

DEPARTMENT OF BIOLOGY COURSE DESCRIPTIONS

Biology (BIOL)

BIOL 111-112. Freshman Seminar.

Weekly sessions designed to introduce freshman biology students to the world of biological sciences, including career options, curricula options, departmental requirements, college requirements, study habits, test-taking strategies, library searches and critical thinking skills. Discussion and study groups will be formed among students and faculty. Final grades will be based on attendance and completion of assignments. One-half hour each semester.

One hour.

BIOL 121. General Biology I.

Prerequisite: BIOL 102 or a major in Biology, Bioinformatics, Biotechnology, Biology Education, Chemistry, Environmental Science, Engineering, Mathematics or Computer Science. This is an introductory lecture-laboratory course studying the unity and diversity of life and emphasizing the chemistry of life, the cell theory, structure and function, energy transformation through living systems and the mechanisms of heredity and genetic variability.

Three lectures and one laboratory per week. Four hours.

BIOL 122. General Biology II.

Prerequisite: A grade of "C" or better in BIOL 121. A lecture-laboratory course that is a continuation of BIOL121, emphasizing the evolutionary history of biological diversity, natural selection, behavior and environmental adaptation, animal form and function, plant form and function, reproduction and ecology. Three lectures and one

laboratory per week. Four hours.

BIOL 200. Special Topics in Biology

Prerequisite: BIOL 102 or a major in Biology, Bioinformatics, Biotechnology, Biology Education, Biochemistry, Chemistry, Environmental Science, Mathematics or Computer Science. Seminar and/or laboratory course covering a current topic selected by the Department. Two hours.

NOTE: Enrollment in any of the following BIOL courses requires acceptance into a major or minor Biology program – see Requirements for Majors above.

BIOL 202. Botany.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121 and CHEM 122 (CHEM 111 and CHEM 112 for Bioinformatics majors). An introductory plant biology course for biology majors. The biology of plants as autotrophic organisms is studied in the context of their primary role in the ecosystem. Lecture and laboratory activities in morphology, anatomy and physiology of plant organs are explored. Taxonomic classifications of plants are also explored as introduction to plant nomenclature. Special emphasis is placed on plant growth and development from germination, vegetative growth and flowering to seed formation and maturation.

Greenhouse experiences to demonstrate practical application of lecture and laboratory concepts are emphasized.

Three lectures and one laboratory per week. Four hours.

BIOL 210. Genetics.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121 and CHEM 122 (CHEM 111 and CHEM 112 for Bioinformatics majors). A basic course in the principles of heredity, including Mendelian genetics and Mendelian variations. Designed to acquaint the student with the fundamental principles of genetics, with their cytological basis and with their application to human heredity. Three lectures and one laboratory per week. Four hours.

BIOL 211-212. Sophomore Seminar.

Prerequisites: A grade of "C" or better in BIOL 111, BIOL 112, BIOL 121, BIOL 122, CHEM 121 and CHEM 122 (CHEM 111 and CHEM 112 for Bioinformatics majors). Weekly sessions designed to introduce sophomore biology students to the scientific method, scientific writing and problem solving. Assignments and discussions will concentrate on basic science skills, including scientific experimentation and analyses, reading comprehension for scientific literature and writing and problem-solving skills. Reviews in preparation for departmental and standardized exams will be conducted. Final grades will be based on attendance and completion of assignments.

One-half hour each semester. One hour.

BIOL 302. Human Anatomy.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121 and CHEM 122 (CHEM 111 and CHEM 112 for Bioinformatics majors). The anatomy of the human integumentary, skeletal, muscular, nervous, endocrine, circulatory, excretory, respiratory, immune, digestive (micro and gross) and reproductive systems. Three lectures and one laboratory per week. Four hours.

BIOL 309. Cell Biology.

Prerequisites. A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232. A study of ultra structural and macro-molecular organization of cells and tissues, emphasizing the convergence of structure and function in life phenomena; principles of molecular aggregation and physiochemical organization of cells; energetics, transport, mobility, irritability and homeostatic mechanisms; cell growth and cell division; cell differentiation and transformation; evolutionary potential of cells; origin of multi cellularity; and techniques useful to the study of cell biology. Three lectures and one laboratory per week. Four hours.

