

# Department of Biology

(College of Humanities, Arts and Sciences)

www.biology.uni.edu

The Department of Biology offers the following undergraduate and graduate programs. Specific requirements for these programs are listed within this Department of Biology section in the following order:

## Undergraduate Major (B.S.)

- Biology (p. 2)
- Environmental Science (p. 2) (also listed in Department of Earth and Environmental Sciences)

## Undergraduate Majors (B.A.)

- Biology (p. 4)
- Biology: Biomedical Emphasis (p. 5)
- Biology: Ecology, Evolution and Organismal Biology Emphasis (p. 6)
- Biology-Teaching (p. 7)
- Environmental Resource Management (p. 7) (also listed in Department of Geography, Department of Earth and Environmental Sciences, and Department of Health, Recreation and Community Services)

## Minors

- Biology (p. 12)
- Biology-Teaching (p. 12)

## Graduate Major (M.S.)

- Biology (p. 12)

Major programs are offered by the Department of Biology in two baccalaureate areas: the Bachelor of Arts and the Bachelor of Science. The Bachelor of Science degree is recommended for most students preparing for graduate study in biology. The Bachelor of Arts degree provides a choice among several tracks depending upon student interest and/or career plans.

**Note:** Students should submit their declaration of a biology major early in their college programs. This will permit them to plan their major courses with a department advisor to avoid future conflicts. Transfer students with previous courses in biology, zoology, or botany must have transfer courses evaluated to avoid duplication and possible loss of credit. Decisions regarding UNI major courses and transfer credits should be approved by the department head.

## Academic Standard Policy

### Majors

1. Students should indicate their interest in majoring in biology by filling out a Declaration of Curriculum form any time after their admission to UNI.
2. A student's freshman year shall be devoted primarily to completing the required course work in general biology (BIOL 2051 General

Biology: Organismal Diversity and BIOL 2052 General Biology: Cell Structure and Function) and chemistry (CHEM 1110 General Chemistry I and CHEM 1120 General Chemistry II, or CHEM 1130 General Chemistry I-II). UNIFI/General Education and/or math classes should be taken by students to complete their schedules.

3. For the BS Biology, the BS Environmental Science, the BA Biology, the BA Biology Biomedical Emphasis, the BA Biology-Teaching, and the BA Biology Ecology, Evolution and Organismal Biology emphasis, students must receive a grade of C- (1.67) or higher in courses that are applied to their major. Prior to enrollment in a course, all prerequisites must be completed with a C- (1.67) or higher.
4. ALEKS is a mathematics placement exam used at the University of Northern Iowa. Your academic advisor will use your score on the ALEKS assessment to determine your placement in UNI mathematics, chemistry, and physics courses.
5. A student enrolled in a biology class during fall or spring semester, or who drops a biology course after the first seven days of classes, should contact the department if they want to take the class again in an immediately subsequent semester. The student will only be allowed to register if space remains after all advanced registrations are completed.
6. To graduate from UNI with a BS Biology, a BA Biology, a BA Biology Biomedical Emphasis, or a BA Biology Ecology, Evolution and Organismal Biology emphasis, students must have both a cumulative and a major UNI GPA of 2.00 or higher, with a grade of C- (1.67) or higher in all courses that are applied to the major. To graduate from UNI with a BA Biology-Teaching, students must have both a cumulative and a major UNI GPA of 2.50 or higher, with a grade of C- (1.67) or higher in all courses that are applied to the major.
7. With the exception of the Biology 3+1 Joint program, to graduate from UNI with a biology major, students must take seven (7) hours of biology at the 4000-level, with four (4) of those hours being taken at UNI.
8. Transfer students entering UNI shall be subject to the acceptance requirements listed in #3.

### Minors

To graduate from UNI with a biology minor, students must have both a cumulative and a minor UNI GPA of **2.00** or higher, with a grade of C- (1.67) or higher in all courses that are applied to the minor.

### Notes:

1. A student can declare only **one** major within the Department of Biology.
2. A student with a major within the Department of Biology cannot declare a Biology minor or a Biology-Teaching minor.
3. A student with a major in the interdisciplinary B.A. Environmental Resource Management: Ecosystems Track may not also declare a major or minor in biology.

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4. A student with a major in the interdisciplinary B.S. Environmental Science: Environmental Life Science Track may not also declare a major or minor in biology.

# Bachelor of Science Degree Program

## Emphasis-Honors Research

Students invited to do Honors Research will complete 4 credit hours of BIOL 3190 Undergraduate Research in Biology and 1 credit hour of BIOL 3191 Senior Thesis. The Biology BS degree is eligible for Honors Research.

## Biology Major

The B.S. Biology major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The Bachelor of Science Biology major is designed to prepare students for careers in areas which require a higher degree of concentration in subject matter and cognate areas, particularly advanced-level courses. This degree is especially appropriate for students planning graduate study. In order to ensure graduation within eight semesters, students should work with advisors early in their programs, as advanced planning for sequenced courses is very important.

### Course List

Required: \*

Introductory track: 15

BIOL 2051 General Biology: Organismal Diversity

BIOL 2052 General Biology: Cell Structure and Function

BIOL 3100 Evolution, Ecology and the Nature of Science

BIOL 3140 Genetics

Biology: 5

BIOL 3190 Undergraduate Research in Biology @

BIOL 4157/5157 Biostatistics

Cognate courses:

Chemistry and Biochemistry: 13-16

CHEM 1110 & CHEM 1120 or CHEM 1130 General Chemistry I and General Chemistry II or General Chemistry I-II

CHEM 2210 Organic Chemistry I

CHEM 2220 Organic Chemistry II

CHEM 2230 Organic Chemistry Laboratory

Mathematics: 3-4

MATH 1420 Calculus I

or STAT 1772 Introduction to Statistical Methods

Physics: 8

PHYSICS 1511 General Physics I

PHYSICS 1512 General Physics II

Electives in Biology: †, ^ 19

Any BIOL 3000-level or above (including CHEM 4510/5510 or MATH 1421). BIOL 3101 will not count as an elective.

Total hours 63-67

\* At least 7 credits of BIOL 4xxx (excludes BIOL 4198) are required for the degree. At least 4 of these credits must be completed at UNI.

