Biology BS

The B.S. degree in biology is designed to prepare students for basic technical positions and graduate studies in the life sciences. Candidates for the degree have the same core courses and general education requirements as those seeking the Bachelor of Arts degree, as well as additional requirements in depth of study, laboratory experience, communication skills, and background in associated science areas.

General Education Requirements

Students must satisfy the university and college general education requirements. Some Biology courses may be used to meet the science and mathematics requirement of the university.

Candidates for the B.A. degree must fulfill the foreign language requirement of the College of Arts and Sciences. There is no foreign language requirement for the B.S. degree.

Satisfactory/Unsatisfactory Option

Up to 18 credit hours may be taken on a satisfactory/ unsatisfactory (s/u) basis. Excluded from this option are required courses in biology, chemistry, physics, and mathematics.

Non-major Biology Courses

The following 1000 level biology courses do not count toward the biology credit hours required for a major in biology. Moreover, if biology majors take these courses, they are treated as biology courses when computing the 70 credit hours outside of biology needed to be included in the 120 total credit hours required for graduation.

Course Number	Title	Hours
BIOL 1012	General Biology: The Science of Life (MOTR BIOL 100)	3
BIOL 1013	General Biology Laboratory: The Science of Life	1
BIOL 1102	Human Biology (MOTR LIFS 150)	3
BIOL 1131	Human Physiology and Anatomy I	4
BIOL 1141	Human Physiology and Anatomy II	4
BIOL 1110	Nutrition in Health	3
BIOL 1150	Concepts in Health and Wellness	3
BIOL 1162	General Microbiology	3
BIOL 1202	Environmental Biology	3

Degree Requirements

The B.S. degree in biology is designed to prepare students for basic technical positions and graduate studies in the life sciences. Candidates for the degree have the same core courses and general education requirements as those seeking the Bachelor of Arts degree, as well as additional requirements in depth of study, laboratory experience, communication skills, and background in associated science areas. Candidates must have a cumulative grade point average of 2.0 or better in biology courses. Candidates must earn a minimum grade of C- in all core courses.

To fulfill the requirements for the B.S. the coursework below must be completed. A minimum of 22 hours of biology courses at or above the 2000 level, including two laboratory courses and one 4000 level course, must be taken in residence in the UMSL Department of Biology in order to receive a B.S. degree from the College of Arts and Sciences with a major in biology.

Lecture and Seminar Course Requirements

The following biology courses or their equivalents are required:

Course Number	Title	Hours
Core		
BIOL 1800	Introduction to the Biology Major	1
BIOL 1821	Introductory Biology: Organisms and the Environment (MOTR BIOL 150LEC)	5
BIOL 1831	Introductory Biology: From Molecules to Organisms	5
BIOL 2012	Genetics	3
BIOL 3302	Evolution	3
BIOL 3622	Cell Biology	3
Capstone		**2-3**
Select one of the following:		
BIOL 4889	Senior Seminar	
SEC ED 4985	Curriculum and Methods of Teaching Life Sciences	
Total Hours		**22-23**

Elective Courses

Five additional biology lecture courses at the 2000 level or higher are required. They may be selected from any of the lecture or lecture-laboratory courses offered. Selection of these courses should reflect the career interest of the student and may be selected from optional academic tracks (see below). CHEM 4712 can also be used toward satisfying this requirement.

At least two biology lecture courses taken as electives must be at the 4000 level or higher with at least one from the UMSL Department of Biology. No more than one of these higher-level courses can be used to fulfill other requirements (e.g. statistics requirement or biochemistry option).

Laboratory Course Requirements

Four biology laboratory courses at the 2000 level or higher are required. They may be selected from any of the lecture-laboratory or laboratory courses offered. Two credit hours of BIOL 3699, BIOL 4905, or BIOL 4915 (no combination of these courses allowed) can be used to fulfill one laboratory requirement. Students may take CHEM 4733 to satisfy one of these laboratory course requirements, but students may not use both BIOL 4713 and CHEM 4733 to fulfill this requirement.

