

Biological and Physical Sciences

Biology (BS)
Biology with Secondary Certification (BS)
Biotechnology (BS)



UNDERGRADUATE
PROGRAMS

The department of biological and physical sciences has as its objectives to introduce students to the methodologies and tools of science; to give them a background in science necessary for daily living and professional competence; to enable them to examine critically the contemporary issues related to the sciences; and to give science majors the proper foundations to pursue their professions or to enter graduate or professional schools.

The department offers a bachelor of science degree with majors in biology, biology with secondary certification, and biotechnology. All majors include a minor in chemistry.

The pre-professional program offers a course of study that includes all courses required for admission to most professional schools. The department also offers courses needed for general education requirements, for majors in the department of human environmental sciences, for elementary and secondary education certification, for sports management, and for Chamberlain College of Nursing, as well as minors in biology and chemistry.

FACULTY

David Thomasson, associate professor of biology/chemistry and chairperson of the department of biological and physical sciences

Libby Rayhel, assistant professor of biology

Stephanie Paine-Saunders, assistant professor of biology

DUAL DEGREE PROGRAM IN ENGINEERING WITH WASHINGTON UNIVERSITY in ST. LOUIS

Students may choose a dual degree program of study in connection with the School of Engineering and Applied Science at Washington University in St. Louis. This program may be combined with the biology major. Students who have completed the required work for the major in biology at Fontbonne and who have a minimum cumulative grade point average of 3.0 on a 4.0 scale, both overall and in the core courses for the biology major, may apply for admission to the dual degree program. Upon satisfactory completion of the program, the student will be awarded a bachelor's degree in biology from Fontbonne University and a bachelor's degree in engineering from Washington University in St. Louis.

MAJOR APPROVAL

Major approval must be completed before the spring semester of junior year. Students seeking major approval must have a minimum cumulative grade point average (GPA) of 2.5 on a 4.0 scale as well as a GPA of 2.5 in the courses specified below.

General Biology I

General Biology II

General Chemistry I

And one other (minimum 200 level) biology course

MAJOR IN BIOLOGY

The biology major offers a course of study that prepares its graduates with the necessary background for a professional program, graduate school, or research in industrial, government, or university laboratories.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in this catalog. A course that meets a general education requirement may also meet a course requirement in the major or a course requirement in another discipline.

The following specific general education course must be chosen to meet the requirements for the Biology major:

MTH 115 Introduction to Statistics (3 hours)

Courses Required in Biology (31 hours)

BIO 112 General Biology I with lab (4 hours)

BIO 114 General Biology II with lab (4 hours)

BIO 220 Anatomy and Physiology I with lab (4 hours)

BIO 222 Anatomy and Physiology II with lab (4 hours)

BIO 250 Microbiology with lab (4 hours)

BIO 312 Genetics (3 hours)

BIO 314 Developmental Biology (3 hours)

BIO 318 Cell and Molecular Biology (3 hours)

BIO 496 Biology Seminar (2 hours)

Courses Required in Chemistry (19 hours)

CHM 106 General Chemistry I with lab (4 hours)

CHM 108 General Chemistry II with lab (4 hours)

CHM 210 Organic Chemistry I with lab (4 hours)

CHM 212 Organic Chemistry II with lab (4 hours)

CHM 318 Biochemistry (3 hours)

Courses Required in Mathematics and Computer Science (11 hours)

MTH 115 Introduction in Statistics (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 151 Calculus with Analytic Geometry II (4 hours)

Courses Required in Physics (8 hours)

PHY 208 College Physics I with lab (4 hours)

PHY 210 College Physics II with lab (4 hours)

MAJOR IN BIOLOGY WITH SECONDARY CERTIFICATION

The required courses for certification to teach secondary school biology (9-12) can be taken in addition to the biology core as outlined below.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

Policies and Procedures for Students in Teacher Certification Programs

Students are responsible for obtaining a copy of policies and procedures for students in teacher certification programs when they begin their program at Fontbonne. These copies are available from the certification coordinator in the East Building, room 235. Students are responsible for carrying out all current policies, procedures, and requirements for graduation and for teacher certification.

The student must maintain a minimum cumulative grade point average of 2.75 on a 4.0 scale for coursework designated as “professional,” and a cumulative grade point average of 2.5 on a 4.0 scale. These standards take into consideration all coursework taken at all colleges and universities. All candidates must pass all segments of the College Basic Skills Examination (C-BASE). Students earning certification in middle school and secondary programs must achieve a GPA of 2.5 in the relevant content areas.