† BIOL 3000-level or above, excluding BIOL 3101 Anatomy and Physiology I. CHEM 4510/5510 or MATH 1421 will also count as an elective.

^ No more than 4 credits from BIOL 3185 Readings in Biology, BIOL 3190 Undergraduate Research in Biology, and BIOL 4198 Independent Study will be counted toward biology degree requirements.

@ This course meets the Bachelor of Science undergraduate research course requirement.

## Environmental Science Major

The B.S. Environmental Science program will include two curricular paths for students, one with a life science emphasis and the other with an earth science emphasis. The program will enable students to prepare for a graduate program in the environmental sciences or to directly enter industry in the public or private sector. All students will have a common core of courses providing a foundation in biology and geosciences, and will also be required to take part in a capstone research project.\*

For students pursuing the B.S. Environmental Science major, the Department of Biology will waive BIOL 2052 as a prerequisite for BIOL 3000-level courses.

For students pursuing the B.S. Environmental Science major, the Department of Biology will waive BIOL 3140 as a prerequisite for BIOL 4000-level courses.

A student with a major in the interdisciplinary B.S. Environmental Science: Environmental Life Science Track may not also declare a major or minor in biology.

### Required Core

BIOL 2051 General Biology: Organismal Diversity 4

BIOL 3100 Evolution, Ecology and the Nature of Science 3

CHEM 1110 General Chemistry I 4

CHEM 1120 General Chemistry II 4

EARTHSCI 1200 Elements of Weather 3

EARTHSCI 1300 Introduction to Geology 4

GEOG 2410 Geographic Information Systems I 3

MATH 1420 Calculus I 4

BIOL 3190 Undergraduate Research in Biology 3

or EARTHSCI 4400 Undergraduate Research in Earth and Environmental Science

**Choose one of the following tracks outlined below: 33**

Environmental Life Sciences Track

Environmental Earth Science Track

**Total Hours 65**

**Environmental Life Sciences Track**

Required: 7

BIOL 4157/5157 Biostatistics

BIOL 4168/5168 Ecology

Electives: 26

Pick courses from each of the three categories (A, B, & C) to accumulate to a minimum of 26 hours.

Category A - Content Policy Related Courses (select a minimum of 2 courses)

BIOL 4105/5105 Wildlife Ecology and Management

BIOL 4108/5108 Biodiversity Conservation Policy

BIOL 4167/5167 Conservation Biology

BIOL 4180/5180 Restoration Ecology

Category B - Content Biology Related Courses (select a minimum of 2 courses)

BIOL 3112 Invertebrate Zoology

BIOL 3120 Plant Diversity and Evolution

BIOL 3151 General Microbiology

BIOL 3170 Entomology

BIOL 4164/5164 Mammalogy

BIOL 4166/5166 Plant Systematics

Category C - Cognates (select a minimum of 2 courses)

CHEM 2040 Applied Organic and Biochemistry

or CHEM 2210 Organic Chemistry I

EARTHSCI 1320 Earth History

EARTHSCI 3210/5210 Meteorology

EARTHSCI 3230/5230 Air Quality

EARTHSCI 3325/5325 Sedimentary Geology

EARTHSCI 3330/5330 Geomorphology

EARTHSCI 3340/5340 Oceanography

EARTHSCI 3345/5345 Environmental Geology

EARTHSCI 3350/5350 Environmental Hydrology

EARTHSCI 3355/5355 Hydrogeology

EARTHSCI 3360/5360 Field and Laboratory Methods in Hydrology

GEOG 2210 Modern Climate Change: Evidence and Predictions

GEOG 3220 Environmental Geography: Variable Topic

GEOG 3380 Remote Sensing of the Environment

GEOG 3410 Geographic Information Systems II

GEOG 4220/5220 Soils and Landscapes

GEOG 4230/5230 Rivers

GEOG 4240/5240 The Ice Age \*\*

MATH 1421 Calculus II

**Total Hours 33**

**Environmental Earth Science Track**

Required: 13

EARTHSCI 1400 Introduction to Environmental Earth Science

EARTHSCI 3230/5230 Air Quality

EARTHSCI 3345/5345 Environmental Geology

EARTHSCI 3350/5350 Environmental Hydrology

Electives: 20

Pick courses from each of the Categories (A & B) to accumulate a minimum of 20 hours

Category A - Physical Environment Related Courses (select a minimum of 4 courses)

EARTHSCI 1320 Earth History

EARTHSCI 3210/5210 Meteorology

EARTHSCI 3240/5240 Air Quality Modeling

EARTHSCI 3250/5250 Measurement and Analysis of Air Quality

EARTHSCI 3322 Earth Materials

EARTHSCI 3325/5325 Sedimentary Geology

EARTHSCI 3327/5327 Paleoclimatology

EARTHSCI 3330/5330 Geomorphology

EARTHSCI 3340/5340 Oceanography

EARTHSCI 3355/5355 Hydrogeology

EARTHSCI 3360/5360 Field and Laboratory Methods in Hydrology

Category B - Cognates (select a minimum of 2 courses)

BIOL 3112 Invertebrate Zoology

BIOL 3120 Plant Diversity and Evolution

BIOL 3170 Entomology

BIOL 4105/5105 Wildlife Ecology and Management

BIOL 4108/5108 Biodiversity Conservation Policy

BIOL 4157/5157 Biostatistics

BIOL 4164/5164 Mammalogy

BIOL 4166/5166 Plant Systematics

BIOL 4167/5167 Conservation Biology

BIOL 4168/5168 Ecology

BIOL 4180/5180 Restoration Ecology

CHEM 2040 Applied Organic and Biochemistry

or CHEM 2210 Organic Chemistry I

GEOG 2210 Modern Climate Change: Evidence and Predictions

GEOG 3220 Environmental Geography: Variable Topic \*\*

GEOG 3380 Remote Sensing of the Environment

GEOG 3410 Geographic Information Systems II

GEOG 4220/5220 Soils and Landscapes

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GEOG 4230/5230	Rivers
GEOG 4240/5240	The Ice Age **
MATH 1421	Calculus II
<b>Total Hours</b>	<b>33</b>

\* Students must receive a grade of C- (1.67) or higher in courses that are applied to their major. Prior to enrollment in a course, all prerequisites must be completed with a C- (1.67) or higher.

