

## Biology-1

### Biology

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*Click here for [Biology courses](#)*

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. 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, in 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, secondary education, seven-year BS/MD, seven-year BS/OD, 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 (education of developmentally handicapped), and deaf and hard of hearing education. For program requirements, consult “Biology Programs” found on the Department of Biology web page at <http://www.tcnj.edu/~biology/programs/index.html>.

### Biology: Liberal Arts

#### Major Courses

BIO 099/Orientation to Biology	0 course units
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 (Qualified students may use BIO 495/496 to serve as the capstone experience—see Biology course descriptions.)	1 course unit
Biology option courses Five biology option courses (by advisement), of which one must be in organismal biology and no more than two may be transfer credits from another institution.	5 course units

**Total major courses** **10 course units**

#### Correlate Courses

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 of the following courses (by advisement) MAT 128/Calculus B MAT 200/Discrete Mathematics STA 215/Statistical Inference	1 course unit
PHY 201/Physics I	1 course unit

**Total required correlate courses** **7 course units**

### Biology: Secondary Education

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 cumulative grade point average (CGPA) of 2.75 or higher before enrolling in the junior year education sequence. To be allowed to student teach (BIO 490), the student must establish a CGPA of 2.75 or higher, and must have completed the biology core.

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Candidates for a teacher-education certificate must have a CGPA of 2.75 or higher to successfully complete their teacher education program. They also must meet the state hygiene/physiology requirement, the harassment-intimidation-bullying 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.

#### **Major Courses**

BIO 099/Orientation to Biology	0 course units
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	1 course unit
(Qualified students may use BIO 495/496 to serve as the capstone experience—see Biology course descriptions.)	
Biology option courses	4 course units
Four biology option courses (by advisement), of which one must be in organismal biology and no more than two may be transfer credits from another institution.	

**Total major courses** **9 course units**

#### **Correlate Courses**

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 of the following courses (by advisement)	1 course unit
MAT 128/Calculus B	
MAT 200/Discrete Mathematics	
STA 215/Statistical Inference	
PHY 201 Physics I	1 course units

**Total required correlate courses** **8 course units**

#### **Professional Education Sequence Courses**

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
	<b>9 course units</b>

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### Biology: Seven-Year BS/OD (Optometry) Program

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 must have an SAT score of at least 1300 (Verbal + Math, with at least 670 in Math) and must be in the top 10 percent of their graduating class. An interview at SUNY is required before acceptance into the program. Seven-Year BS/OD majors must maintain an overall GPA of 3.3 or higher and a GPA of 3.3 or higher in all required science and mathematics courses, with no grade in the required courses below a C. Students are required to take the Optometry Aptitude Test (OAT) and score 320 or higher on all sections. More information about the program is available from Dr. Sudhir Nayak ([nayak@tcnj.edu](mailto:nayak@tcnj.edu)) or at the following web site: <http://www.tcnj.edu/~biology/7med/optometry.html>.

#### Major Courses

BIO 099/Orientation to Biology	0 course units
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/Biology of the Vertebrates	1 course unit
BIO 498/Biological Seminar	1 course unit
(Qualified students may use BIO 495/496 to serve as the capstone experience—see Biology course descriptions.)	
Biology option course (by advisement)	1 course unit

#### Total major courses

**7 course units**

#### Correlate Courses

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 215/Statistics	1 course unit

#### Total required correlate courses

**9 course units**

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

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### Biology: Seven-Year BS/MD (Medical) Program

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 applicant must have an SAT score of 1480 or higher (at one sitting) from the critical reading and mathematics sections only, and a class rank within the top 5 percent. An interview with each institution is required before acceptance into the program. To remain in the program, the student must maintain an overall and semester GPA of 3.5 or higher and earn a B or better in the required science courses (BIO 185, 231; CHE 201, 202, 331, 332; PHY 201, 202). More information is available from Dr. Shevlin at [shevlin@tcnj.edu](mailto:shevlin@tcnj.edu), and at the following website: <http://www.tcnj.edu/~biology/7med/med.html>.

#### Major 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
Two additional 300- or 400-level biology option courses (by advisement), one of which must have a lab and no more than one may be transfer credit from another institution.	2 course units
BIO 498/Biological Seminar (Qualified students may use BIO 495/496 to serve as the capstone experience—see Biology course descriptions.)	1 course unit
Research coursework: BIO 399/Biology Research Internship (1 course unit) <i>or</i> BIO 393 or 493/Independent Research in Biology I or II (2 course units)	1-2 course units

**Total major courses** **8-9 course units**

#### Correlate Courses

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 of the following courses (by advisement) MAT 128/Calculus B MAT 200/Discrete Mathematics STA 215/Statistical Inference	1 course unit
PHY 201, 202/Physics I, II	2 course units
<b>Total required correlate courses</b>	<b>8 course units</b>

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

#### Organismal Biology Option Courses

The Biology-Liberal Arts and Biology-Secondary Education students major will need to enroll in at least one biology option course at the organismal level. The courses that fulfill the organismal requirement are the following:

- Microbiology (BIO 312)
- Plants and People (BIO 315)
- Biology of the Vertebrates (BIO 332)

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- Biology of Seed Plants (BIO 341)
- Biology of the Invertebrates (BIO 342)
- Biology of the Fungi (BIO 350)
- Natural History of the Galapagos Islands and Ecuador (BIO 365/366)
- Animal Physiology (BIO 411)
- Physiological and Behavioral Ecology (BIO 465)

### **Elementary Education M/S/T or Early Childhood Education or Deaf and Hard of Hearing M/S/T 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 must complete MAT 127/Calculus A and an approved second math course, BIO 185/Themes in Biology, CHE 201/General Chemistry I, one additional 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 (BIO 211, 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**

### **Course Registration**

It is the responsibility of the student to ensure that all prerequisites or corequisites for enrolling in a particular course have been met. Students found to not have met prerequisites or corequisites may be dis-enrolled. Furthermore, registering in a course section in order to hold a seat for another student is considered to be a violation of the Student Conduct Code for both the student holding the seat and the student taking the held seat. Seat-holding will be monitored through PAWS.

