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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, with subject matter ranging in biological complexity from molecular and cell biology, through organismal biology, and on to ecology and evolutionary biology. The general objectives of the department are: 1) to develop in students an understanding 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 a variety of opportunities after graduation, including entry into biology-related professional occupations, pursuit of advanced graduate study in biology, enrollment at medical and allied health professional schools, and teaching at the primary and secondary levels.

Students in the Department of Biology learn firsthand about the work of a biological scientist. They learn about both classic experiments and cutting edge research in biology from the classic literature, the finest textbooks, and current primary scientific literature. In the classroom, the field, and in laboratories, scientific inquiry is the basis for learning, enhanced and encouraged by experienced, dedicated professors and the shared experiences of the class. Students construct hypotheses, develop research proposals, and hone their investigative and analytical skills through their work in course laboratories, research with faculty members, and mentored research at other institutions. Biology students discuss each other's work, write research papers, and submit their findings via scientific poster presentations. This rich set of experiences allows each student to realize the concept goals of the biology program 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 required of all biology students, provide a solid foundation within biology from the molecular to the ecosystem level. Students then supplement this core curriculum through the selection of upper-level biology option courses in their particular areas of interest.

Program Concept Goals

The study of biology is increasingly complex and multi-disciplinary. However, there are central concepts which are fundamental to all biological systems. These concepts constitute the biology program's Concept Goals, which are instilled in each student.

- 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.

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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. There also is a biology specialization within the M/S/T major in Elementary Education, Early Childhood Education, Special Education, and Deaf and Hard of Hearing. For program requirements, consult Program Planners found on the Office of Records and Registration web site.

Biology Liberal Arts (BIOA):

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 221/Ecology and Field Biology	1 course unit
BIO 231/Genetics	1 course unit
BIO 498/Biological Seminar	0.5course unit
BIO —/Option in Organismal Biology	1 course unit
Four additional biology option courses (by advisement)	4 course units

Total major courses

9.5 course units

CHE 201, 202/General Chemistry I/II	2 course units
CHE 331, 332/Organic Chemistry I/II	2 course units
MAT 127/Calculus A	1 course unit
One additional mathematics course (by advisement)	1 course unit
PHY 201/Physics I	1 course unit

Total required correlate courses

7 course units

Biology Teaching (BIOT):

An overview of the entire secondary-level teacher preparation sequence for students can be found in the section of this bulletin for the Department of Education Administration and Secondary Education.

Students planning to teach middle or high school biology should consult with advisors in both biology and secondary education 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 in the junior year education sequence. The student must establish a minimum 2.75 CGPA, and must have completed the biology core in order to be allowed to student teach (BIO 490).

Candidates for a teacher-education certificate must have a 2.75 or higher 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 or her first year of teaching. After one year of successful teaching, the candidate is eligible for a permanent certificate.

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Major

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	221/Ecology and Field Biology	1 course unit
BIO	231/Genetics	1 course unit
BIO	498/Biological Seminar	0.5 course unit
BIO	—/Option in Organismal Biology	1 course unit
	Two additional biology option courses (by advisement)	2 course units

Total major courses **7.5 course units**

Correlates

CHE	201, 202/General Chemistry I, II	2 course units
CHE	331, 332/Organic Chemistry I, II	2 course units
MAT	127, 128/Calculus A/B	2 course units
PHY	201, 202/Physics I, II	2 course units

Total required correlate courses **8 course units**

Professional Education Sequence

SED	224/Adolescent Learning and Development	1 course unit
EFN	299/School and Communities	1 course unit
SED	399/Pedagogy in Secondary Schools	1 course unit
SPE	323/Secondary Content Literacy in Inclusive Classrooms	1 course unit
EFN	398/Historical and Political Context of Schools	1 course unit
BIO	490/Student Teaching	2 course units
SED	498/Collaborative Capstone for Professional Inquiry	1 course unit
PHY	390/Methods of Teaching Science	1 course unit

9 course units

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

This accelerated program works in conjunction with the State University of New York's State College of Optometry in Manhattan and is available to entering first-year students and to enrolled biology first-year students and first-semester sophomores. To be considered, entering first-year applicants will need an SAT of at least 1300 and to be in the top 10 percent of their graduating class. An interview with each institution is required before acceptance into the program. BIOP majors will need to maintain a minimum overall GPA no lower than 3.3, and the GPA in science and mathematics prerequisite courses no lower than 3.3, with no grade below a C. They are expected to take the OAT tests and score a 310 or better.

