BIOLOGY

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The Creighton Biology Department offers foundational and advanced courses across major subdisciplines of biology. Lecture and lab experiences are grounded in first principles. Modern facilities, faculty active in research and a commitment to mentoring students all contribute to a rich environment for developing a sound foundation in life science and opportunities to participate in original research.

Biology - B.S.

Specific Requirements for Admission to the Biology Major

- Completion of BIO 201 General Biology: Organismal and Population and BIO 202 General Biology: Cellular and Molecular with a grade of "C" or better in each, OR completion of one 300-level or higher Biology course at Creighton with a grade of "C" or better.

Major in Biology, Requisite Courses

Code	Title	Credits
CHM 203	General Chemistry I	3
CHM 204	General Chemistry I Laboratory	1
CHM 205	General Chemistry II	3
or CHM 285	Advanced General Chemistry II	
CHM 206	General Chemistry II Laboratory	1
or CHM 286	Chemical and Statistical Analysis Laboratory	
CHM 321	Organic Chemistry I	3
CHM 322	Organic Chemistry I Laboratory	1
CHM 323	Organic Chemistry II	3
CHM 324	Organic Chemistry II Laboratory	1
PHY 201	General Physics for the Life Sciences	3
PHY 202	General Physics for the Life Sciences II	3
PHY 205	General Physics Laboratory I	1
PHY 206	General Physics Laboratory II	1

B.S., Major in Biology requirements: 33 Credits

Code	Title	Credits
BIO 202 & BIO 206	General Biology: Cellular and Molecular and General Biology: Cellular and Molecular Laboratory	4
BIO 201 & BIO 205	General Biology: Organismal and Population and General Biology: Organismal and Population Laboratory	4
Upper Division Biology courses		
Seven upper-division lecture courses in the major, which consists of 300-level and above BIO courses of three or more credits, except BIO 297, BIO 350, BIO 397, BIO 493, BIO 495 and BIO 497. These courses must include:		
Five lecture courses at the 300- and/or 400-level, which must include at least one course from each of the following three areas:		
Molecular/Cellular:		
BIO 317	Genetics	
BIO 362	Cell Structure and Function	
BIO 432	Immunology	
BIO 451	Microbiology	
BIO 462	Neurobiology	
BIO 464	Neurobiology of Disease	
BIO 467	Developmental Biology	
Organismal:		
BIO 335	Zoology	
BIO 341	Botany	
BIO 371	Animal Behavior	
BIO 433	Vertebrate Comparative Anatomy	
BIO 439	Parasitology	
BIO 445	Environmental Physiology	
BIO 449	Physiology	
BIO 461	Entomology	
BIO 462	Neurobiology	
BIO 467	Developmental Biology	
Population/Ecology/Evolution:		
BIO 315	Foundations of Ecology & Evolution	
BIO 383	Vertebrate Natural History	
BIO 385	The Ecology, Geography and Health of Lakes	
BIO 415	Evolution	
BIO 435	Coastal and Estuarine Ecology	
BIO 439	Parasitology	
BIO 445	Environmental Physiology	
BIO 460	Environmental Remote Sensing	
BIO 471	Conservation Biology	
BIO 481	Terrestrial Ecology	
BIO 485	Marine And Freshwater Ecology	
One 500-level "focus" course		
Applicable courses are:		
BIO 501	Bioinformatics: Genomics Approach	
BIO 517	Current Topics in Genetics	
BIO 520	Genomes and Chromosomes	
BIO 523	Environmental Toxicology	
BIO 532	Current Topics in Cellular and Molecular Biology	
BIO 539	Ecology of Zoonotic Diseases	
BIO 541	Current Topics in Plant Biology	
BIO 545	Plant Diversity and Evolution	
BIO 559	Current Topics in Physiology	
BIO 567	Current Topics in Neuroscience	
BIO 580	Current Topics in Ecology	
One additional course of the student's choice. This course can be any upper-division BIO lecture course or one of a select group of offerings by other departments. Please check with the Biology department for a list of currently approved courses.		
Four laboratory courses		
This requirement may be satisfied by any combination of 4 credit lecture + laboratory or 1 or 2 credit laboratory-only courses. Lecture + laboratory courses may apply simultaneously to both the lecture and laboratory requirements.		
The following courses apply toward this requirement:		
Lecture/Laboratory courses		
BIO 335	Zoology	

