

Biology

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The Department of Biology at The College of New Jersey provides undergraduate students with a comprehensive modern education in biology, ranging in subject matter from molecular and cell biology, through organismal biology, and up to ecology and evolutionary biology. The general objectives of the department are: 1) to develop an understanding by students of the biological principles that underlie all living things; 2) to instill in students a sense of inquiry; and 3) to sharpen the analytical thinking skills of students. Students who complete the program receive a Bachelor of Science in biology. The major is a liberal arts-based program that prepares students for occupations in biology professions, advanced graduate study in biology, medical and allied health professional schools, or teaching at the secondary level. Students interested in pursuing a career in pharmaceutical sales and marketing can combine a major in biology (BIOA) with a minor in marketing. See Professor Pelham, School of Business, or the biology chairperson for more information.

Students in the Department of Biology learn about the work of a biological scientist firsthand. They learn about both classic experiences in biology and cutting edge research by reading science from the classic literature, the finest textbooks, and the current primary scientific literature. Students learn from their professors in classrooms, in the field, and in laboratories. They develop hypotheses and research proposals, and they apply their understanding of biology during course laboratories, in research in faculty members' labs and in mentored research at other institutions and internships. Biology students discuss each other's work, write scientific papers, and make scientific presentations. This rich set of experiences allows students to reach the program concept goals noted below.

The biology program has been designed to give all majors in the department exposure to the complete range of disciplines within biology. The biology core courses, which are taken by all biology students, provide coverage for areas in biology from the molecular to ecosystem level. However, through the selection of biology options courses, students can concentrate on a particular discipline, if they so choose. At the present time, four concentrations have been outlined:

- Ecology and Evolution
- Physiology, Morphology, and Anatomy
- Cell and Molecular Biology
- Taxonomic Categories

Program Concept Goals

The discipline of biology is increasingly complex and multi-disciplinary. The following constitute the concept driving the biology program:

- Within biological systems, structure and function are interdependent
- Energy production and use underlie all biological processes
- Expression of a unique subset of genes from an organism's inherited DNA genome determines a cell's particular characteristics
- Biological diversity is the result of a continuous process of evolution in an ecological context

Programs within Biology

There are six programs within the biology major: liberal arts (BIOA), secondary teaching (BIOT), seven-year BS/MD (BIOM), seven-year BS/OD (optometry; BIOP), double major with early childhood education, and double major with elementary education. For program requirements, consult program planners found on the Office of Records and Registration Web site: www.tcnj.edu/~recreg/.

Biology Liberal Arts (BIOA):

BIO 099/Orientation to Biology	0 course unit
BIO 185/Themes in Biology	1 course unit
BIO —/Option in Organismic Biology	1 course unit
BIO 211/Biology of the Eukaryotic Cell	1 course unit
BIO 261/Ecology and Field Biology	1 course unit
BIO 321/Genetics	1 course unit
BIO 498/Biological Seminar	1 course unit
Four biology option courses (by advisement)	4 course units
Total major courses	10 course units

CHE 201, 202/General Chemistry I/II	2 course units
CHE 321, 322/Organic Chemistry I/II	2 course units
MAT 127/Calculus A	1 course unit
One additional math course (by advisement)	1 course unit
PHY 201/Physics I	1 course unit
Total required correlate courses	7 course units

Biology Teaching (BIOT):

Students planning to teach middle or high school biology should consult with Professor Lipton in planning their academic program. These plans should take into account requirements for: the major, liberal learning, professional courses, and state certification. To be retained in the program, a student must earn at least a 2.5 cumulative grade point average (CGPA) before enrolling the junior year education sequence. The student must establish a minimum 2.75 CGPA, and must have completed the biology core before he/she is allowed to student teach (BIO 490).

An overview of the entire secondary-level teacher preparation sequence for students matriculating at the College beginning in 2003 can be found in the section of this bulletin for the Department of Education Administration and Secondary Education. Course descriptions for discipline-specific methods courses and student teaching in biology will be available (pending approval) in January 2005.