Communication Skills

Courses in both formal speaking and writing are required for development of the basic communication skills needed to transmit scientific information.

Course Number	Title	Hours
Formal Speaking		
COMM 1040	Introduction to Public Speaking (MOTR COMM 110)	3

Writing		
ENGL 3160	Writing in the Sciences (strongly preferred)	3
or ENGL 3110		
Total Hours		**6**

Associated Science Areas

The following courses or their equivalents must be successfully completed:

Course Number	Title	Hours
PHYSICS 1011	Basic Physics I	3
PHYSICS 1011L	Basic Physics I Laboratory	1
PHYSICS 1012	Basic Physics II	3
PHYSICS 1012L	Basic Physics II Laboratory	1
CHEM 1111	Introductory Chemistry I (MOTR CHEM 150L)	5
CHEM 1121	Introductory Chemistry II	5
CHEM 2612	Organic Chemistry I	3
CHEM 2622	Organic Chemistry II	3
or BIOL 4732	Principles of Biochemistry	
CHEM 2223	Quantitative Analysis in Chemistry	3
or CHEM 2633	Organic Chemistry Laboratory	
MATH 1030	College Algebra (MOTR MATH 130)	3
MATH 1100	Basic Calculus	3-5
or MATH 1800	Analytic Geometry and Calculus I	
BIOL 4122	Biostatistics	3
or MATH 1320	Introduction to Probability and Statistics	
PHIL 2256	Bioethics	3
or PHIL 3380	Philosophy of Science	
Total Hours		**39-41**

Research Opportunity

Students in the B.S. Biology degree program who are interested in gaining research experience are encouraged to take a minimum of 2 credit hours of undergraduate research, BIOL 4905 The privilege of doing undergraduate research provides students with a first-hand opportunity to experience the research process under the supervision of a faculty member or off-campus scientist. The project normally includes a library search of pertinent literature, laboratory or field experience, and a summary paper and a presentation, all based on an average 8 hr. per week per credit hour for a 15 week semester.

Thesis in Biology Research and the Degree with Distinction

The Department of Biology offers high-achieving students the opportunity to present primary research in the form of a written thesis and to graduate with a Degree with Distinction in Biology. The first step in conducting an undergraduate thesis is to identify a faculty research mentor with whom you can conduct novel research. The mentor, along with two UMSL faculty members, will be readers of the thesis. Students need a minimum of two semesters, usually more, to conduct research. After students have identified a research mentor and have completed 75 credit hours, they may apply for a Degree with Distinction in Biology. The final thesis will be written in the form of a scientific manuscript and presented orally in an advertised public forum at least 6 weeks prior to commencement. The readers of the thesis will decide if the thesis merits a Degree with Distinction, and will report their recommendation to the Dean of Arts and Sciences. In addition to fulfilling the coursework required for a B.S. or B.A. in Biology and the thesis itself, students must also fulfill all the requirements for UMSL's Degree with Distinction.

Pre-professional Graduation

The Department of Biology sponsors a 3+4 Program for the UMSL College of Optometry.

In this program students may be admitted to the College of Optometry after completing three years (90 semester hours) of study in the Department of Biology. The undergraduate degree is granted when students satisfactorily complete the first year of optometry school. One or more of the following conditions must be met in order to qualify for the undergraduate degree. All general education requirements and all requirements for the major, except electives, must be completed. Any deficiency in required courses must be remedied with courses taken at UMSL within three years after entering the College of Optometry. Up to 6 hours from the College of Optometry may be substituted for undergraduate degree requirements, with approval of the Department of Biology.

UMSL – Logan College (3+3 program)

The Department of Biology has developed a 3+3 articulation agreement with Logan College of Chiropractic (LCC). This program enables qualified students the opportunity to complete a Bachelor of Science degree in Biology for the University of Missouri – St. Louis as well as a Doctor of Chiropractic for Logan College of Chiropractic in six years.

The program is only open to students who enter UMSL as first-time freshmen.

Participants must complete their first 90 hours of college work (3 years) at UMSL following a prescribed curriculum.

