

# ***Biology***

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*Chair: Dr. Wayne Takacs*

The study of the realm of living things is an essential part of any liberal arts education. The goal of this department is to present the life sciences in a manner that stresses the fundamentals of biology with particular emphasis on the important principles which unite the different divisions of biology with one another and with other disciplines such as the humanities, the social sciences and, in particular, with the physical sciences of physics and chemistry.

Moreover, courses are designed to cover all the important phases of modern biology in order to offer students a complete background in this science and to prepare them best for their future work, whether it be in graduate study and research, teaching, medicine, dentistry, veterinary science, optometry, podiatry, medical technology, physical therapy, public health, forestry, agriculture, conservation, or other related occupations.

In addition to formal coursework, all majors are encouraged to become active members of the Biology Club, Environmental Awareness Society, Scuba Club and the Beta Beta Beta biology honor society, and to apply for summer internships, engage in a departmentally-supervised research project, and participate as laboratory assistants.

See also Biochemistry, Environmental Science, Forestry and Environmental Management, Marine Biology, Medical Technology, Molecular Biology, Neuroscience, Podiatric Science, Pre-Pharmacy, and Pre-Professional.

## **GENERAL SCIENCE**

General Science Secondary Concentration is not a designated undergraduate major at Saint Francis University. Therefore, students who take advantage of the opportunity to gain this certification are normally enrolling or returning in order to secure a second certificate which will complement their first specific science area certificate.

Students pursuing General Science certificates attain approval from the Education Department Chair who works in cooperation with the Biology Department Chair. Students receive content area advisement through the Biology Department and professional preparation advisement from advisors in the Education Department.

Since students seeking General Science certification already hold certificates, their program requirements are developed through advisement on a case-by-case basis.

## **BACHELOR OF ARTS IN BIOLOGY**

### **MAJOR REQUIREMENTS**

Biology 111, 112, 131, 231, 301, 331, 402, and 431; four courses from the following: Biology 203, 211, 212, 218, or any 300-, 400-, or 500-level courses; Chemistry 101, 102, plus 201-202 or 203-204; Mathematics 121-122 or 111-112 with approval of the chair; Physics 104-105 or 121-122.

## **BACHELOR OF SCIENCE IN BIOLOGY**

### **MAJOR REQUIREMENTS**

Biology 111, 112, 131, 211, 212, 231, 301, 302, 331, 401, 402, and 431; two courses from the following: Biology 203, 208, 218, or any 300-, 400- or 500-level Biology course; Mathematics 121-122 or 111-112 with approval of the chair; Physics 104-105 or 121-122; Chemistry 101, 102, 201, 202. Chemistry 301 and 302 are recommended for students preparing for graduate study.

## **BACHELOR OF SCIENCE IN BIOLOGY**

### **SECONDARY EDUCATION CONCENTRATION**

Biology 111, 112, 131, 231, 301, 302, 331, 402, and 431; three courses from the following: Biology 211-212 or 205-206, 203, 208, 218, or any 300-, 400-, or 500-level course; Mathematics 121-122 or 111-112 with approval of the chair; Physics 104-105 or 121-122; Chemistry 101, 102, 203, 204 or 201-202; plus education courses listed under the secondary education program.

## **BACHELOR OF SCIENCE IN BIOLOGY**

### **PRE-PROFESSIONAL CONCENTRATION**

**(Pre-Dental, Pre-Medical, Pre-Optometry, Pre-Pharmacy, Pre-Podiatry, Pre-Veterinary)**

Please consult the Pre-Professional Studies section of this catalog.

**NEUROSCIENCE MINOR** — Students who might be interested in the Interdisciplinary Minor in Neuroscience are invited to consult the description of that program.

**BIOLOGICAL DIVING MINOR** – Biology 111, Biology 218 and Biology 322( or MS 491), MS 101 and MS 102: Advanced Open Water Diver plus an additional 7 credits from Biology 312 (or MS 471) and MS 103-202, excluding MS 110.

