

Biology

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The objectives of the department are to develop an understanding by students of biological principles that underlie all living things, to instill in students a sense of inquiry, and to sharpen the analytical-thinking skills of students. Whenever possible, laboratory experiences emphasize independent research.

At the completion of the program, all students receive a Bachelor of Science in Biology. The major is a liberal-arts-based program that prepares students for: 1) occupations in biologically related professions, 2) advanced graduate study in biology, 3) a variety of health career professions, and 4) teaching at the secondary level. Occupations include, for example, research-oriented positions with private industrial and pharmacological enterprises and state and federal agencies. Graduate study may lead to both Master of Science and Ph.D. degrees. Health careers include allopathic (MD) and osteopathic (DO) medicine, dentistry, pharmacy, physical therapy, occupational therapy, physician assistant, podiatry, optometry, and veterinary medicine.

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.

Requirements for the Major

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), early childhood education/biology (ECBI), and elementary education/biology (ELBI).

Liberal Arts (BIOA) and Secondary Education (BIOT)

Fifty-seven credits (BIOA) or 51 credits (BIOT) of major requirements including 21 credits of biology core courses (BIO or BIOL 100, 185, 211, 261, 321, and 498), 18 credits (BIOA) or 12 credits (BIOT) of biology options, plus eight credits of organic chemistry (CHEM 321–322 or 331–332 or HONR 321-322), and eight credits of physics (PHYS 201–202 or 191–192 if BIOA; or PHYS 201–202 if BIOT). Eight credits of Mathematics and Statistics (including MAT or MATH 127 and STA or STAT 215) and eight credits of General Chemistry (CHEM 201–202 or HONR 210-202) are part of the general education requirements.

Seven-Year BS/MD Program (BIOM)

Available only to an entering freshman. Forty-seven credits of major requirements including 21 credits of biology core courses (BIO or BIOL 100, 185, 211, 261, 321, and 498), eight credits of General Physics (PHYS 201–202), eight credits of Organic Chemistry (CHEM 321–322 or 331–332 or HONR 321-322), and a minimum of 28 credits at NJ Medical School. Eight credits of Calculus (MAT or MATH 127–128) and eight credits of General Chemistry (CHEM 201–202 or HONR 201-202) are part of the general education requirements. The student needs to earn a 3.4 or better each semester overall and in the sciences, and earn a B or better in BIO 185, CHEM 201–202 or HONR 201–202, CHEM 321–322, 331–332, or HONR 321-322, and PHYS 201–202.

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

Available to an entering freshman and to enrolled biology freshmen and first-semester sophomores. Sixty credits of major requirements including 21 credits of biology core courses, (BIO or BIOL 100, 185, 211, 261, 321, and 498), 18 credits of biology options including BIOL 331 or 332, eight credits of General Physics (PHYS 201–202), eight credits of Organic Chemistry (CHEM 321–322, 331–332, or HONR 321-322), three credits of Statistics (STAT 115), and a minimum of 13 credits at S.U.N.Y. State College of Optometry. Eight credits of Calculus (MAT or MATH 127–128), eight credits of General Chemistry (CHEM 201–202 or HONR 201-202), and three credits of Psychology (PSY or PSYC 101) are part of the general education requirements. Minimum overall GPA no lower than 3.2; minimum science and math prerequisite courses GPA no lower than 3.2 with no grade below a C.

Elementary Education/Biology (ELBI) and Early Childhood Education/Biology (ECBI)

Thirty-two credits of major requirements, eight credits of biology core (BIO or BIOL 261 and 321), eight credits of biology options, eight credits of Organic Chemistry (CHEM 321–322, 331-332, or HONR 321-322), and eight credits of College Physics (PHYS 191–192), or General Physics (PHYS 201–202). Four credits of Themes in Biology (BIO 185), eight credits of General Chemistry (CHEM 201–202 or HONR 201–202), six to eight credits of mathematics (two courses from among IDSC 105, STAT 115, MAT or MATH 127–128), eight credits of biology core (BIO or BIOL 211, and BIOL 498) are included in the general education requirements.

Elementary Education M/S/T (ELST) and Early Childhood Education M/S/T (ECST) with a Biology Specialization

This interdisciplinary major integrates formal study in mathematics, biology, chemistry, physics, and technology. Students electing a biology specialization will complete 42 credits of “core” requirements including Calculus (MAT or MATH 127–128), Themes in Biology (BIO 185), Principles of Chemistry (CHEM 101–102), College Physics (PHYS 191–192), Introduction to Human Technological Behavior (TSNG 171), Principles of Structures and Mechanisms (TSNG 211), and an M/S/T-approved elective. The biology specialization consists of a minimum of 18 credits including two of the following core biology courses, BIO 211/Biology of the Eukaryotic Cell, BIO 261/Ecology and Field Biology, BIOL 321/Genetics, and two biology elective courses at the 300 level or higher.

