BIO

Biology

BIO 101-E Human Biology
The major concepts of biology are presented from historical, contemporary, and critical viewpoints. These concepts include the cell, the gene, molecular biology, development, and evolution. The human implications or values associated with each concept are emphasized. Not for major credit.
3 credits per course

BIO 103-E Introduction to Biotechnology
Gene therapy, genetic modification, cloning, stem cells, and vaccines are covered in this course. Lectures and four supplemental laboratory activities use modern equipment and techniques to illustrate core concepts which class discussions relate to health, society, and public policy. Not for biology major credit.
3 credits

BIO 104-E How Science Works
The course aims at expanding students' knowledge about the methods of the natural sciences and to develop the critical thinking abilities to understand scientific claims presented by the media. Students will learn about scientific discoveries as well as the differences between science and pseudoscience. The course includes lectures and discussions based on textbook material, examination of case studies in science, and discussion of items in the news.
3 credits

BIO 111-E The Aquatic World
An introduction to the natural history of the animals and plants of the sea, rivers, and lakes, along with a consideration of water-land transitions. Weekly on-campus exhibits which students attend in addition to the regularly scheduled class time. Not for major credit.
Prerequisite: High school biology
3 credits

BIO 113-E General Ecology
A survey of the principles of ecology in the context of finding solutions to local, national, and global environmental problems. Not for major credit.
3 credits

BIO 115-E Evolution and Society
The historical development of evolutionary thought, the evolutionary diversification of life, and the mechanisms of evolution are presented. The geological, genetic, and other biological principles necessary to comprehend evolutionary concepts are introduced as background. Current controversies over the evidence for evolution are reviewed. Human evolution, medical and agricultural applications of evolutionary theory, and its implications for the development of human and other social systems are considered. Not for major credit.
Advisory Prerequisite: One biology course
3 credits

BIO 150-E The Living World
An exploration of life from organisms to molecules. The connections between biodiversity, molecules, and evolution are examined. Recitations familiarize students with the tools, models, and concepts of modern biology.
Prerequisites: High school biology and chemistry; satisfaction of entry skill in mathematics requirement
3 credits

BIO 201-E Fundamentals of Biology: Organisms to Ecosystems
An introduction to the major groups of living organisms. Structure, functions, the ecological roles of organisms in communities and ecosystems, and their evolutionary history are covered. Genetics and demography are discussed in the context of evolution by natural selection. Three hours of lecture and one three-hour laboratory per week.
Prerequisite: BIO 150
5 credits

BIO 202-E Fundamentals of Biology: Molecular and Cellular Biology
The fundamentals of cell biology, biochemistry, and genetics. The biochemical and molecular bases of cell structure, energy metabolism, gene regulation, heredity, and development in living organisms from bacteria to man are discussed. Three hours of lecture and one three-hour laboratory per week.
Prerequisite: BIO 150 or BME 100
Pre- or Corequisites: CHE 123 or 129 or 131 or 141; MAT 125 or higher or AMS 151
3 credits

BIO 203-E Fundamentals of Biology: Cellular and Organ Physiology
The fundamentals of cell and organ physiology in mammalian and non-mammalian organisms. The structure and function of cell membranes and the physiology of cell-to-cell signaling, cellular respiration, and homeostasis of organs and organisms are examined with an emphasis on the comparative physiology of vertebrates and invertebrates. Three hours of lecture and one three-hour laboratory per week.
Prerequisite: BIO 150 or BME 100
Pre- or Corequisites: CHE 123 or 129 or 131 or 141; MAT 125 or higher or AMS 151
3 credits

BIO 208-H Cell, Brain, Mind
An introduction to the human brain and how it is the target of diseases, drugs, and psychological disturbances. The course explores these topics through a knowledge of basic cell neurobiology. The implications of brain science for human behavior in society are also considered. Not for major credit.
Prerequisite: BIO 101 or 150
Advisory Prerequisite: High school chemistry
3 credits

