

Biological Sciences (BS)

This program is offered by the College of Science and Health/ Natural Sciences and Mathematics Department and is only available at the St. Louis main campus.

Program Description

The bachelor of science (BS) degree is designed for students who seek a rigorous, cross-disciplinary education in the physical sciences. Additional coursework is taken in the areas of biology, chemistry, physics and mathematics, providing the student with a broad scientific foundation suitable for careers in biotechnology, medicine, science-based research, health-related professions, chemical and molecular disciplines and advanced graduate studies.

Students can earn the BS in biological sciences alone, or with one of four emphases: chemistry, bioinformatics, health and medicine, or research and technology.

Learning Outcomes

Students who complete the bachelor of science in biological sciences will be able to:

- Integrate biological, chemical, physical and math principles to develop and carry out an independent research project.
- Communicate current scientific ideas effectively in both oral and written formats to a diverse audience.
- Think critically and quantitatively assess innovative, global research in a scientific discipline.

Degree Requirements

For information on the general requirements for a degree, see Baccalaureate Degree Requirements under the Academic Policies and Information section of this catalog.

- 64 credit hours core coursework
- 16 additional credit hours in BIOL or CHEM or PHYS at the 2000+ level
 - or Courses specific to the selected emphasis
- Applicable University Global Citizenship Program hours, with accommodations for the biological sciences BS
- Electives

Global Citizenship Program for Biological Sciences BS

Requirements are modified to allow BIOL 1550 to satisfy both a requirement of the major and also the GCP 'Physical and Natural World' requirement and to allow MATH 1610 to satisfy both a requirement of the major and the GCP 'Quantitative Literacy' requirement.

Curriculum

All of the degree options for the bachelor of science in biological sciences require the same 64 hours of core coursework as follows:

Core Courses (64 hours)

- BIOL 1550 Essentials of Biology I (4 hours)
and BIOL 1551 Essentials of Biology I: Lab (1 hour)
- BIOL 1560 Essentials of Biology II (4 hours)
and BIOL 1561 Essentials of Biology II: Lab (1 hour)
- BIOL 2010 Evolution (3 hours)
- BIOL 3050 Genetics (3 hours)
and BIOL 3051 Genetics: Lab (1 hour)

- BIOL 3080 Cell Biology (3 hours)
and BIOL 3081 Cell Biology: Lab (1 hour)
- BIOL 4400 Research Methods (3 hours)
- BIOL 4430 Senior Thesis for BS in Biological Sciences (4 hours)
- CHEM 1100 General Chemistry I (3 hours)
and CHEM 1101 General Chemistry I: Lab (1 hour)
- CHEM 1110 General Chemistry II (3 hours)
and CHEM 1111 General Chemistry II: Lab (1 hour)
- CHEM 2100 Organic Chemistry I (3 hours)
and CHEM 2101 Organic Chemistry I: Lab (1 hour)
- CHEM 2110 Organic Chemistry II (3 hours)
and CHEM 2111 Organic Chemistry II: Lab (1 hour)
- CHEM 3100 Biochemistry I (3 hours)
and CHEM 3101 Biochemistry I: Lab (1 hour)
- MATH 1610 Calculus I (5 hours)
- MATH 2200 Statistics (3 hours)
or STAT 3100 Inferential Statistics (3 hours)
or PSYC 2750 Introduction to Measurement and Statistics (3 hours)
- PHYS 2030 University Physics I (3 hours)
and PHYS 2031 University Physics I: Lab (1 hour)
- PHYS 2040 University Physics II (3 hours)
and PHYS 2041 University Physics II: Lab (1 hour)

BS in Biological Sciences (80 hours)

The general degree offers the greatest flexibility, allowing students to select 16 hours of electives from any of the department's 2000+ level BIOL or CHEM or PHYS courses in addition to the 64 credits of core coursework in biological sciences listed above. (Up to 3 credit hours of BIOL 4700/CHEM 4700/PHYS 4700 can be used toward these 16 credit hours.)

