

# BIOLOGY, B.S./M.S.

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**Degrees offered:** Bachelor of Science, Master of Science, Undergraduate Minor

The bachelor of science degree is designed to build a strong foundation in the skills and content of modern biology, improve students' learning skills, and aid students in applying problem-solving skills to scientific and public issues. It is the first professional degree in the discipline and prepares students for careers in biological sciences and/or further training, including Ph.D. programs and professional schools. The degree offers a balanced biology curriculum and a research experience centered around faculty research interests in molecular, cellular, and organismal biology.

A central emphasis of the biology program is mastery of scientific skills and knowledge. Scientific facilities available to students include a new, well-equipped building with research laboratories. Both undergraduate and graduate students use these facilities under the supervision of faculty.

The foundational B.S. and the more-specialized M.S. curricula prepare biology students for many career options, including technicians, scientific sales representatives, project managers in life science and allied health professions, and teachers at the secondary, community college, and university levels. Recent biology graduates have successfully continued their careers in research, medicine, dentistry, and veterinary medicine.

**Contact:** Information about the biology program is available at (217) 206-6630. Information can also be requested at [bio@uis.edu](mailto:bio@uis.edu), or visit the website at [www.uis.edu/~biology](http://www.uis.edu/~biology).

## THE BACHELOR'S DEGREE ENTRANCE REQUIREMENTS

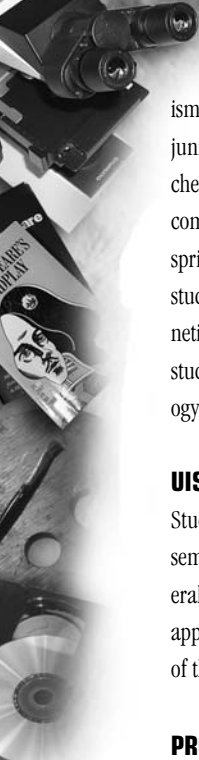
Students entering the program must have completed eight to ten semester hours in general chemistry with laboratory, five to eight semester hours of biology

courses (including general biology with laboratory), and college algebra. Before graduation, a student must complete one semester of organic chemistry with laboratory, which may be taken before or after the student has entered the biology program. During the two years at UIS, up to 12 semester hours of approved lower-division courses may be transferred from an accredited institution of higher education to make up deficiencies.

## ADVISING

Students should consult a program faculty member before initial registration. If this is not possible, students must contact a program representative at registration. During the first semester at UIS, the program will assist the student in selecting an adviser from among the biology faculty.

The student should prepare a plan to ensure that all requirements are being met. The program recommends that students take the general seminar, organ-



ismal botany, and organic chemistry in the fall of their junior year. Students are expected to complete organic chemistry before taking cell biology. Cell biology and comparative vertebrate biology are usually taken in the spring of the junior year. In the fall of the senior year, students typically take ecology and microbiology. Genetics is used as the capstone course. It is assumed that students will have completed most of the required biology sequence before enrolling in this course.

### UIS REQUIREMENTS

Students are required to complete a minimum of 12 semester hours of UIS requirements in the areas of liberal studies colloquia, public affairs colloquia, and applied study. At least four hours in each of at least two of these areas must be completed.

### PROGRAM REQUIREMENTS

#### Core Requirements

BIO 301	General Seminar (suggested fall, junior year)	2 Hrs.
CHE 322	Laboratory Techniques (suggested fall/spring, junior year)	1 Hr.
BIO 311	Cell Biology (suggested spring, junior year)	4 Hrs.

BIO 345 & 346	General Microbiology/Lab (suggested fall, senior year)	4 Hrs.
BIO 351	Organismal Botany (suggested fall, junior year)	4 Hrs.
BIO 361	Comparative Vertebrate Biology (suggested spring, junior year)	4 Hrs.
BIO 371	Principles of Ecology (suggested fall, senior year)	4 Hrs.
BIO 381	Genetics (suggested spring, senior year)	4 Hrs.
	Biology elective (suggested senior year)	<u>4 Hrs.</u>
	<b>Total Biology</b>	<b>31 Hrs.</b>

#### Other Possible Requirements

CHE 367	Fundamental Organic Reactions (suggested fall, junior year)	3 Hrs.
CHE 368	Experimental Organic Chemistry (suggested fall, junior year)	1 Hr.

One semester of organic chemistry is a prerequisite for some biology core courses. Transfer students with credit equivalent to CHE 367 and 368 can substitute general electives.

