BIOLOGY

Biology

Total minimum number of credits required for a major in Biology leading to the B.A. degree – 122
Total minimum number of credits required for a major in Biology leading to the B.S. degree – 122
Total minimum number of credits required for a minor in Biology – 22

Biology Major - Required Courses and Recommended Course Sequences

<table>
<thead>
<tr>
<th>Semester</th>
<th>B.A. Credits</th>
<th>B.S. Credits</th>
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</thead>
<tbody>
<tr>
<td><strong>First Semester</strong></td>
<td></td>
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<tr>
<td>[[BIO-121]] - Principles of Modern Biology I</td>
<td>4</td>
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<tr>
<td>[[CHM-113]] - Elements &amp; Compounds Lab</td>
<td>1</td>
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<tr>
<td>[[CHM-115]] - Elements &amp; Compounds</td>
<td>3</td>
<td>3</td>
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<tr>
<td>[[FYF-101]] - First-Year Foundations</td>
<td>3</td>
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</tr>
<tr>
<td>[[MTH-111]] - Calculus I</td>
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<tr>
<td><strong>Second Semester</strong></td>
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<tr>
<td>[[BIO-122]] - Principles of Modern Biology II</td>
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<tr>
<td>[[CHM-114]] - The Chemical Reaction Lab</td>
<td>1</td>
<td>1</td>
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<tr>
<td>[[CHM-116]] - The Chemical Reaction</td>
<td>3</td>
<td>3</td>
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<tr>
<td>[[ENG-101]] - Composition</td>
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<td>MTH 114 - Calculus &amp; Modeling ...</td>
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<tr>
<td><strong>Third Semester</strong></td>
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<tr>
<td>[[BIO-225]] - Population &amp; Evolutionary Biology</td>
<td>4</td>
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<tr>
<td>CHM 231 - Organic Chemistry I</td>
<td>3</td>
<td>3</td>
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<td><strong>Total Credits</strong></td>
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<tbody>
<tr>
<td><strong>Fourth Semester</strong></td>
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<tr>
<td>[[BIO-226]] - Cellular and Molecular Biology</td>
<td>4</td>
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<tr>
<td>CHM 232 - Organic Chemistry II</td>
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<td>CHM 234 - Organic Chemistry II Lab</td>
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<td><strong>Distribution Requirements</strong></td>
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<tr>
<td><strong>Fifth Semester</strong></td>
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<tr>
<td>[[BIO-397]] - Professional Prep. Techniques*</td>
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<td>BIO Elective or Research**</td>
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<td><strong>Distribution Requirements</strong></td>
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<td>Free Elective(s)***</td>
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<td>[[MTH-150]] - Elementary Statistics</td>
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<td>[[PHY-171]] - Principles of Classical &amp; Modern Physics</td>
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<tr>
<td><strong>Sixth Semester</strong></td>
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<td>[[BIO-397]] - Professional Prep. Techniques*</td>
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<tr>
<td>BIO Elective or Research</td>
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<tr>
<td>Computer Science Elective</td>
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<tr>
<td><strong>Distribution Requirements</strong></td>
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<tr>
<td>[[PHY-174]] - Applications Classical and Modern Physics</td>
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Biology

Seventh Semester

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<tr>
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<tr>
<td>[BIO-391] - Senior Research Projects</td>
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<td>Free Electives***</td>
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Eighth Semester

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<tr>
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<tr>
<td>[BIO-392] - Senior Research Projects</td>
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<td>BIO Electives</td>
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<tr>
<td>Distribution Requirement</td>
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<tr>
<td>Free Electives***</td>
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<tr>
<td><strong>Total Credits</strong></td>
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*Only one semester of BIO 397 is required, but it must be taken in the fifth or sixth semester.

**No more than four credits of BIO 395 or 396 will count toward the major.

***Any course other than a biology course.

Biology Minor

Students in majors other than Biology may wish to elect a minor in Biology. The minor in Biology shall consist of a minimum of 22 credits.

Required courses are as follows:

- BIO-121 - Principles of Modern Biology I
- BIO 122 - Principles of Modern Biology II
- BIO 225 - Population and Evolutionary Biology
- BIO 226 - Cellular and Molecular Biology

Two 300-level, Biology electives. These upper-level electives, exclusive of BIO 395-396 (Independent Research), will be selected after consultation with the department chairperson.

