BIOLOGY MAJOR

Overview

Program Overview

The undergraduate Biology curriculum begins with a core of courses that presents the fundamentals of the life sciences, both in concept and methodology. After completing the core, students take a distribution of upper division courses with at least one course in each of the three major areas of biology. This distribution strategy insures that all students have broad exposure to an extensive range of topics including cell and molecular biology, microbiology, genetics, plant biology, evolution, physiology, ecology, environmental biology, and animal behavior. The curriculum provides appropriate training for students seeking admission to professional and graduate schools and those who wish to enter the job market directly following graduation.

The faculty of the Department of Biology view teaching as the primary mission of both the Department and the University. In addition, Biology faculty are involved in high caliber scientific research. The interplay between teaching and research, and the involvement of students in faculty research strengthens the Biology curriculum. One of the most important qualities of the Department is the opportunity for undergraduates to participate in faculty research. This mentor-student relationship involves the design and execution of experiments, and is a very enriching learning experience. Students can work with faculty as volunteers, for academic credit, or for pay during the summer months. The research done by students often leads to publications and presentations at national and regional conferences. Whatever the career plans, students are encouraged to seriously consider participating in undergraduate research. Up to two semesters of research may be counted as biology electives.

The Department of Biology also has a small but strong graduate program that leads to either a MS or a MA degree in biology. The MA degree is primarily designed for post-graduates who are working or wishing to improve their credentials for professional school. The MS degree requires the development and presentation of a thesis based on original research. This degree is more appropriate for full-time students wishing to engage in research as part of a career or as a prelude to graduate training at the doctoral level. Students in the MS program may be eligible for a teaching assistantship that provides a tuition scholarship and stipend. The presence of diverse and engaged graduate students enhances both faculty research and the academic experience for undergraduate students.

Advisory Option - Biology Pre-Professional

Biology majors may satisfy entrance requirements for medical, dental, osteopathic medical, and other schools of the health professions. Students are advised to take elective courses in liberal arts and behavioral sciences.

Learning Goals and Outcomes

Learning Goals and Outcomes

Goal 1: Students will appreciate and understand cell structure and function, the organization of biological systems, and the evolution of biological diversity.

Outcome 1.1: Students will understand and be able to describe the mechanisms of evolutionary change and the diversity of life.

Outcome 1.2: Students will understand and be able to describe biochemical processes of living organisms and the role of macromolecules in these processes.

Outcome 1.3: Students will understand and be able to describe how organisms interact with their abiotic and biotic environment.

Outcome 1.4: Students will understand and be able to describe molecular, classical, and population genetics.

Goal 2: Students will develop skills in experimental design and the presentation of scientific information.

Outcome 2.1: Students will be able to design an experiment, operate basic laboratory equipment, reduce and present data that includes the interpretation of statistical tests.

Outcome 2.2: Students will be able to develop cogent written and oral presentations of scientific content.

Goal 3: Students will be exposed to career and professional development opportunities.

Requirements

The traditional undergraduate programs includes a minimum of 120 credits distributed across three components: A General Education component divided into Signature Courses, Variable Courses, and an Integrative Learning requirement; a Major and Divisional component; and Free Electives. In addition to course requirements as specified in each area, students must complete one certified course in each of the following overlay areas[1]:

1. *Diversity, Globalization or Non-western Area Studies,*
2. *Ethics Intensive*
3. *Writing Intensive, and*
4. *Diversity*

1

Overlay requirements are part of the 120 credit requirements

General Education Signature Courses

See this page about Signature courses (https://academiccatalog.sju.edu/curricula/#signature).

Code	Title	Hours
First Year Seminar Requirement		
BIO 150L	Bio I: Cells Lab Phage	0

Students can apply to take BIO 150L in place of the BIO 101L. The Phage Safari lab fulfills the First Year Seminar requirement in the signature core.

General Education Variable Courses

See this page about Variable courses (https://academiccatalog.sju.edu/curricula/#variable). Six to Nine courses

Code	Title	Hours
Mathematics		
MAT 155	Fundamentals of Calculus	3
		or
		4
or MAT 161	Calculus I	
Natural Science		
BIO 101 & 101L	Bio I: Cells and Bio I: Cells Lab	4
or BIO 150L	Bio I: Cells Lab Phage	

General Education Overlays

See this page about Overlays (https://academiccatalog.sju.edu/curricula/#overlay).