BIO 301 Cell Biology
The cell is studied as the unit of structure, biochemical activity, genetic control, and differentiation. The principles of biochemistry and genetics are applied to an understanding of nutrition, growth, and development.
Prerequisites: C or higher in BIO 202 and 203; CHE 321 or 331
3 credits

BIO 311 Techniques in Molecular and Cellular Biology
Techniques used in recombinant DNA and cell biology research. Topics include DNA manipulation and analysis, protein expression and analysis, and advanced microscopy.
Prerequisites: BIO 202; CHE 132 or 142; MAT 125 or higher or AMS 151; or permission of instructor
3 credits

BIO 312 Bioinformatics and Computational Biology
This course uses computational methods to analyze current problems and solutions in molecular biology research. Students are exposed to algorithms and tools available for both single gene and larger scale genome research. Emphasis is on practical application. Laboratories allow students to apply their knowledge to real-life molecular biology problems.
Prerequisites: BIO 202; MAT 125 or 132 or 142 or AMS 161
3 credits

BIO 315 Microbiology
The organization, structure, energetics, and reproduction of microorganisms. Interactions of bacteria and viruses are discussed.
Prerequisites: BIO 202, CHE 132
3 credits

BIO 316 Molecular Immunology
Structure, function, and organization of the immune response at the molecular and cellular levels. Molecular mechanisms of immunological responses to microorganisms and various disease states are explored.
Prerequisites: BIO 202 and 203
Pre- or Corequisite: CHE 322 or 326
3 credits

BIO 317 Principles of Cellular Signaling
Basic principles of cellular signaling and maintenance of cellular and organismic homeostasis through intracellular and intercellular signaling mechanisms. Emphasis is on relationships between nuclear events and ongoing processes of the cell. The roles of membrane receptors and second-messenger pathways in mediating such diverse events as bacterial chemotaxis, protozoan locomotion, and secretion are discussed.
Prerequisites: C or higher in BIO 202 and 203
3 credits

BIO 318-H Bioethics and Policy
Current topics in ethics and policy in medicine and science are presented, discussed, and debated. Guest lectures with specialized expertise are interspersed with student debates on the pros and cons of the issues. Issues such as the use of stem cells, in vitro fertilization, patient rights, public health, and conflicts of interest are discussed.
Prerequisite: BIO 201 or 202 or 203
Advisory Prerequisite: PHI 104
3 credits

BIO 320 General Genetics
An advanced course in genetics for biology majors. General areas to be discussed include transmission genetics, cytogenetics, immunogenetics, molecular genetics, population genetics, and quantitative genetics.
Prerequisite: BIO 202
Pre- or Corequisite: CHE 131 or 141
3 credits

BIO 325 Animal Development
An overview of animal embryonic development, emphasizing molecular mechanisms regulating embryonic growth and differentiation. General areas to be discussed include molecular basis of human birth defects, cloning, identification of developmental genes, establishment of polarity in Drosophila and vertebrates, regulation of cell differentiation, morphogenesis and organ development, development of cancer.
Prerequisite: C or higher in BIO 202
3 credits

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BIO 327 Developmental Genetics Laboratory
Exploration of the fundamental concepts in developmental biology and genetics through a combination of classical and modern molecular genetic approaches. Experiments are conducted using *Drosophila* and *Xenopus*, two important animal models for research in developmental biology and genetics. Students gain hands-on experience with the approaches used to investigate processes that control embryonic development on these two model systems, including the use of modern molecular methods for examining the regulation of gene expression during development. Exposure to the genetic approaches that are available in the *Drosophila* system will include participation in a genetic screen for new mutations.
Pre-requisite: BIO 325
Pre- or Corequisite: BIO 320
3 credits

BIO 328 Mammalian Physiology
The basic principles of mammalian physiology. The subject matter includes circulation, respiration, nutrition, excretion (and their control by the nervous and endocrine systems), and sensation and coordination. May not be taken for credit in addition to HBY 350.
Prerequisite: BIO 203
Advisory Prerequisite: CHE 132 or 142
3 credits