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	221/Ecology and Field Biology	1 course unit
BIO	231/Genetics	1 course unit
BIO	332/Comparative Vertebrate Anatomy	1 course unit
BIO	498/Biological Seminar	0.5 course unit

Total major courses **5.5 course units**

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CHE 201, 202/General Chemistry I, II	2 course units
CHE 331, 332/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/Introduction to 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 accelerated program with the University of Medicine and Dentistry of New Jersey's New Jersey Medical School in Newark is available to entering first-year students only. To be considered, the candidate will need an SAT of 1400 or better (at one seating) from the critical reading and mathematics sections only, and a class rank within the top 10 percent. An interview with each institution is required before acceptance into the program. To remain in the program, the student needs an overall and semester GPA of 3.5 or higher and a B or better in the required prerequisite science courses.

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 221/Ecology and Field Biology	1 course unit
BIO 231/Genetics	1 course unit
BIO 413/Microscopic Anatomy Techniques	1 course unit
One additional biology option course (by advisement)	1 course unit
BIO 498/Biological Seminar	0.5 course unit

Total major courses **6.5 course units**

CHE 201, 202/General Chemistry I, II	2 course units
CHE 331, 332/Organic Chemistry I, II	2 course units
MAT 127/Calculus A	1 course unit
One additional mathematics course (by advisement)	1 course unit
PHY 201, 202/Physics I, II	2 course units

Total required correlate courses **8 course units**

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

Organismal Courses

The BIOA and BIOT biology major will need to enroll in one biology course at the organismal level. The courses that fulfill the organismal requirement are the following:

- Microbiology (BIO 312)
- Plants and People (BIO 315)

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- Comparative Vertebrate Anatomy (BIO 332)
- Biology of Seed Plants (BIO 341)
- Biology of the Invertebrates (BIO 342)
- General Entomology (BIO 343)
- Biology of the Fungi (BIO 350)
- Animal Physiology (BIO 411)
- Physiological and Behavioral Ecology (BIO 465)

Elementary Education M/S/T (ELST) or Early Childhood Education M/S/T (ECST) or Deaf and Hard of Hearing M/S/T (DHST) with a Biology Specialization

The M/S/T interdisciplinary major integrates formal study in mathematics, science, and technology to gain a better understanding of the human-designed world in which we all live. The major consists of nine units of courses drawn from a common “core,” one approved M/S/T elective, and a four-unit “specialization” in one of the M/S/T disciplines. Students in the major receive careful course selection advisement so that they qualify for a middle school endorsement in one of the M/S/T disciplines. **All majors must see the M/S/T academic program coordinator for general advisement.**

Students electing a Biology Specialization within the MST major will complete MAT 127/Calculus A and an approved second math course, BIO 185/Themes in Biology, CHE 201/General Chemistry I, and one approved science course, ETE 261/Multimedia Design, ETE 271/Structures and Mechanics, MAT 105/Mathematical Structures and Algorithms for Educators I, TED 460/Integrated M/S/T for the Child/Adolescent Learner, and one M/S/T approved elective. The Biology Specialization consists of two of the following three courses: BIO 211/Biology of the Eukaryotic Cell, BIO 221/Ecology and Field Biology, or BIO 231/Genetics; and two electives at the 200 level or above (BIO211, 221 or 231 may be used as one upper level elective).

M/S/T Suggested First Year Course Sequence

FSP	First Seminar	1 course unit
MAT	127/Calculus A	1 course unit
TST	161/Creative Design	1 course unit
ETE	261/Multimedia Design	1 course unit
	Science Option #1 (by advisement)	1 course unit
	Math or Science Option (by advisement)	1 course unit
	MAT 105/Mathematical Structures and Algorithms for Education I	1 course unit
WRI	102/Academic Writing (if not exempt)*	1 course unit

*It is recommended that students exempted from this course take another liberal learning course.