Emphasis in Chemistry (82 hours)

The emphasis in chemistry is designed for students who desire to further expand and deepen their knowledge in the field of chemistry. It is particularly well-suited for students who are interested in pharmaceuticals and for those pursuing laboratory positions or graduate studies in areas involving chemical techniques. This track requires additional coursework in mathematics and advanced chemistry courses, and the electives include biology courses that contain a significant chemical component. In addition, students pursuing the chemistry track are expected to develop a senior thesis research topic that has a significant chemical basis.

Emphasis-Specific Learning Outcomes

In addition to the general learning outcomes, students who complete the emphasis in chemistry will be able to:

- Explain the molecular structure of chemical substances and the connection between molecular structure and chemical behavior.

Degree Requirements for the Emphasis in Chemistry

In addition to the 64 credit hours of core coursework in biological sciences, the following courses are required for the emphasis in chemistry:

- CHEM 3110 Biochemistry II (3 hours)
and CHEM 3111 Biochemistry II: Lab (1 hour)
- MATH 1620 Calculus II (5 hours)
- Minimum of 9 credit hours of 3000+ level CHEM electives. (Up to 3 credit hours of CHEM 4700 can be used toward this emphasis.)

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Emphasis in Bioinformatics (79 hours)

The emphasis in bioinformatics prepares students with a diverse scientific foundation in biology, math and computer languages, to prepare students for careers in bioinformatics that use data analysis skills, such as: biotechnology, computational biology, academic research labs, medicinal chemistry, pharmaceuticals research, agriculture technology, personalized healthcare, or any biology-related field that involves data analysis.

Emphasis-Specific Learning Outcomes

In addition to the general learning outcomes, students who complete the emphasis in bioinformatics will be able to:

- Use computational and bioinformatics methods to analyze data for studying biological processes, and relate results back to core principles in biological sciences.

Degree Requirements for the Emphasis in Bioinformatics

- MATH 2200 is the required statistics courses in place of STAT 3100 or PSYC 2750

For students completing a dual degree in mathematics, or a minor in mathematics that incorporates MATH 1610 Calculus I and MATH 2200 Statistics, these courses will not be required for the BS in biological sciences with an emphasis in bioinformatics. If the student drops the mathematics major or minor, the courses will be required and counted toward the BS in biological sciences.

In addition to the 64 credit hours of core coursework in biological sciences, the following courses are required for the emphasis in bioinformatics:

- BIOL 2000 Bioinformatics (3 hours)
- COSC 1800 Python Programming (3 hours)
- CSIS 2500 Introduction to Data Science (3 hours)
- CSIS 3300 R Programming for Data Analytics (3 hours)

An additional 3 hours of any of the following electives:*

- 1500+ level COSC courses
- 2000+ level CSIS courses
- 1620+ level MATH electives

*Students planning to enter a graduate program in bioinformatics or a related field involving data analysis after graduation are encouraged to choose from the above courses to fulfill some free electives hours as well.

Emphasis in Health & Medicine (82 hours)

The emphasis in health and medicine is designed for students interested in a continuing education in any of the various medical fields, particularly those pursuing a pre-professional program like pre-med or pre-vet. It is meant primarily for students preparing for careers such as medical doctors, physician's assistants, dentists, veterinarians, chiropractors, physical therapists or athletic trainers. In addition to the science courses listed below, students entering health and medical fields are encouraged to take 4 semesters of a foreign language and 2 semesters of writing intensive courses.

Emphasis-Specific Learning Outcomes

In addition to the general learning outcomes, students who complete the emphasis in health and medicine will be able to:

- Analyze how sickness and disease at the molecular and cellular level affect the functioning of humans and animals.

Degree Requirements for the Emphasis in Health & Medicine

In addition to the 64 credit hours of core coursework in biological sciences, the following courses are required for the emphasis in health and medicine:

- BIOL 3010 Human Anatomy & Physiology I (3 hours) **and** BIOL 3011 Human Anatomy & Physiology I: Lab (1 hour)
- BIOL 3020 Human Anatomy & Physiology II (3 hours) **and** BIOL 3021 Human Anatomy & Physiology II: Lab (1 hour)
- CHEM 3110 Biochemistry II (3 hours) **and** CHEM 3111 Biochemistry II: Lab (1 hour)
- An additional 6 credit hours of 2000+ level BIOL, CHEM or PHYS electives. (Up to 3 credit hours of BIOL 4700/CHEM 4700/PHYS 4700 can be used toward these 6 credit hours.)