BIO 099/Orientation to Biology	0 course unit
BIO 185/Themes in Biology	1 course unit
BIO —/Option in Organismic Biology	1 course unit
BIO 211/Biology of the Eukaryotic Cell	1 course unit
BIO 261/Ecology and Field Biology	1 course unit
BIO 321/Genetics	1 course unit
BIO 498/Biological Seminar	1 course unit
Three biology option courses (by advisement)	3 course units
PHY 390/Methods of Teaching Science	1 course unit
Total major courses	10 course units

CHE 201, 202/General Chemistry I, II	2 course units
CHE 321, 322/Organic Chemistry I, II	2 course units
MAT 127, 128/Calculus A/B	2 course units
PHY 201/Physics I, PHY 202/Physics II	2 course units
Total required correlate courses	8 course units

Seven-Year BS/OD (Optometry) Program (BIOP)

Available to an entering freshman and to enrolled biology freshmen and first-semester sophomores. Entering freshmen applicants will need an SAT of at least 1200 and to be in the top 10 percent of their graduating class. BIOP majors will need to maintain a minimum overall GPA no lower than 3.2, and keep the minimum science and math prerequisite courses GPA no lower than 3.2 with no grade below a C. They are expected to take the OAT tests and score a 310 or better. There are two required interviews.

BIO 099/Orientation to Biology	0 course unit
BIO 185/Themes in Biology	1 course unit
BIO 211/Biology of the Eukaryotic Cell	1 course unit
BIO 261/Ecology and Field Biology	1 course unit
BIO 321/Genetics	1 course unit
BIO 332/Comparative Vertebrate Anatomy	1 course unit
BIO 498/Biological Seminar	1 course unit
Total major courses	6 course units

CHE 201, 202/General Chemistry I, II	2 course units
CHE 321, 322/Organic Chemistry I, II	2 course units
MAT 127/Calculus A	1 course unit
PHY 201, 202/Physics I, II	2 course units
PSY 101/Intro. Psychology	1 course unit
STA 115/Statistics	1 course unit
Total required correlate courses	9 course units

The remainder of requirements for the major will be taken at SUNY State College of Optometry.

Seven-Year BS/MD (Medical) Program (BIOM)

This is available to entering freshmen majors only. The candidates will need an SAT of 1400 or better (at one seating), and a class rank within the top 10 percent. To remain in the program, the student needs an overall and semester GPA of 3.4 or higher and a B or better in the required prerequisite science courses. Two interviews are required.

BIO 099/Orientation to Biology	0 course unit
BIO 185/Themes in Biology	1 course unit
BIO 211/Biology of the Eukaryotic Cell	1 course unit
BIO 261/Ecology and Field Biology	1 course unit
BIO 321/Genetics	1 course unit
BIO 332/Comparative Vertebrate Anatomy	1 course unit
BIO 413/Microscopic Anat. Techniques	1 course unit

BIO 498/Biological Seminar	1 course unit
Total major courses	7 course units
CHE 201, 202/General Chemistry I, II	2 course units
CHE 321, 322/Organic Chemistry I, II	2 course units
MAT 127/Calculus A	1 course unit
PHY 201, 202/Physics I, II	2 course units
PSY 101/General Psychology	1 course unit
One additional math course (by advisement)	1 course unit
Total required correlate courses	9 course units

The remainder of requirements for the major will be taken at UMDNJ Medical School.

Program Entrance, Retention, and Exit Standards

Every major program at the College has set standards for allowing students to remain in that program, to transfer within the College from one program to another, and to graduate from a program.

The following are the standards for BIOA and BIOT:

- Retention in the program is based on the following performance standards in these “critical content courses”: the student must have a minimum cumulative science GPA of 2.0 in three science courses required by the major by the end of the fourth semester in the major.
- Transfer into the program from another program within the College is based upon the following performance standards in these “foundation courses”: There must be at least three 100/200-level science courses and a GPA of 3.0 or better in all science courses. See department for application.
- Graduation requires a GPA of 2.0 in courses for the program and in the all science courses taken at TCNJ and earning a minimum grade point average of C– (1.67) or better in the following courses: BIO 185, BIO 211, BIO 261, BIO 221, and BIO 498.

The following are the standards for BIOM:

- Retention into the program is based on the following performance standards in these “critical content courses”: overall 3.4 GPA each semester and a B or better in BIO 185, CHE 201, 202, 331, 332, and PHY 201, 202.
- Transfer in the program from another program within the College is based upon the following performance standards in these “foundation courses”: there is no internal transfer allowed by the articulation agreement.
- Graduation includes credits earned at the Medical College of New Jersey.

The following are the standards for BIOP:

- Retention in the program is based on having a 3.2 GPA in the biology curriculum and a 3.2 in the optometry science and math prerequisites with no grade below a C; see the articulation agreement for further details.