General Education Integrative Learning Component

See this page about Integrative Learning Component (https://academiccatalog.sju.edu/curricula/#integrative-learning). Three courses:

Code	Title	Hours
Chemistry		
CHM 125 & 125L	General Chemistry II and General Chemistry Lab II [1]	4
CHM 215 & 215L	Organic Chemistry II and Organic Chemistry Lab II [2]	4
Physics		
PHY 102 & 102L	General Physics II and General Physics Laboratory II [3]	4

1

CHM 120 and CHM 120L are pre-requisites for CHM 125

2

CHM 210 and CHM 210L are pre-requisites for CHM 215

3

PHY 101 and PHY 101L are pre-requisites for PHY 102

Note: Students with the appropriate Mathematics background and interests can substitute University Physics for General Physics.

GEP Electives

At least 18 credits. Biology majors may use CHM 120/120L, CHM 210/210L, and PHY 101/101L as free electives if they wish. This will allow them to take fewer courses. Alternatively, Biology majors can choose to take 5 courses each semester, and so have more free electives to use for a second major, minors, etc.

Major Requirements

At least 33 credits.

Code	Title	Hours
Biology		
BIO 102 & 102L	Bio II: Genetics and Bio II: Genetics Lab (second semester, freshman year)	4
or BIO 151L	Phage Lab	
BIO 201 & 201L	Bio III: Organismic Biology and Bio III: Organismic Biol Lab (first semester, sophomore year)	4
MAT 128	Applied Statistics	3
BIO 290	Career Development Seminar (required for first-semester sophomores)	0
BIO 390	Biology Seminar (required each semester for second-semester sophomores, juniors and seniors)	0
Select one from each of the following three groups: [1]		
Group A: Cell Structure and Function		
BIO 402	Advanced Cell Biology	4
BIO 411	Molecular Genetics	4
BIO 416	Microbiology	4
BIO 421	Molecular&Cellular Biophysics	4
BIO 424	Biotechnology	4
BIO 428	Histopathology	4
BIO 430	Neurological Disorders	4
Group B: Systemic Organization		
BIO 405	Biomechanics	4
BIO 412	Neurobiology	4
BIO 413	Plant Physiological Ecology	4
BIO 415	Immunology	4
BIO 417	Systemic Physiology	4
BIO 425	Bacterial Pathogenesis	4
Group C: Evolution and Diversity of Life		
BIO 372	Aquatic Biology	4
BIO 401	Animal Behavior	4
BIO 406	Comparative Anatomy	4
BIO 409	Ecology	4
BIO 419	Invertebrate Zoology	4
BIO 420	Bioinformatics	4
BIO 422	Applied&Environ Microbio	4
BIO 423	Evolution	4
BIO 426	Fermentation Science	4
BIO 429	Environmental Science	4
At least 13 additional credits of upper-level Biology courses. These credits can be from any of the courses in group A - C above, as well as in groups D and E, below. A maximum of 6 of these credits can be from group E courses.		
Group D courses [2]		
BIO 218	Hematology	3
BIO 230	Basic Concepts & Proc MLS	4
BIO 261	Anat&Physiol Nurs/Al Hlth II	4
BIO 348	Clinical Microbiology	4
BIO 433	Parasitology	3
Group E courses: Non-lab courses, maximum of 6 credits		
BIO 205	Introduction to Neuroscience	3
BIO 219	Basic Nutrition	3
BIO 220	Plant Diversity and Morphology	3
BIO 280	Comparative Animal Physiology	3
BIO 336	Plant Therapeutics	3
BIO 400	Developmental Genetics	3

BIO 404	Biochemistry [3]	3
BIO 434	Biology of Aging	3
BIO 436	Virology	3
BIO 455	Molecular Basis Neuro Disorder	3
BIO 474	Emrg Bio Threat & Glbl Sustain	3

1

BIO 101 (https://academiccatalog.sju.edu/search/?P=BIO%20101), BIO 102 (https://academiccatalog.sju.edu/search/?P=BIO%20102), BIO 201 (https://academiccatalog.sju.edu/search/?P=BIO%20201) and CHM 120 (https://academiccatalog.sju.edu/search/?P=CHM%20120), CHM 125 (https://academiccatalog.sju.edu/search/?P=CHM%20125) are prerequisite for all 400 level BIO courses.

