

# BS in Biological Sciences

## Degree Program Description

Biology is a broad field centered on the study of living organisms and processes. While the degree program requires general education courses in behavioral sciences, social sciences, and the humanities, students can specialize their curriculum through their course selections. The main difference between the BS degree and the BA degree is that the BS degree requires more credit hours in biology, chemistry, physics, and math than the BA degree. The curriculum for the BS degree currently has the option of completing a foreign language sequence or substituting one of two tracks for the foreign language requirement. Some of the knowledge that students acquire includes basic sciences necessary for upper-level biological science coursework (i.e., mathematics, statistics, physics, general and organic chemistry), how biologists use mathematical modeling and simulation to describe living systems, and arguments employed by scientists and others in key ethical controversies in biological science and research (for example, stem cell research). This degree is designed to prepare students for graduate study, professional schools, or direct entry into the workplace. Undergraduates majoring in biological sciences go on to careers in a wide range of fields, including medicine and other health professions, biotechnology, industry, government service, conservation and ecology, and secondary and higher education.

## Major Program Requirements

The following degree requirements must be completed in addition to University (<https://catalog.missouri.edu/academicdegreerequirements/universityrequirements/>), general education (<https://catalog.missouri.edu/academicdegreerequirements/generaleducationrequirements/>), and College of Arts and Science (<https://catalog.missouri.edu/collegeofartsandscience/#undergraduatetext>) requirements, students must also meet the following major program requirements. All major requirements in the College of Arts and Science must be completed with grades of C- or higher unless otherwise indicated.

## Requirements

Requirements for the BA and BS degrees with a major in Biological Sciences include course work in biology and related science departments (chemistry, physics and math). The BS degree program requires more extensive course work, with additional studies in biology and the related sciences. The BA degree program is more flexible and has fewer required courses to accommodate students with dual degrees or minors in other departments. Both degree programs can be used to prepare for graduate study or professional school. Students must also complete college and university graduation requirements, including university general education requirements.

All courses in the major (including related sciences) must be completed with a grade of C- or higher with a cumulative GPA of 2.0 or higher. (Satisfactory/Unsatisfactory grading is not acceptable for courses in the major.)

## Major Core Requirements Biology

BIO_SC 1500 or BIO_SC 1010 & BIO_SC 1020	Introduction to Biological Systems with Laboratory General Principles and Concepts of Biology and General Biology Laboratory
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or BIO_SC 1030	General Principles and Concepts of Biology with Laboratory	
or BIO_SC 1200	General Botany with Laboratory	
(BIO_SC 1030 is not offered at MU and is for crediting transfer courses only. Grade of B- or higher required for Bio Sci 1010/1020 & BIO_SC 1030)		
BIO_SC 1550	Introduction to Life Science Research	2
or GN_HON 2453H	Introduction to Research	
BIO_SC 2200	General Genetics	4
BIO_SC 2300	Introduction to Cell Biology	4
Evolutionary Biology (select from):		
BIO_SC 3400	Evolution and Ecology	
BIO_SC 4600	Evolution	
Biological Diversity (select from):		
MICROB 3200	Medical Microbiology and Immunology	
BIO_SC 3210	Plant Systematics	
BIO_SC 3240	Vertebrate Biology	
BIO_SC 3260	Invertebrate Zoology	
BIO_SC 3360	Herpetology	
BIO_SC 3510	Biology of Fungi	
BIO_SC 3710	Introductory Entomology	
BIO_SC 3750	General Microbiology	
F_W 2600	Ornithology	
F_W 2700	Ichthyology	
F_W 3660	Mammalogy	
Capstone course (select one) (complete in last 45 hours):		
BIO_SC 4950 & BIO_SC 4952	Undergraduate Research in Biology and Undergraduate Research in Biology	3-5
BIO_SC 4950H & BIO_SC 4952H	Honors Research in Biology and Honors Research in Biology	
BIO_SC 4972	Developmental Biology	
BIO_SC 4976	Molecular Biology	
BIO_SC 4978	Cancer Biology	
BIO_SC 4982	Human Inherited Diseases	
BIO_SC 4983	Molecular Ecology	
BIO_SC 4984	Mammalian Reproductive Biology	
BIO_SC 4988	Nerve Cells and Behavior	
BIO_SC 4990	Vertebrate Histology and Microscopic Anatomy	
BIO_SC 4994	Senior Seminar	
<b>Degree Requirements</b>		
<b>Related Science Requirements</b>		
Chemistry (all courses required)		
CHEM 1400 & CHEM 1401	College Chemistry I and College Chemistry I Laboratory	4
CHEM 1410 & CHEM 1411	College Chemistry II and College Chemistry II Laboratory	4
CHEM 2100	Organic Chemistry I	3
CHEM 2110	Organic Chemistry II	3
CHEM 2130	Organic Laboratory I	2
Physical Sciences (select one set of courses)		
PHYSICS 1210 & PHYSICS 1220	College Physics I and College Physics II	8
PHYSICS 2750 & PHYSICS 2760	University Physics I and University Physics II	10