BIO 334 Principles of Neurobiology
The ionic bases of nerve potentials, the physiology of synapses, sense organs and effectors, and the integrative action of the nervous system are discussed.
Prerequisites: BIO 203, CHE 131 or 141
3 credits

BIO 335 Animal Physiology Laboratory
Laboratory exercises designed to illustrate principles learned in BIO 328. Topics include muscles and hormones, physiological activities of nerves, circulation, respiration, excretion, digestion, sensory function, and central processes of coordination. One hour of lecture, one hour of recitation, and one three-hour laboratory per week.
Prerequisites: CHE 132, 133
Pre- or Corequisite: BIO 328
3 credits

BIO 338 From Synapse to Circuit: Self-organization of the Brain
Exploration of basic neural and synaptic mechanisms and the operation of representative brain circuits, using both theoretical approaches and experimental evidence. Particular attention is given to Hebb's rule, its cellular basis, its consequences for circuit self-organization and its limits. A solid background in mathematical, physical, or biological science is desirable, but most relevant background material is covered in the course.
Prerequisite: BIO 203 or CHE 132 or PHY 122
Advisory Prerequisite: BIO 334
3 credits

BIO 339 Molecular Development of the Nervous System
An introduction to the molecular events that underlie development and plasticity of both the peripheral and central nervous systems, with a focus on neuronal mechanisms. Molecular and genetic approaches to the analysis of neural induction, neuronal differentiation, neuronal death and survival, neurotrophic factors, synapse formation, and plasticity are presented.
Prerequisite: BIO 202
Advisory Prerequisite: BIO 203 or 325
3 credits

BIO 340 Zoology
Aspects of the natural history, morphology, and evolution of selected marine invertebrates, arthropods, and vertebrates. Three hours of lecture and one three-hour laboratory per week. Not for credit in addition to BIO 343 or 344 if passed with C or higher.
Prerequisite: BIO 111 or 201 or MAR 104
3 credits

BIO 341 Plant Diversity
An introduction to the study of plants, especially green plants, including the origin and evolution of land plants. Topics include cellular structure and function, photosynthesis and respiration, gross anatomy, taxonomy and the diversity of organisms, plant ecology, and agriculture. Three hours of lecture and one three-hour laboratory per week.
Prerequisites: BIO 204 and 203
3 credits

BIO 343 Invertebrate Zoology
Aspects of the diversity, comparative and functional morphology, natural history, evolution, and water-land transitions of invertebrates exclusive of arthropods. Three hours of lecture and one three-and-one-half hour laboratory per week.
Prerequisite: BIO 201 or MAR 104
3 credits

BIO 344 Chordate Zoology
Introduction to the diversity, natural history, and evolution of chordates, emphasizing the living vertebrates. Three hours of lecture or discussion and one three-hour laboratory per week. Not for credit in addition to BIO 346 if passed with C or higher.
Prerequisite: BIO 201
3 credits

BIO 346 Aquatic Arthropods and Vertebrates
Aspects of the diversity, comparative and functional morphology, natural history, and evolution of arthropods and vertebrates. Water-land transitions are considered. Three hours of lecture and one three-and-one-half hour laboratory per week. Not for credit in addition to BIO 344 if passed with C or higher.
Prerequisite: BIO 201 or MAR 104
3 credits

BIO 348 Diversity and Evolution of Reptiles and Amphibians
The course will survey the diversity and natural history of the major groups of reptiles and amphibians, including snakes, lizards, turtles, crocodilians, frogs, and salamanders. Extinct groups (such as dinosaurs and pterosaurs) will also be covered. Furthermore, the course will showcase how studies of reptiles and amphibians have increased our general understanding of evolution and ecology, and will illustrate how diverse aspects of organismal biology (such as physiology, ecology, behavior, morphology) evolve and are interconnected.
Prerequisite: BIO 201
3 credits

BIO 350-H Darwinian Medicine
The ecology and evolution of disease, including evolution of human resistance to infection by pathogens, pathogen evolution in response to natural and technological defenses, and the ecological context of disease. Evolutionary phenomena are treated from molecular, organismal, populational, and environmental perspectives.
Prerequisites: BIO 201 and 202
3 credits