2

One semester of BIO 493 or BIO 494 (Independent Research) and/or BIO 492 (Biology Internship) may count as one Group D biology elective. For students doing a year-long honors thesis, both BIO 493 and 494 may be counted as Group D biology electives. For non-honors research, the second semester of research will count as a free elective.

3

CHM 215/CHM 215L is a prerequisite or co-requisite for BIO 404

Concentrations

Biology Major Concentrations

Students majoring in Biology may elect to declare a single concentration within the major if they choose; however, please note that:

- Students are not required to declare a concentration.
- Students are not guaranteed a particular sequence of courses to ensure that they can complete a concentration.
- Pursuit of a concentration must be declared by the end of the drop-add period in the last semester of enrollment, but students wishing to declare a concentration are advised to plan ahead.
- Courses used to meet the concentration requirements may also be used to satisfy the A-B-C group requirements.
- Students may count one semester of appropriate independent research (BIO 493 or 494) or an internship (BIO 491 or 492) toward any concentration; decisions about whether research or internships can count will be made by the chair or designated faculty member.

Microbiology Concentration

Code	Title	Hours
Required:		
BIO 416	Microbiology	4
Three additional courses from the following:		
BIO 411	Molecular Genetics	4
BIO 422	Applied&Environ Microbio	4
BIO 424	Biotechnology	4
BIO 425	Bacterial Pathogenesis	4
BIO 426	Fermentation Science	4

Neurobiology Concentration

Code	Title	Hours
Required:		
BIO 412	Neurobiology	4
Three additional courses from the following:		
BIO 401	Animal Behavior	4
BIO 402	Advanced Cell Biology	4
BIO 411	Molecular Genetics	4
BIO 417	Systemic Physiology	4
BIO 430	Neurological Disorders	4

Ecology, Evolution & Behavior Concentration

Code	Title	Hours
Four courses from the following:		
BIO 401	Animal Behavior	4
BIO 406	Comparative Anatomy	4
BIO 409	Ecology	4
BIO 413	Plant Physiological Ecology	4
BIO 414	Plant Systematics	4
BIO 419	Invertebrate Zoology	4
BIO 422	Applied&Environ Microbio	4
BIO 423	Evolution	4
BIO 429	Environmental Science	4

Cell & Molecular Biology Concentration

Code	Title	Hours
Required (one of the following):		
BIO 402	Advanced Cell Biology	4
BIO 411	Molecular Genetics	4
Three additional courses from the following:		
BIO 402	Advanced Cell Biology	4
BIO 404	Biochemistry	3
BIO 411	Molecular Genetics	4
BIO 415	Immunology	4
BIO 416	Microbiology	4
BIO 420	Bioinformatics	4
BIO 424	Biotechnology	4
BIO 428	Histopathology	4

Biology/Secondary Education

Biology/Secondary Education

The Bachelor of Arts degree in Biology is for students who wish to pursue a dual major with Secondary Education. The B.A. degree is only available for students who pursue the dual major. Students who do not complete both majors will have to fulfill the requirements for the B.S. in Biology major instead.

Requirements for the B.A. in Biology In order to become certified to teach at the secondary education level (grades 7- 12), students must complete a total of five Education and three Special Education courses, as well as student teaching. Students interested in the five-year program should speak to their academic advisors and to Chair of the Department of Biology as early in their academic careers as possible.

General Education Signature Courses

See this page about Signature courses (https://academiccatalog.sju.edu/curricula/#signature).

Code	Title	Hours
First Year Seminar		
EDU 150	Schools in Society w/ Field	3

General Education Variable Courses

See this page about Variable courses (https://academiccatalog.sju.edu/curricula/#variable). Six to Nine courses

Code	Title	Hours
Mathematics		
MAT 155	Fundamentals of Calculus	3
		or
		4
or MAT 161	Calculus I	
Natural Science		
BIO 101 & 101L	Bio I: Cells and Bio I: Cells Lab	4
or BIO 150L	Bio I: Cells Lab Phage	
Social/Behavioral Science		
EDU 157	Adolescent Development w/Field	3

General Education Overlays

See this page about Overlays (https://academiccatalog.sju.edu/curricula/#overlay).

