

Note: Semesters and years in which specific courses are offered are subject to change.

BIO 099/Orientation to Biology **0 course units**

(8 weeks)

(fall, annually)

Required for all freshmen biology majors. This course provides an orientation to higher education, to The College of New Jersey community, and to the major programs offered by the biology department.

BIO 104/ Inquiries in the Life Sciences **1 course unit**

(with laboratory)

(fall, spring, summer, annually)

Restriction: Open only to students in Elementary Education, Early Childhood Education, Education of the Deaf and Hard of Hearing, and Special Education.

An introduction to general chemistry and biology concepts and their relationship with current issues in the study of genetics, the environment and human health. Scientific principles necessary to understand topics such as human nutrition and disease, human impacts on the biosphere, and the debate over teaching evolution in public schools are considered. A strong emphasis is placed upon the process of science as a form of inquiry, and the theory of evolution as the foundation of modern biology. Laboratory experiments, discussions and written assignments will complement the course, which is designed to meet New Jersey state content curriculum standards in chemistry and life science.

BIO 141, 142/Principles of Human Anatomy and Physiology I, II **2 course units**

(with laboratory)

(fall/spring, annually)

Restriction: Open only to nursing majors

Designed to meet the needs of students who wish to achieve an understanding of the structure and function of the human body. The concept of homeostasis will be emphasized. Includes a laboratory component that uses the cat as the dissection specimen. Opportunities for collecting and analyzing data are provided.

BIO 144/Principles of Microbiology **1 course unit**

(spring, annually)

Restriction: Open only to nursing majors

Study of microorganisms and their relationship to health and disease, biomedical research, and the balance of nature.

BIO 171/Human Form and Function **1 course unit**

(with laboratory)

(fall, spring, summer, annually)

The form and function of the human body are highlighted to illustrate the interdependence of structure and function. Evolution of these attributes are contrasted and explored. The basic principles governing life, and the relationship of biology to other scientific disciplines and mathematics are explored, as are the influence of biology on society and the accompanying ethical issues.

BIO 173/Humanity and the Natural World **1 course unit**

(with laboratory)

(fall, summer, annually)

Humankind's place in, and influence upon, the natural world are addressed. Evolution and genetics are studied in the context of populations, communities and ecosystems. The implications of our environmental impact are explored; and thus the need for planning for sustainability.

BIO 185/Themes in Biology

1 course unit

(with laboratory)

(fall, spring, annually)

Restriction: Open only to entering biology majors in the fall (open to all students in the spring)

An inquiry-based introduction to the scientific process and a focused examination of the concepts that weave through four major themes in biology: Structure and Function; Bioenergetics; Genotype to Phenotype; and Evolution. Students will be expected to go beyond mere assimilation of content, and to understand the deeper meanings in each concept, apply these concepts to new problems, and develop critical thinking and laboratory skills. This course is designed for biology majors, but is open to students in other majors who seek a rigorous background in biology.

BIO 211/Biology of the Eukaryotic Cell

1 course unit

(with recitation)

(fall, spring, annually)

Restriction: Open only to biology majors in the spring (open to all students in the fall)

Prerequisite: BIO 185 (grade of C- or higher); CHE 201; *Pre- or co-requisite:* CHE 202

An introduction to the nomenclature, origin, and function of essential molecules and cellular components of living organisms. Structural and functional characteristics of various eukaryotic cells demonstrate that the molecular and cellular levels of organization are intimately integrated.

BIO 221/Ecology and Field Biology*

1 course unit

(with laboratory)

(fall, spring, annually)

Prerequisite: BIO 185 (grade of C- or higher)

An introduction to modern ecology. The interactions that determine the distribution, abundance, and function of organisms, populations, and species are examined both theoretically and practically within an evolutionary context. Topics covered include physiological ecology, optimization theory, natural selection, population biology, species interactions, community relationships, and ecosystem dynamics. Laboratory and field activities emphasize quantitative and experimental approaches to the study of ecology.