BIOL 310. Molecular Biology.

Prerequisites. A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232. A study of the structure, organization, and regulation of genetic material. Emphasis is placed on the molecular and biochemical regulation of gene expression (including transcription and translation) and on the molecular techniques used in recombinant DNA manipulations. Three lectures and one laboratory per week. Four hours.

BIOL 311-312. Junior Seminar.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212, CHEM 121, CHEM 122,

(CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232. Weekly sessions will be designed to initiate the senior proposal preparation process for junior biology majors. **Note: Any student wishing to select the senior research thesis option rather than the proposal may do so.** Juniors will select a proposal (or thesis) topic and will collect and review scientific literature related to their topic. Students will also present in-class seminars from the literature review of their topics. Current signal papers in the scientific literature will be reviewed through in-class discussions. Final grades for the first semester will be based on attendance and on the successful completion of an acceptable literature review for the senior research proposal (or thesis). Final grades for the second semester will be based on attendance, on the mini-seminar and on successful acceptance of the prospectus by the Department. The deadline for the prospectus will be October 15 (for off-sequence students) or March 15. One-half hour each semester. One hour.

BIOL 321. Intro to Immunology. A grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors). Introduction to human immune system.

Topics to be covered would include: Roles of innate and acquired immunity, T-lymphocytes, B lymphocytes, macrophages and complement system, cellular aspects of cancer immunity, AIDS, transplantation and autoimmune diseases. Three lectures and one lab per week. Four hours.

BIOL 341. Applied Bioinformatics I. Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, BIOL 310, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) MATH 205, and CSCI 226.

Introduction to basic bioinformatics tools including, human genome project, DNA sequence databases, RNA sequence databases, protein sequence databases. Advance use of informational tools such as BLAST, Entrez, Swissprot, phylogenetic trees and others. Three lecture hours and three lab hours per week. Four hours.

BIOL 342. Introduction to Microbiology.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) and CHEM 231. The form, structure, reproduction, physiology, metabolism and identification of bacteria, fungi, protozoa, rickettsiae and viruses; significance of microbes in general sanitation, industry, agriculture, home economics and medicine. Three lectures and one laboratory per week. Four hours.

BIOL 350. Computational Molecular Biology. Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, BIOL 310, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors), and Math 201. The course will summarize some traditional methods in computational biology such as sequence alignment and applications of dynamic programming. Students will explore underlying statistical models of sequence evolution as related to scoring matrices and significance scores attached to popular sequence search programs such as BLAST.

The second half of the course will focus on more recent high-throughput screening of large datasets in biology and explore predictions of protein folding. Three lecture hours and three lab hours per week. Four hours.

BIOL 404. Human Physiology.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, BIOL 211, BIOL 212, BIOL 302, BIOL 309, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232. A

study of integrative physiological processes inherent at all organizational levels which enhance the normal operation

of the human body as a single mechanical unit. Consideration will be given to disease and environmental factors that

may disrupt the homeostatic operation of the human body. Three lectures and one laboratory per week. Four hours.

BIOL 405. Ecology.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, BIOL 202, CHEM 121, and CHEM 122 (CHEM

111 and CHEM 112 for Bioinformatics majors). Concepts and principles of the relationships between the physical

and biotic factors of the environment and living organisms. Practical field experience in techniques, the use of

equipment and technology of ecological investigations are covered. Three lectures and one laboratory per week.

Four hours.

BIOL 411-412. Senior Seminar.

Prerequisites: Graduating senior status and a grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212,

BIOL 311 and BIOL 312, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM

231 and CHEM 232. First-semester seniors will work toward the completion of a proposal/thesis draft for their

proposal adviser. (Students opting for the thesis will also conduct the necessary research during this time and may be

concurrently enrolled in BIOL 420, 421, 422 or 423, Senior Research.) Second-semester seniors will present a

proposal/thesis seminar to the department. Students opting for the research thesis will also be required to formally

defend their thesis before their thesis committee. Final grades will be based on attendance and on the successful and

timely (October 15 or March 15, depending upon graduation status) completion and submission of the senior

proposal/thesis. One-half hour each semester. One hour.