Participants who have achieved at least 3.25 GPA at UMSL will automatically be granted admission by Logan College of Chiropractic.

After successfully completing an additional 30 credit hours (4th year) at Logan, a student will receive a BS in Biology degree from UMSL.

After completing two additional years at Logan, the student will receive a doctorate in chiropractic

The acceptance of transfer credits or testing toward completion of degree requirements shall be governed by current policies of UMSL. However, no more than 20 credits of required courses, and NONE of the science credits required for admission to LCC may be earned via examination or transfer from another school

LCC shall accept, for the entrance date of their choice, all students who successfully complete the Pre-Chiropractic Program with a cumulative GPA of 3.25 or higher and meet all other criteria for admission

Students who earn less than a 3.25 GPA, but at least a 2.50 GPA, will be eligible for admission to LCC, and will receive appropriate consideration in the admission process for having completed the UMSL Pre-Chiropractic Program, but will not receive the assurance of a seat reserved for students earning a 3.25 or higher GPA

Students will make application to LCC one year in advance of their desired entrance date and will complete all required application procedures thereafter in a timely manner, including submission of recommendation and a satisfactory interview.

This program offers benefits to students (six years instead of seven from high school to doctorate). The University of Missouri courses are listed below:

Course Number	Title	Hours
General Education Requirements		
Humanities:		9
Select from General Education List		
Social Sciences (One course must be a Psychology):		9
Select from General Education List of courses meeting Social Science Gen. Ed requirements.		
American History & Government		3
MATH 1320	Introduction to Probability and Statistics	3
or BIOL 4122	Biostatistics	
ENGL 1100	First-Year Writing (MOTR ENGL 200)	3
ENGL 3160	Writing in the Sciences	3
Major		
Foundation courses:		
BIOL 1821	Introductory Biology: Organisms and the Environment (MOTR BIOL 150LEC)	5
BIOL 1831	Introductory Biology: From Molecules to Organisms (MOTR BIOL 150L)	5
BIOL 2012	Genetics	3
BIOL 2482	Microbiology	3
BIOL 3622	Cell Biology	3
BIOL 3302	Evolution	3
BIOL 4732	Principles of Biochemistry	3
BIOL 4889	Senior Seminar	2
PHYSICS 1011	Basic Physics I (MOTR PHYS 150L)	3
PHYSICS 1011L	Basic Physics I Laboratory	1
PHYSICS 1012	Basic Physics II	3
PHYSICS 1012L	Basic Physics II Laboratory	1
CHEM 1111	Introductory Chemistry I (MOTR CHEM 150L)	5
CHEM 1121	Introductory Chemistry II	5
CHEM 2612	Organic Chemistry I	3
CHEM 2622	Organic Chemistry II	3
CHEM 2633	Organic Chemistry Laboratory	2
PHIL 2256	Bioethics	3
MATH 1030	College Algebra (MOTR MATH 130)	3
MATH 1035	Trigonometry	2
MATH 1100	Basic Calculus	3-5
or MATH 1800	Analytic Geometry and Calculus I	
Total Hours		**94-96**

The remaining 30 hours to be taken at Logan include:

- Transfer Credits (34):
- Anatomy I / Lab (6)
- Spinal Anatomy / Lab (5)
- Biochemistry I / Lab (4)
- Histology / Cell Biology / Lab (5)
- Anatomy II / Lab (6)
- Neuroanatomy / Lab (5)
- Biochemistry II (4)
- Physiology I (4)
- Microbiology / Lab (4)

Learning Outcomes

Integrative Knowledge

Graduates will demonstrate a clear understanding of the overriding principles and theorems within and between the content areas of anatomy, botany, cytology, ecology, evolutionary biology, microbiology, physiology, and zoology. Specifically, graduates will demonstrate competency in the following areas:

- Structure and function of the basic biological units of living organisms
- Information flow, exchange and storage from parent to offspring or from parent cells to progeny cells.
- Pathways and transformations of energy and matter that govern metabolism
- Systems that govern interactions between organisms or between organisms and their environment
- Biodiversity at the genetic, organismal, community, and global scales
- Evolution, common ancestry, and changes to biological populations over successive generations.