BIO 341	Botany
BIO 385	The Ecology, Geography and Health of Lakes
BIO 433	Vertebrate Comparative Anatomy
BIO 435	Coastal and Estuarine Ecology
BIO 445	Environmental Physiology
BIO 451	Microbiology
BIO 461	Entomology
BIO 467	Developmental Biology
BIO 481	Terrestrial Ecology
BIO 501	Bioinformatics: Genomics Approach
BIO 520	Genomes and Chromosomes
Laboratory-only courses	
BIO 318	Genetics Laboratory
BIO 363	Cell Structure and Function Laboratory
BIO 372	Animal Behavior Laboratory
BIO 384	Vertebrate Natural History Laboratory
BIO 419	Molecular Genetics Laboratory
BIO 450	Physiology Laboratory
BIO 463	Neurobiology Laboratory
BIO 486	Freshwater Ecology Laboratory

In addition, one of the following may be used as the equivalent of a laboratory course: BIO 490 may be counted as one lab course if taken twice. BIO 497 may be counted as one lab course if: 1. At least six credits of 497 are taken over multiple semesters. 2. The research work is presented by the student at a regional or national scientific meeting 3. The research work is also presented by the student as a poster at the Department of Biology Research Colloquium.

BIO 297 Directed Research, BIO 350 Fundamentals of Microbiology, BIO 397 Directed Independent Research (Extramural), BIO 492 Seminar in Undergraduate Classroom Instruction, BIO 493 Directed Independent Readings, and BIO 495 Directed Independent Study **do not** apply toward the major requirements. BIO 497 Directed Independent Research may be counted as one lab course as noted above. BIO 490 Seminar In Undergraduate Biology Instruction can be applied toward the lab requirement if taken **twice**.

Upon petition prior to enrollment, courses in departments other than Biology (such as CHM 371 Biochemistry of Metabolism) may be approved for non-laboratory biology major credit; a student may exercise this option for only one such course.

Minor in Biology

The Biology minor introduces students to foundational and advanced courses across the major subdisciplines of modern biology. Lecture and lab experiences are grounded on fundamental principles. In addition to the General Biology courses, a diversity of life science topics are available in upper division courses at the cellular and molecular, organismal, and ecological and evolutionary biology levels. Students can design a study plan which allows an in-depth exploration of one area or a broader survey of several subdisciplinary areas of biology.

Biology Minor requirements

Code	Title	Credits
BIO 202 & BIO 206	General Biology: Cellular and Molecular and General Biology: Cellular and Molecular Laboratory	4
BIO 201 & BIO 205	General Biology: Organismal and Population and General Biology: Organismal and Population Laboratory	4
Ten additional credit in BIO courses numbered 300 and above.[1]		10
Must include one lecture + laboratory or laboratory-only course.		
Total Credits		18

[1] Courses in departments other than Biology may not be applied towards this minor. Additionally, BIO 311 Biostatistics, BIO 425 Development of Biological Thought, BIO 297 Directed Research, BIO 397 Directed Independent Research (Extramural), BIO 490 Seminar In Undergraduate Biology Instruction, BIO 492 Seminar in Undergraduate Classroom Instruction, BIO 493 Directed Independent Readings, BIO 495 Directed Independent Study, and BIO 497 Directed Independent Research do not apply towards this minor

Teacher Certification

Students who plan to teach Biology in secondary schools should consult with the Education Department, the Biology Department, and the appropriate agency in the state in which they intend to teach.

Courses

BIO 123. Microbiology for Health Professionals. 4 credits.
Microbiology for Health Professionals is an introductory course covering the biology of microorganisms that are agents of infectious disease. Practical information about microorganisms will be presented that is critical to understanding patient care and disease-prevention strategies. A survey of bacterial and viral disease, antimicrobial chemotherapy options, the response of the body to infection, and concepts in epidemiology will all be presented. 3R.