**Field trips may be required at the student's expense.*

BIO 231/Genetics

1 course unit

(with laboratory)

(fall/spring, annually)

Prerequisite: BIO 211

Introduction to the major concepts of genetics and inherited variation and the nature, distribution, and expression of heredity information in representative plants and animals. Laboratory will emphasize analytical approaches used in genetic studies.

BIO 301, 302/Human Anatomy and Physiology I, II

2 course units

(with laboratory)

(fall/spring, annually)

Prerequisite: BIO 185 (grade of C- or higher)

A detailed study of the structure and function of the human body. Homeostatic mechanisms are emphasized. Laboratory experiences include dissection of the cat, study of human anatomy, microscopic anatomy of both the cat and human, and quantitative studies of the physiological processes taking place in the human body. Available for biology option credit only for secondary education students and students with post-graduate education goals that requires these courses. Not recommended for students who plan to attend medical school.

BIO 312/Microbiology

1 course unit

(with laboratory)

(fall, annually)

Prerequisites: BIO 185 (grade of C- or higher); CHE 202

An introduction to the fundamental concepts in microbiology and the relationship of microorganisms to disease, and the balance of nature. Laboratory emphasis is on the physiology of bacteria, preparation and use of selective and differential media, and related methodologies.

BIO 315/Plants and People*

1 course unit

(with laboratory)

(occasionally)

Prerequisite: BIO 185 (grade of C- or higher)

Integrates the fundamentals of plant growth, reproduction, metabolism, and disease with the utilization of plants by people by focusing on agriculture, medicinal plants, and plant conservation biology. Addresses history and methods of agriculture with attention to modern plant breeding, genetic engineering, and comparison of chemically intensive and organic crop-growing techniques. Also considered are the central role of plant secondary metabolites in traditional healing and modern drug development. Explores different approaches to the conservation of useful plant biodiversity. Laboratory component includes experimental group projects in the laboratory and greenhouse, preparation of an herbarium collection of useful plant specimens collected and identified from the field, and selected trips to see plant sciences in action.

**Field trips may be required at the student's expense.*

BIO 332/Biology of the Vertebrates

1 course unit

(with laboratory)

(irregularly, alternate years)

Prerequisite: BIO 185 (grade of C- or higher)

This course explores the form and function of vertebrate anatomy, physiology and behavior, which is specifically discussed in light of the ecology and evolution of this diverse group of organisms. A strong emphasis is placed on general principles of ecology and evolution, such as how different taxa impact their respective ecological communities, the key innovations that promoted various adaptive radiations, and how recent studies of vertebrate developmental genetics are expanding our broader understanding of phenotypic evolution. The material is presented via lectures, laboratory activities and discussions of primary literature.

**Field trips may be required at the student's expense.*

BIO 341/Biology of Seed Plants*

1 course unit

(with laboratory)

(spring, odd-numbered years)

Prerequisite: BIO 185 (grade of C- or higher)

The integration of form and function in angiosperms and gymnosperms emphasizing evolutionary patterns of development in vegetative and reproductive organs. Topics include plant anatomy and physiology, growth and development, plant classification, and plant ecology. Laboratory includes macro- and microanatomy, physiological experiments, outdoor studies, and field trips to plant habitats and gardens.

**Field trips may be required at the student's expense.*

BIO 342/Biology of the Invertebrates

1 course unit

(with laboratory)

(occasionally)

Prerequisite: BIO 185 (grade of C- or higher)

A detailed consideration of the functional morphology and evolution of the animal phyla from the protozoa through the echinoderms. Adaptive radiation within the major groups is discussed and the interrelationships of the various phyla are analyzed. The laboratory experience encourages individual investigations of representative animals.

BIO 344/Avian Biology **1 course unit**

(with laboratory)

(spring, even-numbered years)

Prerequisite: BIO 221 Ecology (can be taken concurrently).