Mathematical Sciences (select one calculus option and one statistics option) 5-6

MATH 1400 Calculus for Social and Life Sciences I 3-5

or MATH 1500 Analytic Geometry and Calculus I

STAT 1200 Introductory Statistical Reasoning 3

or STAT 2500 Introduction to Probability and Statistics I

No more than 5 credits of introductory coursework (BIO\_SC 1010, BIO\_SC 1020, BIO\_SC 1030, BIO\_SC 1100, BIO\_SC 1200, and BIO\_SC 1500) may be included in the major. At least 12 hours of biology coursework must be taken in residence at MU.

### Electives

All biology majors must take additional biology courses to total at least 33 credits for the BS degree, of which at least 16 credits must be at the 3000 level or higher.

Elective credits must be in formal courses numbered above 2000 and must include at least one 3000- or 4000-level laboratory course, one 4000-level course, and one WI course at the 3000- or 4000-level in a natural science. In addition to the biological diversity and capstone courses listed above, the following courses may be used as elective credit:

BIO\_SC 3002 Topics in Biological Sciences - Biological Sciences 1-3

BIO\_SC 3040 Eugenics Past, Present and Future: An Ugly Partnership Between Science and Society 3

BIO\_SC 3050 Genetics and Society 3

BIO\_SC 3060 Science and Society: Past, Present and Future 3

BIO\_SC 3075 The Human Microbiome 3

BIO\_SC 3210 Plant Systematics 4

BIO\_SC 3240 Vertebrate Biology 3

BIO\_SC 3260 Invertebrate Zoology 4

BIO\_SC 3360 Herpetology 3-4

BIO\_SC 3400 Evolution and Ecology 3

BIO\_SC 3510 Biology of Fungi 3

BIO\_SC 3650 General Ecology 5

BIO\_SC 3700 Human Physiology 5

BIO\_SC 3710 Introductory Entomology 3

& BIO\_SC 3715 and Insect Diversity 5

BIO\_SC 3760 Microbiology Laboratory 2

BIO\_SC 3780 Genetics Laboratory 2

BIO\_SC 4400 Plant Anatomy 4

BIO\_SC 4974 Molecular Biology Laboratory 3

BIO\_SC 4983 Molecular Ecology 4

BIO\_SC 4990 Vertebrate Histology and Microscopic Anatomy 5

F\_W 2600 Ornithology 5

F\_W 2700 Ichthyology 4

F\_W 3660 Mammalogy 4

BIO\_SC 3200 Medical Microbiology and Immunology 4

BIO_SC 4978	Cancer Biology	3
BIO_SC 4982	Human Inherited Diseases	3
BIO_SC 4983	Molecular Ecology	4
BIO_SC 4984	Mammalian Reproductive Biology	3
BIO_SC 4988	Nerve Cells and Behavior	3
BIO_SC 4990	Vertebrate Histology and Microscopic Anatomy	5
BIO_SC 4994	Senior Seminar	3
BIOCHM 4270	Biochemistry	3
BIOCHM 4272	Biochemistry	3
F_W 2600	Ornithology	5
F_W 2700	Ichthyology	4
F_W 3660	Mammalogy	4
MICROB 3200	Medical Microbiology and Immunology	4

List of 3000/4000 level lab courses.