BIO 149. Biology for the Non-Science Major. 3 credits. SP
Introduces non-biology major students to the basics of human anatomy and physiology. Normal functioning of the human body systems, human disease, human genetics, and human population and environmental issues are addressed. The primary goal of this course is to provide the student with a solid, working understanding of the function and occasional malfunction of the human body from an individual and global perspective. Bioethical issues and current medical advances are also discussed and students will gain experience in statistical concepts associated with Epidemiology and Human Disease. 3R.

BIO 159. Human Biology. 4 credits.
This course will explore the general biology of the human body, including investigation into the cells and molecules that make up the body, exploration of organ systems, and discussions of disease. In the laboratory students will learn basic techniques used in various biology fields to discover new information. The students will then apply what they learned to design their own research question and test it. Overall the course will introduce them to science, how the human body works, and how it is studied. This course meets Magis Core Doing Natural Science and Designated Statistical Reasoning. 3R, 3L. Prereq: Understanding Natural Science; Mathematical Reasoning.

BIO 201. General Biology: Organismal and Population. 3 credits. FA, SP
Organismal and population biology with emphasis on organismal diversity, structural and functional strategies of organisms, ecological and behavioral relationships, and evolutionary mechanisms. The diversity of adaptive specialization based on the fundamental unity of life is the theme of the course. 3R.

BIO 202. General Biology: Cellular and Molecular. 3 credits. FA, SP, SU
Introduces the conceptual bases of biology and presents the molecular and cellular aspects of metabolism, genetics, and other selected systems. P. One year of college or high school chemistry of sufficient depth and rigor to enable the student to participate in the study of the molecular aspects of biology. 3R. Prereq: Understanding Natural Science; CHM 105 with a grade of B- or better, or CHM 203 with a grade of C- or better, or IC.

BIO 205. General Biology: Organismal and Population Laboratory. 1 credit. FA
Laboratory portion of BIO 201 designed to reinforce introductory knowledge in ecology, evolution and organismal biology. Students will learn basic biological laboratory techniques. 3L. Prereq or Co-req: BIO 201.

BIO 206. General Biology: Cellular and Molecular Laboratory. 1 credit. SP
Laboratory portion of BIO 202 designed to reinforce introductory knowledge in molecular and cellular biology and genetics. Students will learn basic biological laboratory techniques and principals of experimental design and analysis. 3L. Prereq: Understanding Natural Science; P or CO: BIO 202.

BIO 297. Directed Research. 0-2 credits.
An introduction to laboratory or field methods intended to prepare students for independent research. Research students should enroll in BIO 397 or BIO 497 in subsequent semesters. (No more than 12 semester hours of credit may be accrued in any combination of BIO 297, BIO 397, BIO 493, BIO 495, and BIO 497.) Graded Satisfactory/Unsatisfactory. This course is repeatable. P. IC.

BIO 311. Biostatistics. 4 credits. FA, SP
Introduction to statistical methods, data display, and experimental design as applied to biological studies. Data analysis is conducted using open-source statistical software. Does not count as a laboratory course. P. BIO 201 and BIO 202; Mathematical Reasoning.

BIO 315. Foundations of Ecology & Evolution. 3 credits. FA, SP
Introduces the ecological principals governing interactions between organisms and their environment and the change of populations and species over time in the process of evolution. 3R. P. BIO 201 and BIO 202 or IC.

BIO 317. Genetics. 3 credits. FA, SP
Science of heredity and variation. Basic principles of Mendelian genetics, cytogenetics, molecular genetics, human genetics and evolution are examined. 3R. P. BIO 201, BIO 202, BIO 205, and BIO 206.

BIO 318. Genetics Laboratory. 1 credit. FA
Laboratory projects designed to illustrate basic genetic principles will be conducted with the aid of bacteria, fungi, and Drosophila as experimental organisms. 3L. P or CO: BIO 317.

BIO 335. Zoology. 4 credits. FA (Same as EVS 335)
Biological concepts and principles exemplified by both invertebrates and vertebrates with emphasis on animal diversity, morphology, evolution, and ecological relationships. 3R, 3L. P. BIO 201, BIO 202, BIO 205, and BIO 206; Mathematical Reasoning.