<b>*General Electives</b>	<u>13-17 Hrs.</u>
<b>Total</b>	<b>17 Hrs.</b>

<b>UIS Requirements</b>	<u>12 Hrs.</u>
<b>Total</b>	<b>60 Hrs.</b>

\*Pre-professional students and students planning to go to graduate school should take a year of physics with laboratory.

### ASSESSMENT

The biology program assesses all students for communication skills and for knowledge of biology. This assessment begins when students enter UIS and continues until graduation. Assessment tools include a written evaluation and the development of a portfolio of laboratory reports and papers. The written evaluation is given both at the beginning of a student's study at UIS and just before graduation. This assessment is intended to help students in their academic planning and to help the program in curriculum development.

Assessment in the major and in general education skills is included in BIO 301 General Seminar, a required course for all biology majors that uses the learning skills assessment scores to assist the student in developing specific learning skills in biology. Students in general seminar must earn at least a C to receive credit. Those performing below this level are required

to complete a learning skills development program.

### APPLIED STUDY

Students can gain practical professional experience by participating in an applied study term. Placements have included state agencies such as the Illinois State Museum, Illinois Environmental Protection Agency, Illinois Department of Transportation, SIU School of Medicine, and Lincoln Memorial Gardens. Students may also conduct research with biology faculty members for their AST.

### UNDERGRADUATE HONORS IN BIOLOGY

Biology majors with a GPA greater than 3.25 and one semester residency at UIS may elect to participate in the biology honors option. In addition to biology program and UIS requirements, honors students must maintain a minimum GPA of 3.25, successfully complete BIO 302 Honors Seminar, BIO 402 Biometrics, BIO 400 Undergraduate Research (4 hours), and present their findings in a formal paper and public seminar. Students must apply for participation in the honors program to the program convener and obtain the approval of their faculty research adviser before beginning the program.

## BIOLOGY MINOR

A minor in biology is designed for students who wish to increase their knowledge of biology, increase their biological literacy, and acquire a foundation in biological sciences and critical thinking. Students may plan a broad-based minor, containing courses from each of the major organizational divisions of living things: cells, organisms, and communities. The minor may also focus on a particular aspect of biology such as botany, ecology, or physiology.

To earn a minor in biology, students must complete a minimum of 24 hours in biology, of which at least eight hours must be upper-division courses taken at the University of Illinois at Springfield. Electives should be selected in consultation with a biology faculty member. Some upper-division courses have particular prerequisites other than general biology. The faculty adviser will ensure that each student is properly prepared.

### Core Courses

Two semesters of general biology with laboratory or its equivalent  
Elective Courses  
(A minimum of eight hours in biology

8 Hrs.

must be taken at the University of Illinois  
at Springfield)

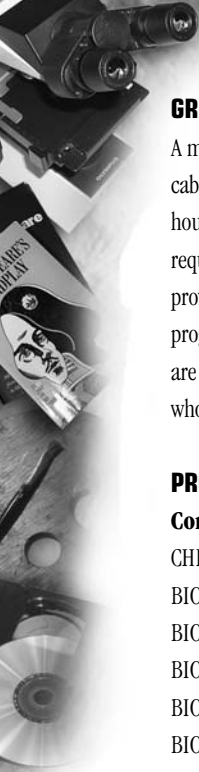
16 Hrs.

Total 24 Hrs.

## THE MASTER'S DEGREE ENTRANCE REQUIREMENTS

Applicants are expected to have completed a program of study similar to that required for a bachelor of science in biology at UIS. They are also expected to have a GPA of 3.00 on a 4.00 scale and to submit a letter of application that discusses academic and vocational goals, as well as GRE scores in both the general and biological sciences. Conditional admission may be granted to students who have not completed their GRE examinations or who have deficiencies in their academic backgrounds.

Accepted students will be assigned to an initial academic adviser who may change as a research focus is decided. Before the completion of 10 hours of program-approved course work, each student must develop a thesis proposal and convene an advisory committee with the assistance of a faculty adviser. See the *Biology Graduate Student Handbook* for additional information and procedures for the M.S. experience.



## GRADING POLICY

A maximum of eight credit hours of C grades are applicable to the degree, provided they are balanced by eight hours of A. However, C grades will not be accepted for required courses, and C grades taken in program-approved elective courses must be balanced by A grades in program-approved courses only. Master's candidates are expected to maintain a B average, and those students who fall below that level may lose their candidacy.