Total for year 8 course units

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.

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The following are the standards for BIOA and BIOT:

- Retention in the program is based on the following performance standards: at the end of the fourth semester at the college, the student must have a minimum cumulative science GPA of 2.0 in all science courses, and must have completed at least three science courses required by the major.
- Transfer into the program from another program within the College is based upon the following performance standards: there must be at least three 100/200-level natural science courses, one of which must be a course for biology majors and one of which must be a course for chemistry or physics majors; and there must be a cumulative GPA of 2.5 or better, and a science GPA of 2.5 or better. Students must submit a completed application to the Department of Biology (which requires two letters of recommendation, one of which must be from a biology professor). Please see department for application.
- Graduation requires: 1) an overall GPA of 2.0 in courses for the program, 2) a cumulative average of 2.0 in all science courses taken at TCNJ, and 3) a cumulative average of C– (1.67) or better in the following core courses: BIO 185, BIO 211, BIO 221, BIO 231, and BIO 498.

The following are the standards for BIOM:

- Retention in the program is based on the following performance standards in these “critical content courses”: overall 3.5 GPA each semester, and a B or better in BIO 185, CHE 201, 202, 331, 332, and PHY 201, 202.
- There is no internal transfer allowed by the articulation agreement.
- Graduation includes credits earned at UMDNJ’s New Jersey Medical School.

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 mathematics prerequisites with no grade below a C. For further details consult the optometry advisor regarding the articulation agreement.
- 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 consult the optometry advisor regarding the articulation agreement.
- Graduation includes credits earned at S.U.N.Y. Optometry. For further requirements and modifications consult the optometry advisor regarding the articulation agreement.

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 221/Ecology and Field Biology

BIO 231/Genetics

Two additional Biology Options

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The minimum GPA for retention in and completion of the minor is the same as for the major.

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 in biology. The student should have an overall GPA of 3.3 or better, and a science GPA of 3.5 or better. The candidate must make application by written request to the biology department honors advisor. The candidate must complete the biology major with an overall GPA of 3.3 and a science GPA of 3.5 or better. In addition, at least 4.5 course units in biology must be completed at TCNJ, and the student must complete the equivalent of three course units of honors-level independent biology research with a faculty member. 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 successfully complete the program will be certified by the Department of Biology to graduate "With Departmental Honors in Biology."

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. In addition, students may take summer courses at the Consortium's field station at Sandy Hook, some of which can be used to fulfill a biology option requirement; although no more than one of these courses can be used to fulfill one of those requirements. The descriptions of courses offered at Sandy Hook are at the end of the course description list below. Students must register for these courses via TESS, and fill out an application available via the [NJMSC Web site](#).

Study Abroad

One of the opportunities available to students pursuing a degree in biology is to study abroad for a semester or a year. Any student interested in studying abroad should meet with his/her faculty advisor early in his/her college career to plan a curriculum so that the student may complete his/her studies in four years. He/she will also need to meet with the college's [Office of International and Off-Campus Programs](#). The student must receive approval from the chair of biology in order for courses taken abroad to count toward requirements for the major.

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. Students interested in pursuing a degree in medicine, or in any of the allied health fields, should take Physics II (PHY 202) in addition to Physics I (PHY 201), in preparation for the Medical College Admissions Test (MCAT). No additional courses are necessary beyond the standard BIOA curriculum.

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Students who are not pursuing a major in biology, yet are considering application to medical school, should contact the Medical Careers Advisory Committee (see Department of Biology office staff or current chair) in order to receive advisement in preparation for medical school.

First Year Suggested Sequence for all biology majors

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

BIO 211/Biology of the Eukaryotic Cell or BIO 221/Ecology and Field Biology
CHE 202/General Chemistry II
WRI 102/Academic Writing (if not exempted)*
Foreign Language (if not exempted)*

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

Within the first four semesters (two years), the student should take BIO 185/Themes in Biology, BIO 211/Biology of the Eukaryotic Cell and BIO 221/Ecology and Field Biology. In addition, students should complete the four semester chemistry sequence. Students may also have the opportunity during the first two years to enroll in either BIO 231/Genetics and/or an organismal biology option course.