Laboratory Skills
Scientists not only learn the results of others, they work in the lab to generate new knowledge. Graduates will demonstrate basic skills associated with performing laboratory experiments or field studies in biology following a broad introduction of commonly used equipment and procedures.

Critical Thinking Skills
Graduates will be able to formulate meaningful hypotheses, design experiments to test them, and evaluate data critically, including an appreciation of the potential sources of error associated with laboratory measurements and troubleshooting technical issues.

Scientific Literacy
Graduates will be able to identify the need for information, procure the information from relevant scientific literature publications and databases, and critically evaluate reliability, validity, accuracy, authority, timeliness, and point of view or bias.

Communication Skills
Scientists not only must be able to solve problems, they also must be able to communicate those solutions to others. Graduates of this program demonstrate how to present scientific concepts and information in a clear and accurate manner. Specifically, graduates will be able to write scientific reports and make effective oral presentations of their results and ideas.

Professional and Research Ethics
Graduates will honestly and objectively evaluate and report data in an ethical and legal manner to promote the values that are essential to scholarly work: trust, accountability, mutual respect, and fairness. By doing so, graduates will come to understand and respect the accepted standards of conduct associated with the scientific

profession regarding citation, use of privileged information, integrity of data, and authorship.

Sample Plan of Study

First Year

Fall	Hours	Spring	Hours
INTDSC 1003[1]	1	MATH 1035	2
BIOL 1800	1	BIOL 1821	5
ENGL 1100	3	CHEM 1111	5
MATH 1030	3	COMM 1040	3
CORE - US History and Government	3		
EXPLORE - Social Sciences	3		
	14		**15**

Second Year

Fall	Hours	Spring	Hours
BIOL 1831	5	BIOL 2012	3
CHEM 1121	5	BIOL 2013	2
MATH 1100	3	CHEM 2612	3
EXPLORE - Humanities and Fine Arts	3	MATH 1320	3
		EXPLORE - Social Sciences	3
	16		**14**

Third Year

Fall	Hours	Spring	Hours
BIOL 2000+ Biology Lecture Elective	3	BiOL 2000+ Biology Lecture Elective	3
BIOL 2000+ Biology Lab Elective	2	BIOL 2000+ Biology Lab Elective	2
BIOL 3622	3	BIOL 3302	3
CHEM 2622, BIOL 4732, or CHEM 4712	3	CHEM 2223	4
PHYSICS 1011	3	PHYSICS 1012	3
PHYSICS 1011L	1	PHYSICS 1012L	1
	15		**16**

Fourth Year

Fall	Hours	Spring	Hours
BIOL 2XXX+ Biology Lecture Elective	3	BIOL 4889	2
BIOL 2XXX+ Biology Lab Elective	2	BIOL 4XXX 4000-Level Biology Lecture Elective	3
BIOL 4000-level Lecture Course	3	ENGL 3160	3
EXPLORE - Humanities and Fine Arts	3	PHIL 2256 or 3380	3
EXPLORE - Humanities and Fine Arts	3	EXPLORE - Social Sciences	3
		Global Perspectives Requirement	3
	14		**17**

Total Hours: 121

[1] INTDSC 1003 is required only for first-time freshman and transfer students with less that 24 college credits.

Please Note: This plan is an example of what a four year plan could look like for a typical student. Placement exam scores in math as well as the completion of coursework may change the plan. It should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor each semester. All requirements are subject to change.

Academic Tracks within the Major of Biology

Biology majors may choose to focus their elective hours in a particular sub-discipline of biology, or academic track. These tracks are groups of departmental courses that fit within sub-disciplines of biology and are recommendations for students wanting to pursue careers in specific sub-disciplines. Academic tracks are NOT majors and are only intended to serve as guides for courses within a particular area of biology and are represented by current faculty expertise. Selecting an academic track does not prevent a student from taking courses in another track. Students should not expect to take all recommended courses for each academic track. Students may choose not to select an academic track. Currently, the Biology Department offers three academic tracks: Cell and Molecular Biology; Ecology, Evolution and Conservation Biology; and Pre-professional/Health Sciences.

