Bioscience

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School of Arts and Sciences

Bachelor of Science Degree

The Biology Department offers a baccalaureate in Bioscience designed to produce versatile graduates prepared for a wide range of positions in the rapidly developing bioscience field or for entry into graduate or professional programs in the life and health sciences. This program combines a strong foundation in the biological sciences and supporting subjects (emphasizing both theoretical concepts and hands-on laboratory methods) with sequences of Technical Electives that enable the student to acquire advanced preparation in one or more applications of bioscience. Technical Electives are selected with advisement according to the objectives of the individual student, and can be drawn from higher level Biology courses or from other academic majors at the College, thus providing the opportunity to gain breadth and depth in a variety of disciplines.

The Biology faculty are committed to supporting student learning in the classroom and laboratory, and to fostering student scholarly activity. Recommended students in Bioscience have the opportunity to gain work experience in an elective credit-bearing internship. This can be through placement into a pharmaceutical, nutraceutical, or cosmetic manufacturing facility, forensic laboratory, genetic testing laboratory, veterinary facility, research laboratory, or other bioscience-related institution off campus, or by invitation into an on-campus credit-bearing research internship under the mentorship of a Biology faculty member.

Typical Employment Opportunities and Graduate/Professional School Options

Examples of career paths and graduate/professional school opportunities for which this program can provide preparation are presented below, with sequences of Technical Electives that are recommended to provide the background necessary to pursue these career or postgraduate career goals:

Bioinformatics

(computer-based mapping and comparison of genomic and other biologically-derived data, with applications such as predicting the function of gene products and developing pharmacogenomic treatments of disease): job titles include Scientific Curator, Gene Analyst, Protein Analyst, Structural Analyst, Molecular Modeler, Biostatistician, Pharmacogenetician. Recommended Technical Electives: Computer Concepts/Problem Solving, Foundations of Computer Programming I & II, UNIX Operating System, Database, Perl Programming

Biopharmaceutical
(pharmaceutical, nutraceutical, and cosmeceutical production, ranging from fermentation and raw material extraction to processing and finishing): job titles include Compounding Supervisor, Process Development Associate, Production Planning Scheduler, Quality Assurance Auditor, Quality Control Analyst, Regulatory Affairs Specialist. Recommended Technical Electives: Management Theory & Practices, Contemporary Business Communications, Occupational Safety, Industrial Hygiene, Biopharmaceutical Regulation, Validation & Regulatory Affairs

Bioscience Laboratory Research & Analysis

(life sciences research support, biotechnology research & development, FDA regulated industry production): job titles include Bioscience Laboratory Associate, Bioscience Laboratory Technician, Food Quality Laboratory Technician, Microbiologist, Development Technician, Quality Control Receiving Inspector. Recommended Technical Electives: Organic Chemistry I & II, Biochemistry, Lab Management & Informatics, Laboratory Research/Education

Graduate/Professional School Admissions:

for those students specifically seeking entry into graduate programs in the life sciences or into professional programs in the health sciences, a sequence of Technical Electives can be chosen to earn the academic credentials necessary to meet admissions requirements of such programs. Recommended Technical Electives: Calculus I with Applications, College Physics I & II, Organic Chemistry I & II, Biochemistry, Lab Management & Informatics. (See Pre-Health Professions Advisement on the Farmingdale State College website.)

Note that training and licensure in Molecular Diagnostics (Molecular Pathology) is available through the BS in Medical Technology rather than through Bioscience.

Bioscience (BS) Program Outcomes:

• Graduates will have the ability to effectively seek out and process scientific information, including primary sources and genomic databases.
• Graduates will demonstrate mastery of basic laboratory skills, expertise in the operation of modern instrumentation, adherence to laboratory safety standards, and good practices.
• Graduates will be able to process experimentally derived data and to communicate results effectively by written, graphical, digital, and verbal means.

Fall 2018: Subject to Revision

Liberal Arts and Sciences (34 credits)

EGL 101 Composition I: College Writing (GE) 3
EGL 102 Composition II: Writing About Literature 3
CHM 152 General Chemistry Principles I (GE) 4
MTH 110 Statistics (GE) 3
Humanities (GE) 3
The Arts (GE) 3
American/Other World/Western Civilization History (GE) 3
Foreign Language (GE) 3
Social and Behavioral Science (GE) 3
General Education Electives (GE) 6
Bioscience Core (33 credits)
BIO 130 Biological Principles I 4
BIO 131 Biological Principles II 4
BIO 210 Introduction to Bioscience 3
BIO 212 Bioscience Laboratory Practices 2
BIO 343 Principles of Genetics 3
BIO 344L Principles of Genetics Lab 1
BIO 345 Introduction to Bioinformatics 3
BIO 348 Cell Biology 3
BIO 349L Cell Biology (Lab) 1
BIO 414 Microbiology 4
BIO 441 Molecular Biology 5
Support Courses (15-16 credits)
BCS 102 Computer Concepts/Applications 3
CHM 153 General Chemistry Principles II 4
CHM 260 Fundamentals of Organic Chemistry or
CHM 270 Organic Chemistry 4-5
MTH 117 Precalculus Modeling for the life and Social Sciences or
MTH 129 Precalculus with Applications or higher 4
Technical Electives (29-39 credits)

Technical Electives must include at least 1 course at the 400-level earning at least 3 credits, and 3-4 courses at the 300-level or above earning a total of at least 10 credits (with all appropriate prerequisites satisfied); the remaining 16-26 credits can be at any level.