BIO 341. Botany. 4 credits. FA (Same as EVS 341)
Biological concepts and principles exemplified by the plant kingdom with emphasis on plant anatomy, development and growth, physiology, and evolution. 3R, 3L. P. BIO 201 and BIO 202; Mathematical Reasoning.

BIO 350. Fundamentals of Microbiology. 4 credits.
This course is designed to provide an overview of the structure, metabolism, physiology, ecology, and interactions of microorganisms such as bacteria, archaea, fungi, protists, helminths, and viruses. We as well as microorganisms that benefit the hosts they inhabit or play key roles in the global ecosystem. NOTE: BIO 350 course is an upper-level elective for the BIO minor but does NOT count for the Biology major. Biology majors should take BIO 451. 3R, 3L. P. BIO 201, 202, 205, and 206.

BIO 362. Cell Structure and Function. 3 credits. FA, SP
Emphasizes the fundamental importance and experimental underpinnings of knowledge in cell biology. The course consists of four segments; 1) common techniques in cell biology research, 2) basic principles of cell structure and function including membranes, vesicular transport, protein sorting, and the cytoskeleton, 3) how cells multiply, assemble into tissues, and interact with their environment, and 4) cell motility, the immune response, and cancer. 3R. P. BIO 202 and BIO 206.

BIO 363. Cell Structure and Function Laboratory. 1 credit.
This course is designed to deepen students' understanding of cell biology through a series of hands-on laboratory experiments. Using both biochemical and optical techniques we will explore many processes discussed in BIO 362. Students will also identify the location and potential role of an unknown protein. 3L. P or CO: BIO 362.

BIO 371. Animal Behavior. 3 credits. FA, SP (Same as EVS 371)
Evolutionary aspects of animal behavior, including physiological bases of behavior, social behavior, behavioral ecology and genetics of behavior. 3R. P. BIO 201, BIO 202, BIO 205 and BIO 206.

BIO 372. Animal Behavior Laboratory. 2 credits. SP (Same as EVS 372)
Introduction to animal behavior research methods using structured observations and experiments in laboratory and field settings. 3L. P. Mathematical Reasoning. P or CO: BIO 371 or EVS 371.

BIO 383. Vertebrate Natural History. 3 credits. SP (Same as EVS 383)
Lecture series designed to provide students with a modern overview of vertebrate diversity. Lectures encompass ancestry, major adaptive shifts between classes of vertebrates, geographic distribution based on physiological limits, specialized feeding and locomotor modes, courtship patterns, reproductive strategies, and conservation issues. Recommended as useful prior to enrollment in BIO 440 (Field Biology of the Desert Southwest) and for students seeking a general understanding of vertebrate life, or those who are interested in teaching biological sciences. 3R. P. BIO 201, BIO 202, BIO 205 and BIO 206.

BIO 384. Vertebrate Natural History Laboratory. 1 credit. SP (Same as EVS 384)
Laboratory exercises that will provide experience in the following areas: dissection of representatives of each major vertebrate class with emphasis on the diagnostic differences between groups; identification and preservation of vertebrate specimens. Field trips are available on a limited basis. 3L. P. BIO 201, BIO 202, BIO 205, and BIO 206.

BIO 385. The Ecology, Geography and Health of Lakes. 4 credits. AY, SU (Same as EVS 385)
A summer field course that examines lakes in the North Central and Rocky Mountains regions of the United States. This course is a combination of lectures and field and laboratory studies of the physical, chemical and biological properties of lakes in a landscape context. The effects of human impacts on lake ecology and ecosystem health are emphasized. The course includes field work at lakes and regional field stations in northern Iowa (Iowa Lakeside Laboratory on West Okoboji Lake), the Boundary Waters and Lake Superior in Minnesota, the hyperalkaline Western Nebraska Sandhills, and alpine lakes in the Colorado Rockies (University of Colorado's Mountain Research Station at Niwot Ridge). P. BIO 201, BIO 202, BIO 205, BIO 206 and IC.