BIOL 420, 421, 422, and 423. Senior Research.

Prerequisite: Junior standing and a grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212, CHEM 121,

CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232 or permission of

the Department. This course provides an opportunity for exposure to research under the guidance of a faculty

member. Students will be shown how to use current literature and how to apply experimental techniques via the

performance of an original research project. A written report will be made to the Department of Biology before a

grade will be awarded. These courses may be used to receive credit for summer internship research if approved by

the Department **before** the internship takes place. The course, if taken in-house, will meet for 4 to 10 hours each week, and a maximum of 2 credit hours will be awarded. If used to receive credit for an internship, the program must consist of a minimum of 6 weeks of research, and a maximum of 2 credit hours will be awarded. Two to eight hours.

BIOL 441. Applied Bioinformatics II. Prerequisites: Senior standing and a grade of “C” or better in BIOL 121, BIOL 122, BIOL310, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) MATH 205, MATH 201, MATH 202, STAT 341, STAT 342, STAT 421, CSCI 240, CSCI 226 and CSCI 436. Research oriented course designed to develop tools by which to compare genomic and proteomics libraries for various organisms. These tools will help students develop ideas related to drug design, gene therapy and other therapeutic modalities. 1 hour recitation per week and independent laboratory study. Four hours.

BIOL 443. Advanced Microbiology. Prerequisites grade of “C” or better in BIOL 121, BIOL 122, BIOL 211 and BIOL 212, BIOL 341, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) and CHEM 231. Advanced treatment of topics to include microbial genetics, virology, and parasitology. Three lectures and one lab per week. Four hours.

BIOL 450. Biotechnical Methods Laboratory.

Prerequisites: A grade of “C” or better in BIOL 121, BIOL 122, BIOL 211 and 212, BIOL 310, BIOL 311 and BIOL 312, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232 and CHEM 401. Advanced laboratory course designed to train students in modern biological laboratory techniques necessary for successful careers in science. Topics to be covered include, but are not limited to, advanced laboratory safety, record keeping, data analysis (including computer-generated graphical analysis), technical writing, techniques for protein analysis, techniques for recombinant DNA analysis, techniques in immunochemistry, tissue culture techniques, chromatography techniques, polymerase chain reaction, micromanipulation, DNA sequencing, DNA fingerprinting and spectrophotometry. Two three-hour laboratories and one recitation per week. Four hours.

BIOL 451. Instrumental Methods in Bioresearch. A grade of “C” or better in BIOL 121, BIOL 122, BIOL 211, BIOL 212, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232. Theoretical and technical training in research instrumentation to include operation and troubleshooting for: spectrophotometry, high performance liquid chromatography, gas chromatography, mass spectroscopy, microscopy, x-ray crystallography, and nuclear magnetic resonance. Three lectures and one lab per week. Four hours.

Honors Courses

BIOL 121H. Honors General Biology I.

Prerequisite: BIOL 102 or a major in Biology, Bioinformatics, Biotechnology, Biology Education, Chemistry,

Environmental Science, Engineering, Mathematics or Computer Science. This is an accelerated Honors introductory lecture-laboratory course in which the unity and diversity of life are studied and the chemistry of life, the cell theory, structure and function, energy transformation through living systems and the mechanisms of heredity and genetic variability are emphasized. Three lectures and one laboratory per week. Four hours.

BIOL 122H. Honors General Biology II.

Prerequisite: A grade of "C" or better in BIOL 121. An accelerated honors lecture-laboratory course that is a continuation of BIOL 121, emphasizing the evolutionary history of biological diversity, natural selection, behavior and environmental adaptation, animal form and function, plant form and function, reproduction and ecology. Three lectures and one laboratory per week. Four hours.

HNTH 391-392. Honors Thesis Seminar I and II.

Prerequisite: Junior status in Honors College and A grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232.