Free Electives: 0-9
Total Credits: 120-121

Degree Type: BS
Total Required Credits: 120-121

Notes:

1. One Writing Intensive course in any of the above courses is required for graduation.

2. Technical Electives may be chosen from selected courses in the departments of Anthropology (ANT), Biology (BIO), Business (BUS), Chemistry (CHM), Computer Systems (BCS), Industrial Technology (IND), Mathematics (MTH), Medical Laboratory Technology (MLT), Physics (PHY), and Psychology (PSY). Courses which satisfy technical elective requirements are listed in the Bioscience Student Advisement Sheet.

3. To continue in the Bioscience BS degree program, a grade of C- or better must be maintained in every Biology and Chemistry course that serve as prerequisites for other courses in the Bioscience major. Earning a grade of less than C- in two required Biology and/or Chemistry courses will result in suspension from the Bioscience curriculum for at least one year. If a student fails to attend the first three laboratory sessions in a course, they may be disenrolled from the course (both lecture and lab, as applicable). Exceptions to these policies can only be made by the Chair of the Biology Department when extenuating circumstances exist.

Course Descriptions

**EGL 101 Composition I: College Writing (GE)**
This is the first part of a required sequence in college essay writing. Students learn to view writing as a process that involves generating ideas, formulating and developing a thesis, structuring paragraphs and essays, as well as revising and editing drafts. The focus is on the development of critical and analytical thinking. Students also learn the correct and ethical use of print and electronic sources. At least one research paper is required. A grade of C or higher is a graduation requirement. Note: Students passing a departmental diagnostic exam given on the first day of class will remain in EGL 101; all others will be placed in EGL 097. Prerequisite is any of the following: successful completion of EGL 097; an SAT essay score (taken prior to March 1, 2016) of 7 or higher; an SAT essay score (taken after March 1, 2016) of 5 or higher; on-campus placement testing. Credits: 3

**EGL 102 Composition II: Writing About Literature**
This is the second part of the required introductory English composition sequence. This course builds on writing skills developed in EGL 101, specifically the ability to write analytical and persuasive essays and to use research materials correctly and effectively. Students read selections from different literary genres (poetry, drama, and narrative fiction). Selections from the literature provide the basis for analytical and critical essays that explore the ways writers use works of the imagination to explore human experience. Grade of C or higher is a graduation requirement. Prerequisite(s): EGL 101 Credits: 3

**CHM 152 General Chemistry Principles I (GE)**
The first part of a two semester sequence in General Chemistry Principles with laboratory. This course covers the qualitative and quantitative aspects of scientific measurement, the nature of matter, gases, liquids and solids, energy, atomic theory, properties of elements, chemical bonding, molecular structure and properties, stoichiometry, thermochemistry and solutions. Note: the laboratory course CHM 152L is a part of your grade for this course. Attendance in the laboratory course is required. Approved eye-protection and a laboratory coat are required materials. A student must pass the laboratory course to receive a passing grade in the entire course. Prerequisite(s): (MP3, RMAT, RMTB, or MTH 116) and (Regents Chemistry or an equivalent High School Chemistry with Laboratory or CHM 124) Credits: 4
MTH 110 Statistics (GE)
Basic concepts of probability and statistical inference. Included are the binomial, normal, and chi-square distributions. Practical applications are examined. Computer assignments using Minitab form an integral part of the course. Prerequisite(s): MP2 or MTH 015 Credits: 3

BIO 130 Biological Principles I
This course deals with biological processes primarily at the molecular and cellular level, and develops the foundations of evolutionary and ecological concepts. There is a study of cell structure, and an examination of cellular composition and metabolic processes including enzyme activity, respiration, and photosynthesis. Principles of genetics are studied at the cellular and molecular level, with reference to current techniques in molecular biology. Evolutionary mechanisms are introduced and ecological concepts are presented as a unifying theme. Note: BIO 130 is the first course in the required two-semester introductory sequence in the Bioscience Curriculum Core. It is also approved in the Natural Sciences General Education Competency Area and can serve as a lower-level laboratory science elective within the Liberal Arts. Note: the laboratory course, BIO 130L is a part of your grade for this course. Corequisite(s): BIO 130L Credits: 4