BIO 390. Environmental Science. 3 credits. SP (Same as EVS 390)
Course presents a balanced, scientific approach to the study of the environment and stresses the application of ecological concepts within a systems perspective. Topics include ecological concepts, population principles, endangered species and habitats, resources, air and water pollution, environmental health, and global perspectives. 3R. P. BIO 201 and BIO 205; BIO 202 and BIO 206 or CHM 205 and CHM 206 (or CHM 285 and CHM 286).

BIO 397. Directed Independent Research (Extramural). 0-3 credits.
A program of independent study emphasizing laboratory or field research, intended for students working with mentors not part of the Biology faculty. (No more than 12 semester hours of credit may be accrued in any combination of BIO 297, BIO 397, BIO 493, BIO 495, and BIO 497.) Graded Satisfactory/Unsatisfactory. P. IC.

BIO 415. Evolution. 3 credits.
A comprehensive introduction to the fundamental paradigm of modern Biology. Topics include the origin and history of life; historical development of evolutionary theory; genetic basis of evolution; evolutionary mechanisms; organismal diversity, speciation and phylogenetic methods of analysis; evolutionary aspects of biological subdisciplines; and selected special topics. 3R. P. BIO 201, BIO 202, BIO 205, and BIO 206.

BIO 419. Molecular Genetics Laboratory. 2 credits. SP
Laboratory activities using contemporary methods of genomic inquiry. Emphasis on fundamental aspects of gene structure and function. 1R, 3L. P. BIO 317 or IC.

BIO 425. Development of Biological Thought. 3 credits. SU
This travel course will examine the development of the intellectual tools used in the natural sciences, particularly Biology, while visiting many of the institutions and locations in which the advances were made. The course will be held in London, UK and will include both lectures and field trips. P. BIO 201, BIO 202, BIO 205, and BIO 206 or IC.

BIO 432. Immunology. 3 credits. SP
This lecture course is designed to present the basic principles and concepts of immunology. Topics such as organization of the immune system, evolution of the immune system, and cellular and molecular mechanisms used by the immune system to protect organisms from disease are discussed in detail. Additionally, course material examines the practical application of immunological experimental advances in basic and medical science. 3R. P. BIO 201, BIO 202, BIO 205, and BIO 206 and one of the following: BIO 317 or BIO 362.

BIO 433. Vertebrate Comparative Anatomy. 4 credits. SP
Lecture and laboratory study of the anatomy of vertebrates. Lectures incorporate the developmental and evolutionary bases of anatomy. 3R, 3L. P. One 300-level or higher BIO course.

BIO 435. Coastal and Estuarine Ecology. 4 credits. AY, SU (Same as EVS 435)
Coastal and Estuarine Ecology is a 3 ½ week, intensive travel course. Participants experience, first-hand, the great diversity of marine ecosystems of the Gulf of Mexico, Tropical Atlantic, and Southeastern Atlantic regions. The class will examine tropical coral reef, sea grass, and mangrove communities, barrier islands (salt marshes, beaches, mudflats), and diverse open water habitats (lagoons, bays, tidal creeks and rivers, and near-shore shelf waters). The course emphasizes physical, chemical, and biological concepts applied to coastal habitats, with an emphasis on adaptations of marine organisms to their environments, ecological relationships, sampling methods and site characterizations, and threats to coastal ecosystems. The class stays at nationally recognized oceanographic and coastal field stations in Florida, Georgia, and Mississippi. The Creighton 18' Sundance Skiff and field station boats serve as work platforms and provide access to various habitats. Students should have completed one field course or one 300-level or above organismal course. P. IC.

BIO 439. Parasitology. 4 credits. SP
A survey of protozoan, helminth, and arthropod parasites with emphasis on their morphology, taxonomy, life histories, and host/parasite relationships. Includes parasites of medical and ecological importance. 3R, 3L. P. One 300-level or higher BIO course; Mathematical Reasoning, Ethics.

BIO 445. Environmental Physiology. 3 credits. (Same as EVS 445)
Impact of environmental changes and environmental extremes on animals and their physiological mechanisms. Examines primarily vertebrates and their responses to variations in temperature, pressure, and salinity. Basic physiological principles associated with each adaptive response covered in lecture and reading assignments. 3R. P. BIO 335, BIO 383, BIO 433 or BIO 449.