- Transfer in the program can only be achieved from the BIOA major and is based on having a 3.2 or better GPA in the required optometry courses and an overall 3.2 or better GPA. For further details see the articulation agreement.
- Graduation includes credits earned at S.U.N.Y. Optometry; see articulation agreement for further requirements and modifications.

Biology Minor

The minor consists of five course units:

BIO 185/Themes in Biology

Two of the following:

BIO 211/Biology of the Eukaryotic Cell

BIO 321/Genetics

BIO 261/Ecology and Field Biology

Plus

Biology Options (two course units). At least one of the courses must be 300 level or higher. No more than three courses can be transferred into the minor.

Departmental Honors

The Departmental Honors Program provides advanced research experience and recognition of outstanding achievement. To be eligible, the biology major must have at least eight course units earned at The College of New Jersey including three course units of biology courses. The student should have an overall grade point average of 3.3 or better, and a science grade point average of 3.5 or better. The candidate must make application by written request to the biology department honors adviser (for further details see Dr. Fangboner). The candidate must complete the biology major with an overall GPA of 3.3 and a science GPA of 3.5 or better including at least 4.5 course units in biology courses completed at TCNJ and must complete the equivalent of three courses of honors biology work. The research will culminate with a presentation and a written thesis presented in a form acceptable to a scientific journal. For completion of departmental honors, the student's Honors Review Committee must judge the initial proposal and the final thesis "Honors Quality." Students who have completed the program successfully will be certified by the Department of Biology to graduate "With Departmental Honors in Biology."

Graduation Requirement

The biology major (BIOA, T, M, and P) will need one biology course at the organismal level or higher from among the following: 215, 312, 332, 341, 342, 343, 350, 411, 443, or 465 and a grade point average of 2.0 or better for science courses taken at the College. The biology core must average 1.67 or more.

Course Transfer

College science course transfer credits will need to be a C or better to be acceptable.

Marine Sciences Consortium

The College of New Jersey is a member of the New Jersey Marine Sciences Consortium (NJMSC), a group of universities and colleges interested in education and research in the marine sciences. Extensive summer programs conducted at field stations along the New Jersey coastline are available to interested students. For details and course descriptions, please refer to the College *Summer Bulletin* and the NJMSC Web site: www.njmssc.org.

Suggested Pre-Medical Curriculum (BIOA Major)

A large number of students whose career goal is in medicine, dentistry, or other allied health fields pursue a pre-medical curriculum through enrollment as a biology major. Careful advisement within the department and through the Medical Careers Advisory Committee is provided. Using the following courses to fulfill requirements has been highly successful in preparing students for such careers and facilitating their admission to appropriate medical or dental schools:

Mathematics: MAT 127
Physics: PHY 201, 202
Social Sciences: PSY 101 and one other social science course
Biology Options: BIO 413 and 332 and .5 course units of any other option courses
(equals 10 credits)
Chemistry: CHE 201, 202, 321, 322, 350

The above courses best prepare students for the Medical College Admissions Test (MCAT) and the course work during the first two years in medical school. Frequent advice should be sought from medical career advisers in the department (O'Connell, Fangboner, Kayne, Klug, and Lipton).

First Year Suggested Sequence

Fall

FSP First Seminar
BIO 099/Orientation to Biology
BIO 185/Themes in Biology
CHE 201/General Chemistry I
Foreign Language (if not exempted)*

Spring

CHE 202/General Chemistry II
WRI 102/Academic Writing (if not exempted)*
Foreign Language (if not exempted)*
MAT 127/Calculus A

Within the first four semesters (two years), the student should take BIO 185/Themes in Biology, BIO 211/Biology of the Eukaryotic Cell, BIO 261/Ecology, BIO 321/Genetics, and an organismal biology option.

**It is recommended that students exempted from these courses take other liberal learning courses.*

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

(7 weeks)

(annually—fall)

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 program offered by the biology department.

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

(with laboratory)

(annually)

Prerequisite: Open only to nursing majors or by permission of instructor

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 181/Human Form and Function **1 course unit**

(with laboratory)

(annually)

Restriction: Not to be taken by biology majors without permission from the chair of the biology department

Prerequisite: Completion of College Basic Skills Reading requirements

Humankind's bodily organization and operation are highlighted. Evolution of these attributes are contrasted and explored. The basic principles governing life and relationship of biology to other science and mathematics are explored. The influence of biology on society and accompanying ethical issues are considered.