Honors Program in Biology

Honor students in Biology will be recognized upon completion of the following requirements: 1) achievement of a graduating cumulative grade point average of 3.25 or better; 2) achievement of grades of 3.00 or better in all biology courses; 3) pursuit of independent research and completion of a research project in biology; and 4) presentation of the research project results at a national or regional scientific conference or by means of publication of a research paper. The distinction “Honors in Biology” will be recorded on the student’s transcript upon graduation.

Biology in Conjunction with the Secondary Education Major or Minor

Students interested in becoming secondary teachers in Biology should make an appointment with the chairperson of the Education Department or the Coordinator of the Secondary Education Program as early as possible in their course of study to plan their professional studies. These students will declare a major in Biology and as well as a major or minor in Secondary Education. The major in Secondary Education must be taken in conjunction with an approved major; it is not a stand alone major. Upon successful completion of the secondary education program, students may become certified in Pennsylvania to teach in grades 7-12 in their chosen field. Students interested in pursuing either the major or the minor in Secondary Education should refer to the Education Department section of this bulletin for complete details of the curriculum and other degree requirements. Students should also consult carefully with their Education program and Biology program advisors in planning their course of studies.

Total credits required for Secondary Education minor - 40

Total credits required for Secondary Education major - 47

Required courses for the major(*) or minor in Secondary Education are as follows:

- ED 180 – Educational Psychology - 3 cr.
- ED 190 – Effective Teaching with Field Experience - 3 cr.
- ED 191 – Integrating Technology into the Classroom - 3 cr.
- EDSP 210 – Teaching Students with Special Needs - 3 cr.
- ED 220 – Teaching Culturally and Linguistically Diverse Learners - 3 cr.
- EDSP 225 – Special Education Methods I with Field Experience - 3 cr.
- *ED 345 – Assessment - 3 cr.
- *ED 375 – Middle Level/Secondary School Methods with Field Exp. - 4 cr.
- ED 371 – Teaching Methods in Science with Field Experience - 4 cr.
- ED 380 – Content Area Literacy - 3 cr.
- EDSP 388 – Inclusionary Practices (taken concurrently with ED 390) - 3 cr.
- ED 390 – Student Teaching with Seminar - 12 cr.

* These additional courses required in order to complete the major in Secondary Education.

- All Teacher Education candidates must apply for admission to the Teacher Education Program in the sophomore or junior year.
- To be admitted into the Teacher Education Program, candidates must
  - Attain a 3.0 GPA
  - Complete 48 credits including six credits in both Mathematics and English
  - Pass a test of basic skills
  - Submit required clearances showing ‘no record’
- To remain in the Teacher Education Program, candidates must
  - Maintain a 3.0 GPA
  - Adhere to the Code of Professionalism and Academic Honesty
- To be certified as a teacher in Pennsylvania in grades 7-12, candidates must
  - Successfully complete all required Education courses, including student teaching
  - Graduate with a 3.0 cumulative GPA
  - Pass the appropriate exit test(s) in their content area
  - Apply for certification through the Pennsylvania Teacher Information Management System (TIMS).
BIO. BIOLOGY

BIO-105. THE BIOLOGICAL WORLD
Credits: 3
This course presents concepts and modern ideas pertaining to the natural world and the life sciences. Each semester, a selected topic will be addressed and explored from an investigative set of perspectives. While the scientific method will be emphasized in each offering, the range of topics, identified as a subtitle in the course offering data, will include, for example, 1) Genetics, Evolution, and Ecology: Implications for a Changing Society, 2) Human Biology, 3) Contemporary Issues in the Life Sciences, and others. This course is intended for students who are not majoring in science, engineering, pre-pharmacy, and nursing, or pursuing B.S. programs in mathematics or computer science. Fall semesters: Human Biology—two hours of lecture and two hours of laboratory per week. Dissections of specimens may be required in the laboratory component. Spring semesters: Contemporary Issues in the Life Sciences—three hours of lecture each week.
Click here for course fee.

Pre-Requisites
[BIO-115] or permission of the instructor.

BIO-113. MICROBIOLOGY
Credits: 4
This course presents the basic principles of bacteriology and the relationship of micro-organisms to disease and its prevention, control, and treatment. It considers the effects of microbes within the body and the body's reaction to them. Lecture, three hours per week; laboratory, three hours per week. Offered every spring semester.
Click here for course fee.