## PROGRAM REQUIREMENTS

### Core Requirements

CHE 415 Biochemistry I (or equivalent)	4 Hrs.
BIO 402 Biometrics (or equivalent)	4 Hrs.
BIO 502 Biological Research and Policy I	2 Hrs.
BIO 503 Biological Research and Policy II	2 Hrs.
BIO 551 Advanced Cell Biology <i>or</i>	
BIO 561 Advanced Microbiology <i>or</i>	
BIO 571 Advanced Ecology	<u>4 Hrs.</u>
Total	16 Hrs.

### Thesis Option

BIO 585 Master's Thesis	8 Hrs.
Biology approved electives	<u>12 Hrs.</u>
Total	36 Hrs.

## Project Option

BIO 575 Master's Project	4 Hrs.
Biology approved electives	<u>16 Hrs.</u>
Total	36 Hrs.

BIO 502 and 503 must be taken within the first 10 hours of graduate work, and BIO 402 must be completed before the project or thesis proposal is approved.

## MASTER'S CLOSURE

The closure activity is an oral presentation – open to faculty, students, and guests – of the written master's project or thesis. Each thesis/project begins with a proposal approved by the student's master's committee, who will determine if the project/thesis meets the standards of the profession. Students must enroll for either four hours of credit for the master's project (BIO 575) or eight hours of credit for the master's thesis (BIO 585); however, the total may be accrued in increments of one hour for the project and two hours for the thesis. Campus policy requires that students be enrolled in at least one semester hour of closure exercise credit for *each* semester after they have begun their graduate closure exercises until the exercise is com-

pleted. For biology students, this means that if the project is not completed by the end of four credit hours of continuing enrollment in BIO 575, students must register to audit the course for one hour in all subsequent semesters until the project is complete. Likewise, if the thesis is not completed by the time eight hours in BIO 585 is accrued in continuing enrollment, the student must enroll for one hour of audit credit in BIO 585 in each semester until the thesis is complete. Additional information and procedures for completing the master's closure exercise are available in the *Biology Graduate Student Handbook* in the program office.

## COURSE DESCRIPTIONS

### BIO 301 General Seminar (2 Hrs.)

Development of learning skills following self-assessment. Mastery of library skills and ability to organize material are demonstrated by a paper on a topic of interest and a seminar based on the paper. Recommended for fall of junior year. See CHE 301. Prerequisite: Chemistry or biology major.

### BIO 302 Honors Seminar (1 Hr.)

Integrative seminar to share research methods and experiences and analyze procedures and protocols in research.

**BIO 305 Plants and Society (2 or 4 Hrs.)**

Course available online; may also be available on campus. Refer to the current course schedule for further information.

Lecture and laboratory experiences about plants as used by people and the importance of plants in human affairs. Includes an overview of the fundamentals of life and flowering plant form, function, and reproduction. Plant products such as fruits, grains, legumes, medicines, herbs and spices, drinks, textile fibers, lumber, poisonous and psychoactive plants, and forages are studied. The two-hour option is a non-laboratory science course for non-science majors. The four-hour option is a laboratory science course for non-science majors.

**BIO 306 Environmental Biology (2 or 4 Hrs.)**

Introduction to basic ecological concepts and relationships that tie our biotic and abiotic worlds together as they relate to today's threats to our biosphere. Provides non-science majors with a review of the major principles of ecology to broaden their expertise. The two-hour option is a non-laboratory science course for non-science majors. The four-hour option is a laboratory science course for non-science majors.

**BIO 311 Cell Biology (4 Hrs.)**

Molecular basis of structure and function of cells, with an emphasis on the mechanisms of biological processes. Laboratory integrates study of cellular processes with introduction to current research techniques and instrumentation. Prerequisite: Organic chemistry. Recommended spring of junior year.

**BIO 345 General Microbiology (3 Hrs.)**

Discussion of basic topics in microbial physiology, genetics, and ecology, along with an introduction to virology, immunology, and applied microbiology. Prerequisite: Concurrent enrollment in organic chemistry. Recommended fall of senior year.

**BIO 346 General Microbiology Laboratory (1 Hr.)**

Application of basic microbiological techniques to the identification and classification of microorganisms. Introduction and application of molecular genetic and immunological techniques to the study of various aspects of microbial physiology and ecology.