BIO 449. Physiology. 3 credits. FA, SP
Introduction to human biological function from the cellular to the organ-systems level. 3R. P. BIO 362 or IC.

BIO 450. Physiology Laboratory. 1 credit. FA
A hands-on laboratory using modern experimental techniques and technology to illustrate fundamental processes in animal physiology, spanning from cellular mechanisms to whole-animal responses. P or CO: BIO 449.

BIO 451. Microbiology. 4 credits. SP (Same as EVS 451)
Microbiology is the study of organisms too small to be seen with the naked eye. Despite their small size, these organisms are ubiquitous and play important roles in human health, industry, and the functioning of ecosystems. This course is designed to cover a wide range of material in lecture and through laboratory exercises, introducing students to the breadth of microbial diversity and physiology, as well as the basic techniques used in microbiology. 3R, 3L. P. Two of the following: BIO 317, BIO 362, CHM 371, CHM 381 or IC; Mathematical Reasoning.

BIO 460. Environmental Remote Sensing. 4 credits. SP
This course is an introduction to the techniques of observing the Earth from air- and space-bourne instruments. We will cover the basic issues of geometry and scale associated with making these instrument measurements, electromagnetic properties of Earth surface metals, the range of instruments used to observe the Earth, and applications of satellite remote sensing to geological and environmental materials. The course will involve an independent research project utilizing remote sensing data and software. 3R, 3L. P. BIO 201, BIO 202, BIO 205 and BIO 206; or EVS 113 and EVS 114; or IC.

BIO 461. Entomology. 4 credits. AY, FA (Same as EVS 461)
Introduction to insect biology with emphasis on the major insect groups. Anatomy, physiology, and behavior of insects and their ecological, agricultural, and medical importance. 3R, 3L. P. BIO 201, BIO 202, BIO 205, and BIO 206.

BIO 462. Neurobiology. 3 credits. FA
Introduction to the fundamental concepts of comparative neurobiology and the neural basis of behavior. Topics covered include the cell biology of the neuron, neural systems, sensory systems, motor systems, sensory-motor integration and higher brain functions, the interactions between hormones, brain and behavior, and human neurobiology. Lectures emphasize the comparative approach of studying the structure and function of nervous systems by using both invertebrate and vertebrate model systems to illustrate how the brain controls behavior. 3R. P. BIO 201, BIO 202, BIO 205, and BIO 206, and either BIO 362, BIO 433 or BIO 449.

BIO 463. Neurobiology Laboratory. 1 credit. FA
Introduction to neurobiological and behavioral research methods using experimental techniques to understand functional aspects of neurophysiology and the neural basis of behavior. 3L. P or CO: BIO 462.

BIO 464. Neurobiology of Disease. 3 credits.
To understand neurological disease, its profession, and discover novel therapeutics requires in-depth knowledge of the cellular and molecular underpinnings of the disorders. Students will revisit concepts from prerequisite courses but apply them to the function and activity of the brain and to circumstances where normal biology breaks down. 3L. Prereq: Ethics; Contemporary Composition; BIO 202 and BIO 362.

BIO 467. Developmental Biology. 4 credits. FA
Animal development with emphasis on the higher vertebrates. Gametogenesis, cleavage patterns and basic body plans, organ system formation, embryo-maternal relationships. Control of growth, differentiation, and morphogenesis. 3R, 3L. P. One 300-level or higher molecular/cellular BIO course and one 300-level or higher organismal BIO course; Ethics.

BIO 471. Conservation Biology. 3 credits. AY, FA
Introduction to the science of biodiversity preservation. Relevant principles of ecology, population genetics, and behavioral biology; aspects of biodiversity, threats to biodiversity and strategies for limiting them; protected area design and management; ecological economics, environmental ethics, sustainable development, and the interplay between human needs and biodiversity preservation. 3L. P. BIO 201, 202, 205 and 206 or IC.