Pre-Requisites
[BIO-115] or permission of the instructor.

BIO-115. ANATOMY & PHYSIOLOGY I
Credits: 4
Terms Offered: Fall
This course provides a general study of the human body, its structure and normal function. It provides an appreciation of the complex nature of the human body with relation to the promotion of a healthy organism. Dissections of specimens are required in the laboratory portion of these courses. Lecture, three hours per week; laboratory, three hours per week.
Click here for course fee.

BIO-116. ANATOMY & PHYSIOLOGY II
Credits: 4
Terms Offered: Spring
This course is a continuation of [BIO-115] and provides a general study of the human body, its structure and normal function. It provides an appreciation of the complex nature of the human body with relation to the promotion of a healthy organism. Dissections of specimens are required in the laboratory portion of these courses. Lecture, three hours per week; laboratory, three hours per week.
Click here for course fee.

Pre-Requisites
[BIO-115] or permission of instructor.

BIO-116. ANATOMY & PHYSIOLOGY II
Credits: 4
Terms Offered: Spring
This course is a continuation of [BIO-115] and provides a general study of the human body, its structure and normal function. It provides an appreciation of the complex nature of the human body with relation to the promotion of a healthy organism. Dissections of specimens are required in the laboratory portion of these courses. Lecture, three hours per week; laboratory, three hours per week.
Click here for course fee.

Pre-Requisites
[BIO-115] or permission of instructor.

BIO-116. ANATOMY & PHYSIOLOGY II
Credits: 4
Terms Offered: Spring
This course is a continuation of [BIO-115] and provides a general study of the human body, its structure and normal function. It provides an appreciation of the complex nature of the human body with relation to the promotion of a healthy organism. Dissections of specimens are required in the laboratory portion of these courses. Lecture, three hours per week; laboratory, three hours per week.
Click here for course fee.

Pre-Requisites
[BIO-115] or permission of instructor.

BIO-115. ANATOMY & PHYSIOLOGY I
Credits: 4
Terms Offered: Fall
An introduction to concepts of modern biology for students majoring in biology and other sciences. Topics covered include the origin of life, basic biochemistry, cell structure and function, energetics, reproduction and heredity, molecular genetics, and evolution. Four hours of lecture and three hours of laboratory work per week. Offered every fall semester. Required of all Biology majors.
Click here for course fee.

Co-Requisites
[[CHM-115]]

BIO-116. ANATOMY & PHYSIOLOGY II
Credits: 4
Terms Offered: Spring
An introduction to biological diversity and mammalian structure and function for science majors, usually taken as a continuation of [[BIO-115]]. Topics include organismal classification, a survey of biological diversity (including characteristics, ecology, phylogenetic relationships, and economic and biomedical uses) of plants, animals, and microbes, and an overview of the mammalian body addressing the form and function of key organ systems. Dissections of specimens are required in the laboratory portion of this course. Four hours of lecture and three hours of laboratory per week. Offered every spring semester. Required of all Biology majors.
Click here for course fee.

BIO-198. TOPICS
Credits: 1-3
A study of topics of special interest not extensively treated in regularly offered courses. Offered every spring semester. Required of all Biology majors.
Click here for course fee.

Pre-Requisites
Will vary according to the specific topics course.

BIO-225. POPULATION AND EVOLUTIONARY BIOLOGY
Credits: 4
This course emphasizes the patterns and processes of evolutionary change in living systems in an ecological context. It reviews the basic characteristics and dynamics of populations and the relevance of population ecology and population genetics to the evolution of species. Human evolutions, sociobiology, and other controversial issues are also covered. Laboratory exercises emphasize an experimental approach to more in-depth study of specific topics covered in lecture. Four hours of lecture and three hours of laboratory per week. Offered every fall semester. Required of all Biology majors.
Click here for course fee.

Pre-Requisites
[[BIO-121]] and [[BIO-122]].

BIO-226. CELLULAR AND MOLECULAR BIOLOGY
Credits: 4
Fees:
Cell structure in relation to function. Biochemistry and physiology of animal, plant, and bacterial cells and their viruses are presented in a molecular biology context. The cell in division and development. Four hours of lecture and three hours of laboratory per week. Offered every spring semester. Required of all Biology majors.
Click here for course fee.