**BIOLOGY MINOR REQUIREMENTS** — Biology 111 plus four Biology courses selected from Biology 112 or any courses numbered 200 or higher with the exception of Biology 312, Biology 398-399, Biology 408, Biology 412-416, Biology 420, Biology 421-424, Biology 430, Biology 431 and Biology 501. The accompanying laboratory for all courses must be completed to receive credit for the minor

## BIOLOGY — COURSE DESCRIPTIONS

### 101. General Biology

#### (3 credits)

For non-science majors. Fundamental principles; historical background of the major biological concepts as well as the contemporary status of the discipline. *Three lectures. May be used in partial fulfillment of graduation requirements in science. Fall, Spring, Summer.*

### 102. Physical Anthropology (same as Anthropology 102)

#### (3 credits)

For non-science majors. The stages of human evolution; geological sequence, fossil records, and physical variations in living peoples. *Two lectures and one laboratory or recitation session. May be used in partial fulfillment of graduation requirements in science. Spring.*

### 103. Environmental Studies

#### (3 credits)

For non-science majors. Ecological principles on the theme that a comprehensive segment of existing animal and plant species and natural communities should be preserved for the future population of man. Detailed consideration of the environmental threats facing the human population, and the task of stabilizing and reversing the deterioration that has already occurred. *May be used in partial fulfillment of graduation requirements in science. Spring.*

### 104. Human Heredity

#### (3 credits)

For non-science majors. The fundamental principles of genetics; present and future possibilities of genetic research and medical science in such areas of biology as cloning, test tube babies, genetic engineering, research, and the social implications of these genetic studies. *May be used in partial fulfillment of graduation requirements in science. Spring.*

### 105. Human Biology

#### (3 credits)

For non-science majors. Biological principles are applied to practical understanding of body functions and the importance of exercise, nutrition, etc. Current human concerns such as AIDS, cardiovascular disease, and cancer are discussed and related to recent scientific evidence. *May be used in partial fulfillment of graduation requirements in science. Fall, Spring.*

### 111. Biology I

#### (4 credits)

Introduction to biological principles fundamental to understanding animal life. Cell structure, cell function and biochemistry, heredity, molecular genetics, classification of the major phyla evolution, and the structure and function of major animal organ systems. *Lecture and laboratory. Fall, Spring.*

### 112. Biology II

#### (4 credits)

The plant cell; the major divisions of the plant kingdom stressing life cycles and possible evolutionary pathways; morphology and physiology of the plants; and an introduction to ecological and evolutionary processes. *Lecture and laboratory. Spring.*

### 131. Biology Freshman Seminar

#### (0 credits)

This course will cover topics including, but not limited to: study skills, time management, campus and departmental resources, and discussion of a biology related book. Required of all biology majors. *Fall.*

### 203. Ecology

#### (4 credits)

Basic principles of the relationship between organisms and the biotic and chemical aspects of their environment; population and community dynamics. Field trips to aquatic and terrestrial habitats. Three lectures and one laboratory session. *Prerequisite: Biology 101 or 111. BIOL 111 Lab. Fall.*

### 204. Invertebrate Zoology

#### (4 credits)

Specialized consideration of the animals without a backbone; morphology, physiology, taxonomy and evolution of this particular group. *Lecture and laboratory. Prerequisite: Satisfactory completion of both BIOL 111 and BIOL 111 Lab. As needed.*

### 205. Human Anatomy and Physiology I

#### (4 credits)

Basic course in the study of the structure and function of the human body. The specialized structure and function of each organ system is studied at the cellular, tissue and organ level of organization, as well as homeostatic mechanisms. Integumentary, skeletal, muscular, nervous, and sensory systems. *Lecture and laboratory. Prerequisite: Satisfactory completion of both BIOL 111 and BIOL 111 Lab. Fall.*

**206. Human Anatomy and Physiology II  
(4 credits)**

Continuation of study of major organ systems, including endocrine, circulatory, lymphatic, digestive, regulation of metabolism, respiratory and excretory systems; reproduction and development; fluid electrolyte and acid-base balance. *Prerequisite: Lecture and laboratory, and Satisfactory completion of both BIOL 205 and BIOL 205 Lab. Spring.*

**208. Animal Behavior  
(same as Psychology 208)  
(4 credits)**

A comprehensive, integrated comparison of the behavior patterns of animals utilizing findings from many other disciplines such as evolution, genetics, and neuroendocrinology. Methodology in collection of data and techniques of analysis and reporting. *Lecture and laboratory. Prerequisite: Biology 111 or consent of instructor. Fall.*

