BIOLOGY

Interdepartmental Undergraduate Program

Iowa State University is a major center for research and education in the biological sciences. With over 200 faculty in the life sciences, students have the opportunity to learn from some of the nation's leaders in biological research and teaching and to participate in innovative, meaningful research projects that explore frontiers of biology. Few other universities have such a wealth of faculty expertise available to undergraduate students, making Iowa State's Biology Program the logical choice for those who want to participate in a thriving academic community.

The faculties of the Department of Ecology, Evolution, and Organismal Biology and the Department of Genetics, Development, and Cell Biology jointly offer the undergraduate biology major. This high-quality academic program has the flexibility to accommodate a range of career goals while taking advantage of the university's strengths in science and technology. A bachelor's degree in biology provides excellent preparation for graduate study in biological disciplines ranging from the molecular to the ecological levels, and for entrance into various professional schools, such as human medicine, physical therapy, or veterinary medicine. The major is well suited for those who plan to teach biology, who wish to enter government or industrial employment in health or environmental professions, or who prefer educational breadth as an end in itself. By working with our professional advisors, it is possible to design a unique program of study that will meet student needs and objectives.

Students with special interests and aptitudes should consider combining biology with a minor or a second major in another subject, such as chemistry, environmental studies, journalism, mathematics, music, statistics, or many other subjects offered by the university.

Customizing a Degree

Biology encompasses an amazing diversity of disciplines and scales of study ranging from molecules to the biosphere. The biology major offers a rich variety of coursework addressing most of the areas of biology. The major's curriculum requirements offer tremendous flexibility in creating an individualized program of study to facilitate achievement of a student's career goals, while simultaneously assuring some exposure to all areas of biology and providing complementary knowledge from supporting courses in chemistry, physics, and math/statistics.

While flexibility is the hallmark of the biology major, the breadth of the field can also be challenging. Thus, in an effort to provide more guidance to students who desire such, the major also provides six advising tracks, or areas of specialization, for students who wish to focus on subfields of biology or who have specific career goals in mind. Course plans for each area of specialization are listed on the biology web site. The areas are:

Pre-medical and Human Health Professions--This area emphasizes preparation for further study in medical school or allied human health professions such as dentistry, optometry, genetic counseling, physical therapy, occupational therapy, physician assistant, nursing, chiropractic, and others. It also will prepare students for a broad range of careers in the biological sciences. Students are urged to determine the specific entrance requirements for the professional schools where they might study and to plan a program of study accordingly, in addition to following the basic plan.

Pre-veterinary--An eventual degree in Veterinary Medicine can lead to a wide variety of careers, including private clinical practice in small animal medicine or agricultural animal production. But pre-veterinary students can also prepare themselves for careers in animal research, public health, laboratory animal medicine, food safety, regulatory medicine, and education. Specific requirements for entrance to the Iowa State Veterinary College or other schools should be consulted as programs of study are planned, in addition to following the basic plan.

Molecular and Cellular Biology--Students specializing in this field will explore the structure, function, and interactions of the molecules and sub-cellular features that make up living cells. This area is particularly designed for those who plan to pursue a career in research in molecular or cell biology or in related areas such as biochemistry, genetics, microbiology, developmental biology, human medicine, or veterinary medicine. Many students in this area will choose to go on to graduate school.

Ecology and Conservation Biology--Ecologists examine the interactions and relationships that living organisms have with each other and their environment. Conservation biologists study the nature and status of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from excessive rates of extinction and loss. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Evolution and Biodiversity--This area provides students with a sound understanding of evolutionary principles and the biological patterns that result from evolutionary change. Students have the opportunity to explore, in depth, the biodiversity found within a wide range of groups of organisms. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Teacher licensure--Biology majors seeking recommendation for licensure to teach biology in secondary schools must meet requirements of the Teacher Education Program as well as those of the Biology Program. In addition, they must apply formally for admission to the teacher education program. See the section on Teacher Education for a list of licensure areas, degree requirements, and other information about this program.

