Biology BS

General Education Requirements

Students must satisfy the university and college general education requirements (http://bulletin.umsl.edu/generaleducationrequirements). 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.

BIOL 1012	General Biology (MOTR BIOL 100)	3
BIOL 1013	General Biology Laboratory	2
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 1162	General Microbiology	3
BIOL 1999	Evolution for Everyone	3
BIOL 1202	Environmental Biology	3

Declaring the Biology Major

Students seeking to major in biology are first designated as pre-biology majors until they have successfully completed Genetics, BIOL 2012, in residence with a grade of C or better. Students who have completed a Genetics course elsewhere will have to either pass a proficiency examination in Genetics or complete BIOL 2012 in residence with a grade of C or better. Students may then declare biology as their major. BIOL 2012 must be completed successfully within two attempts, including excused withdrawals.

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.

There is no foreign language requirement for the B.S. degree. However, students should realize that the literature for biological studies is in many different languages and the ability to extract information from this literature is an important skill.

To fulfill the requirements for the B.S. degree a minimum of 45 hours, but not more than 50 hours, must be completed in appropriate biology course work. A minimum of 22 hours at or above the 2000 level (including two laboratory courses) 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:

Core		
BIOL 1800	Introduction to the Biology Major	1
BIOL 1821	Introductory Biology: Organisms and the Environment (MOTR BIOL 150L)	5
BIOL 1831	Introductory Biology: From Molecules to Organisms (MOTR BIOL 150L)	5
BIOL 2012	Genetics	3
BIOL 3302	Introduction to Evolution	3
BIOL 3622	Cell Biology	3
Biological Diversity		3-5
Select one of the following diversity courses:		
BIOL 2102	General Ecology	
BIOL 2402	Vertebrate Anatomy	
BIOL 2482	Microbiology	
BIOL 2501	Biology of Plants	
BIOL 4402	Ornithology	
BIOL 4422	Entomology	
BIOL 4501	Flowering Plant Families: Phylogeny and Diversification	
Capstone		2-6
Select one of the following:		
BIOL 4889	Senior Seminar	
SEC ED 4985	Curriculum and Methods of Teaching Life Sciences	
Total Hours		25-31

Elective Courses

Four 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). Biology courses taken to fulfill basic skill requirements (e.g., statistics requirement or biochemistry option can be used to satisfy this requirement.

At least two biology lecture courses taken as electives must be at the 4000 level or higher. No more than one of these higher level courses can be used to fulfill other requirements (e.g., statistics requirement or biochemistry option). Biochemistry CHEM 4722 can also be used toward satisfying this requirement. BIOL 4905 or BIOL 4915 can be applied to the electives requirement but two 4000 level lecture courses are still required.

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.

Basic Skills Requirement

A well-rounded biologist needs certain skills outside the biology subject matter. The basic skills requirement is designed to provide the student with a background in communication skills and knowledge in associated science areas.

Communication Skills

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

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	Junior-Level Writing for International Students	
Total Hours		6

Associated Science Area

The following courses or their equivalents must be successfully completed:

PHYSICS 1011	Basic Physics I (MOTR PHYS 150L)	4
PHYSICS 1012	Basic Physics II	4
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 2223	Quantitative Analysis	3
MATH 1030	College Algebra (MOTR MATH 130)	3
MATH 1035	Trigonometry	2
MATH 1100	Basic Calculus	3
or MATH 1800	Analytic Geometry and Calculus I	
Select one of the following:		3-4
BIOL 4122	Biometry	
MATH 1310	Elementary Statistical Methods	
MATH 1320	Introduction to Probability and Statistics	
PHIL 2256	Bioethics	3
or PHIL 3380	Philosophy of Science	
Total Hours		41-42

Research Opportunity

Students in the B.S. Biology degree program who are interested in gaining research experience are encouraged to take a minimum 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 (http://bulletin.umsl.edu/undergraduatestudy/#academicrecognitiontext).

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:

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 1310	Elementary Statistical Methods	3
or MATH 1320	Introduction to Probability and Statistics	
or BIOL 4122	Biometry	
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 150L)	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 4712	Biochemistry	3
BIOL 4889	Senior Seminar	2
PHYSICS 1011	Basic Physics I	3
PHYSCIS 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)

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.

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 4612	Molecular Genetics of Bacteria	3
BIOL 4614	Biotechnology Laboratory I	4
BIOL 4615	Biotechnology Laboratory II	4
BIOL 4622	Cellular Basis of Disease	3
BIOL 4632	Nucleic Acid Structure and Function	3
BIOL 4642	Plant Molecular Biology and Biotechnology	3

BIOL 4652	Virology	3
BIOL 4712	Biochemistry	3
BIOL 4713	Techniques in Biochemistry	2
BIOL 4842	Immunobiology	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 2501	Biology of Plants	5
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	Biometry	3
BIOL 4182	Population Biology	3
BIOL 4192	Applications of Geographic Information Systems	5
BIOL 4222	Tropical Ecology and Conservation	3
BIOL 4245	Field 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
BIOL 4501	Flowering Plant Families: Phylogeny and Diversification	5
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 Disease	3
BIOL 4652	Virology	3
BIOL 4712	Biochemistry	3
BIOL 4822	Introduction to Neuroscience	3
BIOL 4842	Immunobiology	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.*

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

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.

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
CORE - Math Proficiency	3	COMM 1040	3
CORE - US History and Government	3		
EXPLORE - Social Studies	3		
	14		15

Second Year

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

Third Year

Fall	Hours	Spring	Hours
PHYSICS 1011	3	PHYSICS 1012	3
PHYSICS 1011L	1	PHYSICS 1012L	
BIOL 2000+ Lecture Course	3	BiOL 2000+ Level Lecture Course	3
BIOL 2000+ Lab Course	3	BIOL 2000+ Level Lab Course	2
BIOL 3302	3	CHEM 2223 or 2633	2-3
CHEM 2622, BIOL 4712, or CHEM 4712	3	EXPLORE - Humanities and Fine Arts	3
	16		13-14

Fourth Year

Fall	Hours	Spring	Hours
BIOL 3622	3	BIOL 4889	2
Biology Diversity Course	3	BIOL 4000+ level lecture course	3
Biology Lab Elective	2	ENGL 3160	3
BIOL 4000-level Lecture Course	3	Elective or minor	5
EXPLORE - Humanities and Fine Arts	3	PHIL 2256 or 3380	3
		Cultural Diversity Requirement	3
	14		19

Total Hours: 121-122

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