Pre-Requisites
[[BIO-121]] and [[BIO-122]].
BIO-254. SUPERLAB  
**Credits:** 3  
Superlab is a research-oriented course in which students carry out laboratory and field-based investigations into research areas such as ecotoxicology, plant physiology, molecular biology, and cancer biology. In this course, students have one hour of classroom instruction per week during the regular semester followed by ten days (over a period of two weeks) of intensive laboratory work after the end of the semester, in which students design and implement experiments and carry out research discussed during the semester with the aid of their instructors. Offered each year.

**Pre-Requisites**  
[[BIO-225]], [[BIO-226]] or [[BIO-226]] as co-requisite.

BIO-298. TOPICS  
**Credits:** 1-3  
A study of topics of special interest not extensively treated in regularly offered courses.  
Click here for course fee.

**Pre-Requisites**  
Will vary according to the specific topics course.

BIO-306. INVERTEBRATE BIOLOGY  
**Credits:** 4  
This course is a study of the major invertebrate phyla with respect to their taxonomy, evolution, morphology, physiology, and ecology. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-121]], [[BIO-122]], [[BIO-225]], or permission of the instructor.

BIO-311. COMPARATIVE PHYSIOLOGY  
**Credits:** 4  
Comparative Physiology encompasses the study of organ functions and organ system functions in different animal groups. Emphasis will be on the systemic physiology of vertebrate animals. Three hours of lecture and three hours of laboratory per week. Offered every spring semester. Offered in alternate years.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-121]], [[BIO-122]], [[BIO-225]], or permission of the instructor.

BIO-312. PARASITOLOGY  
**Credits:** 4  
Parasitology is the study of organisms that live on or within other organisms and the relationship of these organisms to their hosts. This course deals with the common parasites that infect man and other animals. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-121]], [[BIO-122]], [[BIO-225]], or permission of the instructor.

BIO-314. COMPARATIVE VERTEBRATE ANATOMY  
**Credits:** 4  
This course deals with the evolution and anatomy of the organ systems of vertebrates. Lectures survey the comparative anatomy of the vertebrate classes. Laboratory dissections include the lamprey, shark, mud puppy, and cat in detail. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-121]], [[BIO-122]], or permission of the instructor.

BIO-321. MAMMALIAN PHYSIOLOGY  
**Credits:** 4  
This course examines the function of mammalian systems with regard to homeostasis, metabolism, growth and reproduction. Normal physiological processes as well as some pathophysiological situations are covered. The emphasis is on human physiology; other mammalian systems, however, are discussed to demonstrate physiological adaptability to various environmental situations. Laboratory exercises include physiological experimentation in living systems and in computer simulations. Three hours of lecture and three hours of laboratory per week. Offered in alternate years. This course satisfies the requirement for a course with an emphasis in quantitative biology.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-121]], [[BIO-122]], or permission of the instructor.

BIO-323. FUNCTIONAL HISTOLOGY  
**Credits:** 4  
This course emphasizes the microscopic examination of mammalian tissues from morphological and physiological perspectives. Reference is made to organ embryogenesis to support the understanding of organ form and function. Tissue preparation for histological examination is included. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-121]], [[BIO-122]], [[BIO-225]], or permission of the instructor.

BIO-324. MOLECULAR BIOLOGY  
**Credits:** 4  
This course will introduce students to modern concepts and techniques in molecular biology through a genuine research experience in using cell and molecular biology to learn about a fundamental problem in biology. Rather than following a set series of lectures, we will study a problem and see where it leads us. We will use the information given in lectures and reading assignments to solve research problems and, in the process, learn a lot of molecular biology. Offered in alternate years.  
Click here for course fee.

**Pre-Requisites**  
[[BIO-225]], [[BIO-226]], [[CHM-231]], [[CHM-232]].
BIO-325. ENDOCRINOLOGY  
Credits: 4  
This course will focus on the structure, biochemistry, and function of mammalian hormones and endocrine glands, avian, amphibian, and invertebrate hormones will also be discussed, where relevant. Clinical pathologies resulting from excess or insufficient hormones will be discussed, as this is essential to mastering an understanding of Endocrinology. Laboratory exercises include experimentation in living systems and computer simulations. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

Pre-Requisites  
[[BIO-121]],[[BIO-122]], [[BIO-225]], [[BIO-226]], or permission of instructor.