Code	Title	Hours
Diversity (class of '25 forward only)		
EDU 246	Language and Culture w/ Field	3
Diversity/Globalization/Non-Western Studies		
EDU 150	Schools in Society w/ Field	3
or EDU 160	Schools in Society w/ Field	
Ethics-Intensive		
SPE 160	Intro to Special Education	3
Writing-Intensive	Any writing-intensive certified course.	

General Education Integrative Learning Component

See this page about Integrative Learning Component (https://academiccatalog.sju.edu/curricula/#integrative-learning). Three courses:

Code	Title	Hours
The courses below fulfill the Integrative Learning Requirement		
SPE 160	Intro to Special Education	3
SPE 205	Inclusive Classrooms w/ Field	3
MAT 128	Applied Statistics	3

Code	Title	Hours
GEP Electives		
The number of Electives will vary. One hundred and twenty credits are required for graduation. Complete enough electives fulfill this requirement. Because of the double major, there is no minimum elective credit requirement.		

Code	Title	Hours
Biology Major Requirements		
Biology		
BIO 102	Bio II: Genetics	4
BIO 201	Bio III: Organismic Biology	4
Biology Seminars		
BIO 290	Career Development Seminar (Fall semester of sophomore year)	0
BIO 390	Biology Seminar (Every semester after BIO 290)	0
Choose one course from each of the following four groups: [1]		
Group 1		
BIO 400	Developmental Genetics	3
BIO 406	Comparative Anatomy	4
BIO 415	Immunology	4
BIO 417	Systemic Physiology	4
Group 2		
BIO 416	Microbiology	4
BIO 419	Invertebrate Zoology	4
BIO 422	Applied&Environ Microbio	4
BIO 372	Aquatic Biology	4
Group 3		
BIO 401	Animal Behavior	4
BIO 409	Ecology	4
BIO 423	Evolution	4
BIO 429	Environmental Science	4
Group 4		
BIO 220	Plant Diversity and Morphology	3
BIO 336	Plant Therapeutics	3
BIO 413	Plant Physiological Ecology	4
BIO 414	Plant Systematics	4
Chemistry		
CHM 120	General Chemistry I	3
CHM 125	General Chemistry II	3
CHM 210	Organic Chemistry I	3
Environmental Science		
ENV 106	Exploring the Earth	4
Physics		
PHY 101	General Physics I	3
PHY 102	General Physics II	3
Education Major Requirements		
EDU 157	Adolescent Development w/Field	3
EDU 246	Language and Culture w/ Field	3
EDU 247	Literacy in Cont Areas w/Field	3
EDU 418	Instr Techniq Science w/Field	3
EDU 491	Secondary Student Teaching	12
SPE 160	Intro to Special Education	3
SPE 205	Inclusive Classrooms w/ Field	3
SPE 320	Progress Monitoring w/ Field	3

1

BIO 101 (https://academiccatalog.sju.edu/search/?P=BIO%20101), BIO 102 (https://academiccatalog.sju.edu/search/?P=BIO%20102), BIO 201 (https://academiccatalog.sju.edu/search/?P=BIO%20201) and CHM 120 (https://academiccatalog.sju.edu/search/?P=CHM%20120), CHM 125 (https://academiccatalog.sju.edu/search/?P=CHM%20125) are prerequisite for all 400 level BIO courses.

5 year Program

Biology Five-year BS/MS or BS/MA

Students who are completing undergraduate degrees leading to the BS in Biology have the option to complete a combined BS/MS or BS/MA degree in five years (including the summer term after the fifth year). Students electing this option must apply to the graduate program in their senior year and be provisionally accepted before they complete the BS. (Students applying for the BS/MS program must have been accepted by a faculty mentor for the thesis portion of their work at the time of application.) They will be required to complete all the requirements for the normal MS or MA degree, with the following additions/exceptions:

- Students in the five year programs will have the option of taking up to nine credits of graduate courses that can count toward BOTH their undergraduate AND graduate degrees while they are still enrolled as undergraduates. The graduate courses will only count toward the graduate degree if they are not needed for the BS in Biology.
- Students in the five year programs will be expected to take at least three credits during the summer between their senior year and the fifth year. These credits may be for research or coursework.
- Students considering the five year programs should speak with their advisors and the graduate director as early as possible.