Other Opportunities

Undergraduate research--Students who have interests in biological research are encouraged to become involved in the research projects of faculty members on campus. Those doing so may receive credit for the experience in BIOL 4990 Undergraduate Research Experience. Making the effort to find a suitable research mentor and engaging in research work can be one of the most valuable experiences of an undergraduate education. Internship experiences are often available at other universities, zoos, museums, governmental and non-governmental entities focused on environmental issues, and industrial or government laboratories. Students participating in such projects may receive internship credit in BIOL 4940 Biology Internship.

Field trip courses – The Biology Program offers two field trip courses: BIOL 3930 (North American Field Trips in Biology) and BIOL 3940 (International Field Trips in Biology). In recent years field trip opportunities to Honduras and Spain have been available. These courses involve a pre-trip seminar followed by one-week to one-month long field trip at a time when academic year classes are not in session. The classes are low enrollment and allow extensive interaction between instructors and students in locations of biological interest.

International experience--Because major discoveries in science often result from global efforts, biology majors are encouraged to include an international or study abroad component in their degree programs. This can be done by participating in international field trips originating from the ISU campus in BIOL 3940 International Field Trips in Biology. In addition, many students choose to study abroad, attending a university in another country for up to a year as an exchange student. Minors in a foreign language can also add an international emphasis to a degree in biology.

Courses Offered at Other Locations

In addition to biological science courses taught on campus, students may take courses at various remote locations and arrange to have the credits count toward the advanced courses required in the biology major. Attending a summer field station adds an important component to an undergraduate program of study.

Gulf Coast Research Laboratory--The Gulf Coast Research Laboratory is affiliated with the University of Southern Mississippi. Iowa State students may register for marine biology courses and transfer credit to their degree programs under the number BIOL 4800 Studies in Marine Biology. Written permission of the Biology Program Director is required for this arrangement.

Summer Biological Field Stations--Courses taken at summer field stations may be transferred to Iowa State University as credit in BIOL 4810 Summer Field Studies. Such stations are found throughout the country and often offer courses that emphasize the adaptation of plants and animals to unique environments. See www.biology.iastate.edu (http://www.biology.iastate.edu/) for links to Iowa Lakeside Laboratory and other field stations in different biomes, e.g., marine/coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mts., etc.

Organization for Tropical Studies--Iowa State students may register for courses in tropical biology taught in Costa Rica by the Organization for Tropical Studies. Credit is transferred to Iowa State as BIOL 4820 Tropical Biology. For further information, contact the Biology Student Services Office in 103 Bessey Hall.

Student Learning Outcomes

Upon graduation, students should be able to:

- Explain and apply the core biological concepts of:
  - Evolution
  - Structure and function
  - Information flow, exchange, and storage
  - Pathways and transformations of energy and matter
  - How systems are interconnected and interact:
- Apply the process of science.
- Use quantitative reasoning.
- Use modeling and simulation.
- Utilize, communicate with, and collaborate with other disciplines.
- Understand the relationship between science and society.

Undergraduate Study

Biology majors start their studies in the biological sciences by taking a two-semester long Principles of Biology course sequence:

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1

During the first year, students also take BIOL 1100 Introduction to Biology and BIOL 1110 Opportunities in Biology, which are half-semester courses designed to introduce the student to the discipline of biology and opportunities for careers in biology. Students transferring into the biology major take BIOL 1120 in place of BIOL 1100 and BIOL 1110.

Students then explore, in any order depending on their interests, four upper-level core courses including: concepts of ecology in BIOL 3120; the principles of genetics in BIOL 3130 and BIOL 3130L; cell and molecular biology in BIOL 3140; and evolutionary biology in BIOL 3150. Biology majors must take an additional 21 credits of advanced biological science courses at the 3000 level, or above, from an approved list of courses. Many of these courses have as prerequisites BIOL 2110/L and BIOL 2120/L, so students do not need to complete the four upper-level core courses before taking advanced courses. Of these advanced courses, at least 9 credits must be taken as BIOL courses, and a minimum of two laboratory or field courses must also be included from an approved list.

Biology majors should carefully consider their selection of upper-level courses to allow them to emphasize one, or more, of the sub-disciplines of Biology relevant to their post-baccalaureate objectives. Most biology courses numbered 3000 or above can be used to satisfy the additional credit requirement. Some courses taught in other departments can also be applied to the biology major. Advanced students should consider including 5000 level courses in their programs. The Biology Program's web site has a complete listing of acceptable upper-level life science courses.