BIO-326. IMMUNOLOGY AND IMMUNOCHEMISTRY  
Credits: 4  
This course is concerned with the biologic mechanisms and chemistry of reactants and mediators associated with natural and acquired states of immunity, tissue and blood serum responses to infection and immunization, and related pathophysiologic alterations of hypersensitivity phenomena in vertebrate animals and man. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

Pre-Requisites  
[[BIO-121]],[[BIO-122]], [[BIO-225]], [[BIO-226]], or permission of the instructor.

BIO-327. MEDICAL MICROBIOLOGY  
Credits: 4  
Medical Microbiology provides a professional level introduction to microbiology that is focused on application of microbiology to the study of infectious disease etiology and epidemiology. The laboratory covers techniques used in isolation and identification of micro-organisms. Three hours of lecture and three hours of laboratory per week. Cross-listed with [[PHA-327]].  
Click here for course fee.

Pre-Requisites  
[[BIO-121]],[[BIO-122]],[[CHM-231]],[[CHM-232]].

BIO-328. DEVELOPMENTAL BIOLOGY  
Credits: 4  
A course dealing with the principles of animal development from descriptive, experimental, and evolutionary perspectives. Laboratory work includes both descriptive and experimental embryology as well as more molecular techniques. Three hours of lecture and three hours of laboratory per week. Offered in alternate years.  
Click here for course fee.

Pre-Requisites  
[[BIO-121]],[[BIO-122]],[[BIO-225]],[[BIO-226]], or permission of the instructor.

BIO-329. VIROLOGY  
Credits: 3  
Virology provides an introduction to the biology of animal viruses. Description of viral molecular architecture and genome organization is followed by a survey of strategies employed for multiplication and regulation of gene expression. Pathogenesis of viral infections is considered from perspectives of viral reproduction strategies and host defense.

Pre-Requisites  
[[BIO-121]],[[BIO-122]],[[BIO-225]],[[BIO-226]],[[CHM-231]],[[CHM-232]],[[CHM-233]],[[CHM-234]].

BIO-330. INTRODUCTION TO BIOINFORMATICS  
Credits: 3  
An introduction to the ways computers are used to make sense of biological information, especially the data generated by the human genome project. Topics covered include databases and data mining, pair-wise, and multiple sequence alignment, molecular phylogeny, finding genes in raw DNA sequences, predicting protein and RNA secondary and tertiary structures, generating and analyzing microarray data, DNA fingerprinting, rational drug design, metabolic simulation and artificial intelligence. Offered online alternate spring semesters, with one assignment each week. This course satisfies the requirement for a course with an emphasis in quantitative biology.

Pre-Requisites  
[[BIO-225]],[[BIO-226]],[[CHM-231]],[[CHM-232]],[[MTH-150]], or permission of the instructor.

BIO-338. BIOLOGY OF CANCER  
Credits: 3  
This lecture course is designed to explore the various concepts and mechanisms associated with the origins, elaborations, and future developments in cellular transformation and carcinogenesis. Emphasis is placed on the molecular biology and physiology of these processes; therefore, a solid background in basic biology is required. Oncogenes, tumor suppressor genes, and the disruption of homeostasis are covered in detail, while the medical phenomena typically receive a more general level of coverage.

Pre-Requisites  
[[BIO-121]],[[BIO-122]],[[CHM-231]],[[CHM-232]].

BIO-340. CONSERVATION BIOLOGY  
Credits: 3  
This course will cover the major topics of conservation biology including an introduction to biodiversity, threats to biodiversity, and solutions to diminish extinctions and population declines. Lecture: three hours per week. Offered each year.

Pre-Requisites  
[[BIO-225]],[[BIO-226]], or permission of the instructor.
BIO-341. FRESHWATER ECOSYSTEMS  
Credits: 3  
A study of the biological and ecological aspects of streams, lakes, and wetlands from a watershed perspective. An initial introduction to physical, chemical, and geological principles of limnology is followed by a focus on freshwater biology. Laboratories include field-based watershed investigations and lake management assessments using geographic information systems techniques. Two hours of lecture and three hours of laboratory per week. Offered in alternate years. Cross-listed with [EES-341].  
Click here for course fee.

Pre-Requisites  
[EE-211] or [EE-240] or [BIO-121] or [BIO-122] or consent of the instructor.