In this course students will investigate the behavior, ecology, evolution, morphology, and physiology of birds. While some course goals, such as being able to identify a variety of bird species, are rooted solidly in the field of avian biology, other course goals, such as being able to apply broader concepts in organismal biology, are common to a wide variety of organisms. Field-based and literature-based research are major components of the coursework.

**Field trips may be required at the student's expense.*

BIO 350/Biology of the Fungi* **1 course unit**

(with laboratory)

(irregularly, alternate years)

Prerequisite: BIO 185 (grade of C- or higher)

An introduction to the structure, physiology, ecology, genetics, classification, and economic importance of representative taxa of fungi. Laboratory topics parallel those of lecture but also include the initiation and maintenance of axenic fungal cultures.

**Field trips may be required at the student's expense.*

BIO 352/Biostatistics **1 course unit**

(with laboratory)

(spring, odd-numbered years)

Prerequisite: BIO 185 (grade of C- or higher)

Introduction to the use of statistical methods in the biological sciences. Emphasis is placed upon the application and interpretation of statistical analyses as an aid to drawing meaningful conclusions from field and laboratory investigations. Topics include: sampling methods, descriptive statistics, hypothesis testing, analysis of variance, correlation, regression, frequency analysis, and the design of experiments.

BIO 360/Oceanography* **1 course unit**

(with laboratory)

(spring, even-numbered years)

Prerequisites: BIO 185 (grade of C- or higher); CHE 202

Introduction to physical, chemical, geological, and biological oceanography. Lecture and discussion topics include plate tectonics, bathymetry, physical and chemical properties of seawater, currents, waves, tides, open ocean and benthic ecosystems, estuarine, intertidal and coral reef ecology, and marine mammals. The laboratory will focus on biological oceanography and will include two one-day weekend field trips.

**Field trips may be required at the student's expense.*

BIO 365, 366/Natural History of the Galapagos Islands and Ecuador I, II **1 course unit**

(with field laboratory component)

(spring/Maymester, odd-numbered years)

(same as HON 365, 366)

Prerequisite: BIO 185 (grade of C- or higher)

Restriction: Open only to students who have been accepted into the TCNJ faculty-led abroad program—a two-week, intensive trip to the Galapagos Islands and Ecuador.

An immersion experience to develop a deep understanding of the natural history (including ecology of plants and animals, geology, and climate) of the Galapagos Islands and Ecuador, with a reflection on interactions between these and the history, culture and economics of the Islands and Ecuador from pre-colonial to modern times.

**Participation in the faculty-led program is required and is at the student's expense.*

BIO 370/Topics in Biology **1 course unit**
(with laboratory or recitation)
(irregularly)

Prerequisites: BIO 185 (grade of C- or higher); other prerequisites as determined by the department, dependent upon the topic.

Selected topics which may vary from year to year.

BIO 392/Guided Study in Biology **0.25–1 course unit**
Permission of instructor and department chair.

BIO 393/Independent Research in Biology I **0.5 or 1 course unit**
Prerequisites: BIO 185 (grade of C- or higher)

A hands-on research experience under the supervision of a professor. This experience culminates in the production of a final product, the specific details of which are at the discretion of the advisor. Examples of appropriate final products include, but are not limited to, significant data analysis, a paper, or a poster. All final documents must be archived by the Department of Biology. May be taken for credit more than once. Only one course unit of research courses (BIO 393, 394, 399, 493, 494) can count as a biology option course.

BIO 394/Honors Independent Research in Biology I **0.5 or 1 course unit**
Prerequisites: BIO 185 (grade of C- or higher)

A hands-on research experience under the supervision of a professor. This experience culminates in the production of a final product, the specific details of which are at the discretion of the advisor. Examples of appropriate final products include, but are not limited to, significant data analysis, a paper, or a poster. All final documents must be archived by the Department of Biology. May be taken for credit more than once. Only one course unit of research courses (BIO 393, 394, 399, 493, 494) can count as a biology option course.