**211. Comparative Vertebrate Anatomy  
(4 credits)**

Comparative anatomical study of adult vertebrates including man with some reference to functional implications; review of phylum Chordata, classification and evolutionary trends; brief introduction to embryonic development emphasizing significance of germ layers and tissues to an understanding of the comparative anatomy of the organ systems of chordates. *Lecture and laboratory. Prerequisite: BIOL 111. Fall. Satisfactory completion of lecture and lab.*

**212. Developmental Biology  
(4 credits)**

A descriptive morphological and experimental physiological study of the ontogenetic development of representative vertebrates including such topics as postembryonic development, regeneration, metamorphosis and the relationship between inheritance and development. *Lecture and laboratory. Prerequisite: BIOL 111. Spring. Satisfactory completion of lecture and lab.*

**214. Clinical Microbiology  
(4 credits)**

A study of the normal body flora and pathogenic micro-organisms; microbial physiology associated with pathogenicity of bacteria, viruses, fungi and common protozoal parasites; host responses to pathogenic invasion; diagnostic tests used for identification of pathogens; antimicrobial agents; principles of immunology. *Lecture and laboratory. Prerequisites: Biology 111, Chemistry 104. Fall, Summer.*

**218. Marine Biology  
(4 credits)**

A study of the biological aspects of marine ecosystems along with physical relationships. Students will survey marine plants and animals and the relationships which exist between them and the chemical and physical features of the ocean. Studies of the various ecosystems which exist in the marine environment including intertidal zones, brackish water, coral reefs, open ocean, and the continental shelf will be used to further students' understanding of these complex relationships. *Lecture and laboratory. Prerequisite: BIOL 111, 112, and satisfactory completion of BIOL 111, 112 labs. Spring.*

**231. Biology Sophomore Seminar  
(0 credits)**

This course will cover topics including, but not limited to: information on internships, writing resumes, cover letters and a career statement and an introduction to scientific literature. *Required of all biology majors. Spring.*

**301. Genetics  
(4 credits)**

A study of the principles of heredity; the structure and function of DNA; applications of recombinant DNA technology; and the action of genes in populations. *Three lectures and one laboratory. Prerequisite: Satisfactory completion of BIOL 111 and BIOL 111 lab. Fall.*

**302. General Microbiology  
(4 credits)**

Morphology, physiology, and ecology of the major groups of micro-organisms: bacteria, fungi, protozoa, slime-molds, algae, rickettsiae and viruses, principles of immunology. *Lecture and laboratory. Prerequisite: Satisfactory completion of BIOL 111 and BIOL 111 Lab. Chemistry 201 or 203. Spring.*

**305. Immunology  
(3 credits)**

A study of the general principles of immunology. Both cellular and humoral immunology will be studied covering immune tissues and cells, antigens, antibody production, MHC, genetic basis of immunological structure, cellular interactions, and specific applications of immunology to modern medical science including immunological disorders and laboratory techniques. *Prerequisite: Satisfactory completion of BIOL 111. Spring, as needed. And BIOL 111 lab.*

### **312. Research Diver Techniques (3 credits)**

Aquatic research methods using SCUBA as a research tool. Students will experience various research methods that are best completed with the use of SCUBA equipment. *Prerequisites: Biology 111 (General Zoology), BIOL 111 Lab and basic SCUBA certification. As needed, summer only.*

### **BIOL 315. Biostatistics (4 Credits)**

The study of probability and statistics with application to biological research. Statistics tools are used to investigate and understand the biological parameters with their inherent variability. Students will utilize statistical theory and methods to develop the framework for understanding variation, and distinguishing random from non-random events. *Three lectures and one laboratory. Prerequisite: Biology 111 Lecture and Lab. As needed.*

### **BIOL 320. Natural History of the Vertebrates (4 credits)**

Specialized consideration of the animals with a backbone: natural history, morphology, physiology, taxonomy and evolution of this particular group. *Three lectures and one laboratory. Prerequisite: Biology 111 Lecture and Lab. As needed.*