BIO 351-H Ecology
An examination of the interactions of living organisms with their physical and biological environments. Special attention is given to population dynamics and the interactions among organisms that determine the structure, function, and evolutionary development of biological communities.
Prerequisites: BIO 201 or permission of instructor
3 credits

BIO 352 Ecology Laboratory
Stresses the collection, analysis, and interpretation of ecological data, mostly in terrestrial settings. Laboratory and field exercises demonstrate the operation of general ecological principles in specific populations and communities. One lecture, one three-hour field trip or laboratory, and one hour of recitation per week. Three all-day Saturday field trips.
Pre- or Corequisites: BIO 351; or permission of instructor
3 credits

BIO 353 Marine Ecology
A survey of biotic responses to ecological challenges in different marine realms. Controls of diversity and trophic structure in the marine ecosystem, historical aspects of marine realms, productivity in the oceans, plankton, soft-bottom communities, intertidal habitats, coral reefs, deep-sea environments, and effects of pollution in the ocean are discussed. This course is offered as both BIO 553 and GEO 553.
Prerequisite: BIO 201 or MAR 104
Advisory Prerequisite: BIO 343
3 credits

BIO 354 Evolution
A detailed discussion of the mechanisms of evolution, focusing on the ways in which genetic changes in populations lead to adaptation, speciation, and historical patterns of evolutionary change.
Prerequisite: BIO 201 and 202, or BIO 320
3 credits

BIO 356 Applied Ecology and Conservation Biology Laboratory
A computer laboratory course introducing students to ecological risk analysis and conservation biology. Laboratories are based on interactive software. Computer simulation techniques for addressing problems in applied ecology are emphasized.
Prerequisites: BIO 201 or 202 or 203; MAT 126 or higher
2 credits

BIO 358-H Biology and Human Social and Sexual Behavior
Major features of human social and sexual behavior are examined from a biological perspective. Insights from ethology, evolutionary biology, and neurobiology are synthesized into a picture of human nature and behavior. Implications of this picture for human sexual and social behavior are considered.
Prerequisites: U3 or U4 standing; one of the following: BIO 101, 201, 202, or 203
3 credits

BIO 359 Behavioral Ecology
A consideration of the patterns of animal behavior in relation to ecological circumstances and evolutionary history. Vertebrate examples are emphasized.
Prerequisites: BIO 201 and 203
3 credits

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**BIO 361, 362 Biochemistry I, II**

Biochemistry I surveys the major chemical constituents of the cell, including carbohydrates, lipids, and proteins. Emphasis is on enzyme structure, enzyme kinetics, reaction mechanisms, and metabolic pathways. Biochemistry II treats nucleic acid structure, replication, and transcription, both in vivo and in vitro. The machinery of protein synthesis is also covered, including amino acid activation; transfer RNA; ribosomes; the genetic code; and peptide chain initiation, elongation, and termination.

*Prerequisites:* C or higher in BIO 202; CHE 322, 326 or 332

3 credits per course

**BIO 365 Biochemistry Laboratory**

A series of laboratory experiments and discussions designed particularly to complement BIO 361 and 362. This laboratory covers such topics as enzyme kinetics, spectrophotometry, recombinant DNA technology, the polymerase chain reaction and genotyping, cellular extraction of DNA, RNA, and proteins, and analytical biochemistry. Four hours of laboratory and discussion per week.

*Pre or Corequisite:* BIO 310 or 361

2 credits

**BIO 367 Molecular Diversity Laboratory**

Hands-on experience with methods to detect and analyze molecular (DNA, RNA, protein) variation to study ecology, adaptation, and evolutionary history using natural populations of Drosophila, plankton, and other locally available species.

*Prerequisites:* BIO 201, 202, and 354

*Advisory Prerequisite:* BIO 361

3 credits

**BIO 380 Entomology**

A survey of the anatomy, development, classification, biogeography, physiology, ecology, and evolution of the insects. The laboratory stresses a knowledge of insect diversity and morphology. Three hours of lecture and three hours of laboratory per week.