**BIO 347 Medical Bacteriology (4 Hrs.)**

Concise overview of pathogenic bacteriology. Includes discussion of techniques for culturing and identifying bacteria and an introduction to epidemiology. Prerequisite: BIO 345, or equivalent. Required of clinical laboratory science students. Offered fall semester.

**BIO 351 Organismal Botany (4 Hrs.)**

Development of "higher" plants from seed to seed considering both the structure and function of plants. Consideration of principles of plant systematics using representatives from both the plant and fungus kingdoms as examples. Recommended fall of junior year.

**BIO 361 Comparative Vertebrate Biology (4 Hrs.)**

Comparative study of the evolutionary origins, embry-

ological development, and functional anatomy of the various classes of vertebrates. Interrelatedness of form and function is stressed in both lecture and laboratory. Recommended spring of junior year.

**BIO 371 Principles of Ecology (4 Hrs.)**

Structure and function of ecological systems including basic ecological principles and concepts. Applicable to individuals, populations, communities, and ecosystems. Laboratory involves outdoor and lab experiments. Recommended fall of senior year.

**BIO 381 Genetics (4 Hrs.)**

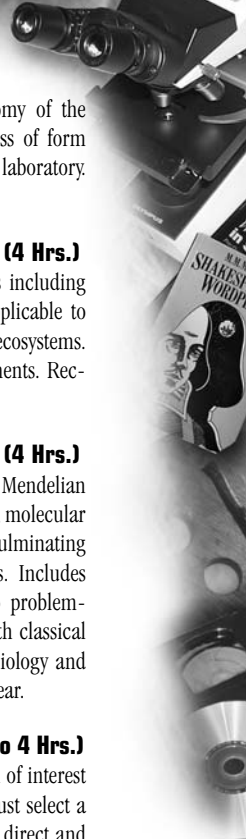
Studies a range of topics including classical Mendelian analysis, chromosome structure and mapping, molecular genetics and recombinant DNA technology, culminating with an introduction to population genetics. Includes laboratory sessions to introduce students to problem-solving situations using the techniques of both classical and molecular genetics. Prerequisite: Microbiology and cell biology. Recommended spring of senior year.

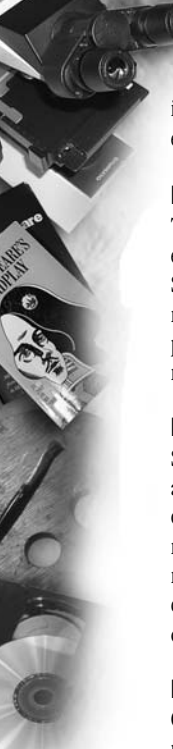
**BIO 400 Undergraduate Research (1 to 4 Hrs.)**

Independent investigation of specific problem of interest to the student. Before enrolling, a student must select a faculty member from the biology program to direct and review the project. Research paper, formal seminar, or both may be required for credit. Maximum of four semester hours may be earned. Offered each semester.

**BIO 402 Biometrics (4 Hrs.)**

Statistical analytical tools in biology and their application





in developing strategies for experimental procedures and evaluation of results. Introduction to statistics software.

**BIO 422 Electron Microscopy (4 Hrs.)**

Theory and procedures of electron microscopy integrated with an understanding of ultrastructural morphology. Students develop competencies within three broad areas: material preparation, instrumentation, and information processing in both transmission and scanning electron microscopy. Emphasis on laboratory experience.

**BIO 429 Human Physiology (4 Hrs.)**

Systems approach to understanding fundamental mechanisms of human physiology with emphasis on homeostasis: in-depth discussion of membranes and cellular mechanisms; nervous system; muscle; cardiovascular, renal, respiratory, and digestive physiology; and endocrine regulatory mechanisms. Prerequisite: Prior chemistry required; anatomy recommended.

**BIO 435 Invertebrate Biology (4 Hrs.)**

Comprehensive study of major and minor invertebrate phyla. Emphasis on morphology and adaptations, evolutionary relationships among groups. Laboratory includes field collections and study of specimens.

**BIO 439 Comparative Physiology (4 Hrs.)**

Study of fundamental physiological mechanisms characteristic of the animal kingdom. Examples of functional diversity in adaptation to varied lifestyles and environments from insects to mammals. Weekly labs illustrate the principal physiological functions on animal models.

**BIO 444 Aquatic Ecology (4 Hrs.)**

Fundamentals of freshwater ecology, including abiotic-biotic interactions, aquatic ecosystems structure and function, and relationships among organisms. Lecture and laboratory. Prerequisite: Ecology. See ENS 444.