BIO_SC 3210	Plant Systematics	4
BIO_SC 3260	Invertebrate Zoology	4
BIO_SC 3360	Herpetology	3-4
BIO_SC 3510	Biology of Fungi	3
BIO_SC 3650	General Ecology	5
BIO_SC 3700	Human Physiology	5
BIO_SC 3710	Introductory Entomology	5
& BIO_SC 3715	and Insect Diversity	5
BIO_SC 3760	Microbiology Laboratory	2
BIO_SC 3780	Genetics Laboratory	2
BIO_SC 4400	Plant Anatomy	4
BIO_SC 4974	Molecular Biology Laboratory	3
BIO_SC 4983	Molecular Ecology	4
BIO_SC 4990	Vertebrate Histology and Microscopic Anatomy	5
F_W 3660	Mammalogy	4

The following two courses satisfy the lab requirement if taken for 4 credit hours.

BIO_SC 3260	Invertebrate Zoology	4
BIO_SC 4640	Behavioral Biology	4
BIO_SC 4950	Undergraduate Research in Biology	1-3
or BIO_SC 4950H	Honors Research in Biology	

Students completing research courses (BIO\_SC 2950, BIO\_SC 4950, BIO\_SC 4950H, BIO\_SC 4952, or BIO\_SC 4952H) for 6 credits may apply 3 credits toward fulfillment of capstone or biology elective hours for the BS degree.

Students may repeat readings, internships, problems, or research courses for a total of 18 hours. Any credits remaining after 3 hours are used as a capstone or an elective in biology will be applied toward total hours to graduate. A maximum of 18 credit hours from the following courses (BIO\_SC 2940, BIO\_SC 2950, BIO\_SC 2960, BIO\_SC 2965H, BIO\_SC 4085, BIO\_SC 4950, BIO\_SC 4950H, BIO\_SC 4952 and BIO\_SC 4952H) can be counted toward graduation.

### Second Language Alternative (SLA) for students pursuing a BS degree in biological sciences

Students may opt to satisfy the second language requirement through alternative coursework consisting of at least 12 credits in courses numbered 2000 or above. These courses may not be used to satisfy other degree requirements. Students should confer with the Biology Advising Office to ensure that alternative courses meet departmental

requirements. All alternative courses must be approved by the Director of Undergraduate Studies.

**Second Language Alternative (choose one option)**
**Environmental and Conservation Biology**

AN_SCI 3213	Genetics of Agricultural Plants and Animals	3
AN_SCI 4323	Applied Livestock Genetics	3
AN_SCI 4324	Genomics of Plants and Animals	3
ANTHRO 4320	Ecological and Environmental Anthropology	3
ENV_SC 2600	Sustainability Foundations: An Introduction to Sustainability	3
ENV_SC 3400	Water Quality and Natural Resources Management	3
ENV_SC 4024	Foundations of Environmental Education	3
ENV_SC 4051	Environmental Art	3
ENV_SC 4100	Lake Ecology	3
ENV_SC 4200	Stream Ecology and Hydrology	3
ENV_SC 4320	Hydrologic and Water Quality Modeling	3
ENV_SC 4400	Environmental Law, Policy, and Justice	3
F_W 2900	Principles of Wildlife Management	4
F_W 3600	Introduction to Conservation Biology	3
F_W 4200	Urban Wildlife Conservation	3
F_W 4300	Fisheries Management	3
F_W 4600	Ecosystem Management	3
F_W 4650	Natural Resource Planning and Management	4
FOREST 2151	Dendrology	4
FOREST 4320	Forest Ecology	5
FOREST 4390	Watershed Management and Water Quality	3
GEOG 2610	Climate, Landforms and Vegetation: Introduction to Physical Geography	3
GEOG 2660	Environmental Geography	3
GEOG 3040	Introduction to Geographic Information Systems GIS	3
GEOG 3610	Physical Geography of the United States	3
GEOG 4620	Biogeography: Global Patterns of Life	3
GEOG 4810	Landscape Ecology and GIS Analysis I	3
HIST 4440	History of the American Environment	3
NAT_R 2325	Introduction to Geographic Information Systems	3
PHIL 2900	Environmental Ethics	3
PLNT_SCI 4500	Biology and Pathogenesis of Plant-Associated Microbes	4
SOIL 2100	Introduction to Soils	3
SOIL 2106	Soil Science Laboratory	2
SOIL 3290	Soils and the Environment	3
PRST 4260	Sustainable Tourism	3
<b>Medicine, Health and Society</b>		
ANTHRO 2050	Introduction to Biological Anthropology with Laboratory	5
ANTHRO 2500	Primate Anatomy and Evolution	3
ANTHRO 2580	Evolution of Human Sexuality	3
ANTHRO 3560	Plagues and Peoples	3
ANTHRO 4360	Medical Anthropology	3
ANTHRO 4540	Human Biological Variation	3

