, GEN 3200, and AGRON 3200. (Typically Offered: Fall, Spring)

BIOL 3140: Principles of Molecular Cell Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

Integration of elementary principles of metabolism, bioenergetics, cell structure, and cell function to develop a molecular view of how the cell works. (Typically Offered: Fall, Spring)

BIOL 3150: Biological Evolution

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

The mechanisms of evolution. Topics in microevolution: population genetics, natural selection, genetic variation, and adaptation.

Macroevolution: speciation, extinction, phylogeny, and major evolutionary patterns. (Typically Offered: Fall, Spring)

BIOL 3180: Introduction to Ecosystems

(Cross-listed with AGRON 3180/ ENSCI 3180/ NREM 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability. (Typically Offered: Spring)

BIOL 3190: Analysis of Environmental Systems

(Cross-listed with ENSCI 3190/ ENV 3190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENSCI 3120; junior classification

Systems approach to the analysis and modeling of material and energy flows in natural and managed environmental systems and the primary environmental factors controlling these systems. Applications in hydrology, biogeochemistry, and population dynamics. (Typically Offered: Spring)

BIOL 3220: Introduction to Bioinformatics and Computational Biology

(Cross-listed with BC BIO 3220/ GEN 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics. (Typically Offered: Fall)

BIOL 3280: Molecular and Cellular Biology of Human Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Survey of molecular, genetic, and cellular aspects of human diseases. Fundamental concepts of cell biology and how they are linked to the pathologies of different classes of human diseases. Recent scientific advances with an emphasis on new methods of diagnosis and treatment. (Typically Offered: Fall)

BIOL 3350: Principles of Human and Other Animal Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to physiology of metabolic function in mammals and other animals. Metabolic processes and their interactions with various subsystems, approached from an organismal perspective. Integration of cellular, gastrointestinal, cardiovascular, respiratory, and renal processes, relevant to their control and integration at the nervous and endocrine system levels. Functional aspects of organismal physiology, energy and water balances, physiology of rest exercise, and environmental stress. (Typically Offered: Spring)

BIOL 3350L: Principles of Human and Other Animal Physiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Optional laboratory to accompany Biology 3350. Student-conducted experiments investigating concepts of physiology. (Typically Offered: Spring)

BIOL 3360: Ecological and Evolutionary Animal Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Study of mechanisms by which animals perform life-sustaining functions; the evolution and adaptive significance of physiology traits, the diversity of physiological mechanisms, and how physiology and ecology interact.

BIOL 3440: Human Reproduction

(Cross-listed with WGS 3440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy. (Typically Offered: Spring)

BIOL 3490: The Genome Perspective in Biology

(Cross-listed with GEN 3490).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: GEN 3130 or GEN 3200

Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems. (Typically Offered: Spring)

BIOL 3500: Comprehensive Human Anatomy

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2120

Comprehensive survey of human anatomy, emphasizing structural and functional relationships of major organ systems. Compartmental study of normal anatomy; practical clinical application of anatomical regions. Laboratory using 3-dimensional software to study anatomy in augmented reality. Recommended for pre-medical and pre-health professional students. (Typically Offered: Fall)

BIOL 3510: Comparative Chordate Anatomy

Credits: 5. Contact Hours: Lecture 3, Laboratory 4.

Prereq: BIOL 2120, *junior classification*

The evolution of chordates as reflected in the anatomy of extinct and living forms. Lecture topics include the history and diversity of chordates, comparisons of anatomic structures among major groups, and the adaptive significance of anatomic structures. Laboratory involves dissection of representative species. (Typically Offered: Spring)

BIOL 3520: Vertebrate Histology

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: BIOL 2120

Microanatomy of animal cells, tissues, and organs; histology from a functional perspective; ultra-structure of cells, the four primary tissues, and different anatomical organs, focusing on function and clinical significance. Offered even-numbered years. (Typically Offered: Spring)

BIOL 3530: Introductory Parasitology

(Cross-listed with VPTH 3530/ MICRO 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

(Typically Offered: Spring)