\*\* These courses have additional prerequisites as follows: GEOG 3220 has a prerequisite of GEOG 1120 or GEOG 1210 or GEOG 2210 or GEOG 1110 or consent of instructor. GEOG 4240/5240 has prerequisite of GEOG 1210; GEOG 2210; EARTHSCI 1300.

## Bachelor of Arts Degree Programs

### Emphasis-Honors Research

Students invited to do Honors Research will complete 4 credit hours of BIOL 3190 Undergraduate Research in Biology and 1 credit hour of BIOL 3191 Senior Thesis. The following BA degrees are eligible for Honors Research: Biology BA, Biology: Biomedical BA, and Biology: Ecology, Evolution and Organismal Biology BA.

### Biology Major

The B.A. Biology major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This major provides a broad training in biology but allows different specializations through choice of electives. Students who select this major to prepare themselves for graduate study in the biological sciences should consult with their advisor for elective courses. Field courses offered during the summer program at Iowa Lakeside Laboratory may be accepted for biology elective credit.

Required: \*

Introductory track: 15

BIOL 2051	General Biology: Organismal Diversity
BIOL 2052	General Biology: Cell Structure and Function
BIOL 3100	Evolution, Ecology and the Nature of Science
BIOL 3140	Genetics

Cognate courses:

Chemistry and Biochemistry: 9-13

CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II General Chemistry I-II
CHEM 2210 & CHEM 2230 or CHEM 2040	Organic Chemistry I and Organic Chemistry Laboratory Applied Organic and Biochemistry

Mathematics: 3-5

Select one of the following:

MATH 1120 & MATH 1130	Mathematics for Biological Sciences and Trigonometry	
MATH 1140	Precalculus	
MATH 1420	Calculus I	
STAT 1772	Introduction to Statistical Methods	
Earth Science/Physics (select one of the following):		8
EARTHSCI 1300 & EARTHSCI 1320	Introduction to Geology and Earth History	
PHYSICS 1511 & PHYSICS 1512	General Physics I and General Physics II	
Electives in Biology: †, ^		18
Any BIOL 3000-level or above (including CHEM 2220 or CHEM 4510/5510). BIOL 3101 will not count as an elective.		
Total hours		53-59

\* At least 7 credits of BIOL 4xxx (excludes BIOL 4198) are required for the degree. At least 4 of these credits must be completed at UNI.

† BIOL 3000-level or above, excluding BIOL 3101 Anatomy and Physiology I. CHEM 2220 or CHEM 4510/5510 will also count as an elective.

^ No more than 4 credits from BIOL 3185 Readings in Biology, BIOL 3190 Undergraduate Research in Biology, and BIOL 4198 Independent Study will be counted toward biology degree requirements.

### Biology 3+1 Joint Major

Students interested in one of the following professional programs may complete the basic work on the University of Northern Iowa campus and transfer back to UNI a year's credit from the professional school to complete the requirements for a Bachelor of Arts degree in Biology at UNI:

- Chiropractic
- Medical Laboratory Sciences
- Nursing 3+1

A student shall complete the core and cognate requirements for the B.A. (Joint Program Option) in Biology, an additional 10 credits at the BIOL 3000/4000 level, and have a total of 90 semester hours recognized by UNI, at least 32 of which were completed at UNI. The professional courses transferred must bring the total hours to at least 120 semester hours. Credit is accepted only from professional schools which are fully accredited. Details of the B.A. (Joint Program Option) are available from the Biology Department.

The student must know the requirements for entrance to the professional school so as to be able to take at the University of Northern Iowa the work required for admission while at the same time meeting UNI degree requirements. The student will work with the Biology Department advisor who will help in the selection of proper courses.

A student who meets the above requirements may use professional credit from one of the approved professional programs with which the Department of Biology has an articulation agreement to satisfy

the remaining hours required for the baccalaureate degree at the University of Northern Iowa. The student shall have completed all of the specific requirements for the B.A. (Joint Program Option).

Required:

Introductory Track		15
BIOL 2051	General Biology: Organismal Diversity	
BIOL 2052	General Biology: Cell Structure and Function	
BIOL 3100	Evolution, Ecology and the Nature of Science	
BIOL 3140	Genetics	
Cognate Courses:		
Chemistry and Biochemistry:		9-13
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II or General Chemistry I-II	
CHEM 2210 & CHEM 2230 or CHEM 2040	Organic Chemistry I and Organic Chemistry Laboratory or Applied Organic and Biochemistry	
Mathematics:		3-5
Select one of the following:		
MATH 1120 & MATH 1130	Mathematics for Biological Sciences and Trigonometry	
MATH 1140	Precalculus	
MATH 1420	Calculus I	
STAT 1772	Introduction to Statistical Methods	
Earth Science/Physics (select one of the following):		8
EARTHSCI 1300 & EARTHSCI 1320	Introduction to Geology and Earth History	
PHYSICS 1511 & PHYSICS 1512	General Physics I and General Physics II	
Electives in Biology (3000/4000 level) ^		10
<b>Total Hours</b>		<b>45-51</b>

^ No more than 4 credits from BIOL 3185 Readings in Biology, BIOL 3190 Undergraduate Research in Biology, and BIOL 4198 Independent Study will be counted toward biology degree requirements.

### Biology Major: Biomedical Emphasis

The B.A. Biology Major: Biomedical Emphasis requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This major offers basic preparation to students for allopathic, osteopathic, chiropractic, pharmacy, physical therapy, dental, veterinary, optometric, podiatric and other health-related programs. In addition, it prepares students for graduate study in biomedical sciences, e.g., pharmacology, toxicology, pathology, physiology, cellular biology, and related areas. Students should seek advice and information early in their programs so that individual goals and

specific additional requirements of some graduate and professional programs can be considered in curricular planning.