Course Number	Title	Hours
Cell and Molecular Biology Track		
BIOL 2482	Microbiology	3
BIOL 2483	Microbiology Laboratory	2
BIOL 4442	Developmental Biology	3
BIOL 4550	Bacterial Pathogenesis	3
BIOL 4602	Molecular Biology	3
BIOL 4614	Biotechnology Laboratory I	4
BIOL 4615	Biotechnology Laboratory II	4
BIOL 4622	Cellular Basis of Cancer	3
BIOL 4632	Nucleic Acid Structure and Function	3
BIOL 4642	Plant Molecular Biology and Biotechnology	3
BIOL 4652	Virology	3
BIOL 4713	Techniques in Biochemistry	2
BIOL 4842	Immunology	3
Ecology, Evolution and Conservation Biology Track		
BIOL 2102	Ecology	3
BIOL 2103	Ecology Laboratory	2
BIOL 2402	Vertebrate Anatomy	3
BIOL 2403	Vertebrate Anatomy Laboratory	2
BIOL 2482	Microbiology	3
BIOL 2483	Microbiology Laboratory	2
BIOL 3102	Animal Behavior	3
BIOL 3103	Animal Behavior Laboratory	2
BIOL 3203	Conservation Biology Laboratory	2
BIOL 3802	Vertebrate Physiology	3
BIOL 3803	Vertebrate Physiology Lab	2
BIOL 4102	Behavioral Ecology	3
BIOL 4122	Biostatistics	3
BIOL 4182	Population Biology	3
BIOL 4299	Practicum in Conservation	2
BIOL 4402	Ornithology	3
BIOL 4403	Ornithology Laboratory	2
BIOL 4422	Entomology	3
BIOL 4423	Entomology Laboratory	2
Pre-professional/Health Sciences Track		
BIOL 2402	Vertebrate Anatomy	3
BIOL 2403	Vertebrate Anatomy Laboratory	2
BIOL 2482	Microbiology	3
BIOL 2483	Microbiology Laboratory	2
BIOL 3802	Vertebrate Physiology	3
BIOL 3803	Vertebrate Physiology Lab	2
BIOL 4442	Developmental Biology	3
BIOL 4550	Bacterial Pathogenesis	3
BIOL 4602	Molecular Biology	3
BIOL 4622	Cellular Basis of Cancer	3

BIOL 4652	Virology	3
BIOL 4732	Principles of Biochemistry	3
BIOL 4822	Principles of Neuroscience	3
BIOL 4842	Immunology	3

B.S. Ed. in Secondary Education with Emphasis in Biology

The B.S. Ed. is a professional education degree designed for students who wish to pursue a teaching career in secondary schools. Much of the discipline-specific coursework parallels the B.A. or B.S. degree in the discipline; however, the Missouri Department of Elementary and Secondary Education (DESE) requires specific coursework for teacher certification. Therefore, students interested in the B.S. Ed. should contact the advising office (OASIS) 314-516-5937 in the College of Education for discipline-specific requirements. *Note: To obtain teaching certification, DESE requires a 3.0 GPA in the discipline and professional education coursework, as well as a 2.75 GPA overall.*

B.A. or B.S. in Biology with Master's Level Coursework for Secondary Teacher Certification

In addition to the B.S. Ed., students may opt to complete a B.A. or B.S. degree in their discipline as an undergraduate, followed by admission to the Graduate School for Master's level teaching certification. The College of Education has a one-year accelerated program for post-graduate certification called Teach in 12, or students can choose a traditional path to certification. Graduate coursework for certification can apply towards a Master's Degree in Secondary Education, with additional coursework. Students interested in Master's Level teacher certification should contact the advising office (OASIS) 314-516-5937 in the College of Education. *Note: To obtain teaching certification, DESE requires a 3.0 GPA in the discipline and professional education coursework, as well as a 2.75 GPA overall.*