BIOL 3540: Animal Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Ethological and sociobiological approaches to animal behavior. Genetic and developmental aspects of behavior, biological rhythms, orientation (including navigation, migration), communication, and social behavior (mating, aggression, parental care). (Typically Offered: Fall)

BIOL 3540L: Laboratory in Animal Behavior

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 3540

Laboratory techniques for observation, description and analysis of animal activities; independent projects. (Typically Offered: Fall)

BIOL 3550: Plants and People

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Uses of plants and fungi by humans and the importance of plants in the past, present, and future. Discussion of fruits, vegetables, grains, herbs, spices, beverages, oils, fibers, wood, medicines, and drugs, in the context of their agricultural, cultural, and economic roles in modern societies.

Emphasis on origins and worldwide diversity of culturally important plants, their characteristics, and uses. (Typically Offered: Spring)

BIOL 3560: Dendrology

(Cross-listed with FOR 3560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 2110

Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Historical conditions of North American forest regions will also be addressed. (Typically Offered: Fall)

BIOL 3570: Biology of Plants

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Study of the general biology of plants, including plant cells and functions, basic anatomy of tissues, meristems, and organs; adaptive morphological features. Review of processes of photosynthesis, respiration, basic plant metabolic functions, and plant reproduction. Survey of evolutionary aspects of all major groups of land plants, and relationships of plants to their environment. Intended for Biology and other life science undergraduate majors. BIOL 2110L and BIOL 2120L recommended. (Typically Offered: Fall)

BIOL 3580: Bee Biology, Management, and Beekeeping

(Cross-listed with ENT 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Introductory (2000-level) biology coursework or permission of an instructor

Bee diversity and evolution, ecology, role as pollinators, behavior, anatomy, and development. Management of bees as agricultural pollinators and honey producers, focusing on honey bees. Working with live bee hives and demonstration of practical beekeeping skills will occur during several field trips to local hives. (Typically Offered: Fall)

BIOL 3640: Invertebrate Biology

Credits: 3-4. Contact Hours: Lecture 3, Laboratory 4.

Prereq: BIOL 2110 and BIOL 2120

Emphasis on diversity, development, physiology, and behavior of invertebrate organisms- the 'spineless wonders' of the world. Laboratory involves hands-on study and investigation of living invertebrates. (Typically Offered: Fall)

BIOL 3650: Vertebrate Biology

(Cross-listed with AECL 3650).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: BIOL 2110 and BIOL 2110L

Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates. (Typically Offered: Fall)

BIOL 3660: Plant Systematics

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: BIOL 2110

Introduction to plant phylogenetic systematics, plant classification, survey of flowering plant families, and identification and field study of local plants. (Typically Offered: Spring)

BIOL 3700: GIS for Ecology and Environmental Science

(Cross-listed with ENSCI 3700).

Credits: 1-6. Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring)

BIOL 3710: Ecological Methods

(Cross-listed with AECL 3710).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120; STAT 1010 or STAT 1040

Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations. (Typically Offered: Fall)

BIOL 3750: Marine Ecology and Ecosystems Dynamics

(Cross-listed with AECL 3750/ ENSCI 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Overview of the ecological processes, ecosystems, and biodiversity in marine environments. Ever-changing dynamics caused by environmental disturbances, internal forces, or by human impacts on species and ecosystems. (Typically Offered: Spring)

BIOL 3930A: North American Field Trips in Biology: Pre-trip Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Discussion of relevant biological and cultural topics during semester preceding extended field trips to North American locations of interest to biologists.

BIOL 3930B: North American Field Trips in Biology: North American Field trip

Credits: 1-3. Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Extended field trip under supervision of faculty member, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Report required.

BIOL 3940A: International Field Trips in Biology: Pre-trip Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Discussion of relevant biological and cultural topics during semester preceding extended field trip to international locations of interest to biologists. Meets International Perspectives Requirement.

BIOL 3940B: International Field Trips in Biology: Field Trip to International Location

Credits: 1-3. Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Extended field trips, under supervision of faculty member, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Meets International Perspectives Requirement.