BIO-342. THE ARCHOSAURS: BIRDS, DINOSAURS, AND CROCODILIANS  
Credits: 4  
This course will cover the biology of the Archosaurs. Major topics include evolutionary history, morphology, physiology, behavior, ecology, and conservation of archosaurs. Laboratory is largely field-based with an emphasis on identifying local fauna and population estimation methods. Laboratory also includes dissection, histology, and a field trip to a museum. Offered in alternate years.  
Click here for course fee.

Pre-Requisites  
[BIO-225] or permission of the instructor.

BIO-343. MARINE ECOLOGY  
Credits: 3  
An examination of the biology of marine life within the context of modern ecological principles. The structure and physiology of marine organisms will be studied from the perspectives of adaptation to the ocean as habitat, biological productivity, and interspecific relationships. Emphasis will be placed on life in intertidal zones, estuaries, surface waters, and the deep sea. Two hours of lecture and three hours of laboratory per week. Offered in alternate years. Cross-listed with [EES-343].  
Click here for course fee.

Pre-Requisites  
[EES-230] and [BIO-121] or [BIO-122]. Students must have formal course experiences in oceanography and biology at the science major level or have completed their sophomore year as a biology major.

BIO-344. ECOLOGY  
Credits: 4  
An examination of contemporary ecological thinking as it pertains to the interrelationships of organisms and their environments. Interactions at the population and community level are emphasized. Three hours of lecture and three hours of laboratory per week. Offered in alternate years. Cross-listed with [EES-344]. This course satisfies the requirement for a course with an emphasis in quantitative biology.  
Click here for course fee.

Pre-Requisites  
[BIO-121] or [BIO-122] or permission of the instructor.

BIO-345. GENETICS  
Credits: 4  
This course presents a detailed treatment of genetics beyond the introductory level in the areas of both transmission and molecular genetics. Includes discussion of the role of genetics in such areas as developmental medicine. Three hours of lecture and three hours of lab per week. Offered every fall semester.  
Click here for course fee.

Pre-Requisites  
[BI-121] or [BI-122].  
Click here for course fee.

BIO-346. ANIMAL BEHAVIOR  
Credits: 4  
Animal Behavior is a course emphasizing behavior as the response of an organism to physical and social environmental change and covering the processes that determine when changes in behavior occur and what form the changes take. Laboratories, using local fauna, demonstrate principles discussed in lecture. Three hours of lecture and three hours of laboratory per week. Offered in alternate years. This course satisfies the requirement for a course with an emphasis in quantitative biology.  
Click here for course fee.

Pre-Requisites  
[BI-121]- [BI-122], or permission of the instructor.

BIO-347. BIOSTATISTICS AND EXPERIMENTAL DESIGN  
Credits: 4  
This course reviews the statistical paradigms and techniques involved in analyzing biological phenomena. Frequentist and Bayesian methods are employed when appropriate with an emphasis on applied statistics and experimental design. Laboratory exercises include designing, analyzing, and communicating experiments. Computation and computer coding is employed in laboratory exercises. Offered in alternate years.  
Click here for course fee.

Pre-Requisites  
[BIO-225], [MTH-150], or permission of the instructor.

BIO-348. FIELD ZOOLOGY  
Credits: 3  
The goals of this summer course are to introduce field methods of zoology and increase familiarity with Pennsylvania animals. Taxa covered include turtles, snakes, birds, fish, insects, and mammals. Topics covered include conservation issues, population estimation, and sampling methods. Lecture: one hour per week. Laboratory: two hours per week. Offered annually.  
Click here for course fee.

Pre-Requisites  
[BIO-225]- [BIO-226] or permission of the instructor.
BIO-352. PATHOPHYSIOLOGY  
Credits: 4  
Pathophysiology provides a series of lectures, exercises, and problem-solving sessions integrating the concepts of functional anatomy with human disease. Problem-based learning is encouraged by reviewing illustrative clinical cases and using interactive audio-visual media. Offered in alternate years.  
Click here for course fee.  

Pre-Requisites  
[[BIO-225]]; [[BIO-226]] or permission of the instructor.  