Required: \*

Introductory track:		15
BIOL 2051	General Biology: Organismal Diversity	
BIOL 2052	General Biology: Cell Structure and Function	
BIOL 3100	Evolution, Ecology and the Nature of Science	
BIOL 3140	Genetics	
Anatomy and Physiology group:		8
BIOL 3101 or BIOL 3106	Anatomy and Physiology I or Vertebrate Anatomy	
BIOL 3102	Anatomy and Physiology II	
Cognate courses:		
Chemistry and Biochemistry:		13-16
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II or General Chemistry I-II	
CHEM 2210	Organic Chemistry I	
CHEM 2220	Organic Chemistry II	
CHEM 2230	Organic Chemistry Laboratory	
Mathematics:		3-5
Select one of the following:		
MATH 1120 & MATH 1130	Mathematics for Biological Sciences and Trigonometry	
MATH 1140	Precalculus	
MATH 1420	Calculus I	
STAT 1772	Introduction to Statistical Methods	
Physics:		8
PHYSICS 1511	General Physics I	
PHYSICS 1512	General Physics II	
Electives selected from the following (consult with advisor): ^		10
BIOL 3106	Vertebrate Anatomy §	
BIOL 3108	Vertebrate Histology	
BIOL 3147	Cancer and Emerging Infectious Diseases	
BIOL 3151	General Microbiology	
BIOL 3190	Undergraduate Research in Biology	
BIOL 4114/5114	Comparative Animal Physiology	
BIOL 4116/5116	Neurobiology	
BIOL 4128/5128	Cell Biology	
BIOL 4129/5129	Genomics	
BIOL 4130/5130	Genetic Technologies in Medicine	
BIOL 4137/5137	Vertebrate Physiology	
BIOL 4144/5144	Virology	

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BIOL 4146/5146	Developmental Biology of Animals
BIOL 4150/5150	Immunology
BIOL 4157/5157	Biostatistics
BIOL 4164/5164	Mammalogy
CHEM 4510/5510	Biochemistry I **
Total hours	57-62

- \* At least 7 credits of of BIOL 4xxx (excludes BIOL 4198) are required for the degree. At least 4 of these credits must be completed at UNI.
- ^ No more than 3 credits of BIOL 3190 Undergraduate Research in Biology will be counted toward biology elective requirements for this degree. For students pursuing the Honors Emphasis, the remaining credit of BIOL 3190 Undergraduate Research in Biology and BIOL 3191 Senior Thesis will be applied to university electives.
- § If not used to satisfy the Anatomy and Physiology group requirement.
- \*\* For students pursuing graduate programs in Allopathic or Osteopathic Medicine, Physician Assistant, or Veterinary Medicine, Biochemistry I (CHEM 4510) and Biochemistry II (CHEM 4520) are recommended and would satisfy a Chemistry minor in addition to the BA Biology Biomedical degree.

### Biology Major: Ecology, Evolution and Organismal Biology Emphasis

The B.A. Biology Major: Ecology, Evolution and Organismal Biology Emphasis requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This emphasis provides training to students interested in organismal and/or ecological biology. This emphasis is appropriate for students interested in a career with private and governmental organizations conducting endangered species recovery, ecological restoration, biological surveys, toxicity evaluations, environmental impact analyses, field research, museum or herbarium curation, or who wish to work in zoos, nature centers, museums, or botanical gardens. This emphasis also provides suitable background for students wishing to pursue graduate degrees in animal behavior, botany, conservation biology, ecology, environmental toxicology, evolutionary biology, systematics, population biology, and zoology. Students should seek advice and information early in their programs so that individual goals and specific additional requirements of some graduate and professional programs can be considered in curricular planning. Field courses offered during the summer program at Iowa Lakeside Laboratory may be accepted for biology elective credit.

Required: \*

Introductory track:	15
BIOL 2051	General Biology: Organismal Diversity
BIOL 2052	General Biology: Cell Structure and Function
BIOL 3100	Evolution, Ecology and the Nature of Science

BIOL 3140	Genetics
Cognate courses:	
Chemistry and Biochemistry:	5-8
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II General Chemistry I-II
Mathematics:	3-5
Select one of the following:	
MATH 1120 & MATH 1130	Mathematics for Biological Sciences and Trigonometry
MATH 1140	Precalculus
MATH 1420	Calculus I
STAT 1772	Introduction to Statistical Methods
Physical Science	4
EARTHSCI 1300 or PHYSICS 1511	Introduction to Geology General Physics I
Electives: select from the following (consult with advisor):	26
Biology: ^	
BIOL 3106	Vertebrate Anatomy
BIOL 3107	Environmental Physiology
BIOL 3112	Invertebrate Zoology
BIOL 3118	Marine Biology
BIOL 3120	Plant Diversity and Evolution
BIOL 3160	Field Zoology of Vertebrates
BIOL 3170	Entomology
BIOL 3174	Field Biology: _____
BIOL 3185	Readings in Biology
BIOL 3190	Undergraduate Research in Biology
BIOL 4105/5105	Wildlife Ecology and Management
BIOL 4108/5108	Biodiversity Conservation Policy
BIOL 4114/5114	Comparative Animal Physiology
BIOL 4122/5122	Plant Physiology
BIOL 4137/5137	Vertebrate Physiology
BIOL 4142/5142	Evolutionary Biology
BIOL 4146/5146	Developmental Biology of Animals
BIOL 4157/5157	Biostatistics
BIOL 4164/5164	Mammalogy
BIOL 4166/5166	Plant Systematics
BIOL 4167/5167	Conservation Biology
BIOL 4168/5168	Ecology
BIOL 4172/5172	Developmental Plant Anatomy
BIOL 4180/5180	Restoration Ecology
BIOL 4198	Independent Study
CHEM 2040	Applied Organic and Biochemistry

or CHEM 2210 & CHEM 2230	Organic Chemistry I and Organic Chemistry Laboratory	
GEOG 2410	Geographic Information Systems I	
or GEOG 4220/522	Soils and Landscapes	
Total hours		53-58

\* At least 7 credits of BIOL 4xxx (excludes BIOL 4198) are required for the degree. At least 4 of these credits must be completed at UNI.

^ No more than 4 credits from BIOL 3185 Readings in Biology, BIOL 3190 Undergraduate Research in Biology, and BIOL 4198 Independent Study will be counted toward biology degree requirements.

## Biology Major-Teaching

The B.A. Biology-Teaching major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements, the Professional Education Requirements, and the following specified major requirements to complete the minimum of 120 hours.