BIO 131 Biological Principles II
This course deals with biological processes primarily at the organismal level, and examines the diversity of living things. The origins and adaptations of the Prokaryota, Protista, and Fungi are explored, with emphasis on their ecological roles, economic value, and medical significance. Plant life cycles are introduced, and plant structure, physiology, and utilization are studied. The evolution and adaptations of various animal phyla are presented, with a consideration of structure and function in each; organ systems are studied with emphasis on humans as representative vertebrates. Note: BIO 131 is the second course in the required two-semester introductory sequence in the Bioscience Curriculum Core. It is also approved in the Natural Sciences General Education Competency Area and can serve as a lower-level laboratory science elective within the Liberal Arts. Note: the laboratory course, BIO 131L is a part of your grade for this course. Prerequisite(s): BIO 130 Corequisite(s): BIO 131L Credits: 4

BIO 210 Introduction to Bioscience
Moving beyond the basic concepts of general biology, this class explores how biology is used in both academic and commercial settings within the fields of biotechnology, pharmaceutical and clinical sciences. Topics will include: applications of biotechnology in microbes, plants, and animals, the human genome project and its relation to medical biotechnology, DNA forensics, and pharmaceutical drug discovery, delivery, and FDA approval. The debate surrounding subjects such as cloning, stem cells, and genetically modified foods will also be discussed. Prerequisite(s): BIO 130 with a grade of C- or higher Credits: 3

BIO 212 Bioscience Laboratory Practices
This course is designed to enable students to develop understanding of and proficient technical ability in basic bioscience laboratory practices. There is an in-depth presentation of laboratory safety standards, utilization of material safety data sheets, and the theoretical basis for a full range of preparatory and analytical methods and the opportunity to develop expertise in these methods with a variety of laboratory equipment. Students are required to maintain a laboratory notebook, analyze and display data in graphic form, and report results in a standard format. Prerequisite(s): BIO 130 with a grade of C- or higher Corequisite(s): BIO 212L Credits: 2

BIO 343 Principles of Genetics
Students will understand and be able to apply basic principles of genetic analysis. These principles include the Mendelian laws of inheritance, factors that contribute to modification of Mendelian patterns, chromosome organization, genetic variation, the structure of selected eukaryotic and prokaryotic genomes and the analysis of the genetic makeup of populations. Note: Bioscience and/or MLT students taking BIO 343 must also take BIO 344L either during the same semester or after
completion of BIO 343L Prerequisite(s): (BIO 130, 131, 210, 212, and MTH 110) or (BIO 130, MLT 227 and MTH 110) all with a grade of C- or higher Credits: 3

**BIO 344L Principles of Genetics Lab**
Laboratory exercises include both computer simulations and the use of living organisms to illustrate genetic principles and techniques. Students will collect data utilizing standard genetics investigational techniques. Note: BIO 343 is a prerequisite OR a corequisite for this course. BIO 343 must be taken either prior to or during the same semester as BIO 344L. Prerequisite(s): BIO 130, BIO 131, BIO 210 and BIO 212 and MTH 110 all with a grade of C- or higher or BIO 130, MLT 227 and MTH 110 all with a grade of C- or higher. Corequisite(s): BIO 343 Credits: 1

**BIO 345 Introduction to Bioinformatics**
This course is intended to teach the basic tools used in bioinformatics in order to investigate biological questions. Students will conduct independent projects utilizing existing computer programs and databases for gene searches, sequence comparisons, and phylogenetic analysis. Prerequisite(s): BIO 343, BIO 344L and BCS 101 or BCS 102 all with a grade of C- or higher Credits: 3

**BIO 348 Cell Biology**
This course investigates how cells develop, work, communicate, and control their activities. Topics include basic biochemistry and metabolism, DNA structure and function, membrane/organelle function and transport, cell communication, the cytoskeleton, and cell division. At the completion of this course the student should be able to engage in the broad themes of cell and molecular biology, and to relate these concepts to other studies in biology and other disciplines. Note: Bioscience and/or MLT students taking BIO 348 must also take BIO 349L either during the same semester or after completion of BIO 348. Prerequisite(s): BIO 130, 131, 210 and 212 or (BIO 130 and MLT 227) all with a grade of C- or higher Credits: 3

**BIO 349L Cell Biology (Lab)**
This course introduces students to the theory and methodology of protocols routinely used in research laboratories investigating cell structure and function. Students have the opportunity to use both common and high tech instruments to perform weekly laboratory exercises. Experimental design, controls and data presentation and analysis are emphasized. Note: BIO 348 is a prerequisite OR a co-requisite for this course. BIO 348 must be taken either prior to or during the same semester as BIO 349L. Prerequisite(s): BIO 130, 131, 210 and 212 or (BIO 130 and MLT 227) all with a grade of C- or higher Corequisite(s): BIO 348 Credits: 1