BIOL 3950X: Professional Development in Biological Sciences- Identifying Opportunities and Preparing Application

Credits: 2. Contact Hours: Lecture 2.

For students interested in undergraduate research, competitive internships, graduate or professional school. This course will help students identify opportunities, create, and polish your applications. (Typically Offered: Fall)

BIOL 4010: Bioinformatics of Sequences

(Cross-listed with BCBIO 4010/ COMS 4010/ GEN 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BCBIO 3220; (COMS 1270 OR COMS 2270); (MATH 1600 or MATH 1650); (MATH 1660 or STAT 3010); (STAT 1010 or STAT 1040 or STAT 3300) or Permission of Instructor

Application of computer science and statistics to molecular biology with a significant problem-solving component, including hands-on programming using Python to solve a variety of biological problems. String algorithms, sequence alignments, homology search, pattern discovery, genotyping, genome assembly, genome annotation, comparative genomics, protein structure. Offered odd-numbered years. (Typically Offered: Fall)

BIOL 4020: Introduction to Pathology

(Cross-listed with VPTH 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury. (Typically Offered: Fall)

BIOL 4030: Introduction to Pathology II

(Cross-listed with VPTH 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: VPTH 4020 and BIOL 4020

Continuation of pathology topics begun in VPTH/BIOL 4020. How specific organ systems respond to injury using principles and information covered in VPTH 4020/ BIOL 4020. Study of a set of prototypical diseases that affect humans and animals. (Typically Offered: Spring)

BIOL 4060: Bioinformatics of OMICS

(Cross-listed with BC BIO 4060/ COMS 4060/ GEN 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to cutting edge OMICS analyses including transcriptome, proteome, metabolome, DNA-protein interactome, protein-protein interactome and methylome. Genomic analysis including transcriptome analysis, cancer genomics, comparative genomics, and regulatory network analysis. (Typically Offered: Spring)

BIOL 4140: Life History and Reproductive Strategies

(Dual-listed with EEOB 5140).

Credits: 3. Contact Hours: Lecture 3.

Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescence; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios. BIOL 3150 or equivalent recommended. Offered odd-numbered years. (Typically Offered: Fall)

BIOL 4210: Biological Principles of Aging

(Dual-listed with EEOB 5210/ GERON 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered. (Typically Offered: Summer)

BIOL 4230: Developmental Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130

Principles of embryogenesis and animal development. Establishment of body axes, organ and limb development, and specification of cell fates. Emphasis on cell signaling and the control of gene expression within the context of a developing organism. Medically relevant subjects will be discussed, including stem cells, cancer biology, fertilization, and cloning. (Typically Offered: Spring)

BIOL 4230L: Developmental Biology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Repeatable, maximum of 4 times.

Prereq: Credit or enrollment in BIOL 4230 or permission of the instructor.

Experiments and explorations illustrating fundamental principles of multicellular development. (Typically Offered: Spring)

BIOL 4280: Cell Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3140

Cell structure and function in health and disease. Emphasis on cellular dynamics, transport, organelle biogenesis and signaling, and how defects in these processes disrupt cell function. (Typically Offered: Spring)

BIOL 4300: Principles of Plant Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; CHEM 2310 or CHEM 3320

An overview of classical and current concepts, principles, and approaches regarding the basic mechanisms of plant function underlying growth, development, and survival of plants. Topics covered include environmental and developmental signals, plant hormone action, signal transduction, mineral nutrition, water relations, metabolism, and photosynthesis. (Typically Offered: Spring)

BIOL 4340: Endocrinology

(Dual-listed with EEOB 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones. (Typically Offered: Spring)

BIOL 4360: Neurobiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Basic principles of brain function and development. Signaling of nerve cells, synaptic transmission, structure/function of ion channels and receptors, memory and synaptic plasticity, movement and central control, sensation and sensory processing, construction of neural circuits, early brain development, complex brain functions in health and disease. (Typically Offered: Fall)

BIOL 4510: Plant Evolution and Phylogeny

(Dual-listed with EEOB 5510).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 3150

Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies. (Typically Offered: Fall, Spring, Summer)

BIOL 4540: Plant Anatomy

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2120L

Characteristics of cell and tissue types in vascular plants. Anatomy of developing and mature stems, roots, and leaves, including secondary (woody) growth. Introduction to the special anatomy of flowers and seeds. BIOL 3660 recommended. Offered odd-numbered years. (Typically Offered: Fall)

BIOL 4550: Bryophyte and Lichen Biodiversity

(Dual-listed with EEOB 5550).