Students who have “conditions” placed upon them by the teacher certification committee will not be approved for teacher certification. Conditions may be defined as deficiencies related to the potential success of the candidate to be an effective teacher. (Students should refer to the procedures manual for specific guidelines in this area.)

Students who transfer to Fontbonne University from another institution who have been granted transfer credit for courses equivalent to EDU 234 Philosophical Foundations and/or EDU 200/201 Introduction to Classroom Teaching are required to enroll for EDU 301 Teacher Education at Fontbonne University. While this course carries zero credit, it is a requirement for major approval. Students so designated will enroll for course during their first semester on campus. The course will be taught predominately online, but a limited number of face-to-face meetings will be required. Students will receive a grade of P/NP. This course is required for all transfer students majoring in education or whose content major includes teacher certification, and will be taught in the fall, spring, and summer.

All candidates for teacher certification must fulfill all Missouri Department of Elementary and Secondary Education requirements, including passing scores on entrance and exit tests, grade point average, culminating project, and criminal background checks. These requirements are subject to change. The most current requirements must be met.

Most school districts require that any individual who teaches, supervises, or has access to students in a school undergo an FBI fingerprint check, a criminal record check, and child abuse/neglect screening. The Missouri Highway Patrol and the Department of Social Services conduct these screenings. Every Fontbonne student engaged in clinical experiences in the pre-service teacher certification programs must complete background checks as required prior to placement in any school. Costs for these background checks will be borne by the student.

Acceptance into the Teacher Certification Program

Qualified students may apply for acceptance to the teacher certification program. Application should be made at the close of the second semester of the junior year for native students and no later than the third semester of attendance at Fontbonne University for transfer students. Acceptance into the teacher certification program is based upon major approval; final validation of professional (2.75) and cumulative (2.5) GPA; final validation of a 2.5 GPA in relevant content areas for middle/secondary candidates; successful completion of the C-BASE; and approval

by the teacher certification committee. Without approval by the teacher certification committee, students cannot enroll for student teaching.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in the catalog. A course that meets a general education requirement may also meet a course requirement in another discipline.

The following specific general education courses must be chosen to meet the requirements for the biology major with secondary certification:

- MTH 115 Introduction to Statistics (3 hours)
- PSY 200 Developmental Psychology (3 hours)
- CIS 103 Microcomputer Applications in Education (3 hours)
- COM 102 Public Speaking (3 hours)
- GOV 101 US and MO Constitutions (1 hour)
- EDU 234 Philosophical Foundations of Education (3 hours)

Courses Required in Biology (39 hours)

- BIO 106 Topics in Environmental Science with Lab (3 hours)
- BIO 110 The History and Philosophy of Science and Technology (2 hours)
- BIO 112 General Biology I with Lab (4 hours)
- BIO 114 General Biology II with Lab (4 hours)
- BIO 220 Anatomy and Physiology I with Lab (4 hours)
- BIO 222 Anatomy and Physiology II with Lab (4 hours)
- BIO 250 Microbiology with Lab (4 hours)
- BIO 312 Genetics (3 hours)
- BIO 318 Cell and Molecular Biology (3 hours)
- BIO 320 Evolutionary Biology (3 hours)
- BIO 371 Methods of Teaching Science in Secondary School (2 hours)
- BIO 396 Biology Seminar (3 hours)

Courses Required in Chemistry (19 hours)

- CHM 106 General Chemistry I with Lab (4 hours)
- CHM 108 General Chemistry II with Lab (4 hours)
- CHM 210 Organic Chemistry I with Lab (4 hours)

CHM 212 Organic Chemistry II with Lab (4 hours)

CHM 318 Biochemistry (3 hours)

Courses Required in Mathematics and Computer Science (11 hours)

MTH 115 Introduction to Statistics (3 hours)

MTH 150 Calculus with Analytic Geometry I (4 hours)

MTH 151 Calculus with Analytic Geometry II (4 hours)

Course Required in Physics (4 hours)

PHY 208 College Physics I (4 hours)

Courses Required in Education (24 hours)

EDU 120 Psychology of the Exceptional Child (3 hours)

EDU 201 Introduction to Classroom Teaching-Middle/Secondary (3 hours)

EDU 300 Classroom/Behavior Management Techniques (3 hours)

EDU 350 Methods of Teaching Reading in the Content Area (2 hours)