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 of C– or better in the following courses: BIOL 183 /184 or BIO 185 (as of Fall 2003), BIO or BIOL 211, BIO or BIOL 261, BIOL 321, and BIOL 498. See control sheet for clarifications.

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 BIOL 183/184 or BIO 185 (as of Fall 2003), CHEM 201/202, CHEM 331/332, and PHYS 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; see control sheet for clarification.

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. 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 21 credits:

BIOL 181–182 or 183–184 8

or

BIO 185/Themes in Biology

and

one approved organismic course 8

Two of the following: 8

BIO or BIOL 211/Biology of the Eukaryotic Cell

BIOL 321/Genetics

BIO or BIOL 261/Ecology and Field Biology

Plus

Biology Options (two courses) 5 cr. minimum

At least two of the courses making up this minor must be 300 level or higher. No more than three courses (up to a total of 12 credits) can be transferred into the minor. Must have a grade point average of 2.0 or better in 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 32 credits earned at The College of New Jersey including 12 credits 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 Professor 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 18 credits in biology courses completed at TCNJ and must complete the equivalent of nine credits 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: 331, 332, 341, 342, 343, 350, 370, 371, 375, 442, or 465 and a grade point average of 2.0 or better for science courses taken at the College.

Course Transfer and AP Standards

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

AP Biology credit is given as elective credit only.

Marine Sciences Consortium

The College of New Jersey is a member of the New Jersey Marine Sciences Consortium, 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.

Biology Major: Teacher Preparation (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, general education, 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 in SCED 303/Junior Professional Experience. The student must establish a minimum 2.75 CGPA, and must have completed the biology core before he/she is allowed to student teach (BIOL 490).

Candidates for a teacher-education certificate must have a 2.75 cumulative grade point average to successfully complete their teacher education program. They also must meet the state hygiene/physiology requirement, and pass the appropriate Praxis examination before the New Jersey State Department of Education will issue the appropriate certificate. Teacher-education candidates will receive a "certificate of eligibility with advanced standing" which requires a candidate to be provisionally certified for his/her first year of teaching. After one year of successful teaching, the candidate is eligible for a permanent certificate. The teacher candidate will also have to pay a fee during his/her first year of teaching.

Elementary Education/Biology Major and Early Childhood Education/Biology Major

A student who wants to major in biology and teach in an elementary school or who wants to major in biology and teach nursery school or young elementary school children must follow a modified teaching curriculum. For details see Professor Klug.

Suggested Course Sequence

During academic year 2003-2004, The College of New Jersey is in the process of transformative curricular change. Therefore only the course of study for the first-year students entering in 2003-2004 is set out below. These students should consult their advisors when planning courses for future years. Supplements to this online bulletin also will be available on an ongoing basis.

First Year Suggested Sequence BIOA

BIOL	100/Freshman Seminar	1
BIO	185/Themes in Biology	4
CHEM	201, 202/General Chemistry I, II	8
WRI	102/Academic Writing	4
IDSC	151/Athens to New York	3 or 4
<i>or</i>		
FSP	101/First Year Seminar	
	Foreign Language	0-6*
	Electives	0-8
Total for year		28 - 35

Within the first four semesters the student should take BIO 185/Themes in Biology, BIO 211/Biology of the Eukaryotic Cell, BIOL 321/Genetics and an organismal biology option.

*Students exempting three to nine credits of the foreign language requirement should substitute the same number of electives.

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 or MATH 127, 128
Physics: PHYS 201, 202
Social Sciences: PSY or PSYC 101 and any other social sciences course
Biology Options: BIOL 413 and 332 and 10 credits of any other option courses
Chemistry: CHEM 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).

BIOL 100/Biology Freshman Seminar 1 cr.

(one meeting per week for 10 wks)

(annually—fall)

Required of all freshman biology majors, this course provides an orientation to higher education, to the The College of New Jersey community, and to the major program offered by the biology department, including, among other topics, its curriculum, advisement opportunities, career options, laboratory safety procedures, and facilities. An academic component involving a set of common readings may also be part of the course. Grading is pass/fail.

BIOL 141, 142/Principles of Human Anatomy and Physiology I, II 8 cr.

(3 class hours, 3 lab hours)

(annually)

Prerequisites: 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.

BIOL 181, 182/Principles of Biology I, II 8 cr.