BIO-361. PLANT FORM AND FUNCTION  
Credits: 4  
An introduction to the morphology, anatomy, cytology, and physiology of vascular plants. Structural and functional aspects of plants are interpreted in relation to each other and within ecological and evolutionary contexts. Offered in a workshop format of two three-hour sessions per week. Offered every fall semester.  
Click here for course fee.  

Pre-Requisites  
[[BIO-121]]; [[BIO-122]]; [[BIO-225]]; [[BIO-226]], or permission of the instructor.  

BIO-362. PLANT DIVERSITY  
Credits: 4  
A comprehensive survey of algae, bryophytes, and vascular plants emphasizing their structure, reproductive biology, natural history, evolution, and importance to humans. Offered in a workshop format of two three-hour sessions per week. Offered every spring semester.  
Click here for course fee.  

Pre-Requisites  
[[BIO-121]]; [[BIO-122]]; [[BIO-225]]; [[BIO-226]], or permission of the instructor.  

BIO-366. FIELD BOTANY  
Credits: 3  
A specialized summertime field course that emphasizes a taxonomic, phylogenetic, and ecological survey of vascular plants indigenous to Northeastern Pennsylvania. Course includes field trips to a diverse array of habitats in Northeastern Pennsylvania. Cross-listed with []EES-366]. Offered in alternate years.  
Click here for course fee.  

Pre-Requisites  
[[BIO-121]]; [[BIO-122]]; [[BIO-225]]; [[BIO-226]], or permission of the instructor.  

BIO-369. PLANT PATHOLOGY  
Credits: 4  
This course introduces students to modern concepts and techniques in plant physiology through a genuine research experience in using the techniques of plant physiology to learn about a problem in plant biology. Rather than following a set series of lectures, we will study a problem and see where it leads us. We will use the information given in lectures and reading assignments to solve research problems and, in the process, learn a lot of plant physiology. Offered in alternate years.  
Click here for course fee.  

Pre-Requisites  
[[BIO-225]]; [[BIO-226]]; [[CHM-231]]; [[CHM-232]], or permission of the instructor.  

BIO-391. SENIOR RESEARCH I  
Credits: 1-2  
Terms Offered: Fall  
The student will pursue independent research as a member of a team of senior biology majors. Each team will be responsible for the identification of an original research problem, a thorough literature review of the problem, a detailed prospectus prepared in the format of a grant proposal, complete execution of the research project, a formal oral presentation, and a final manuscript prepared in standard journal format. Senior research is required of all biology majors seeking a four-year degree in Biology. Open only to senior Biology majors.  
Click here for course fee.  

Pre-Requisites  
Biology major senior standing  

BIO-392. SENIOR RESEARCH II  
Credits: 1-2  
Terms Offered: Spring  
The student will pursue independent research as a member of a team of senior biology majors. Each team will be responsible for the identification of an original research problem, a thorough literature review of the problem, a detailed prospectus prepared in the format of a grant proposal, complete execution of the research project, a formal oral presentation, and a final manuscript prepared in standard journal format. Senior research is required of all biology majors seeking a four-year degree in Biology. Open only to senior Biology majors.  
Click here for course fee.  

Pre-Requisites  
Biology major senior standing  

BIO-394. BIOLOGICAL FIELD STUDY  
Credits: 1-3  
Pre-Requisites  
[[(BIO-121)]- [(BIO-122)] or permission of the instructor.  

BIO-397. PROFESSIONAL PREPARATION TECHNIQUES  
Credits: 2  
Professional Preparation Techniques introduces Biology majors to Biology as a profession. Students learn how to read, write, and analyze research papers and how to make oral presentations and posters using electronic and paper-based supplements. Career development issues, including effective presentation of credentials, are also addressed. Offered every fall and every spring semester.  

Pre-Requisites  
Junior-level standing.
Biology

BIO-398. TOPICS
Credits: 1-3
A study of topics of special interest not extensively treated in regularly offered courses.
Click here for course fee.

Pre-Requisites
Will vary according to the specific topics course.

BIO-399. COOPERATIVE EDUCATION
Credits: 1-6
Professional cooperative education placement in a private or public organization related to the student's academic objectives and career goals. In addition to their work experience, students are required to submit weekly reaction papers and an academic project to a Faculty Coordinator in the student's discipline. See the Cooperative Education section of this bulletin for placement procedures. Requirements: Sophomore standing, 2.0 minimum cumulative GPA, consent of the academic advisor, and approval of placement by the department chairperson.