EDU 447 Planning for Instruction and Assessment [Middle and Secondary] (3 hours)

EDU 451 Student Teaching at the Secondary Level (10 hours)

Culminating Project Requirement

The culminating project requirement of Fontbonne University's teacher certification unit is a performance assessment through which the pre-service teacher provides evidence of his/her ability to facilitate learning. This project assesses the pre-service teacher's ability to design and teach an effective unit of instruction, to assess student performance, and to reflect on the experience. The artifacts collected for this project will provide evidence of the candidate's competency in the 11 quality indicators of the Missouri Standards for Teacher Education Programs. An approved culminating project is required prior to the recommendation for certification being made to the Missouri Department of Elementary and Secondary Education.

MAJOR IN BIOTECHNOLOGY

The biotechnology major provides a course of study that equips its graduates with the necessary background for a career in the biotechnology field.

Baccalaureate Degree Requirements

The requirements for all undergraduate degrees are listed in the academic policies and regulations section in this catalog. These requirements include a course requirement in religion or theology.

General Education Requirements

The 42 credit hours of general education requirements are presented in the academic information section in this catalog. A course that meets a general education requirement may also meet a course requirement in the major or a course requirement in another discipline.

The following specific general education course must be chosen to meet the requirements for the biotechnology major:

MTH 115 Introduction in Statistics (3 hours)

Courses Required in Biology (31 hours)

BIO 112 General Biology I with lab (4 hours)

BIO 114 General Biology II with lab (4 hours)

BIO 250 Microbiology with lab (4 hours)

BIO 312 General Genetics (3 hours)

BIO 318 Cell and Molecular Biology (3 hours)

BIO 322 Immunology (3 hours)

BIO 481 Biotechnology I (2 hours)

BIO 483 Biotechnology II (2 hours)

BIO 485 Biotechnology III (2 hours)

BIO 487 Biotechnology IV (2 hours)

BIO 496 Biology Seminar (2 hours)

Courses Required in Chemistry (19 hours)

CHM 106 General Chemistry I with lab (4 hours)

CHM 108 General Chemistry II with lab (4 hours)

CHM 210 Organic Chemistry I with lab (4 hours)

CHM 212 Organic Chemistry II with lab (4 hours)

CHM 318 Biochemistry (3 hours)

Courses Required in Mathematics and Computer Science (11 hours)

- MTH 115 Introduction in Statistics (3 hours)
- MTH 150 Calculus with Analytic Geometry I (4 hours)
- MTH 151 Calculus with Analytic Geometry II (4 hours)

Courses Required in Physics (8 hours)

- PHY 208 College Physics I with lab (4 hours)
- PHY 210 College Physics II with lab (4 hours)

RESIDENCY REQUIREMENTS

A student must successfully complete, at Fontbonne, a minimum of 50% of the credit hours required for the major, with a minimum of 15 credit hours in upper division (300/400) courses.

GRADUATION REQUIREMENTS

In addition to the academic requirements of the university (*see the sections on academic information and academic policies and regulations in this catalog*) and the department, all students must take either the Graduate Record Examination (Biology Subject Test) or the professional school admission examination of his or her choice prior to graduation. Scores must be submitted to the department.

MINORS

In addition to majors, the department of biological and physical sciences offers minors in biology and chemistry. These minors are designed for students from other majors interested in science. A student must successfully complete, at Fontbonne, a minimum of 50 percent of the credit hours required for the minor. All courses for the minor must be completed with grades of C- or above.

Minor in Biology (18 credit hours)

Upon completion of the following courses in biology, the student is eligible to receive a minor in biology.

- BIO 112 General Biology I with lab (4 hours)
- BIO 114 General Biology II with lab (4 hours)
- BIO 250 Microbiology with lab (4 hours)
- BIO 312 General Genetics (3 hours)
- BIO 318 Cell and Molecular Biology (3 hours)

Minor in Chemistry (19 credit hours)

Upon completion of the following courses in chemistry, the student is eligible to receive a minor in chemistry.