(2 class hours, 1 recitation hour, 2 lab hours)

(annually)

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

Prerequisite: Pass Basic Skills Reading (test or course)

Perspectives on the World: Science

Major principles of biology as they relate to humans are emphasized. Human evolution, bodily organization, physiology, and relatedness to other life forms are highlighted in the first semester. During the second semester, the human organism, populations, and ecosystems are stressed via focus on reproduction, genetics, behavior, interspecies relations, and environmental quality.

BIO 185/Themes in Biology 4 cr.

(3 class hours, 3 lab hours)

(every semester)

Prerequisites: Pass Basic Skills math and reading tests or courses

Perspectives on the World: Science

For biology majors. Students who are not science majors or are not planning to enter a health profession should consider taking BIOL 181–182 to fulfill their general education requirement in science.

BIO 211/Biology of the Eukaryotic Cell 4 cr.

(3 class hours, 1 recitation hour)

(every semester)

Prerequisites: BIOL 183, 184 or BIO 185

Corequisite: CHEM 321 or 331 or HONR 321

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.

BIOL 212/Principles of Microbiology 4 cr.

(3 class hours, 3 lab hours)
(annually—spring)

Restriction: To be taken only by nursing majors

Prerequisites: BIOL 141, 142; CHEM 201, 202

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

BIOL 213/Laboratory Techniques in Cell and Molecular Biology 3 cr.

(2 class hours, 3 lab hours)
(annually—fall)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201,202

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

BIOL 241, 242/Human Anatomy and Physiology I, II 8 cr.

(3 class hours, 3 lab hours)
(annually)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201, 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. Not an option for BIOA, BIOP or BIOM majors.

BIO 261/Ecology and Field Biology* 4 cr.

(3 class hours, 3 lab hours)
(every semester)

Prerequisites: BIOL 183, 184 or 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.*

BIOL 312/Microbiology 4 cr.

(3 class hours, 3 lab hours)
(annually)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 322, 331 or HONR 321

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.

BIOL 313/Applied and Industrial Microbiology* 4 cr.

(3 class hours, 3 lab hours)
(alternate years)

Prerequisite: BIOL 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.*

BIOL 321/Genetics 4 cr.

(3 class hours, 3 lab hours)
(every semester)

Prerequisites: BIOL 183, 184 or BIO 185; BIOL or BIO 211; CHEM 201, 202 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.

BIOL 332/Comparative Vertebrate Anatomy 4 cr.

(3 class hours, 3 lab hours)
(annually—spring)

Prerequisites: BIOL 183, 184 or 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.

BIOL 341/Biology of Seed Plants***4 cr.**

(3 class hours, 3 lab hours)

(alternate years)

Prerequisites: BIOL 183, 184 or 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.*BIOL 342/Biology of the Invertebrates****4 cr.**

(3 class hours, 3 lab hours)

(alternate years)

Prerequisites: BIOL 183, 184 or 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.

BIOL 343/General Entomology**4 cr.**

(3 class hours, 3 lab hours)

(occasionally)

Prerequisites: BIOL 183, 184 or 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.

BIOL 350/Biology of Fungi***4 cr.**

(3 class hours, 3 lab hours)

(alternate years)

Prerequisites: BIOL 183, 184 or 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.

BIOL 351/Developmental Biology**4 cr.**

(3 class hours, 3 lab hours)

(annually)

Prerequisites: BIOL 183, 184 or BIO 185; BIOL or BIO 211; BIOL 321; CHEM 322 or 332 or HONR 322

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.

BIOL 352/Biometry**4 cr.**

(3 lecture hours, 3 lab hours)

(alternate years)

Prerequisites: BIOL 183, 184 or 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.

BIOL 370/Oceanography***4 cr.**

(3 class hours, 3 lab hours)

(alternate years)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201, 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**4 cr.**

(3 class hours; 1 recitation hour)

(alternate years)

Prerequisites: BIOL 181, 182 or BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201, 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.

BIOL 375/Environmental Quality, Protection, and Health***4 cr.**

(3 class hours, 3 lab hours)

(annually—fall)

Prerequisites: CHEM 201, 202 or HONR 201, 202; BIOL 261 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.*

BIOL 387/Faculty-Student Research**3 cr.***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.

BIOL 397/Biology Internship**3 or 6 cr.***Prerequisites:* Sophomore status, completion of at least 16 credits of biology and eight credits of chemistry courses, minimum GPA of 2.5 (for transfer students at least 12 credits in science at TCNJ), and departmental permission

Application of biological principles through completion of an approved supervised project in a paid or non-paid work setting. The first six credits count toward biology options. 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.