### **322. Field Biology (3 credits)**

An opportunity for completing ecological field studies in an area other than the region around Saint Francis University. Students will research the ecology of the field site, study the animals and plants present in the ecosystem and plan their travel before leaving on a 7-9 day research trip. Studies will be completed on site. Upon completion of the trip, students will write a research paper and formally present their findings. Course can be completed twice for credit when completed at different locations. Students will incur an additional expense to cover field costs. *Prerequisite: Biology 203, Spring, Summer.*

### **326. Freshwater Aquatic Biology (4 credits)**

A study of the physical, chemical, and biological aspects of streams, rivers, ponds and lakes. Emphasis on the role of water chemistry, pollution and biotic interactions on the distribution of aquatic life. Laboratory includes field sampling and identification of aquatic organisms. Lecture and laboratory. *Prerequisite: Biology 203. Fall, as needed.*

### **331. Biology Junior Seminar (0 credits)**

This course will cover topics including, but not limited to: professional and graduate school options, preparation for entrance exams, and applying for internships. *Required of all biology majors. Fall.*

### **398-399. Biology Internship (3-15 credits)**

The integration of classroom theory with practical work experience under which students have specific periods of attendance at college and specific periods of employment, either full- or part-time, with or without pay. *Credit may vary from three to 15 credits, but no more than six credits may be counted toward major requirements, with additional credits counted as free electives. Open only to Biology majors with approval of the department chair and the Provost. Fall, Spring, Summer. Fulfills Departmental Senior Capstone.*

### **401. Cell and Molecular Biology (4 credits)**

A broad coverage of cell and molecular biology. Emphasizing experimental design and data analysis. Three lectures and one laboratory session. Library research, journal reviews and paper. Lecture and laboratory *Prerequisites: Satisfactory completion of BIOL 111 and BIOL 111 lab. Fall.*

### **402. Evolution (3 credits)**

Development of the theory of organic evolution of plants and animals through evidence obtained from fossil records, genetics, cytogenetics, ecology, biochemistry, comparative anatomy, comparative physiology and serology. *Restricted to seniors. Spring.*

### **403. Advanced Botany (4 credits)**

Specialized consideration of the plant kingdom, taxonomy, anatomy and physiology. Lecture and laboratory. *Prerequisite: BIOL 112, as needed and BIOL 112 Lab. As needed.*

### **405. Biochemistry (same as Chemistry 405) (4 credits)**

Basic chemical processes of living organisms, from single-cells to humans, emphasizing the use and production of energy and macromolecules; metabolic regulation; and structure-function relationships. Lecture and laboratory. *Prerequisite: Biology 111, Chemistry 202. Spring.*

**406. Vertebrate Physiology  
(4 credits)**

A study of the function of the life processes that maintain homeostasis. Emphasis on the integration of systems that regulate normal values in the intact organism. Lecture and laboratory. *Prerequisite: Biology 211. Spring.*

**408. Special Problems in Environmental Science and Seminar  
(4 credits)**

Examination of the recent literature dealing with pollution, endangered species, agricultural systems, demographic trends and effects of environmental disruptions on human health and well-being. One class period per week to be devoted to the presentation of student reports on their environmental activities. *Prerequisite: Biology 203. Spring.*

**412-416. Special Topics in Biology  
(1-4 credits each)**

Students pursue advanced study in a specialized area of biology. Course includes lectures, library research or laboratory research, and a paper pertaining to subject matter not covered in other courses. *As needed.*

**420. Research I  
(1-2 credits)**

Original experimental investigation in selected biological problems. Students will work with a research advisor to complete a research proposal in an area of interest. *Open only to students with a minimum Q.P.A. of 3.25 who enroll in the course no later than the Spring of their junior year. As needed.*

**421-424. Research II  
(1 credit each)**

Completion of the research project proposed in Biology 420, including experimentation and the writing of a journal-style paper presenting the results of the research. Results will also be presented to students and faculty in the Biology Department. *Students must enroll in the course no later than the Fall of their senior year. Prerequisite: Biology 420. As needed. Fulfills Departmental Senior Capstone.*

**430. Advanced Laboratory Methods in Molecular Biology  
(2 credits)**

Techniques used in the manipulation of DNA; laboratory methods needed to transfer genes from one organism to another; additional methods with wide application in molecular biology. *Lecture and laboratory. Prerequisites: Biology 301, 302, 401. As needed.*