The Biology Teaching major provides a broad education in biology. Along with professional education courses and student teaching, this curriculum is a sound preparation for teaching life science, biology, and other secondary science courses. This is an extended program requiring at least nine semesters; therefore, students should contact their advisors early in their program. This program is an excellent preparation for graduate work in biology or science education.

This major leads to endorsement #151 5-12 Biological Science.

Required: \*

Introductory track:		
BIOL 2051	General Biology: Organismal Diversity	4
BIOL 2052	General Biology: Cell Structure and Function	4
BIOL 3100	Evolution, Ecology and the Nature of Science	3
BIOL 3140	Genetics	4
Evolutionary Biology:		
BIOL 4142/5142	Evolutionary Biology	3
Plant group:		
Select one of the following:		
BIOL 3120	Plant Diversity and Evolution	
BIOL 4122/5122	Plant Physiology	
BIOL 4166/5166	Plant Systematics	
BIOL 4172/5172	Developmental Plant Anatomy	
Animal group:		
Select one of the following:		
BIOL 3102	Anatomy and Physiology II **	4
BIOL 3106	Vertebrate Anatomy	
BIOL 4114/5114	Comparative Animal Physiology	
BIOL 4146/5146	Developmental Biology of Animals	

Cellular group:		4
Select one of the following:		
BIOL 3151	General Microbiology	
BIOL 4128/5128	Cell Biology	
Cognate courses:		
Chemistry and Biochemistry:		
CHEM 1110	General Chemistry I	4
CHEM 1120	General Chemistry II ^	4
CHEM 2040	Applied Organic and Biochemistry	4
Earth Science:		
EARTHSCI 1320	Earth History ^^	4
Physics:		
PHYSICS 1511	General Physics I	4
Methods:		
Science and Science Education:		
SCI ED 3300/5300	Orientation to Science Teaching	4
SCI ED 4800/5800	Methods for Teaching Secondary Science or MTSS (Methods for Teaching Secondary Science)	3
Teaching:		
TEACHING 3129	Secondary and Special-Area Classroom Management	1
Biology:		
Electives in Biology: †		
<b>Total Hours</b>		<b>62</b>

\* At least 7 hours of BIOL 4xxx (excludes BIOL 4198) is required.

\*\* BIOL 3101 is a prerequisite for BIOL 3102. Students who take BIOL 3101 Anatomy and Physiology I will receive university elective credit. BIOL 3102 Anatomy and Physiology II will fulfill the Animal Group requirement. BIOL 3102 Anatomy and Physiology II cannot count as biology elective credit if used to fulfill the Animal Group requirement.

^ Students with excellent preparation in chemistry may substitute CHEM 1130 General Chemistry I-II plus 3 additional credit hours of biology or chemistry electives for CHEM 1110 General Chemistry I and CHEM 1120 General Chemistry II.

† Not more than four (4) semester hours of credit from BIOL 3185 Readings in Biology, BIOL 3190 Undergraduate Research in Biology, and BIOL 4198 Independent Study will be accepted for biology elective credit.

^^ EARTHSCI 1320 has a prerequisite of EARTHSCI 1300. This prerequisite is waived for Biology Teaching majors.

## Environmental Resource Management Major

The Environmental Resource Management major is aimed at students searching for career options in the broadly-defined 'outdoor environment' that are related to natural resources, environmental systems, and sustainable development. This program will prepare students for careers in the environmental and human management of

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public and private spaces across differing categories of environmental systems - from public parks and lands to conservancy units managed by governmental and other non-profit agencies and organizations. This program aims to serve those students who do not wish to pursue careers as environmental scientists *per se* from more tightly focused 'environmental science' programs.

- **STUDENTS ARE REQUIRED TO TAKE THE CORE REQUIREMENTS (31 HOURS) AND MAY CHOOSE ONLY ONE OF THE FOUR SPECIALIZATION TRACKS (30-32 HOURS).**
- Each track is composed of clusters of courses with a specific concentration, each of which has a separate hourly requirement.
- For purposes of this degree program, those prerequisite courses required by BIOL, EARTHSCI, GEOG, and RTNL for mid/upper-level courses in each Track THAT ARE NOT INCLUDED IN THE CORE REQUIREMENTS will normally be waived by the appropriate departments.
- The separate tracks allow students to specialize in the area of most general interest while the primary & secondary foci within each track make sure students also are exposed to a wide range of important auxiliary coursework.
- A student with a major in the interdisciplinary B.A. Environmental Resource Management: Ecosystems Track may not declare another major or minor in biology.
- By permission of the Provost's Office, students enrolled in the B.A. Environmental Resource Management major will be considered majors in all four of the participating departments.

### Core Requirements

BIOL 2051	General Biology: Organismal Diversity	4
BIOL 3100	Evolution, Ecology and the Nature of Science*	3
CHEM 1110	General Chemistry I	4
EARTHSCI 1300	Introduction to Geology	4
or		
GEOG 1210 & GEOG 1211	Planet Earth and Planet Earth Laboratory	
EARTHSCI 3330/5330	Geomorphology	4
GEOG 2260	Environmental Resource Management	3
GEOG 2410	Geographic Information Systems I	3
RTNL 4320	Financial Resource Management in Recreation, Tourism and Nonprofit Leadership	3
HIST 4170/5170	U.S. Environmental History	3
<b>Total Hours</b>		<b>31</b>

\* For students pursuing the Environmental Resource Management B.A. degree, the Department of Biology will waive the BIOL 2052 and CHEM 1120 prerequisites for enrollment into BIOL 3100.

**Encouraged Certificates:** Certificate programs that are appropriate to couple with the ERM major and help to expand specific, relevant experiences for students.

- GIS & Cartography (Department of Geography)
- Sustainability (Interdisciplinary)
- Outdoor Recreation (Department of Health, Recreation and Community Services)
- Tourism (Department of Health, Recreation and Community Services)
- Nonprofit Management Certificate (Department of Health, Recreation and Community Services)
- Environmental Health Certificate (Department of Health, Recreation and Community Services)
- Public History (Department of History)

### Ecosystems Track

A total of 32 hours are needed for this track. There are 12 hours of required courses. In addition, student select courses from all three elective categories (A, B, & C) to accumulate to a minimum of 20 hours. At least one course must be taken from each elective category.