*Prerequisites:* BIO 201 and 202

4 credits

**BIO 385-H Plant Ecology**

Basic ecological principles as applied to the biology of individual plants, plant populations, communities, and ecosystems in relation to their environments. Examples from Long Island pine barrens, tropical rain forests, beaches, deserts, and other plant communities are studied. Examination of the connections between human societies and plant communities, which are rapidly being altered or destroyed worldwide.

*Prerequisite:* BIO 201

*Advisory Prerequisite:* BIO 351

3 credits

**BIO 386-H Ecosystem Ecology and the Global Environment**

Ecosystem ecology with an emphasis on biogeochemical cycling in oceans and on land, as well as on biosphere-atmosphere interactions. Topics include earth system processes such as climate and atmospheric composition, the hydrological cycle, cycling of chemicals such as nutrients and metals in the ocean, the soil cycle, and the fate and transport of materials in the atmosphere. Natural and perturbed systems are discussed. This course is offered as both BIO 386 and ENS 311.

*Prerequisites:* BIO 201; CHE 131 or 141

*Advisory Prerequisite:* MAR 104

3 credits

**BIO 401-405 Seminars in Biology**

Discussions of a specific area of current interest in biology. The work of each semester covers a different area of biology. Semester Supplements to this Bulletin contains topic descriptions when courses are offered. May be repeated as the topic changes.

*Prerequisite:* Permission of instructor

2-3 credits per course

**BIO 407 Colloquium in Ecology and Evolution for Biology Majors**

Students attend the weekly departmental colloquia in ecology and evolution. The content of each session is discussed during a separate class meeting. Conducted as a seminar.

*Prerequisites:* BIO 201, 202 and 203; at least one course from biology major areas 4 or 5 with grades of B or higher; CHE 132 or 142; U3 standing as a biology major

2 credits

**BIO 444, 446, 447, 449 Readings in Biological Sciences**

*BIO 444 Readings in Biology and Society*

*BIO 446 Readings in Neurobiology and Physiology*

*BIO 447 Readings in Molecular, Cellular, and Developmental Biology*

*BIO 449 Readings in Ecology and Evolution*

Tutorial readings in the biological sciences. These courses may be repeated, but not more than two credits may be used toward biology major requirements. Limit of one topic per semester.

*Prerequisites to BIO 444, 446, and 449:* Written permission of instructor and undergraduate studies committee

*Prerequisites to BIO 447:* Permission of instructor and Department of Biochemistry and Cell Biology

1-2 credits per course, S/U grading

**BIO 475, 476 Undergraduate Teaching Practica in College Biology I, II**

Study of the literature, resources, and teaching strategies in a field of biology, coordinated with a supervised clinical experience in instruction. Not for major credit. Students may not serve as teaching assistants in the same course twice.

*Prerequisites to BIO 475:* Permission of instructor and undergraduate studies committee

*Prerequisites to BIO 476:* BIO 475; permission of instructor and undergraduate studies committee

0-3 credits per course, S/U grading

**BIO 484, 486, 487, 489 Research in Biological Sciences**

*BIO 484 Research in Biology and Society*

*BIO 486 Research in Neurobiology and Physiology*

*BIO 487 Research in Molecular, Cellular, and Developmental Biology*

*BIO 489 Research in Ecology and Evolution*

In these courses, the student works under the supervision of a faculty member in developing an individual project that makes use of the knowledge and techniques acquired in previous courses. The student prepares an appropriate report on the project. Any of the courses may be taken for more than two semesters, but no more than four credits of research may be used for biology major requirements. Limit of one topic per semester.

*Prerequisites to BIO 484, 486, and 489:* Written permission of instructor and undergraduate studies committee

*Prerequisites to BIO 487:* Written approval of the faculty member of the research committee

1-6 credits per course, S/U grading

**BIO 488 Internship in Biological Sciences**

May be repeated up to a limit of 12 credits. Not for biology major credit.

*Prerequisites:* BIO 201, 202, 203; CHE 132; permission of faculty sponsor and biology internship committee

0-6 credits, S/U grading