BIO 185/Themes in Biology **1 course unit**

(with laboratory)

(every semester)

Prerequisite: Completion of all College Basic Skills requirements

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; Continuity of Life; 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. Students who are not planning to enter a health profession should consider taking other 100-level biology courses to fulfill their Liberal Learning requirement in science.

BIO 211/Biology of the Eukaryotic Cell **1 course unit**

(with recitation)

(every semester)

Prerequisite: BIO 185

Pre- or Corequisite: CHE 321 or 331

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 212/Principles of Microbiology **1 course unit**

Restriction: To be taken only by nursing majors

Prerequisites: One semester of biology and one semester of chemistry or permission of instructor
Study of microorganisms and their relationship to health and disease, biomedical research, and the balance of nature.

BIO 213/Laboratory Techniques in Biotechnology **1 course unit**

(with laboratory)
(annually)

Prerequisites: BIO 185, CHE 202

A theoretical and practical presentation of the experimental laboratory techniques and instrumentation used in cell and molecular biology.

BIO 215/Plants and People* **1 course unit**

(with laboratory)
(alternate years)

Prerequisite: BIO 185

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 241, 242/Human Anatomy and Physiology I, II **2 course units**

(with laboratory)
(annually)

Restriction: Not to be taken by BIOA, BIOP, or BIOM majors for biology option credit.

Prerequisites: BIO 185, CHE 202

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 opportunities for the student to make quantitative studies of the physiological processes taking place in the human body.

BIO 261/Ecology and Field Biology* **1 course unit**

(with laboratory)
(every semester)

Prerequisite: BIO 185

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 312/Microbiology **1 course unit**
(with laboratory)
(annually)

Prerequisites: BIO 185; CHE 322 or 332

Fundamental concepts in microbiology and the relationship of microorganisms to disease, and the balance of nature. Laboratory emphasis: the physiology of bacteria, preparation and use of selective and differential media, and related methodology.

BIO 313/Applied and Industrial Microbiology* **1 course unit**
(alternate years)

Prerequisite: BIO 312

Topics research, development, and quality control in water testing, food preparation, pharmaceutical manufacture, and medical diagnosis. Laboratory emphasizes manipulative skills and field trips.

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

BIO 321/Genetics **1 course unit**
(with laboratory)
(every semester)

Prerequisite: BIO 185 or permission of instructor

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

BIO 332/Comparative Vertebrate Anatomy **1 course unit**
(with laboratory)

(annually—spring)

Prerequisite: BIO 185 or permission of the instructor

Descriptive and functional comparative anatomy of representative vertebrates is developed with strong emphasis on the themes of phylogeny and ontogeny of organs and organ systems. Structural-functional relationships are also elucidated.

BIO 341/Biology of Seed Plants* **1 course unit**
(with laboratory)

(alternate years)

Prerequisite: BIO 185

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)

(alternate years)

Prerequisite: BIO 185

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 343/General Entomology

1 course unit

(with laboratory)

(occasionally)

Prerequisite: BIO 185

Emphasis will be placed on the biology, morphology, physiology, taxonomy, and economic importance of insects. Evolution within the class will be woven into various lectures, particularly those pertaining to morphology. Laboratory investigations include preparation of an insect collection.

BIO 350/Biology of Fungi*

1 course unit

(with laboratory)

(alternate years)

Prerequisite: BIO 185

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 351/Developmental Biology

1 course unit

(with laboratory)

(annually)

Prerequisites: BIO 211

Introduction to morphogenetics, cellular, genetic, and epigenetic aspects of an organism's development. The study will explore classical and molecular approaches. Emphasis will be on the molecular mechanisms of development. Model systems will range from *C. elegans* and *Drosophila* to vertebrates.

BIO 352/Biometry

1 course unit

(with laboratory)

(alternate years)

Prerequisite: BIO 185 or permission of instructor

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 370/Oceanography*

1 course unit

(with laboratory)

(alternate years)

Prerequisites: BIO 185; 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.*

BIOL 371/Evolution **1 course unit**

(with recitation)

(alternate years)

Prerequisites: BIO 185, CHE 202

Nothing in biology makes sense except in light of evolution. This famous quote by a renowned evolutionary biologist emphasizes the centrality of evolution to all fields of biology. BIOL 371 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 375/Environmental Quality, Protection, and Health* **1 course unit**

(with laboratory)

(annually—fall)

Prerequisites: Two semesters of biology and two semesters of chemistry or permission of instructor

A multidisciplinary, scientific consideration of environmental problems, management, engineering, and law. Epidemiology, toxicology, and pathophysiology of environmental diseases are emphasized. Modeling simulations and case histories are included. Laboratory consists of assay for and interpretation of biological parameters that characterize natural and altered environments.