BIO 481. Terrestrial Ecology. 4 credits. FA (Same as EVS 481)
Introduction to the interactions of organisms and the environment, especially the biology of populations, communities, and ecosystems. Individual adaptations, the nature of the environment, population dynamics, and community organization are stressed. Laboratory exercises include field trips to terrestrial habitats. 3R, 3L. P. BIO 201, BIO 202, BIO 205 and BIO 206; Mathematical Reasoning.

BIO 485. Marine And Freshwater Ecology. 3 credits. FA (Same as EVS 485)
An introduction to the community structure, biological production, and physical and chemical properties of aquatic ecosystems. The major features of water columns, benthic substrates, and lotic zones will be reviewed and compared. 3R. P. BIO 201, BIO 202, BIO 205 and BIO 206.

BIO 486. Freshwater Ecology Laboratory. 2 credits. FA (Same as EVS 486)
Introduction to methods for analyzing lake, stream, and wetland habitats. Exercises will examine physical and chemical properties, biological production and food chains, and water quality of freshwater ecosystems. 3L. P or CO: BIO 485 or IC.

BIO 490. Seminar In Undergraduate Biology Instruction. 0-1 credits.
Required of all undergraduate Teaching Assistants in those semesters in which they are teaching. Course provides instruction in both course content and its effective communication. Emphasis on laboratory and field skills, preparation of examinations, classroom supervision, and student evaluation. Course may be repeated up to a maximum of four times. P. IC.

BIO 492. Seminar in Undergraduate Classroom Instruction. 0-1 credits.
Required of all undergraduate Teaching Assistants supporting lecture-based courses in those semesters they teach. Course provides instruction in course content and its effective communication, fair and constructive grading techniques, and management of course records. Specific duties will vary depending on the requirements for specific courses. P. IC.

BIO 493. Directed Independent Readings. 1-3 credits.
Assigned readings in the student's area of interest. Course is only an addition to and not a substitution for any portion of the major requirement. No more than 12 semester hours of credit may be accrued in any combination of BIO 297, BIO 397, BIO 493, BIO 495, and BIO 497. P. IC.

BIO 495. Directed Independent Study. 1-3 credits.
A program of independent study with emphasis on activities other than laboratory or field research. (Examples include library research or special course attendance). Course is only an addition to and not a substitution for any portion of the major requirement. 2-4 C and/or L. No more than 12 semester hours of credit may be accrued in any combination of BIO 297, BIO 397, BIO 493, BIO 495, and BIO 497. P. IC.

BIO 497. Directed Independent Research. 0-3 credits.
A program of independent study with emphasis on laboratory or field research. Course is only an addition to and not a substitution for any portion of the major requirement. No more than 12 semester hours of credit may be accrued in any combination of BIO 297, BIO 397, BIO 493, BIO 495, and BIO 497. P. IC.

BIO 501. Bioinformatics: Genomics Approach. 4 credits. AY, SP
Introduction to the field of bioinformatics and genome science. Lectures will discuss the pivotal role of bioinformatics in metabolizing the massive amounts of biological information generated from genome projects. Students will also have hands-on experiences of data mining, processing, and analysis, using computer software publicly available or hand-coded by students. 3R, 3L. P. BIO 317 or IC.

BIO 517. Current Topics in Genetics. 3 credits. FA, SP
The chromosome is the physical basis of genetics in Eukaryotes, and controls major aspects of gene regulation. In this course, we will examine the structure, function and behavior of eukaryotic chromosomes. The accompanying laboratory will emphasize modern genome-wide approach, including student participation in a genome project focusing on disease transmitting flies. 3R. P. BIO 317, Oral Communication.

BIO 520. Genomes and Chromosomes. 4 credits. AY, SP
The chromosome is the physical basis of genetics in Eukaryotes, and controls major aspects of gene regulation. In this course, we will exam the structure, function and behavior of eukaryotic chromosomes. The accompanying laboratory will emphasize modern genome-wide approach, including student participation in a genome project focusing on disease transmitting flies. 3R, 3L. P. BIO 317.