**BIO 414 Microbiology**
Based on contemporary applications of microbiology, this course is designed to present both fundamental concepts of microbial physiology and growth as well as microbial control measures ranging from asepsis to antibiosis. The role of microorganisms in natural ecosystems, research, manufacturing and human infection will be explored, with emphasis on prokaryotic genetics and metabolism. Mechanisms of evolution will be discussed within the context of emerging pathogens and novel bioengineered organisms. The dynamics between the human microbiome and resistance to infection will be presented along with basic epidemiological models. Note: the laboratory course, BIO 414L is a part of your grade for this course. Prerequisite(s): BIO 210, 212 and (343 and 344L) with a grade of C- or higher Corequisite(s): BIO 414L Credits: 4

**BIO 441 Molecular Biology**
A detailed introduction to molecular biology, the course covers the techniques common to all molecular biology such as nucleic acid separation and visualization, PCR blotting, and sequencing. In addition, the course focuses on topics such as transcriptional regulation, RNA processing, DNA replication, DNA repair, and DNA recombination. Each is presented from both the view of prokaryotes as well as eukaryotes. Scientific journal articles highlighting class topics will be used to supplement class lectures. Note: the laboratory course, BIO 441L is a part of your grade for this course. Prerequisite(s): BIO 343 and 344L and BIO 348 and BIO 349L all with a grade of C- or higher Corequisite(s): BIO 441L (3,4) Credits: 5
BCS 102 Computer Concepts/Applications
This is an introductory course in the use of personal computers in today's society. Students will receive instruction in basic computer concepts and terminology, the fundamentals of the Windows operating system and have hands on experience at the beginning to intermediate level using Microsoft Word, Excel, and PowerPoint. The Internet will be used to supplement textbook and lecture materials. Computer Systems students cannot use BCS 102 to meet a BCS Elective requirement.
Credits: 3

CHM 153 General Chemistry Principles II
A continuation of General Chemistry Principles I, which includes laboratory. Topics include: solutions and their colligative properties, acids and bases, chemical equilibrium, ionic equilibrium, pH, buffers, titration curves, oxidation and reduction balancing, electrochemistry, chemical kinetics, the covalent bond and the shape of molecules. Note: the laboratory course CHM 153L is a part of your grade for this course. Attendance in the laboratory course is required. Approved eye-protection and a laboratory coat are required materials. A student must pass the laboratory course to receive a passing grade in the entire course. Prerequisite(s): CHM 152 Credit: 4

CHM 260 Fundamentals of Organic Chemistry
A one semester course in organic chemistry designed to provide background in the fundamentals of nomenclature, mechanisms, structures, and synthesis of carbon based compounds. This course is designed for science and health science majors who desire a general rather than a detailed knowledge of the compounds of carbon. Topics to be covered include: structure and bonding, acid/base chemistry, isomerism, stereochemistry, and structure determination. Functional groups to be covered include: hydrocarbons, alcohols, ethers, aldehydes and ketones, carboxylic acids, carboxylic acid derivatives and amines. Laboratory work will include common organic techniques and experiments supporting the principles covered in lecture. Note: the laboratory course CHM 260L is a part of your grade for this course. Attendance in the laboratory course is required. Approved eye-protection and a laboratory coat are required materials. A student must pass the laboratory course to receive a passing grade in the entire course. Prerequisite(s): CHM 153 Credits: 4

CHM 270 Organic Chemistry
A study of the compounds of carbon involving a thorough integration of observation and theory and emphasizing the relationships between structures, properties, mechanisms and reactions. This course, intended for science and pre-professional majors, covers topics such as bonding and structure, alkanes, alkenes, alkynes, cycloaliphatic hydrocarbons, stereochemistry, dienes, benzene, electrophilic aromatic substitution, arenes, spectroscopy and structure determination. Note: the laboratory course CHM 270L is a part of your grade for this course. Attendance in the laboratory course is required. Approved eye-protection and a laboratory coat are required materials. A student must pass the laboratory course to receive a passing grade in the entire course. Prerequisite(s): CHM 153 Credits: 4

MTH 117 Precalculus Modeling for the life and Social Sciences
This is a Precalculus course with applications from various disciplines including technology, science, and business. This course uses linear, power, polynomial, exponential, logarithmic, and trigonometric functions to model real world problems. The important characteristics and properties of these functions are investigated. The emphasis is on applications and problem solving. Note: Students completing this course may not receive credit for MTH 129. Prerequisite(s): MP3 or MTH 116 Credits: 4

Admission to Farmingdale State College - State University of New York is based on the qualifications of the applicant without regard to age, sex, marital or military status, race, color, creed, religion, national origin, disability or sexual orientation.