#### Required

BIOL 4168/5168	Ecology**	4
CHEM 1120	General Chemistry II §	4
MATH 1140	Precalculus	3-4
or STAT 1772	Introduction to Statistical Methods	

**Electives: 20**

#### Category A - Content Management Related Courses (pick at least 1 course)

BIOL 4105/5105	Wildlife Ecology and Management***	
BIOL 4108/5108	Biodiversity Conservation Policy**	
BIOL 4167/5167	Conservation Biology**	
BIOL 4180/5180	Restoration Ecology**	

#### Category B - Content Related Courses (pick at least 1 course)

BIOL 3112	Invertebrate Zoology*	
BIOL 3118	Marine Biology*	
BIOL 3160	Field Zoology of Vertebrates*	
BIOL 3170	Entomology*	
BIOL 4157/5157	Biostatistics**	
BIOL 4164/5164	Mammalogy**	
BIOL 4166/5166	Plant Systematics**	
BIOL 4172/5172	Developmental Plant Anatomy**	

GEOG 4310/5310	GIS Applications: (Variable Topic)	
GEOG 3410	Geographic Information Systems II	

#### Category C - Cognates (pick at least 1 course)

EARTHSCI 1200	Elements of Weather	
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ENGLISH 4785/5785	Applied Writing: Projects, Grants and Careers <sup>^</sup>
GEOG 2210	Modern Climate Change: Evidence and Predictions
GEOG 2240	Natural Hazards and Disasters
GEOG 2270	Science of Scenery
GEOG 3179	Cooperative Education in Geography <sup>^</sup>
or BIOL 3179	Cooperative Education
or EARTHSCI 343	Internship
or RTNL 4510	Internship in Recreation, Tourism and Nonprofit Leadership
or PH 4180	Internship
GEOG 3220	Environmental Geography: Variable Topic <sup>^</sup>
GEOG 3380	Remote Sensing of the Environment
GEOG 4220/5220	Soils and Landscapes
GEOG 4240/5240	The Ice Age <sup>^</sup>
GEOG 4250/5250	Laboratory Methods in Environmental Geography
MGMT 3183	Leadership Skills <sup>^</sup>
MGMT 3185	Project Management <sup>^</sup>
RTNL 2120	Foundations of Tourism
RTNL 4553/5553	Trends and Issues in Outdoor Recreation
RTNL/HIST 4556	History of Outdoor Recreation

**Total Hours** **31-32**

\* For students pursuing the Environmental Resource Management B.A. degree, the Department of Biology will waive BIOL 2052 and CHEM 1120 for BIOL 3000-level courses.

\*\* For students pursuing the Environmental Resource Management B.A. degree, the Department of Biology will waive BIOL 3140 as a prerequisite for BIOL 4000-level courses.

§ Students pursuing the Ecosystems track can take CHEM 1110 and CHEM 1120 (8 credits) OR CHEM 1130 (5 credits). CHEM 1130 is designed for students with exceptional preparation in Chemistry. Taking CHEM 1130 changes the total degree requirement from 62-63 credit hours to 59-60 credit hours.

<sup>^</sup> These courses have additional prerequisites as follows:  
 ENGLISH 4785/5785 has prerequisites of ENGLISH 2770 or consent of instructor; junior standing.  
 GEOG 3220 has a prerequisite of GEOG 1120 or GEOG 1210 or GEOG 2210 or GEOG 1110 or consent of instructor.  
 GEOG 4240/5240 has prerequisites of GEOG 1210; GEOG 2210; EARTHSCI 1300; or consent of instructor; junior standing.  
 MGMT 3183 has a prerequisite of MGMT 3965/5965.  
 GEOG 3179 has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.  
 RTNL 4320 has prerequisites of three (3) credit hours of RTNL 31XX; junior standing. For students pursuing the

Environmental Resource Management major, Department of Health, Recreation and Community Services will waive the prerequisites of 3 hours of RTNL 31XX.  
 RTNL 4510 has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of RTNL 4520.  
 For students pursuing the Environmental Resource Management major, Department of Health, Recreation and Community Services will waive this corequisite.  
 PH 4180 has prerequisites of PH 3170; senior standing; 2.50 cumulative GPA; consent of Division of Health Promotion and Education Coordinator of Student Field Experiences.

## Geosystems Track

A total of 30 hours are needed for this track, with a minimum of 21 hours from the Primary Focus group and 9 hours from the Secondary Focus group.

### Electives

#### Primary Focus - Content Related Courses 21

EARTHSCI 1200	Elements of Weather
EARTHSCI 3350/535	Environmental Hydrology <sup>^</sup>
EARTHSCI 3322	Earth Materials <sup>^</sup>
GEOG 2210	Modern Climate Change: Evidence and Predictions
GEOG 2240	Natural Hazards and Disasters
GEOG 3220	Environmental Geography: Variable Topic <sup>*, ^</sup>
or	
EARTHSCI 3345/534	Environmental Geology <sup>***</sup>
GEOG 4220/5220	Soils and Landscapes
GEOG 4230/5230	Rivers
GEOG 4250/5250	Laboratory Methods in Environmental Geography
GEOG 3380	Remote Sensing of the Environment
RTNL 2130	Foundations of the Nonprofit Sector
RTNL 4553/5553	Trends and Issues in Outdoor Recreation
RTNL 4554/5554	Managing Recreation Impacts on the Natural Environment

#### Secondary Focus - Management Cognates 9

BIOL 4105/5105	Wildlife Ecology and Management <sup>**</sup>
BIOL 4180/5180	Restoration Ecology <sup>**</sup>
EARTHSCI 3325/5325	Sedimentary Geology <sup>****</sup>
EARTHSCI 3360/536	Field and Laboratory Methods in Hydrology
ECON 3225/5225	Environmental Economics <sup>^</sup>
ENGLISH 4785/5785	Applied Writing: Projects, Grants and Careers <sup>^</sup>
GEOG 4170/5170	Climate Action Planning
GEOG 4240/5240	The Ice Age <sup>*</sup>
GEOG 2270	Science of Scenery