BIOL 410/Advances in Molecular Biology**4 cr.**

(3 class hours, 3 lab hours)

(alternate years)

Prerequisites: BIO or BIOL 211, BIOL 321; CHEM 322 or 332 or HONR 322

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.

BIOL 411/Animal Physiology**4 cr.**

(3 class hours, 3 lab hours)

(annually)

Prerequisites: BIOL 183, 184 or BIO 185, BIO or BIOL 211; CHEM 322 or 332 or HONR 322

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 investigation of selected aspects of the physiology of humans and other animals.

BIOL 413/Microscopic Anatomy and Techniques**4 cr.**

(3 class hours, 3 lab hours)

(annually—fall)

Prerequisite: BIO or BIOL 211

An in-depth examination of histology (the study of the function and microscopic structure of cells, tissues and organs as a basis for understanding biochemistry, physiological, and pathological processes) as well as hands-on experience in techniques for preparing specimens for histological examination and use of clinical microscopes.

BIOL 442/Applied Botany***4 cr.**

(3 class hours, 3 lab hours)
(occasionally)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201, 202

Integrates the fundamentals of plant growth, reproduction, metabolism, and disease with the utilization of plants by people. Topics include the history of agriculture, modern methods of plant breeding, and genetic engineering, and crop-growing techniques ranging from the chemistry intensive to organic. Also considered are plants as medicines in traditional societies and in the modern search for drugs, plants as herbs and spices, and plant conservation. In addition to experiments in lab and field collections of useful plants, the laboratory includes field trips to places where botany is practiced such as an agricultural research firm, a native plant nursery, and a botanical garden.

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

BIOL 445/Introduction to Virology**4 cr.**

(3 class hours, 3 lab hours)
(occasionally)

Prerequisites: BIO or BIOL 211, BIOL 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.

BIOL 446/Introduction to Immunology**4 cr.**

(3 class hours, 3 lab hours)
(occasionally)

Prerequisites: BIO or BIOL 211, BIOL 312

An introduction to the fundamentals of immunology. Provides a background for understanding the immune system and basic serological techniques.

BIOL 463/Topics in Biology**3–4 cr.**

(2–3 class hours, 0–3 lab hours, 0–1 recitation hour)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201, 202; other prerequisites as determined by the department
Selected topics which may vary from year to year.

BIOL 465/Physiological and Behavioral Ecology***4 cr.**

(3 class hours, 3 lab hours)
(alternate years)

Prerequisite: BIOL 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 470/Topics in Biology**4 cr.**

(2–3 class hours, 0–3 lab hours, 0–1 recitation hour)

Prerequisites: BIOL 183, 184 or BIO 185; CHEM 201, 202 or HONR 201, 202; other prerequisites as determined by the department
Selected topics which may vary from year to year.

BIOL 476, 477/Honors Independent Study**3 or 6 cr.**

Prerequisite: Approval of the departmental honors adviser; to be used by students enrolled in the College's Honors Program, if independent study is to count among their honors courses

An original laboratory or field research project under the supervision of a faculty member. The experience culminates in both a written and oral/poster presentation of the work to the department.

BIOL 487/Faculty-Student Research**3 cr.**

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.*

BIOL 488/Current Themes in Biology 2 cr.

(2 recitation hours)

(occasionally)

Prerequisites: Advanced standing and completion or enrollment in BIO or BIOL 211, 261 and BIOL 321; or permission of the instructor. May be taken for credit as a biology option only once

Student discussions of readings centered on a common topic or theme relevant to the study of modern biology. Emphasis is on the analysis, synthesis, and integration of ideas and issues presented in assigned readings. Topics and themes vary each offering.

BIOL 489/Secondary Education Biology 1 cr.

Student-Teaching Seminar

(1 class hour)

Corequisites: BIOL 490 and SCED 489

Discussion of and help with practical problems faced by the student teacher and beginning teachers. Study of important issues in science education. Course to be taken during student-teaching semester.

BIOL 490/Student Teaching 10 cr.

(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.

BIOL 491/Electron Microscopy for Biologists 4 cr.

(3 class hours, 4 lab hours)

(annually—spring)

Prerequisites: BIO or BIOL 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 microscope, and the necessary darkroom equipment. Limited to 12 students.

BIOL 498/Biological Seminar 2 cr.

(2 class hours)

(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. Topics vary each semester.

BIOL 499/Independent Study in Biology 1–6 cr.

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.

PHYS 390/Methods of Teaching Science 3 cr.

(3 class hours)

Modern trends in content, methods, techniques, organization, and philosophy of science education. Preparation for student teaching.