Non-Honors College students electing to prepare a thesis in place of a proposal may enroll in this course in the place of BIOL 411/412 if other course prerequisites are satisfied. A two-semester sequence designed to initiate the thesis process required for graduation from the Honors College. The first semester is an introduction to research, the scientific method, scientific writing and problem solving. Students will collect and review scientific literature related to areas of interest and select a thesis topic in addition to satisfying other course requirements described above.

During the second semester, students will write a research prospectus outlining the goals and methodology for their thesis project. The student must take initiative in seeking a mentor to help in the design and supervision of the project. The deadline for submission of the prospectus to the Department will fall on October 15 (for off-sequence students) or March 15. Final grades will be based on attendance and acceptance of the prospectus by the Department. One hour each semester. Two hours.

HNTH 491. Honors Thesis Seminar III.

Prerequisite: Graduating senior status and a grade of "C" or better in BIOL 121, BIOL 122, BIOL 211 and 212,

HNTH 391, HNTH 392 (or BIOL 311 and BIOL 312 may be substituted for HNTH 391 and 392), CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) CHEM 231 and CHEM 232. A year-long

laboratory research/technical writing project done during the senior year under the supervision of a mentor from the appropriate department. A final document (prepared according to the specific format approved by the Division of Natural Sciences and Mathematics) will be prepared along with a seminar presentation. Following the seminar the student will formally defend the thesis in front of his/her thesis committee. The deadline for completion of the thesis is October 15 (for December graduation) and March 15 (for May graduation). Two hours.

Biology Education

EDUC 328. Methods and Materials of Teaching Biology in Secondary Schools.

Prerequisites: Acceptance into the Teacher Education Program, BIOL 121 and BIOL 122. History and objectives of science education in the U.S., materials, teaching strategies, curricular trends and issues, current research, reading in biology content area and assessment procedures applicable to the teaching of biology in secondary schools (grades 9 - 12). Students are required to participate in clinical experiences at a selected public school in the local school district. Three hours.

Environmental Science (ESCI)

ESCI 221. Principles of Environmental Science.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121 and CHEM 122 (CHEM 111 and CHEM 112 for Bioinformatics majors). Basic concepts of environmental science and the impact of human activities on the environment will be introduced. Energy generation, population growth, food production, vector-borne diseases, sources of radiation, pollution of air, land and water and their effects on living things and on the physical environment will be discussed. The basic testing in chemical and biological testing techniques are taught. Sampling methodology is reviewed. Three lectures and one laboratory per week. Four hours.

ESCI 222. Environmental Policies and Regulations.

Prerequisites: A grade of "C" or better in BIOL 121, BIOL 122, CHEM 121, CHEM 122, (CHEM 111 and CHEM 112 for Bioinformatics majors) and ESCI 221. Environmental issues and concerns in modern society are explored. The policies and regulations promulgated by various governmental agencies to address these issues are catalogued. The standards setting and enforcement procedures are detailed along with opportunities for and responsibilities of corporations, private organizations, and individual citizens. Financial liability and bonding options are discussed. The conflicting interests of society and individuals are explored. Three lectures per week. Three hours.

ESCI 321. Technology and Environmental Interaction.

Prerequisites: ESCI 222, CHEM 232, BIOL 121 and BIOL 122. The role of commercialized technologies in meeting human needs is discussed. The impact of industrial and technological processes on the environment is discussed. The complex problems of acid rain, global warming, groundwater depletion, hazardous waste and air, water and soil pollution will be considered. The role of microbial organisms and technology in the abatement and remediation of these problems is also investigated. Energy production and conservation measures in industrial activities are included. Regulatory and compliance processes are introduced. Three lectures and one laboratory per week. Four hours.

ESCI 322. Environmental Management.

Prerequisite: ESCI 321. Planning, management and conservation of terrestrial, aquatic and forest resources for a sustainable use in both urban and non-urban habitats. Residential, commercial and industrial wastes are included as both a resource and a pollutant with methods of reduction, control and management discussed. Three lectures and one laboratory per week. Four hours.

ESCI 407. Waste Characterization and Management.

Prerequisite: ESCI 321. Available technology is applied to the classification of residential, commercial and industrial waste. Current quantities of generation are estimated. Polluting effects are identified. The most common

current methods of reduction, control and management are discussed along with possible options for the future.