### **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 Biology-Liberal Arts and Biology-Secondary Education Programs:

- Retention in the program is based on the following performance standards: 1) at the end of the fourth semester at the college, the student must have a minimum cumulative GPA of 2.0 in all math and science courses (excluding any biology courses numbered below 185), and 2) 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: 1) students are eligible to apply at the end of the semester in which they will have completed at least 8 course units at TCNJ (transfer credits and AP credits are excluded) and will have completed the following required courses: BIO 185, BIO 211, CHE 201, CHE 202, and MAT 127; 2) the applicant must have earned a grade of C or higher in at least four of these five required courses (if taken at TCNJ); 3) the applicant must have completed at least 2 course units of biology and 2 course units of other science at TCNJ and must have an overall math and science GPA of at least 2.67 (B-); and 4) the cumulative GPA for all courses completed at TCNJ must be at least 2.50. These criteria are the minimum criteria for submitting an application, and they are not necessarily sufficient for acceptance into the program. Consult the Department of Biology web page for complete application details: <http://www.tcnj.edu/~biology/programs/index.html/>.
- Graduation requires: 1) an overall GPA of 2.0 in courses for the program, 2) a cumulative GPA of 2.0 in all math and science courses taken at TCNJ, and 3) a cumulative GPA of C- (1.67) or higher in the following core courses: BIO 185, BIO 211, BIO 221, and BIO 231.

The following are the standards for the Biology-Seven-Year Medical Program:

- Retention in the program is based on the following performance standards in these “critical content courses”: 1) overall 3.5 GPA each semester, and 2) a B or higher in BIO 185, BIO 231, CHE 201, 202, 331, 332, and PHY 201, 202.
- Internal transfer into the program is not allowed by the articulation agreement.
- Graduation includes credits earned at UMDNJ’s New Jersey Medical School.

The following are the standards for the Biology-Optometry Program:

- Retention in the program is based on the following performance standards: a GPA of 3.3 in the biology curriculum and a GPA of 3.3 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 into the program can only be achieved from the Biology-Liberal Arts program. Students must have a GPA of 3.3 or higher in the required optometry courses and an overall GPA of 3.3 or higher. For further details consult the optometry advisor regarding the articulation agreement.
- Graduation includes credits earned at SUNY College of Optometry. For further requirements and modifications consult the optometry advisor regarding the articulation agreement.

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### **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 (*Please note that BIO 211 is a prerequisite for BIO 231.*)

Two additional biology option courses, of which no more than one may be transfer credits from another institution.

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

A minimum of three of the biology courses for the minor must be taken at TCNJ.

### **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 higher, and a science GPA of 3.5 or higher. The candidate must apply by submitting a 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 higher. In addition, at least five course units in biology must be completed at TCNJ, and the student must complete the equivalent of three course units of Independent Research in Biology with the same faculty member. The research will culminate with an oral presentation and a written thesis presented in a format 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 as being of "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, one of which (Introduction to Marine Biology, BIO 363) can be used to fulfill a biology option course requirement. 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 PAWS, and fill out an application available via the NJMSC web site (<http://www.njseagrant.org/education/college-programs>).

### **Coursework at Other Institutions**

All students interested in enrolling in a course at another institution should contact the chair of the Biology Department before enrolling to determine the transferability of the course. For students currently enrolled at TCNJ, transfer credit will not be awarded for any on-line (distance learning) course offered to fulfill a biology major or minor degree requirement with a laboratory or field component. The course may, however, be transferable as free elective credit.

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### 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 [Center for Global Engagement](#). The student must receive approval from the chair of biology in order for courses taken abroad to count toward requirements for the major. (Please note: For each biology program, there is a maximum number of biology option course units that may be transfer credits from another institution; refer to descriptions of individual programs for specific details.) For those not able to spend a full semester abroad, BIO 365/366/Natural History of the Galapagos Islands and Ecuador offers a short-term abroad immersion experience.

### Suggested Pre-Medical Curriculum (Biology-Liberal Arts)

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 Biology-Liberal Arts curriculum.

Students who are not pursuing a major in biology, yet are considering application to medical school, should contact the Medical Careers Advisory Committee (see <http://www.tcnj.edu/~biology/career/medadvisory.html>) 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)\*\*/or math/or liberal learning

#### 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)\*\*/or math/or liberal learning

*\*It is recommended that students exempted from this course take other liberal learning courses.*

*\*\* Arabic 151 and 152, Chinese 151 and 152, Japanese 151 and 152, and Russian 151 and 152 (offered annually); and Persian 151 and 152 (offered occasionally) are intensive courses and carry two course units of credit each. Students should take this into account when planning a normal four-course semester.*

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Within the first four semesters (two years), the student should complete BIO 185/Themes in Biology, BIO 211/Biology of the Eukaryotic Cell and BIO 221/Écology and Field Biology, as well as the four-semester chemistry sequence. Note that students must have earned a C- or higher in BIO 185 in order to enroll in biology courses numbered 200 or above; BIO 211 is a prerequisite for BIO 231/Genetics, which should be completed during the sophomore/junior years. Students may also have the opportunity during the first two years to complete either BIO 231/Genetics and/or an organismal biology option course. Students must have completed or be co-enrolled in BIO 211, 221, *and* 231 before they can enroll in any 400-level course in biology; students must have *completed* all three of these core courses before they can enroll in BIO 498/Biological Seminar.