BIO 523. Environmental Toxicology. 3 credits. SP (Same as EVS 523)
Principles of environmental tolerance, bioenergetics and nutrition, homeostasis, and toxicology and disease will be developed and related to the organismal, population and community levels and to comparative responses to environmental disturbance. The course uses a reading/ discussion format. Meets Designated Oral Communication requirement. 3R. P. BIO 201, BIO 202, BIO 205 and BIO 206; Oral Communication.

BIO 532. Current Topics in Cellular and Molecular Biology. 3 credits. FA
Interactions between nucleic acids and proteins responsible for cell growth, division, and development. Assumes basic knowledge of biomolecules and gene expression. Topics include DNA and chromatin structure and modification, DNA cloning and sequencing, DNA replication and repair, DNA recombination and transposition, regulation of gene expression (transcription, RNA processing, translation, and protein modification), functions of non-coding RNAs, genomics, and analytical techniques of molecular /cellular biology. Original scientific literature study including student-facilitated discussions and a term paper. 3R. P. Any two of the following courses: BIO 317, BIO 362, BIO 451, or CHM 371, or IC; Contemporary Composition; Oral Communication.

BIO 539. Ecology of Zoonotic Diseases. 3 credits. FA (Same as EVS 539)
Over the past few decades there has been a resurgence of zoonotic diseases such as SARS and Avian Influenza. Why do zoonotic diseases emerge, and what factors lead to epidemics? This course will address these questions, and apply an ecological approach to an understanding of epidemiology in human, livestock, and wildlife populations. P. One of the following: BIO 390, BIO 432, BIO 451, or BIO 481; Contemporary Composition; Oral Communication.

BIO 541. Current Topics in Plant Biology. 3 credits. AY, SP (Same as EVS 541)
This course focuses on historical and current questions in plant biology. Students will explore the evolution, function, and development of plants from the genetic, cellular, and organismal perspective. Specific topics may include hormone function, plant responses to stimuli, and the evolution of plant structures, and plant reproductive strategies. 3R. P. BIO 201, BIO 202, BIO 205 and BIO 206; Contemporary Composition; Oral Communication; Senior standing or IC.

BIO 545. Plant Diversity and Evolution. 4 credits. AY, SP ((Same as EVS 545))
An investigation of the diversity, morphology, and evolution of fossil and living plants. Topics emphasized include the origin of land plants, plant life cycles, evolution of the vascular cylinder, leaf, seed and flower, and the origin of flowering plants. 3R, 3L. P. BIO 201, BIO 202, BIO 205, and BIO 206; Contemporary Composition; Oral Communication; Senior standing or IC.

BIO 559. Current Topics in Physiology. 3 credits. FA
This course provides an in-depth examination of one or more physiological topics through a combination of lecture, discussion and student presentations. Reference materials will include textbooks, book chapters, review articles and the primary literature. Topics may include but are not limited to aspects of environmental, comparative and evolutionary physiology, as well as mammalian and human physiology. In most semesters the focus will be on current research, but historical aspects of some subjects may also be addressed. P. BIO 449; Contemporary Composition; Oral Communication; Senior standing or IC.

BIO 567. Current Topics in Neuroscience. 3 credits. SP
The course addresses several current topics within the field of neuroscience. Topics are selected based on the most highly cited works in the field over the past two years. Neuroscience encompasses information from many different scientific fields. We will cover anatomical, cellular, molecular, physiological, and biochemical aspects of developmental neurobiology. Please think of this course as a mental exercise and open yourself up to the intricate, intertwining concepts underlying the function of the brain. Students are required to present primary literature using an oral presentation format. 3R. P. BIO 462 or IDC 662; Oral Communication.

BIO 580. Current Topics in Ecology. 3 credits. SP (Same as EVS 580)
The focus of this course will be advanced topics in ecology, with an emphasis on the concepts and current approaches in ecosystem ecology. Primary literature will serve as a key resource for students. The structure and function of several model ecosystems will be explored in detail, with particular attention to the concepts of biodiversity, productivity, decomposition and nutrient cycling. In addition, the degree of human alteration of ecosystem structure and function as well as consequences for global ecological processes will be presented. P. BIO 390, BIO 481, BIO 485 or EVS 390; Contemporary Composition; Oral Communication.