Credits: 3.

Prereq: Credit in BIOL 2110 *and* BIOL 2110L

Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning. (Typically Offered: Spring)

BIOL 4560: Principles of Mycology

(Cross-listed with MICRO 4560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 10 credits BIOL or MICRO

Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health. (Typically Offered: Fall)

BIOL 4570: Herpetology

(Cross-listed with AECL 4570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BIOL 3510 or BIOL 3650

Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

BIOL 4570L: Herpetology Laboratory

(Cross-listed with AECL 4570L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: BIOL 3510 or BIOL 365 or AECL 3650; *enrollment in* BIOL 4570 or AECL 4570

Laboratory to accompany Biology/Animal Ecology 4570. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

BIOL 4580: Ornithology

(Cross-listed with AECL 4580).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BIOL 3510 or AECL 3650

Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation. (Typically Offered: Spring)

BIOL 4580L: Ornithology Laboratory

(Cross-listed with AECL 4580L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: BIOL 3510 or AECL 3650/BIOL 3650 *and Credit or concurrent enrollment in* AECL 4580/BIOL 4580

Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips. (Typically Offered: Spring)

BIOL 4590: Mammalogy

(Dual-listed with EEOB 5590). (Cross-listed with AECL 4590).

Credits: 2. Contact Hours: Lecture 2.

Prereq: AECL 3650 or BIOL 3510

Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation. (Typically Offered: Spring)

BIOL 4590L: Mammalogy Laboratory

(Cross-listed with AECL 4590L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: BIOL 3510 or BIOL/AECL 3650; *concurrent enrollment in* BIOL 4590 or AECL 4590 *required*

Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips. (Typically Offered: Spring)

BIOL 4620: Evolutionary Genetics

(Cross-listed with GEN 4620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3150

The population and quantitative genetic basis of evolutionary processes. The role of genetic variation in natural selection and the influences of random processes on evolutionary change. The determinants of phenotype. (Typically Offered: Fall)

BIOL 4640: Wetland Ecology

(Dual-listed with EEOB 5640/ ENSCI 5640). (Cross-listed with ENSCI 4640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 15 credits in BIOL

Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands. (Typically Offered: Fall, Spring, Summer)

BIOL 4650: Macroevolution

(Dual-listed with EEOB 5650).

Credits: 4. Contact Hours: Lecture 2, Discussion 1.

Prereq: BIOL 3150

The history and diversity of life on earth; evolutionary patterns and processes above the species level. Diversity from a phylogenetic perspective. Empirical exercises include: phylogeny estimation, ancestral states, estimating diversification rates, evaluating the tempo and mode of evolution, biogeographic patterns, and trait associations across the tree of life. Offered even-numbered years. (Typically Offered: Spring)

BIOL 4710: Introductory Conservation Biology

(Cross-listed with AECL 4710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. (Typically Offered: Spring)

BIOL 4740: Plant Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

Principles of plant population and community ecology. (Typically Offered: Fall, Spring, Summer)

BIOL 4760: Functional Ecology

(Dual-listed with EEOB 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms. Offered odd-numbered years. (Typically Offered: Spring)

BIOL 4800: Studies in Marine Biology

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

BIOL 4810: Summer Field Studies

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Courses taken at summer biological field stations are transferred to Iowa State University under this number. See www.biology.iastate.edu for links to field stations located in different biomes: coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mountains.

BIOL 4820: Tropical Biology

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 credits.