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

BIO 387/Faculty-Student Research **1 course unit**

Prerequisite: Junior standing

The course provides the opportunity for a small group of students (usually four to six) to work together with a faculty member on a collaborative project, or a series of related projects, that are part of a faculty member's ongoing research or scholarly program.

BIO 392/Guided Readings in Biology **.25–1 course unit**

Permission of instructor and sign off by department chair.

BIO 399/Biology Internship **variable course units**

Prerequisites: Sophomore status, completion of at least four course units of biology and two course units of chemistry, minimum GPA of 2.5 (for transfer students at least three course units in science at TCNJ), and departmental permission

The course can be taken more than once. Up to two units can count toward biology options. Application of biological principles through completion of an approved supervised project in a paid or non-paid work setting. A student may take a maximum of six additional credits that will apply toward free electives. All placements must be approved by Professor Klug, who coordinates internships.

BIO 410/Advances in Molecular Biology **1 course unit**

(with laboratory)

(alternate years)

Prerequisites: BIO 211, BIO 321; CHE 322 or 332

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**

(annually)

(with laboratory)

Prerequisites: BIO 185, BIO 211; CHE 322 or 332

A detailed examination of general and comparative animal 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)

(annually—fall)

Prerequisite: BIO 211

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

(occasionally)

Prerequisite: BIO 211

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

BIO 445/Introduction to Virology **1 course unit**

(with laboratory)

(occasionally)

Prerequisites: BIO 211, BIO 312

An introduction to the viruses of eukaryotic and prokaryotic hosts. Basic principles and phenomena of virology will be stressed. Tissue culture, serologic tests, and isolation techniques will be introduced in the laboratory.

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

(with laboratory)

(occasionally)

Prerequisite: BIO 211

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 465/Physiological and Behavioral Ecology* **1 course unit**
(with laboratory)

Prerequisite: BIO 261

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 467/Electron Microscopy for Biologists **1 course unit**
(with laboratory)

(annually—spring)

Prerequisites: BIO 211 and permission of instructor

Theory and operation of the transmission and scanning electron microscopes with special emphasis on applications to biological studies. Basic principles and procedures for preparation of biological specimens for electron microscopy. In the laboratory, students will gain experience in the operation of the ultramicrotome, electron microscopes, and the necessary darkroom and digital image processing equipment. Limited to 12 students.

BIO 470/Topics in Biology **1 course unit**
(with laboratory and/or recitation)

Prerequisites: BIO 185; CHE 202; other prerequisites as determined by the department, dependent upon the topic

Selected topics which may vary from year to year.

BIO 480/Neurobiology **1 course unit**
(with laboratory)

(occasionally)

Prerequisite: BIO 211

A detailed examination of nervous system function at the cellular, molecular, system, and organismal level, including 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. Laboratory studies will focus on selected underlying principles of neural function, using invertebrate model systems.

BIO 487/Faculty-Student Research **1 course unit**

Prerequisite: Senior standing

The course provides the opportunity for a small group of students (usually four to six) to work together with a faculty member on a collaborative project, or a series of related projects, that are part of a faculty member's ongoing research or scholarly program.

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

BIO 490/Student Teaching**2 course units**

(every semester)

Prerequisite: Meeting all criteria for admission to student teaching

Student teaching during the senior year. Teaching in approved public schools, supervised and observed by college and public school teachers. Observation, participation, and responsible teaching.

BIO 493/Independent Research in Biology II**1 course unit***Prerequisites:* Advanced standing in biology and a 2.5 GPA overall and in all science courses taken at TCNJ

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.

BIO 494/Honors Independent Research in Biology II**1 course unit***Prerequisite:* Advanced standing in biology and a 2.5 GPA overall and in all science courses taken at TCNJ.**BIOL 498/Biological Seminar****.5 course unit**

(every semester)

Prerequisite: Completion of the biology core curriculum

Oral and written presentations by students in current research topics oriented around a unifying theme. Primary and secondary literature sources are utilized. May be taken for credit more than once. This is the biology capstone course. Topics vary each semester.