**BIO 445 Biology of Water Pollution (4 Hrs.)**

Effects of organic wastes, industrial chemicals, and non-point pollutants on aquatic fauna and flora and humans; detection and measurement of water pollution. Laboratory involves detection and measurement of water pollution by toxicity tests and field sampling. See ENS 445.

**BIO 468 Animal Behavior/Ethology (4 Hrs.)**

Historical foundations of ethology, current methods, concepts, and research problems; analysis of the organization and development of behavior in individual animals and applications to understanding human behavior. Laboratory and/or field research projects are emphasized.

**BIO 479 Evolution (4 Hrs.)**

Origin of life and history of development of living systems. Analysis of classical Darwinism, the neo-Darwinian synthesis, and mechanisms of evolution, with emphasis on microevolutionary studies as an analytical tool.

**BIO 502 Biological Research and Policy I (2 Hrs.)**

First part of a two-course sequence. Must be taken during the first fall semester of graduate enrollment. An introduction to graduate studies that emphasizes graduate

student responsibilities, introduction to faculty advisers and research topics, development of library research skills, conceptualization of a topic and course of study for the M.S. thesis or project, completion of a professional presentation, and exploration of societal policy interactions in science. Offered every fall. Prerequisite: Biology graduate standing.

**BIO 503 Biological Research and Policy II (2 Hrs.)**

Second part of a two-course sequence. Must be taken in the spring semester immediately after enrollment in BIO 502. Students complete introduction to graduate studies and extend their skills in library research, professional presentation, and research study design. Students select a research adviser and thesis/project advisory committee, as well as develop and present a draft proposal of their theses/projects. Societal policy applications and implications are addressed throughout. Offered every spring. Prerequisite: Biology graduate standing and BIO 502.

**BIO 510 Topics in Biology (1 to 4 Hrs.)**

Intensive study of a topic under investigation by contemporary biologists. Description of topic for a given semester will be stated in course schedule. Prerequisite: Dependent on topic. Course may be repeated for an indefinite number of credit hours, but topic must differ. Offered every semester.

**BIO 551 Advanced Cell Biology (4 Hrs.)**

Critical analysis of selected concepts in eukaryote cell biology, a subject of intense current scientific inquiry. Fo-

cuses on modern technology in the study of molecular mechanisms of eukaryote cell functions. Flexible format accommodates individual student interests and needs. Prerequisite: BIO 311, or equivalent.

### **BIO 561 Advanced Microbiology (4 Hrs.)**

Selected advanced topics that may vary in response to student need but include aspects of microbial physiology such as growth, metabolism, photosynthesis, and genetics. Independent laboratory project required. Prerequisite: BIO 345, or equivalent.

### **BIO 571 Advanced Ecology (4 Hrs.)**

Critical review of contemporary ecological concepts, mainly through analysis and discussion of primary references. Designed especially for M.A. students focusing on environmental biology. Independent laboratory project required. Prerequisites: BIO 371, or equivalent.

### **BIO 575 Master's Project (1 to 4 Hrs.)**

An in-depth investigation of a biological topic that may analyze existing data and/or be related to science policy. Conducted under the supervision of a faculty adviser and advisory committee. Product must be approved by the graduate committee. **Note:** If the project is not completed by the end of four hours of continuing enrollment in BIO 575, students must register to audit the course for one hour in all subsequent semesters until the project is complete. Prerequisite: Permission of instructor.

### **BIO 580 Independent Research (1 to 6 Hrs.)**

Student may enroll for 1-6 hours of graduate research, with the permission of a biology faculty member.

### **BIO 585 Master's Thesis (2 or 4 Hrs./1 Hr.)**

A research effort involving collection and analysis of

original data (e.g., field or laboratory experiments). Conducted under supervision of a faculty adviser and advisory committee. Thesis must be approved by the graduate committee. **Note:** If the thesis is not complete by the time eight hours in BIO 585 is accrued in continuing enrollment, students must register to audit BIO 585 for one hour in all subsequent semesters until the thesis is complete. Prerequisite: Permission of instructor.

The following courses are accepted for the program major –

CHE 421 Instrumental Analysis  
CHE 425 Interpretive Spectroscopy  
CHE 431 Environmental Chemistry  
CHE 465 Environmental Toxicology  
ENS 419 Environmental Law