Biology majors must demonstrate competency in their understanding of the biological sciences. A 2.0 cumulative average is required in biology and advanced biology coursework. In order to graduate, a student must have a cumulative average in the major of at least 2.00.

General requirements

Students may earn the B.S. degree in Biology from either the College of Liberal Arts and Sciences or from the College of Agriculture and Life Sciences. Students in the College of Liberal Arts and Sciences must fulfill the College of Liberal Arts and Sciences (http://catalog.iastate.edu/collegeofliberalartsandsciences/#lascollegerequirementstext) and University-wide requirements (http://catalog.iastate.edu/collegescurricula/) for graduation in addition to those stated for the major. Students in the College of Agriculture and Life Sciences must meet University-wide requirements (http://catalog.iastate.edu/collegescurricula/) for graduation and requirements for that college. Contact the Student Services Office for details regarding differences in general education and course requirements that are specific to these colleges.

Supporting course requirements -- Understanding biology requires a basic understanding of the physical sciences and mathematics. Consequently, a minimum number of credits in general chemistry, organic chemistry, biochemistry, and physics is required. See the Biology Program Web Site for specific supporting science requirements.

The Math requirement is competency based. After demonstrating competency in algebra and trigonometry, biology majors must take two semesters of calculus; or two semesters of Statistics; or one semester of calculus and one semester of Statistics chosen from a list of approved courses available on the Biology Program Web Site and in the Biology Program Office.

Given the important role of communications in the modern sciences, biology majors must demonstrate communication competency by earning a minimum of C in ENGL 2500 Written, Oral, Visual, and Electronic Composition or equivalent composition courses and in one advanced writing course numbered ENGL 3020 through ENGL 3160, or JLMC 3470, or SPCM 2120. (Students in the College of Agriculture and Life Sciences are required to earn a C or better in ENGL 1500, as well.)

Curriculum in Biology

Administered by the Departments of Ecology, Evolution, and Organismal Biology; and Genetics, Development and Cell Biology. Students should consult the Biology Student Services Office, 103 Bessey (or biology@iastate.edu) for the appropriate course selections for professional or graduate school preparation.

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Biology: 23.5 cr.

2.00 GPA average required.

BIOL 1100	Biology Major Orientation	1
BIOL 1110	Opportunities in Biology	0.5
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3120	Ecology	4
BIOL 3130	Principles of Genetics	3
BIOL 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
BIOL 3150	Biological Evolution	3
Total Credits		**23.5**

Advanced Biology: 21 cr.

2.00 GPA average required. Must include two approved Advanced Biology labs. See the Biology Program website for list of approved Advanced Biology courses, or consult an advisor in the Biology Student Services office, 103 Bessey Hall.

Biology advanced courses (from approved list)	9
Additional approved biology advanced courses	12
Total Credits	**21**

Mathematical Sciences 7 cr.

Students in College of Agriculture and Life Sciences must have a Math and Statistics.

MATH 1600 or MATH 1650 and STAT 1010 or STAT 1040		
Or		
MATH 1650 & MATH 1660	Calculus I and Calculus II	8
Or		
STAT 1010 or STAT 1040 and STAT 3010		4-7

Physical Sciences

General Chemistry: 5 cr. minimum

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	5
Or		
CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 1780 & 1780L	General Chemistry II and Laboratory in College Chemistry II	4
Organic Chemistry: 4 cr. minimum		
CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4
Or		
CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I	4
Biochemistry: 3 cr.		
BBMB 3160	Principles of Biochemistry	3
Or		
BBMB 4040	Biochemistry I	3
Or		
BBMB 4200	Mammalian Biochemistry	3
Physics: 5 cr. minimum		
PHYS 1150 & 1150L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	5
Or		
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	5
PHYS 1320 & 1320L	General Physics II and General Physics II Laboratory	5

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication/Information Literacy

Students must earn a C or better in ENGL 2500 and the advanced communication course. Additionally, students in the College of Agriculture and Life Sciences must earn a C or better in ENGL 1500. Students should consult their advisor to discuss advanced communication course options other than SPCM 2120.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		**10**

Humanities and Social Sciences

Chosen from approved lists.