ANTHRO 4580	Evolutionary Medicine	3
ANTHRO 4890	Human Skeletal Identification and Analysis	5
BIOCHM 4272	Biochemistry	3
BIOMED 2110	Biomedical Terminology	3
CDS 2190	Medical Terminology	3
CHEM 2140	Organic Laboratory II	2
CHEM 2400	Fundamentals of Inorganic Chemistry with Lab	3
CHEM 3200	Quantitative Methods of Analysis with Lab	4
F_S 2172	Elements of Food Microbiology	3
F_S 4370	Food Microbiology	3
HIST 3550	Science and Medicine in Ancient and Medieval Europe	3
HLTH_SCI 2400	Contemporary Health Issues	3
HLTH_SCI 3800	Holistic Health Systems for the Health Professions	3
HLTH_SCI 3700	Health Care in the United States	3
HLTH_SCI 4430	Health Care Across the Lifespan	3
MICROB 4304	Immunology for Health Professions	3
MPP 4204	Medical Pharmacology	4
NEP 2222	Socio-Cultural Perspectives on Obesity	3
NEP 2340	Human Nutrition I	3
NEP 2380	Diet Therapy for Health Professionals	3
NEP 2450	Nutrition Throughout the Life Span	3
NEP 2460	Eating Disorders	3
NEP 3450	Activity Throughout the Lifespan	3
NEP 4400	Pathophysiology of Diseases Affecting Metabolic Health	3
PHIL 2440	Medical Ethics	3
PHIL 4400	The Nature of Scientific Inquiry: An Introduction to Philosophy of Science	3
P_HLTH 2200	Introduction to Public Health and Health Promotion	3
P_HLTH 3310	Social and Behavioral Health Theory and Practice	3
P_HLTH 4350	Principles of Environmental Health for Public Health	3
P_HLTH 4485	Ethics in Public Health	3
PSYCH 3830	Health Psychology	3
PTH_AS 2201	Human Anatomy Lecture	3
PTH_AS 2203	Human Anatomy Laboratory	2
PTH_AS 4220	Forensic Pathology and Death Investigation	2
SOCIOL 3440	Sociology of Health	3
WGST 2050	Gender and Public Health	3
WGST 4600	Women and Health	3
V_PBIO 3345	Fundamentals of Parasitology	3
V_PBIO 3551	Introduction to Immunology I	3
V_PBIO 3554	Introduction to Virology	3
V_PBIO 3600	Bacterial Genetics and Genomics	3
V_PBIO 3658	Public Health Microbiology	3

**Semester Plan**

NOTE: These plans are intended only as general guides. Courses outside Biology and Chemistry are provided only for illustrative purposes.

Advanced credit or exemption from the Foreign Language requirement and/or advanced credit in non-science courses, along with the interests of each individual student will determine a final combination of courses in each semester that is unique for each student. Note also that the sample schedules in Semester 5 and beyond are left incomplete on purpose because each schedule should be highly individualized at that point.