BIO 399/Biology Research Internship **.0.5-1 course unit**
(spring, annually)

Prerequisites: BIO 185 (grade of C- or higher); sophomore status, minimum GPA of 2.5 overall
Application of biological principles through completion of an approved supervised project (paid or non-paid position). All placements must be approved by the internship coordinator. Only one course unit of research courses (BIO 393, 394, 399, 493, 494) can count as a biology option course.

BIO 410/Advances in Molecular Biology **1 course unit**
(with recitation)
(occasionally)

Prerequisites: BIO 211, BIO 231; CHE 332; *prerequisite/corequisite:* BIO 221

An in-depth study of the molecular basis of important biological processes of both prokaryotes and eukaryotes, including DNA replication, gene control, chromosome structure and function, and protein biosynthesis.

BIO 411/Animal Physiology **1 course unit**
(with laboratory)
(spring, annually)

Prerequisites: BIO 211; CHE 332; *prerequisite/corequisite:* BIO 221, BIO 231.

A detailed examination of general and comparative physiology, with emphasis on vertebrates, regulatory processes, and mechanisms of function at cellular, tissue, organ and organ system levels. Laboratory involves investigation of selected aspects of the physiology of humans and other animals.

BIO 413/Microscopic Anatomy and Techniques **1 course unit**
(with laboratory)
(fall, odd-numbered years)

Prerequisite: BIO 211; *prerequisite/corequisite:* BIO 221, BIO 231.

A study of basic histology and hands-on training in microscopy and microtechnique. The correlation between the structure and function of cells, tissues and organs of vertebrates as examined using light and electron microscopy is used as a basis for understanding biochemical, physiological, and pathological processes. Goals of the course include learning to identify cells and tissues in histological sections, understanding and practicing the techniques used for specimen preparation for histological and histochemical examination of tissues, and application of these techniques in a semester-long research project.

BIO 434/ Molecular Biology of Gene Expression **1 course unit**

(with laboratory)

(fall, odd-numbered years)

Prerequisites: BIO 211, BIO 231; *prerequisite/corequisite:* BIO 221.

All eukaryotic cells must regulate the expression of their genes in response to both internal stimuli and changes in the extracellular environment. Gene expression is a highly-coordinated, multi-step process that commences with transcription and RNA processing in the nucleus, followed by RNA export (and often localization) and translation in the cytoplasm. Moreover, correct gene expression relies on quality control mechanisms that can degrade non-function or potentially deleterious RNAs so that they are not translated to produce harmful proteins. This course, which includes a semester-long yeast laboratory project, will cover the molecular details of several of the steps in gene expression, the mechanisms that underlie the careful coordination of these steps, and examples of human diseases that result from inappropriate gene expression. Students will learn about experimental approaches to study gene expression using a combination of textbook readings, review articles, and current primary journal articles.

BIO 444/Molecular Immunology and Human Disease **1 course unit**

(with recitation)

(irregularly, annually)

Prerequisite: BIO 211; *prerequisite/corequisite:* BIO 221, BIO 231.

An introduction to the fundamentals of immunology. Provides a background for understanding the immune system--and its correlation to disease.

BIO 450/Advanced Eukaryotic Cell Biology **1 course unit**

(with laboratory)

(fall, even-numbered years)

Prerequisite: BIO 211; *prerequisite/corequisite:* BIO 221, BIO 231.

Designed to provide students with in-depth exposure to the field of cellular and molecular biology, this course is structured to include students in a detailed and sophisticated analysis of several important topics in modern cell biology. Students will be expected to read original articles from the primary literature, and to be able to critically analyze and critique the experimental approaches, design and conclusions. Furthermore, student will be responsible for communicating this knowledge with one another by presenting the articles in the classroom setting.

BIO 451/Developmental Biology **1 course unit**

(with laboratory)

(irregularly, annually)

Prerequisite: BIO 211; *prerequisite/corequisite:* BIO 221, BIO 231.