Emphasis in Research & Technology (84 hours)

The research and technology emphasis features upper-level courses that emphasize the variety of laboratory technologies, research methods, and data analysis techniques commonly encountered in a research environment. It is designed primarily for students pursuing a career path in: (a) commercial, academic or government research, (b) high-demand technical and laboratory positions and (c) graduate studies in advanced biology fields and related areas such as biochemistry and biophysics.

Emphasis-Specific Learning Outcomes

In addition to the general learning outcomes, students who complete the emphasis in research and technology will be able to:

- Analyze methods in research from current literature in biology.

Degree Requirements for the Emphasis in Research & Technology

In addition to the 64 credit hours of core coursework in biological sciences, the following courses are required for the emphasis in research and technology:

- BIOL 3900 Journal Club (3 hours)
- BIOL 4700 Independent Research in Biology I (2 hours) **or** CHEM 4700 Independent Research in Chemistry I (2 hours) **or** PHYS 4700 Independent Research in Physics I (2 hours)
- An additional 15 credit hours of 2000+ level BIOL, CHEM or PHYS electives. (Up to 3 credit hours of BIOL 4700/CHEM 4700/PHYS 4700 can be used toward these 15 credit hours.)

Dual Major Option: Psychological Science/ Biological Sciences

Students who wish to pursue a dual major in biological sciences and psychological science may do so. The two majors cannot be awarded separately or sequentially under this arrangement.

Degree Requirements

For information on the general requirements for a degree, see Baccalaureate Degree Requirements under the Academic Policies and Information section of this catalog. For information on the general requirements for dual degrees, see Dual Majors and Dual Degrees under the Academic Policies and Information section of this catalog.

- 117 required credit hours

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- Applicable University Global Citizenship Program hours, with accommodations*

*All students pursuing a dual degree will complete the Global Citizenship Program requirements of one of the programs. Students should review the GCP accommodations for each degree before making their selection of which GCP program to pursue.

Curriculum

- WRIT 1010 The Craft of College Writing (3 hours)
- PSYC 1100 Introduction to Psychology (3 hours)
- PSYC 1800 Careers in Psychology (1 hour)
- PSYC 2750 Introduction to Measurement and Statistics (3 hours)
- PSYC 2825 Introduction to Research Methods (3 hours)
- PSYC 2975 Sophomore Assessment (0 hours)
- PSYC 3025 Psychology and Ethics (2 hours)
- PSYC 4750 Advanced Statistics (3 hours)
- PSYC 4825 Senior Thesis (3 hours)
- PSYC 4925 Senior Capstone: History, Philosophy and Systems of Psychology (3 hours)
- PSYC 4950 Senior Assessment (0 hours)
- Psychology electives (*at least 3 hours at the 4000-level*) (6 hours)
- Psychology content areas (15 hours)
- BIOL 1550 Essentials of Biology I (4 hours)
and BIOL 1551 Essentials of Biology I: Lab (1 hour)
- BIOL 1560 Essentials of Biology II (4 hours)
and BIOL 1561 Essentials of Biology II: Lab (1 hour)
- BIOL 2010 Evolution (3 hours)
- BIOL 3010 Human Anatomy & Physiology I (3 hours)
and BIOL 3011 Human Anatomy & Physiology I: Lab (1 hour)
- BIOL 3020 Human Anatomy & Physiology II (3 hours)
and BIOL 3021 Human Anatomy & Physiology II: Lab (1 hour)
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- CHEM 2100 Organic Chemistry I (3 hours)
and CHEM 2101 Organic Chemistry I: Lab (1 hour)
- CHEM 2110 Organic Chemistry II (3 hours)
and CHEM 2111 Organic Chemistry II: Lab (1 hour)
- CHEM 3100 Biochemistry I (3 hours)
and CHEM 3101 Biochemistry I: Lab (1 hour)
- MATH 1610 Calculus I (5 hours)
- PHYS 2030 University Physics I (3 hours)
and PHYS 2031 University Physics I: Lab (1 hour)
- PHYS 2040 University Physics II (3 hours)
and PHYS 2041 University Physics II: Lab (1 hour)
- BIOL, CHEM or PHYS upper level electives (3 hours)