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GEOG 4310/5310	GIS Applications: (Variable Topic) <sup>^</sup>
GEOG 3410	Geographic Information Systems II
RTNL 2120	Foundations of Tourism
RTNL/HIST 4556	History of Outdoor Recreation
RTNL 4776/5776	Eco, Adventure and Sport Tourism
MGMT 3185	Project Management <sup>^</sup>
POL AMER 3172	Public Budgeting <sup>^</sup>
BIOL 3179	Cooperative Education <sup>^</sup>
or GEOG 3179	Cooperative Education in Geography
or EARTHSCI 3430	Internship
or RTNL 4510	Internship in Recreation, Tourism and Nonprofit Leadership
or PH 4180	Internship
Other courses as approved by advisors and program director	
<b>Total Hours</b>	<b>30</b>

- \* For students pursuing the Geosystems Track, the Geography Department will accept GEOG 1210 and GEOG 1211 or EARTHSCI 1300 as the prerequisite for enrollment into all listed Geography courses except GEOG 4310/5310 and GEOG 3410.
- \*\* The Biology Department will waive BIOL 3140 as a prerequisite for BIOL 4105/5105 and BIOL 4180/5180.
- \*\*\* The Earth and Environmental Sciences Department will accept GEOG 1210 and GEOG 1211 as substitutes for courses that require EARTHSCI 1300.
- \*\*\*\* The Earth and Environmental Sciences Department will waive the requirement of EARTHSCI 1320 for EARTHSCI 3325/5325.
- # The Department of Health, Recreation and Community Services will waive RTNL 2120 as a prerequisite for RTNL 4776/5776.
- <sup>^</sup> These courses have additional prerequisites as follows:  
 EARTHSCI 3322 has a prerequisite of EARTHSCI 1300.  
 EARTHSCI 3350/5350 has prerequisites of EARTHSCI 1300; junior standing.  
 GEOG 3220 has a prerequisite of GEOG 1120 or GEOG 1210 or GEOG 2210 or GEOG 1110 or consent of instructor.  
 ECON 3225/5225 has prerequisites of ECON 1041, ECON 1051; junior standing.  
 ENGLISH 4785/5785 has prerequisites of ENGLISH 2770 or consent of instructor; junior standing.  
 GEOG 4310/5310 has prerequisites of GEOG 2410; junior standing.  
 GEOG 3410 has prerequisites of GEOG 2410 or consent of instructor; junior standing.  
 POL AMER 3172 has prerequisites of POL AMER 1014; POL AMER 1048.  
 GEOG 3179 has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.  
 RTNL 4510 has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of RTNL 4520.  
 For students pursuing the Environmental Resource

Management major, the Department of Health Recreation and Community Services will waive this corequisite. PH 4180 has prerequisites of PH 3170; senior standing; 2.50 cumulative GPA; consent of Division of Health Promotion and Education Coordinator of Student Field Experiences.

## Resource Administration Track

A total of 30 hours are needed for this track, with a minimum of 21 hours from the Primary Focus group and 9 hours from the Secondary Focus group.

Primary Focus - Content Related Courses		21
GEOG 2210	Modern Climate Change: Evidence and Predictions	
GEOG 4170/5170	Climate Action Planning	
GEOG 2240	Natural Hazards and Disasters	
PH 3720/5720	Environmental and Occupational Health Regulations	
RTNL 2130	Foundations of the Nonprofit Sector	
RTNL 3337	Human Resource Development for Recreation, Tourism and Nonprofit Leadership	
RTNL 4310/5310	Areas and Facilities in Recreation, Tourism and Nonprofit Leadership	
RTNL 4554/5554	Managing Recreation Impacts on the Natural Environment	
RTNL/HIST 4556	History of Outdoor Recreation	
RTNL 4776/5776	Eco, Adventure and Sport Tourism	
Secondary Focus - Cognates		9
BIOL 4167/5167	Conservation Biology <sup>**</sup>	
GEOG 4220/5220	Soils and Landscapes	
GEOG 4230/5230	Rivers	
GEOG 4250/5250	Laboratory Methods in Environmental Geography	
GEOG 2270	Science of Scenery	
GEOG 4310/5310	GIS Applications: (Variable Topic)	
GEOG 3410	Geographic Information Systems II	
GEOG 3380	Remote Sensing of the Environment	
ENGLISH 4775/5775	Applied Writing: Specialized Documents <sup>^</sup>	
or ENGLISH 4785/5785	Applied Writing: Projects, Grants and Careers	
PH 3710/5710	Environmental Health Science	
RTNL 2120	Foundations of Tourism	
RTNL 4552/5552	Theory and Practice of Outdoor Education	
RTNL 4553/5553	Trends and Issues in Outdoor Recreation	

RTNL 4779/5779	Community Planning Workshop
MGMT 3185	Project Management <sup>^</sup>
POL AMER 3172	Public Budgeting <sup>^</sup>
GEOG 3179	Cooperative Education in Geography <sup>^</sup>
or BIOL 3179	Cooperative Education
or EARTHSCI 3430	Internship
or RTNL 4510	Internship in Recreation, Tourism and Nonprofit Leadership
or PH 4180	Internship
Other courses as approved by advisors and program director	

**Total Hours** **30**

- \* \* The Biology Department will waive BIOL 3140 as a prerequisite for BIOL 4167/5167.
- \*\* \*\* The Geography Department and the Department of Health, Recreation and Community Services will waive RTNL 2120 as a prerequisite for enrollment into RTNL 4310/5310.
- <sup>^</sup> <sup>^</sup> These courses have additional prerequisites as follows:  
 RTNL 4776/5776 has prerequisites of RTNL 2120 or consent of instructor; junior standing.  
 ENGLISH 4775/5775 has prerequisites of MGMT 2080 or ENGLISH 2770 or consent of instructor; junior standing.  
 ENGLISH 4785/5785 has prerequisites of ENGLISH 2770 or consent of instructor; junior standing.  
 POL AMER 3172 has prerequisites of POL AMER 1014; POL AMER 1048.  
 GEOG 3179 has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.  
 RTNL 4510 has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of RTNL 4520. For students pursuing the Environmental Resource Management major, the Department of Health, Recreation and Community Services will waive this corequisite.  
 PH 4180 has prerequisites of PH 3170; senior standing; 2.50 cumulative GPA; consent of Division of Health Promotion and Education Coordinator of Student Field Experiences.