Prereq: One year of college biology

Students registering for courses taught by the Organization for Tropical Studies will receive credit for this ISU course when requesting a transfer of credits. Knowledge of Spanish desirable but not required.

BIOL 4830: Environmental Biogeochemistry

(Dual-listed with ENSCI 5830). (Cross-listed with ENSCI 4830/ GEOL 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

An exploration of biological, physical and geochemical impacts on the structure and function of ecosystems from local to global scales. Emphasis on the cycles of carbon, nitrogen, phosphorus, sulfur, and metals, and how these have been impacted by human activity. Topics may include biological feedbacks to climate change, microbial physiology and redox reactions, plant/soil feedbacks, terrestrial/aquatic linkages, early Earth processes and the origins of life. Offered odd-numbered years. (Typically Offered: Spring)

BIOL 4840: Ecosystem Ecology

(Cross-listed with ENSCI 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues. Offered odd-numbered years. (Typically Offered: Spring)

BIOL 4850: Community Ecology

(Dual-listed with EEOB 5850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecific interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates. (Typically Offered: Spring)

BIOL 4860: Aquatic Ecology

(Dual-listed with AECL 5860/ EEOB 5860/ ENSCI 5860). (Cross-listed with AECL 4860/ ENSCI 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3190 or ENSCI 4020 or NREM 3010

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

BIOL 4860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 5860L/ EEOB 5860L/ ENSCI 5860L). (Cross-listed with AECL 4860L/ ENSCI 4860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Concurrent enrollment in BIOL 4860

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

BIOL 4870: Microbial Ecology

(Dual-listed with EEOB 5870/ ENSCI 5870/ GEOL 5870/ MICRO 5870).

(Cross-listed with ENSCI 4870/ GEOL 4870/ MICRO 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in Biology and 6 credits in Chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

BIOL 4880: Identification of Aquatic Organisms

Credits: 1. Contact Hours: Laboratory 3.

On-line taxonomic and identification exercises to accompany 4860. Instruction and practice in the identification of algae, aquatic macrophytes, zooplankton, and benthos. (Typically Offered: Fall, Spring)

BIOL 4890: Population Ecology

(Dual-listed with AECL 5890/ EEOB 5890). (Cross-listed with AECL 4890).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 3120; (STAT 1010 or STAT 1040); (MATH 1510, 1600, 1650 or Graduate standing)

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

BIOL 4900: Independent Study

Credits: 1. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Independent study opportunities for undergraduate students in the biological sciences. Graduation Restriction: No more than 9 credits in BIOL 4900 may be counted toward graduation and, of those, only 2 credits may be applied toward the biology advanced course requirement. (Typically Offered: Fall, Spring, Summer)

BIOL 4910: Undergraduate Teaching Experience

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

For students registering to be undergraduate teaching assistants. Offered on a satisfactory-fail basis only.

BIOL 4920: Preparing for Graduate School in the Biological Sciences

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore classification; major in College of Agriculture and Life Sciences

For students considering pursuing a graduate degree in the biological sciences. Professional development topics including the defining of academic and career areas of interest, finding and evaluating appropriate programs of graduate study, the graduate school application process, and developing a curriculum vita. Exploration of learning opportunities at field stations, research internships, and independent research activities. (Typically Offered: Fall)

BIOL 4940: Biology Internship

Credits: 1-3. Repeatable.

Prereq: 8 credits in Biology and Permission of Instructor

Professional experiences in biological sciences. Intended for Biology majors. Graduation Restriction: No more than 9 credits in BIOL 4940 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement. (Typically Offered: Fall, Spring, Summer)

BIOL 4950: Undergraduate Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Content varies from year to year and may include detailed discussion of special topics in biology, current issues in biology, or careers in biology. (Typically Offered: Fall, Spring)

BIOL 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Cooperative Education Coordinator Permission for Course

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

BIOL 4990: Undergraduate Research Experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Research opportunities for undergraduate students in the biological sciences. Intended for Biology majors. Graduation Restriction: No more than 9 credits in BIOL 4990 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement. (Typically Offered: Fall, Spring, Summer)