- CHM 106 General Chemistry I with lab (4 hours)
- CHM 108 General Chemistry II with lab (4 hours)
- CHM 210 Organic Chemistry I with lab (4 hours)
- CHM 212 Organic Chemistry II with lab (4 hours)
- CHM 318 Biochemistry (3 hours)

COURSES

BIOLOGICAL SCIENCES

BIO 106 Topics in Environmental Science with Lab (3 hours)

An introduction as to how nature works, how the environment has been and is being modified and abused by human activities, and what can be done to protect and improve it for future generations of humans and other living things. FA (odd years)

BIO 108 Introduction to Life Science with Lab (3 hours)

Introductory course covering the basic principles of life with an emphasis on the scientific method, characterization of life, organization of living things, energetics, and evolution. FA, SP, SU

BIO 110 The History and Philosophy of Science and Technology (3 hours)

An introductory course examining the history of science, with an emphasis on modern science, as well as the philosophy of scientific thought. FA (odd years)

BIO/CHM 111 Science Laboratory (1 hour)

A broad-based set of laboratory experiments in biology, chemistry, physics, and/or earth science emphasizing the scientific method. Prerequisite: A minimum two credit hour science lecture course that meets GER taken prior to matriculation at Fontbonne. FA, SP

BIO 112 General Biology I with Lab (4 hours)

Selected principles and problems in general biology with emphasis on those principles most applicable to all living organisms: cellular organization, energy exchange, and inheritance. FA

BIO 114 General Biology II with Lab (4 hours)

A general course in organismal biology, covering diversity of living things from the prokaryote to higher

plants and animals. Lecture. Prerequisite: BIO 112 with minimum grade of C within last five years or permission of department chair. SP

BIO 124 Anatomy and Physiology of the Speech and Hearing Mechanism (3 hours)

A detailed study of the structure and function of those parts of the skeletal, muscular, respiratory, and nervous systems as they pertain to the process of communication. Offered in the department of communication disorders. (Science credit only for students in deaf education.) FA

BIO 206 Essentials of Human Anatomy and Physiology with Lab (4 hours)

An introduction to the human body and how it functions, with special emphasis on the skeletal, muscular, digestive, respiratory, and cardiovascular systems. Prerequisite: BIO 108. FA

BIO 220 Anatomy and Physiology I with Lab (4 hours)

A course designed to introduce students to those aspects related to the study of the human body. Particular attention is given to cells, tissues, integumentary, skeletal, muscular, nervous, and endocrine systems. FA, SP, SU

BIO 222 Anatomy and Physiology II with Lab (4 hours)

Continuation of Anatomy and Physiology I. Particular attention is given to the digestive, cardiovascular, respiratory, urinary, and reproductive systems. Prerequisite: BIO 220 with minimum grade of C within last five years or permission of department chair. SP, SU

BIO 250 Microbiology with Lab (4 hours)

A general course with emphasis on classification, physiology, and pathology of microorganisms. Prerequisites: Introductory biology course and introductory chemistry course with minimum grade of C within last five years or permission of department chair. SP, SU

BIO 306 Introduction to Kinesiology with Lab (4 hours)

An introduction to the mechanical principles of movement. Emphasis is placed on how the use of these principles can help improve sports skills for the athlete at all levels of training. Prerequisites: BIO 206; PHY 108. SP

BIO 312 Genetics (3 hours)

Study of the fundamental laws of inheritance in biological systems. Prerequisites: Introductory biology course; CHM 106 and CHM 108 with minimum grade of C within last five years or permission of department chair. SP (even years)

BIO 314 Developmental Biology (3 hours)

Study of the dynamics of development of organisms from gametogenesis to a more complex form, concentrating on mechanisms and metabolic changes. Prerequisites: Introductory biology course; CHM 106 and CHM 108 with minimum grade of C within last five years or permission of department chair. SP (even years)

BIO 318 Cell and Molecular Biology (3 hours)

Study of fine structures, metabolism, physical, and chemical activities of cells and subcellular structures. Prerequisites: BIO 112; BIO 114; CHM 106 and CHM 108 with minimum grade of C within last five years or permission of department chair. FA (odd years)

BIO 320 Evolutionary Biology (3 hours)

This course examines the basic processes and patterns of evolution: natural selection, evolutionary genetics, the analysis of adaptation, the phylogeny of life, the fossil record, molecular evolution, macroevolution and speciation; as well as an evaluation of current evolutionary issues. Prerequisites: BIO 112; BIO 114 and BIO 312. FA (even years)

BIO 322 Immunology (3 hours)

Introductory course which covers the basic concepts of antibody-mediated and cell-mediated immunity. Recent advances in the field will be emphasized, from basic scientific and clinical perspectives. Prerequisites: BIO 112; BIO 114; BIO 250; CHM 106 and CHM 108. FA (odd years)

BIO 370 Teaching of Science in Early Childhood and Elementary (2 hours)