Introduction to cellular, genetic, and epigenetic aspects of an organism's development. The focus for the majority of the semester is on the example of embryogenesis as it occurs and is regulated in several animal species. The emphasis is on the molecular mechanisms of that regulate development in various model systems, including *C. elegans*, *Drosophila*, and several vertebrate species. Several of these model systems are the subject of the experiments in the laboratory portion of the course.

BIO 461/Evolution

1 course unit

(with recitation)

(irregularly)

Prerequisite: BIO 221; *prerequisite/corequisite:* BIO 211, BIO 231.

“*Nothing in biology makes sense except in the light of evolution.*” This famous quote by renowned evolutionary biologist Theodosius Dobzhansky emphasizes the centrality of evolution to all fields of biology. This course takes a multidisciplinary approach to the study of genetic change and the origination of biological diversity. Students will gain expertise in historical and modern perspectives of evolutionary theory and concepts, and explore the dynamic nature of evolutionary processes in the contemporary world.

BIO 465/Physiological and Behavioral Ecology*

1 course unit

(with laboratory)

(fall, odd-numbered years)

Prerequisite: BIO 221; *prerequisite/corequisite:* BIO 211, BIO 231.

A detailed investigation into the role of physiological function and behavior in shaping the interactions among organisms and between organisms and their environment. Emphasis is placed upon the study of physiological and behavioral adaptations of animals to adverse environmental conditions. Topics examined will include the physiological and behavioral aspects of feeding, digestion, excretion, reproduction, metabolism, temperature regulation, and water balance.

**Field trips may be required at the student's expense.*

BIO 470/Topics in Biology

1 course unit

(with laboratory or recitation)

(irregularly)

Prerequisites/corequisites: BIO 211, 221, 231; other prerequisites as determined by the department, dependent upon the topic.

Selected topics which may vary from year to year.

BIO 471/Genomics and Bioinformatics

1 course unit

(with laboratory)

(spring, odd-numbered years)

(same as CSC 471)

Prerequisites: BIO 185 (grade of C- or higher); *prerequisite/corequisite:* BIO 211, BIO 221, BIO 231. (Note: For students who enroll in CSC 471 only BIO 185 and CSC 230 or 250 are prerequisites.)

This course will cover theoretical and practical components of genomics and bioinformatics. The major topics will include mapping and sequencing genomes, sequence alignment of nucleic acids and proteins, haplotype maps, analysis of complex traits, parallel profiling of gene expression, proteomics, phylogenetic analysis, and data mining. The laboratory will begin with the *in silico* analysis of gene families, continue to the formulation of a testable hypothesis about gene function, writing a mini-grant for peer review, testing of the hypothesis in a model organism, and conclude with a formal presentation of the data generated during the semester. This course is best suited for undergraduates who wish to continue with a career in basic science or biomedical research.

BIO 480/Neurobiology

1 course unit

(with laboratory)

(fall, annually)

Prerequisite: BIO 211; *prerequisite/corequisite:* BIO 221, BIO 231.

A detailed examination of nervous system function at the cellular, molecular, system and organismal level, including neuronal signaling and synaptic transmission, sensory and motor systems, sensorimotor integration, synaptic plasticity in learning and memory and mechanisms of neural development. Emphasis will be placed on how elements of the nervous system interact to produce or modify behavior. In the laboratory component of this course, students will work in

small research teams to conduct open-ended multi-week research projects of their own design, using the crayfish tail as a model neural system.

BIO 490/Student Teaching in Biology

2 course units

(fall, spring, annually)

Prerequisite: Meeting all criteria for admission to student teaching

Student teaching during the senior year. Teaching is conducted in approved public schools, and supervised and observed by college and public school teachers. Students learn through observation and participation in the classroom, and through supervised teaching.

BIO 493/Independent Research in Biology II

0.5 or 1 course unit

Prerequisites/corequisites: BIO 211, 221, 231; minimum overall GPA of 2.5 overall

Pursuit of an original research project under the direction of a supervising professor. Results and conclusions serve as the basis of an oral or poster presentation to faculty and students as well as a written paper submitted to the faculty mentor and archived by the Department of Biology. May be taken for credit more than once. Only one course unit of research courses (BIO 393, 394, 399, 493, 494) can count as a biology option course.