LAS - Biology	
Note: Students must have completed 3 years of a single world language or take 4-8 credits of university level world language.	
Humanities	12
Social Sciences	9
Career Preparation (LAS 2030)	1
Total Credits	**22**

Humanities and Social Sciences

Chosen from approved lists.

CALS - Biology	
Note: Students in CALS - Biology must take an approved speech course and an approved Math and Statistics course.	
Humanities	3
Social Sciences	3
Ethics	3
Total Credits	9

Biology, B.S. (College of Agriculture and Life Sciences)

The minimum number of credits required to graduate is 120. Students are required to take 21 credits in advanced biology of which 9 credits must be from the Biology Program (BIOL). At least two advanced courses must have a lab or field component.

General Sample Plan

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100	1	BIOL 2120	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110	0.5	BIOL 2120L	1		
BIOL 2110	3	Chemistry*	4		
BIOL 2110L	1	Social Science Choice	3		
CHEM 1630 or 1770*	4	Math/Stat Choice*	4		
CHEM 1630L or 1770L*	1				
ENGL 1500 or 2500	3				
LIB 1600	1				
	14.5		**15**		**0**

Sophomore

Fall	Credits	Spring	Credits
ENGL 2500 (or Elective)	3	BIOL 3130	3
BIOL 3140	3	BIOL 3130L	1
Chemistry or Elective*	3-4	Biochemistry*	3
Advanced Biology	3	Math/Stat Choice*	4
Humanities Choice	3	Elective Choice	3
	15-16		**14**

Junior

Fall	Credits	Spring	Credits
BIOL 3120	4	BIOL 3150	3
Advanced Biology	3	Advanced Biology with Lab	4
PHYS 1150 or 1310*	4	PHYS 1320 (or Elective)*	4
PHYS 1150L or 1310L*	1	PHYS 1320L (or Elective)*	1
Ethics Choice	3	U.S. Diversity	3
	15		**15**

Senior

Fall	Credits	Spring	Credits
Advanced Biology	4	Advanced Biology with Lab	4
International Perspectives	3	Advanced Biology	3
SPCM 2120 or COMST 2140	3	Minor or Electives	9
Minor or Electives	6		
	16		**16**

Total Credits: 120.5-121.5

* Students should meet with an academic advisor to determine the proper plans for chemistry, math and physics before selecting those options above.

Biology, B.S. (College of Agriculture and Life Sciences)

Pre-Medical Sample Plan

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100	1	BIOL 2120	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110	0.5	BIOL 2120L	1		
BIOL 2110	3	CHEM 1780	3		
BIOL 2110L	1	CHEM 1780L	1		
CHEM 1770	4	MATH 1600 or 1650	4		
CHEM 1770L	1	PSYCH 1010	3		
ENGL 1500 or 2500	3				
LIB 1600	1				
	14.5		**15**		**0**

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140	3	Advanced Biology Choice	3
CHEM 3310	3	BIOL 3130	3
CHEM 3310L	1	BIOL 3130L	1
ENGL 2500 (or Elective)	3	CHEM 3320	3
STAT 1040 or 1010	3-4	CHEM 3320L	1
FSHN 3670	1	Ethics Choice	3
		Elective	2
	14-15		**16**

Junior

Fall	Credits	Spring	Credits
BBMB 3160 or 4040	3	BBMB 4050 (Or Advanced Biology Choice)	3
BIOL 3500	4	BIOL 3350	3
SOC 1340	3	BIOL 3350L	1
PHYS 1310	4	US Diversity	3
PHYS 1310L	1	PHYS 1320	4
		PHYS 1320L	1
		Take MCAT in May or June	
		Submit application in June or July	
	15		**15**

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice	3	Advanced Biology Choice	3
SPCM 2120 or COMST 2140	3	BIOL 3150	3
BIOL 3120 (with lab)	4	Humanities Choice	3
International Perspectives	3	Elective	6
Elective	3		
	16		**15**