Application of principles of teaching science on the early childhood and elementary school level; examination of various approaches of presenting approaches to presenting hands-on activities. Prerequisites: BIO 108; PHY 108 with minimum grade of C or equivalent within last five years or permission of department chair. FA, SP

BIO 371 Teaching of Science in Middle and Secondary School (2 hours)

Application of principles of teaching science on the middle and secondary school level; examination of various approaches to presenting hands-on activities. Prerequisite: BIO 370. FA, SP

BIO 481 Biotechnology I (2 hours)

A course designed to provide students with basic laboratory skills used in biotechnology methods with emphasis on solution preparation, measurements, and laboratory safety. Prerequisites: BIO 312; BIO 318; CHM 318. FA

BIO 483 Biotechnology II (2 hours)

A continuation of Biotechnology I with an emphasis on cell culture. Prerequisites: BIO 312; BIO 318; BIO 481; CHM 318. SP

BIO 485 Biotechnology III (2 hours)

A continuation of Biotechnology I with an emphasis on immunology and protein methods. Prerequisites: BIO 312; BIO 318; BIO 481; CHM 318. SP

BIO 487 Biotechnology IV (2 hours)

A continuation of Biotechnology I with an emphasis on DNA manipulations. Prerequisites: BIO 312; BIO 318; BIO 481; CHM 318. FA

BIO 490 Independent Study (1-4 hours)

Course in which students may pursue a library, curriculum development, or experimental research project in some aspect of science. Students with 60 or more semester credit hours may register for an independent study course. Offered as needed with permission of department chairperson.

BIO 495 Department Research (1-4 hours)

This course is designed to provide the student with a non-classroom, non-structured, individualized experience in experimental research in the biological and physical sciences, utilizing the knowledge and skill obtained in other science courses. Offered as needed with permission of department chairperson.

BIO 496 Biology Seminar (2 hours)

A capstone course designed to equip students with the skills of reading and evaluating primary scientific literature, while exploring current topics in science. An oral presentation will be required. Prerequisites: BIO 112; BIO 114; BIO 318; and junior standing. FA

PHYSICAL SCIENCES

CHM 102 Essentials of Chemistry with Lab (4 hours)

An introductory course; includes stoichiometry, basic atomic theory, environmental, nuclear, acid-base, organic, and biochemistry. FA, SP, SU

CHM 106 General Chemistry I with Lab (4 hours)

An introductory course in chemistry for science majors. Includes stoichiometry, atomic structure, chemical reactions, and solutions. Prerequisite: College algebra or equivalent. FA

CHM 108 General Chemistry II with Lab (4 hours)

A continuation of CHM 106; includes kinetics, equilibrium, thermodynamics, acids and bases, and electrochemistry. Prerequisite: CHM 106 with minimum grade of C within last five years or permission of department chair. SP

CHM/BIO 111 Science Laboratory (1 hour)

A broad-based set of laboratory experiments in biology, chemistry, physics, and/or earth science emphasizing the scientific method. Prerequisite: A minimum two credit hour science lecture course that meets GER taken prior to matriculation at Fontbonne. FA, SP

CHM 210 Organic Chemistry I with Lab (4 hours)

A study of the compounds of carbon with emphasis on functional groups, structure nomenclature, and reactions. Prerequisites: CHM 106; CHM 108 with minimum grade of C within last five years or permission of department chair. FA

CHM 212 Organic Chemistry II with Lab (4 hours)

A study of the mechanisms of reactions of organic compounds. Prerequisite: CHM 210 with minimum grade of C within last five years or permission of department chair. SP

CHM 318 Biochemistry (3 hours)

Study of chemical properties and metabolism of compounds of biological interest: carbohydrates, lipids, proteins, and nucleic acids. Prerequisites: CHM 106; CHM 108; BIO 112 with minimum grade of C within last five years or permission of department chair. SP

PHY 108 Introduction to Physical Science with Lab (3 hours)

Introductory course in physical science covering the scientific method, basic principles of physics, chemistry, earth science and astronomy. FA, SP, SU

PHY 208 College Physics I with Lab (4 hours)

A calculus-based course intended for science and math majors. Includes principles of mechanics, heat, wave motion, and sound. Prerequisite: MTH 150. FA

PHY 210 College Physics II with Lab (4 hours)

A continuation of PHY 208; includes light, electricity, magnetism, and quantum physics. Prerequisite: PHY 208 or equivalent. SP