BIO 494/Honors Independent Research in Biology II

0.5 or 1 course unit

Prerequisites/corequisites: BIO 211, 221, 231; minimum overall GPA of 2.5

Only for students in college-wide honors program or pursuing honors in biology. Pursuit of an original research project under the direction of a supervising professor. Results and conclusions serve as the basis of an oral or poster presentation to faculty and students as well as a written paper submitted to the faculty mentor and archived by the Department of Biology. May be taken for credit more than once. Only one course unit of research courses (BIO 393, 394, 399, 493, 494) can count as a biology option course.

BIO 495/Independent Research in Biology Capstone

1 course unit

Prerequisites: Completion of at least one course unit of BIO 493/494 under the same instructor and a minimum overall GPA of 2.5

May substitute for BIO 498/Biological Seminar as the capstone course, but not as a biology option course. Pursuit of an original research project under the direction of a supervising professor. Results and conclusions serve as the basis of an oral or poster presentation to faculty and students as well as a written paper that has gone through multiple drafts and submitted to the faculty mentor and archived by the Department of Biology. Students should enroll in this course during their final semester of independent research.

BIO 496/Honors Independent Research in Biology Capstone

1 course unit

Prerequisites: Completion of at least one course unit of BIO 493/494 under the same instructor and a minimum overall GPA of 2.5

May substitute for BIO 498/Biological Seminar as the capstone course, but not as a biology option course. Only for students in college-wide honors program or pursuing honors in biology. Pursuit of an original research project under the direction of a supervising professor. Results and conclusions serve as the basis of an oral or poster presentation to faculty and students as well as a written paper that has gone through multiple drafts and submitted to the faculty mentor and archived by the Department of Biology. Students should enroll in this course during their final semester of independent research.

BIO 498/Biological Seminar

1 course unit

(fall, spring, annually)

Prerequisites: BIO 211, 221, and 231

This is the biology capstone course. Students deliver and develop oral presentations and write a comprehensive and current literature review on a research topic oriented around a unifying theme in biology or within a broad area of biological research. Topics vary each semester and with different instructors. May be taken for credit more than once.

Courses offered in the summer at the Marine Sciences Consortium in Sandy Hook, NJ

BIO 362/Marine Consortium Introduction to Marine Science **1 course unit**
(summer, annually)

Note: This course is held at the Marine Consortium (NJMSC) in Sandy Hook, New Jersey. Students must register at The College of New Jersey AND complete an NJMSC application with the Marine Consortium.

This course can only be used to fulfill a liberal learning science requirement. A field-oriented course covering the principle divisions in the marine sciences. Designed to help students evaluate his/her interest in the marine science world. Not available for biology option credit.

BIO 363/Marine Consortium Introduction to Marine Biology **1 course unit**
(summer, annually)

Prerequisite: BIO 185

Note: This course is held at the Marine Consortium (NJMSC) in Sandy Hook, New Jersey. Students must register at The College of New Jersey AND complete an NJMSC application with the Marine Consortium.

This course can be taken to fulfill a biology option requirement and counts as a biology organismal course. A field and laboratory oriented course covering the biology and characteristics of marine plants and animals. Designed to provide students with instruction and experience in collecting and identifying examples of local marine flora and fauna.

BIO 364/Marine Consortium Topics Course **1 course unit**
(summer, annually)

Prerequisite: BIO 185

Note: This course is held at the Marine Consortium (NJMSC) in Sandy Hook, New Jersey. Students must register at The College of New Jersey AND complete an NJMSC application with the Marine Consortium.

A field and laboratory course covering selected marine science topics which vary from year to year. Example topics include marine fossils, seashore ornithology, marine science and education in the K-12 classroom, and marine biology field methods. Students should verify with the Biology Department whether a particular topics course is available for biology option credit.