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 programs offered by the biology department.

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

(with laboratory)
(annually)

Restriction: 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.

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

(annually-spring)

Restriction: Open only to 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.

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BIO 171/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

The form and function of the human body are highlighted to illustrate the interdependence of structure and function. Evolution of these attributes is 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)

(annually)

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

Humankind's place in, and influence upon, the natural world are addressed. Evolution and genetics are studied. Nature's organization and regulation of populations, communities and ecosystems are explored. The implications of our environmental impact, and the argument for sustainability are explored.

BIO 185/Themes in Biology

1 course unit

(with laboratory)

(every semester)

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; 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)

(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.

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

BIO 231/Genetics **1 course unit**

(with laboratory)

(every semester)

Prerequisite: BIO 185 or permission of instructor

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)

(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 311/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 312/Microbiology **1 course unit**

(with laboratory)

(annually)

Prerequisites: BIO 185; CHE 332

Fundamental concepts in microbiology are covered, as well as 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 methodology.

BIO 315/Plants and People* **1 course unit**

(with laboratory)

(alternate years)

Prerequisite: BIO 185

This course 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. The history and methods of agriculture are also addressed, 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. Different approaches to the conservation of useful plant biodiversity are explored. 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.*

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BIO 332/Comparative Vertebrate Anatomy **1 course unit**

(with laboratory)

(annually)

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 explored.

BIO 341/Biology of Seed Plants* **1 course unit**

(with laboratory)

(alternate years)

Prerequisite: BIO 185

This course explores 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)

(alternate years)

Prerequisite: BIO 185

Emphasis will be placed on the biology, morphology, physiology, taxonomy, and economic importance of insects. Evolution within the class *insecta* 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.*

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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)
(occasionally)

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.*

BIO 392/Guided Study in Biology

.25–1 course unit

Permission of instructor and department chair.

BIO 399/Biology Research Internship

.25-1 course unit

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

May be taken for credit 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 two additional course units that will apply toward free electives. All placements must be approved by the internship coordinator.

BIO 410/Advances in Molecular Biology

1 course unit

(with laboratory)
(alternate years)

Prerequisites: BIO 211, BIO 231; CHE 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

(with laboratory)
(annually)

Prerequisites: BIO 211; CHE 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.

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BIO 413/Microscopic Anatomy and Techniques

1 course unit

(with laboratory)

(annually)

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

(alternate years)

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)

(alternate years)

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, students 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)

(alternate years)

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 discussed will range from *C. elegans* and *Drosophila* to vertebrates.

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BIO 461/Evolution

1 course unit

(with recitation)
(annually)

Prerequisites: BIO 221, CHE 202

“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)
(alternate years)

Prerequisite: BIO 221

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)
(alternate years)

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.

BIO 470/Topics in Biology

1 course unit

(with laboratory and/or recitation)

Prerequisites: BIO 185; 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)
(annually)

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.

Biology-15

BIO 490/Student Teaching in Biology

2 course units

(every semester)

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 responsible teaching.

BIO 493/Independent Research in Biology

.25-1 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. May be taken for credit more than once.

BIO 494/Honors Independent Research in Biology

.25-1 course unit

Prerequisite: Advanced standing in biology and a 2.5 GPA overall and in all science courses taken at TCNJ. For students in college-wide honors program or pursuing honors in biology only.

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. May be taken for credit more than once.

BIO 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.

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)

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-oriented course covering the principle divisions in the marine sciences. Designed to help students evaluate his/her interest in the marine science world.

BIO 363/Marine Consortium Introduction to Marine Biology

1 course unit

(summer)

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-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.

Biology-16

BIO 364/Marine Consortium Topics Course

1 course unit

(summer)

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.

BIO 495/Marine Consortium Independent Research

variable course units

(summer)

Prerequisite: Advanced standing in biology and a 2.5 GPA overall and in all science courses taken at TCNJ

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

Individual research projects at the undergraduate level selected under the guidance of a professor. Examples of subject matter: marine biology, oceanography, paleobiology, and coastal geology.