## Plan 1

### A student that is exempt from MATH 1100

First Year			
Fall	CR	Spring	CR
CHEM 1400		3 CHEM 1410	3
CHEM 1401		1 CHEM 1411	1
Bio 1550 or Gn Hon 2453H		2 BIO_SC 1500	5
Math 1400 or 1500, Related Science Requirements		3 ENGLSH 1000	3
Behavioral or Social Science		3 Humanities from Arts and Science	3
Int Disc 1001, SSC 1150, or elective		2	
		14	15

Second Year			
Fall	CR	Spring	CR
BIO_SC 2200		4 BIO_SC 2300	4
CHEM 2100		3 CHEM 2110	3
Stat 1200 or 2500, Related Science Requirements		3 CHEM 2130	2
Second Language or Language Alternative Requirement		3 Second Language or Language Alternative Requirement	3
Missouri State Law Requirement: Social Science from Arts and Science		3 Undergraduate research, second major, minor, certificate, or elective	3
		16	15

Third Year			
Fall	CR	Spring	CR
Biology Lab Requirement, 3000+ level	5		4
PHYSCS 1210		4 PHYSCS 1220	4
Behavioral or Social Science, 2000+ level		3 Humanities, 2000+ level	3
Second Language or Language Alternative Requirement		3 Second Language or Language Alternative Requirement	3
		Undergraduate research, second major, minor, certificate, or elective	1
		15	15

Fourth Year			
Fall	CR	Spring	CR
Biology Capstone		3 Bio 3400 or 4600, Evolutionary Biology Requirement	3
First Writing Intensive		3 Biology Elective, Second Writing Intensive	3
Humanities, 2000+ level		3 Undergraduate research, second major, minor, certificate, or elective	3
Undergraduate research, second major, minor, certificate, or elective		3 Second major, minor, certificate, or elective	3

Second major, minor, certificate, or elective	3 Second major, minor, certificate, or elective	3
	15	15

Total Credits: 120

## Plan 2

### A student that needs MATH 1100

First Year			
Fall	CR	Spring	CR
BIO_SC 1500		5 CHEM 1400	3
Math 1100: Math and Quantitative Reasoning		3 CHEM 1401	1
Behavioral or Social Science		3 Bio 1550 or Gn Hon 2453H	2
Missouri State Law		3 Math 1400 or 1500, Related Science Requirements	3
Requirement: Social Science from Arts and Science			
Int Disc 1001, SSC 1150, or elective		2 Humanities from Arts and Science	3
		Behavioral or Social Science, 2000+ level, Arts and Science Diversity Requirement	3
		16	15

Second Year			
Fall	CR	Spring	CR
BIO_SC 2200		4 BIO_SC 2300	4
CHEM 1410		3 CHEM 2100	3
CHEM 1411		1 ENGLSH 1000	3
Stat 1200 or 2500, Related Science Requirements		3 Humanities, 2000+ level	3
Second Language or Language Alternative Requirement		3 Second Language or Language Alternative Requirement	3
		14	16

Third Year			
Fall	CR	Spring	CR
Biology Lab Requirement, 3000+ level		5 Biological Diversity Requirement	4
CHEM 2110		3 PHYSCS 1210	4
CHEM 2130		2 Second Language or Language Alternative Requirement	3
Second Language or Language Alternative Requirement		3 First Writing Intensive	3
Undergraduate research, second major, minor, certificate, or elective		1	
		14	14

Fourth Year			
Fall	CR	Spring	CR
Biology Capstone		3 Bio 3400 or 4600, Evolutionary Biology Requirement	3
PHYSCS 1220		4 Biology Elective, Second Writing Intensive	3
Undergraduate research, second major, minor, certificate, or elective		3 Humanities, 2000+ level	3
Second major, minor, certificate, or elective		3 Undergraduate research, second major, minor, certificate, or elective	3

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Second major, minor, certificate, or elective	3
16	15

**Total Credits: 120**