**431. Senior Seminar  
(0-1 credit)**

Students select a current topic of interest in biology that has been approved by the instructor. The topic is covered in-depth in the form of a research paper and an oral presentation to the class. *Required of all biology majors. Fulfills Departmental Senior Capstone. Spring.*

**501. Independent Study in Biology  
(1-8 credits)**

*As needed. Fulfills Departmental Senior Capstone.*

## **Biology/Environmental Science**

*Chair: Dr. Wayne Takacs*

*Program Coordinator: Dr. Lane Loya*

### **BACHELOR OF SCIENCE IN BIOLOGY ENVIRONMENTAL SCIENCE CONCENTRATION MAJOR REQUIREMENTS**

Biology 111, 112, 131, 203, 231, 301, 302, 331, 402, 408, 431, and at least 11 credits from Biology 208, 211, 212, 218, Chemistry 205, and/or any 400-level course not listed above; Chemistry 101, 102, 201, 202; Economics 101 or 102; Management 101; Mathematics 121-122 or 111-112 with approval of the chair; Physics 104-105; Political Science 102 or 103 or 305; Psychology 101; Sociology 102 or 303; Statistics 101.

Those considering participation in the SFU/Duke University cooperative program should follow recommendations for graduate study. Those choosing the 3-2 option may have to accelerate their program at Saint Francis and should see their advisors as soon as possible for a detailed description of the program.

Contact program coordinator for additional information.

### **ENVIRONMENTAL SCIENCE COURSE DESCRIPTION 501. Independent Study in Environmental Science (1-8 credits)**

## **Biology/Marine Biology — Track I**

*Chair: Dr. Wayne Takacs*

*Program Coordinator: Dr. Devonna S. Morra*

### **BACHELOR OF SCIENCE IN BIOLOGY**

#### **MARINE BIOLOGY CONCENTRATION**

#### **MAJOR REQUIREMENTS**

Biology 111, 112, 131, 211, 218, 231, 301, 331, 402, 431, and two of the following three courses: Biology 203, 302, 401; eight to nine credits of Marine Biology; (can include 6 credits from Biology 312, 322, or Marine Biology internships); Mathematics 121-122 or 111-112 with approval of the chair; Physics 104-105 or 121-122; Chemistry 101, 102, 201, 202.

Contact program coordinator for additional information.

#### **MARINE STATION SUMMER SESSION**

Above required eight to nine credits of Marine Biology courses are to be taken at Wallops Island or another approved marine biology station. Acceptable courses at Wallops Island include:

MS-110:	Introduction to Oceanography
MS-211:	Field Methods in Oceanography
MS-221:	Marine Invertebrates
MS-241:	Marine Biology
MS-260:	Marine Ecology
MS-300:	Behavior of Marine Organisms
MS-331:	Chemical Oceanography
MS-343:	Marine Ichthyology
MS-345:	Marine Ornithology
MS-451:	Coastal Environment Oceanography
MS-464:	Biological Oceanography
MS-471:	Research Diver Techniques
MS-490:	Aquaculture
MS-491:	Coral Reef Ecology
MS-500:	Problems in Marine Science

Other approved courses may also be taken. Grades earned at the marine biology station are included in the student's final quality point average.

Saint Francis University is a member of the Marine Science Consortium at Wallops Island, Virginia; however, students may attend any accredited marine station with the approval of the chair of the Biology Department.

## Biology/Marine Biology — Track II

### MARINE AND ENVIRONMENTAL EDUCATIONAL SPECIALITIES

*Chair: Dr. Wayne Takacs*

*Program Coordinator: Dr. Devonna S. Morra*

#### BACHELOR OF ARTS IN MARINE AND ENVIRONMENTAL

#### EDUCATIONAL SPECIALITIES

#### MAJOR REQUIREMENTS

Biology 111, 131, 208, 218, 231, 331, 402, 431, and six credits of Marine Biology from Wallops Island or Marine Biology internships; three courses from the following : Biology 112, 203, 204, 211, 301\*, 302\*, 322, 326, and 401\*, of which one course\* must be of the cellular basis; Chemistry 105 or 101-102 or 103-104 as determined by the program coordinator; Math 111, Stat 101, Psys 101; plus five courses from the following with no more than three courses from one area:

EDUC 210	Educational Psychology
EDUC 302	Methods Block II
ART 111	General Drawing
ART 115	Photography
ART 300	Special Projects
COMM 308	Desktop Publishing
COMM 210	Public Relations
COMM 310	Advertising
THTR 103	Theatre Arts Workshop
THTR 110-13	Performance and Production
THTR 120	Oral Interpretation
THTR 200	Educational Theatre
THTR 301	Design
MGMT 101	Principles of Management
MGMT 302	Marketing
PSYC 201	Quantitative Research Methods
PSYC 302	Sensation and Perception
PSYC 303	Learning
PSYC 314	Biopsychology

Highly recommended are Scuba certification, and first aid and CPR certification.

#### BIOLOGICAL DIVING

**MINOR REQUIREMENTS** – Biology 111, 218, and 322 (or MS 491), MS 101 and 102 plus an additional 7 credits from Biology 312 (or MS 471) and MS 103 – 202, excluding MS 110.

#### BIOLOGICAL DIVING MINOR COURSE DESCRIPTIONS

MS 101	Open Water Diver
MS 102	Advanced Open Water Diving
MS 103	Rescue Diver
MS 104	Divemaster
MS 105	Diving First Aid, AEDs, Neurological Assessment, and O2 Provider
MS 106	Underwater Digital Photography
MS 107	Underwater Photography
MS 108	Underwater Videography
MS 109	Underwater Naturalist
MS 111	Fish Identification
MS 112	Research Diver
MS 113	Enriched Air Diver
MS 114	Wreck Diver
MS 115	Underwater Navigator
MS 116	Deep Diver
MS 117	Night Diver
MS 118	Underwater Search and Recovery
MS 119	Boat Diver
MS 120	Dive Propulsion Vehicle
MS 121	Dry Suit Diver
MS 122	Altitude Diver
MS 123	Drift Diver
MS 124	Peak Performance Buoyancy
MS 125	Equipment Specialist
MS 201	Assistant Instructor
MS 202	Instructor Development

## Biochemistry

*Chair: Dr. Wayne Takacs*

*Program Coordinator: Dr. John Trimble*

The biochemistry concentration for biology majors is designed to pursue studies in the hybrid field of biochemistry. Students in this concentration will earn a biology degree and a minor in chemistry. It allows students to tailor their career directions during their junior and senior years by selecting biology courses of interest combined with undergraduate research. It is a concentration that prepares students for post-graduate study or for employment in research laboratories, in forensic laboratories, in the biomedical and biotechnology fields and in pharmaceutical research.

### **BACHELOR OF SCIENCE IN BIOLOGY CONCENTRATION IN BIOCHEMISTRY**

#### **MAJOR REQUIREMENTS**

Biology 111, 112, 131, 231, 301, 302, 331, 401, 402, 405, 431, and six credits from Biology 398-399, 406, 412-416, 420-424 and 430; Mathematics 121-122; Physics 104-105 or 121-122; Chemistry 101-102, 201-202 and 301.

Contact program coordinator for additional information.

## Molecular Biology

*Chair: Dr. Wayne Takacs*

*Program Coordinator: Dr. Sue Reimer*

This concentration is designed with both rigor and flexibility, in order to reflect the many different employment pathways open to molecular biologists. Fields such as cell biology, immunology, developmental biology, genetics and the exploding field of bioinformatics offer opportunities for graduates with a solid understanding of the inner workings of the cell. This concentration also allows students the option of combining computer skills with their knowledge of biology.

### **BACHELOR OF SCIENCE IN BIOLOGY CONCENTRATION IN MOLECULAR BIOLOGY**

#### **MAJOR REQUIREMENTS**

Biology 111, 112, 131, 231, 301, 302, 331, 401, 402, 405, 430, 431, and ten credits from Biology 212, 305, 398-399, 406, 412-416, 420-424; Neuroscience 279; Computer Science 121, 122; Chemistry 301-302 and 404. Mathematics 121-122 or 130; Physics 104-105 or 121-122; Chemistry 101-102, 201-202.

Contact program coordinator for additional information.