Three lectures and one laboratory per week. Four hours.

ESCI 422. Environmental Toxicology and Health.

Prerequisites: ESCI 322 and BIOL 309. Provides an overview of the impact of hazardous substances on ecological

systems and human health. Basic principles of toxicology, acute and chronic, ranging from the molecular level to the

dynamics of an ecosystem, will be studied. Topics included are biodegradation, structure activity relationship, routes

of entry, mode of action, acceptable limits of toxic substances and potential biomarkers. Three lectures and one

laboratory per week. Four hours.

Masters of Science degree:**Core Curriculum (six courses for all tracks)**

1 **Genetic Engineering I, BTEC 501.** Molecular biology, recombinant DNA technology, transgenic organisms,

cloning vectors, molecular modeling. Three hours.

2. **Genetic Engineering II, BTEC 502. Prerequisite: BTEC 501** Production of biological molecules using cell culture

technologies. Introduction to bioreactor design and control, to molecular and cellular bioseparations, and to tissue and

cellular engineering. An overview of current scientific, regulatory and ethical issues in biotechnology. Drug discovery; elements of pharmaceutical patent law; design of clinical trials; FDA approval process.

Developments in

computational biology. Introduction to and practical aspects of clinical pharmacology. Contemporary issues in

bioethics, scientific misconduct. Three hours.

3. **Laboratory in Genetic Engineering, BTEC 511 and 512.** Laboratory applications of theoretical concepts taught in

BTEC 501 and 502. Allows hands-on integration of diverse Biotechnical applications as a cohesive synthesis to

answer research questions *via* laboratory investigation. Two hours.

4. **Pathobiology, BTEC 521.** Mechanism of Disease will be presented along with basic concepts of pathobiology. This

course will prepare students for their future professional careers in biotechnology related fields, including Biomedical

Research, Forensics Research, Pharmacology, Genetic Engineering, Recombinant DNA Technology, as well as other

Biomedically related fields. Three hours.

5. **Research Ethics, BTEC 531.** Ethical issues in research including, but not limited to: Human subjects research,

animal care, conduct of responsible research and requirements of regulatory agencies. Three hours.

6. **Research I, BTEC 599.** Mentored original research in molecular biotechnology, plant biotechnology or Bioinformatics. Two hours per semester

Molecular Biotechnology Track

Advanced Immunobiology, BTEC 621. Prerequisite, Biol 321. Advanced coverage of topics to include: molecular basis

of generation of diversity, antigen recognition, cytokines and chemokines biology, xenotransplantation, vaccination, evolution

of immune system, allergies and therapeutics, gene therapy, immunodeficiency, Also to be discussed is the development of

recombinant antibodies in vitro, in plants, in bacteria and animals. Three hours.

Forensic DNA Analyses, BTEC 630. Instruction in DNA fingerprinting, paternity identification, mitochondrial sequencing, Restriction Fragment Length Polymorphism analysis, Polymerase Chain Reaction, **HLA-DQA1**, DNA databases searches,

Forensic laws. Three hours.

Research II, BTEC 699. Mentored original research in molecular biotechnology, plant biotechnology or Bioinformatics

culminating with the production of a Master's Thesis. Two hours per semester.

2) Plant Biotechnology Track

Plant Tissue Culture, propagation and transformation. BTEC 640. Methods and research applications of plant tissue

culture followed by principles and methods of propagation and transformation. Three hours

Plant Cell Biology, BTEC 645. Advanced study of plant cell responses to environmental stresses such as pollutants, parasites, viruses and insecticides. Three hours

Research II, BTEC 699. Mentored original research in molecular biotechnology, plant biotechnology or Bioinformatics

culminating with the production of a Master's Thesis. Two hours per semester

3) Computational Biology/Bioinformatics Track

Statistics I, BTEC 660. Graduate course in mathematics, computer science, or statistics, approved by the student's advisor.

Advanced Computational Biology, BTEC 665. Molecular modeling and its applications.

Research II, BTEC 699. Mentored original research in molecular biotechnology, plant biotechnology or Bioinformatics

culminating with the production of a Master's Thesis.