Total Credits: 120.5-121.5

Biology, B.S. (College of Agriculture and Life Sciences)

Pre-Physician Assistant Sample Plan

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100	1	BIOL 2120	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110	0.5	BIOL 2120L	1		
BIOL 2110	3	CHEM 1780	3		
BIOL 2110L	1	CHEM 1780L	1		
CHEM 1770	4	MATH 1600 or 1650	4		
CHEM 1770L	1	PSYCH 1010	3		
ENGL 1500	3				
LIB 1600	1				
	14.5		**15**		**0**

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140	3	Advanced Biology Choice	3
CHEM 2310	3	BIOL 3130	3
CHEM 2310L	1	BIOL 3130L	1
Or CHEM 3310 & CHEM 3310L		Elective	3
ENGL 2500 (or Elective)	3	International Perspectives + Humanities Choice	3
STAT 1040 or 1010	3-4	PSYCH 2300	3
FSHN 3670	1		
	14-15		**16**

Junior

Fall	Credits	Spring	Credits
BBMB 3160	3	Advanced Biology	3
BIOL 3120	4	BIOL 3350	3
BIOL 3500	4	BIOL 3350L	1
Elective	2	US Diversity + Ethics	3
PSYCH 4600	3	PHYS 1150/L or PHYS 1310/L	5
	16		**15**

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice	3	Advanced Biology Choice	3
Written Communication/ Speech	3	Elective	3
BIOL 3150	3	Elective	3
Elective	3	Elective	3
Elective	3	Elective	3
	15		**15**

Total Credits: 120.5-121.5

Biology, B.S. (College of Agriculture and Life Sciences)

Pre-Physical Therapy Sample Plan

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100	1	BIOL 2120	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	

BIOL 1110	0.5	BIOL 2120L	1	
BIOL 2110	3	CHEM 1780	3	
BIOL 2110L	1	CHEM 1780L	1	
CHEM 1770	4	MATH 1600 or 1650	4	
CHEM 1770L	1	PSYCH 1010	3	
ENGL 1500 or 2500	3			
LIB 1600	1			
	14.5		**15**	**0**

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140	3	Advanced Biology	3
CHEM 2310	3	BIOL 3130	3
CHEM 2310L	1	BIOL 3130L	1
ENGL 2500 (or Elective)	3	Elective	3
STAT 1010 or 1040	3-4	International Perspectives +Humanities Choice	3
FSHN 3670	1	Elective (Psych course recommended)	3
	14-15		**16**

Junior

Fall	Credits	Spring	Credits
BBMB 3160	3	Advanced Biology	3
US Diversity + Ethics	3	BIOL 3350	3
BIOL 3500	4	BIOL 3350L	1
PHYS 1310	4	Elective	3
PHYS 1310L	1	PHYS 1320	4
		PHYS 1320L	1
	15		**15**

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice	3	Advanced Biology Choice	3
SPCM 2120 or COMST 2140	3	Elective	3
BIOL 3120 (with lab)	4	BIOL 3150	3
Elective	3	Elective	3
Elective	3	Elective	3
	16		**15**

Total Credits: 120.5-121.5

Minor

A minor in Biology is offered by the Biology Program. The minor requires 15 credits in Biology and includes the completion of the specific courses listed below and 7 credits in biology courses numbered 3000 or above. Nine (9) credits of the required courses must apply only to the minor. For more information, see the Biology Program web site or contact the Student Services Office in 103 Bessey Hall.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
Total Credits		**8**

Graduate Programs

Biology is an undergraduate major only. Persons interested in graduate study in the biological sciences should apply directly to one of the life science graduate programs at Iowa State University.

Programs

- Bioinformatics and Computational Biology
- Ecology and Evolutionary Biology
- Genetics
- Molecular Cellular and Developmental Biology
- Neuroscience
- Plant Biology
- Toxicology
- Immunobiology
- Environmental Science

Interdisciplinary Graduate Studies

A non-thesis master's degree in Interdisciplinary Graduate Studies (biological sciences) has been established particularly for those who wish to have a more diversified program of advanced study than that generally permitted by specific departments and programs.