### Environmental Compliance Track

A total of 32 hours need for this focus area, with 15 hours of required courses, a minimum of 10 hours from the Primary Focus group and 7 hours from the Secondary Focus group.

#### Required

ECON 1041	Principles of Macroeconomics	3
ECON 1051	Principles of Microeconomics	3
ECON 3225/5225	Environmental Economics	3
PH 3720/5720	Environmental and Occupational Health Regulations	3
PHIL 2550	Environmental Ethics	3
<b>Primary Focus - Content Related Courses</b>		<b>10</b>
EARTHSCI 1200	Elements of Weather	

EARTHSCI 1400	Introduction to Environmental Earth Science	
EARTHSCI 3230/5230	Air Quality <sup>^</sup>	
EARTHSCI 3345/5345	Environmental Geology *	
or		
GEOG 3220	Environmental Geography: Variable Topic	
EARTHSCI 3350/5350	Environmental Hydrology *	
<b>Secondary Focus - Cognates</b>		<b>7</b>
EARTHSCI 3240/5240	Air Quality Modeling <sup>^</sup>	
EARTHSCI 3250/5250	Measurement and Analysis of Air Quality <sup>** ^</sup>	
EARTHSCI 3325/5325	Sedimentary Geology <sup>***</sup>	
EARTHSCI 3355/5355	Hydrogeology *	
GEOG 4220/5220	Soils and Landscapes	
GEOG 4230/5230	Rivers	
GEOG 3380	Remote Sensing of the Environment	
PH 3710/5710	Environmental Health Science	
RTNL 4554/5554	Managing Recreation Impacts on the Natural Environment	
MGMT 3153	Organizational Management *	
MGMT 3185	Project Management <sup>^</sup>	
POL AMER 1048	Current and Emerging Issues in Public Administration	
GEOG 3179	Cooperative Education in Geography <sup>^</sup>	
or BIOL 3179	Cooperative Education	
or EARTHSCI 3430	Internship	
or RTNL 4510	Internship in Recreation, Tourism and Nonprofit Leadership	
or PH 4180	Internship	
Other courses as approved by advisors and program director		

**Total Hours** **32**

- \* \* The Earth and Environmental Sciences Department will accept GEOG 1210 and GEOG 1211 as a substitute for courses that require EARTHSCI 1300.
- \*\* \*\* The Earth and Environmental Sciences Department will waive EARTHSCI 3230/5230 as a prerequisite for enrollment into EARTHSCI 3250/5250.
- \*\*\* \*\* The Earth and Environmental Sciences Department will waive the requirement for EARTHSCI 1320 for EARTHSCI 3325/5325.
- <sup>^</sup> <sup>^</sup> These courses have additional prerequisites as follows:  
 GEOG 3220 has a prerequisite of GEOG 1120 or GEOG 1210 or GEOG 2210 or GEOG 1110 or consent of instructor.  
 EARTHSCI 3240/5240 has prerequisites of EARTHSCI 1200; junior standing.  
 EARTHSCI 3250/5250 has prerequisites of EARTHSCI 1200; junior standing and a prerequisite or corequisite of EARTHSCI 3230/5230.  
 GEOG 3179 has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.

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RTNL 4510 has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of RTNL 4520. For students pursuing the Environmental Resource Management major, the Department of Health, Recreation and Community Services will waive this corequisite. PH 4180 has prerequisites of PH 3170; senior standing; 2.50 cumulative GPA; consent of Division of Health Promotion and Education Coordinator of Student Field Experiences.

## Minors

### Biology Minor

Required:

Introductory track:		8
BIOL 2051	General Biology: Organismal Diversity	
BIOL 2052	General Biology: Cell Structure and Function	
Chemistry and Biochemistry:		8
CHEM 1110 & CHEM 1120	General Chemistry I and General Chemistry II *	
Electives in Biology: **		10-12
<b>Total Hours</b>		<b>26-28</b>

\* Students with excellent preparation in chemistry may substitute CHEM 1130 General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 General Chemistry I and CHEM 1120 General Chemistry II.

\*\* 3000/4000-level, excluding BIOL 3101 Anatomy and Physiology I, BIOL 3179 Cooperative Education, BIOL 3185 Readings in Biology, BIOL 3190 Undergraduate Research in Biology, and BIOL 4198 Independent Study

### Biology Minor-Teaching

The Biology Minor-Teaching provides for second endorsement approval by the Iowa Board of Educational Examiners and requires first endorsement approval (major) in another science discipline or general science.

This minor leads to endorsement #151 5-12 Biological Science. Students must also complete all requirements for a Secondary Education major, including student teaching.

Required:

Introductory track:		
BIOL 2051	General Biology: Organismal Diversity	4
BIOL 2052	General Biology: Cell Structure and Function	4
BIOL 3100	Evolution, Ecology and the Nature of Science	3
BIOL 3140	Genetics	4
Chemistry and Biochemistry:		8
CHEM 1110 & CHEM 1120	General Chemistry I and General Chemistry II **	

Methods:

Science and Science Education:		
SCI ED 3300/5300	Orientation to Science Teaching	4
SCI ED 4800/5800	Methods for Teaching Secondary Science or MTSS (Methods for Teaching Secondary Science)	3
Teaching:		
TEACHING 3129	Secondary and Special-Area Classroom Management	1
<b>Total Hours</b>		<b>31</b>

\*\* Students with excellent preparation in chemistry may substitute CHEM 1130 General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 General Chemistry I and CHEM 1120 General Chemistry II.

## Master of Science Degree Program Major in Biology

This major is available for students seeking an extensive research experience. Students interested in enrolling in the program must submit a completed Application for Admission to Graduate Study and should refer to their MyUNIverse Student Center To-Do list or contact the Department of Biology for any other application requirements. Applications should include three recommendations and transcripts of undergraduate and graduate credits. Graduate information and application for graduate admission can be found at <https://admissions.uni.edu/application>.

The Graduate Record Examination (General Test) **is not** required for admission to the program.

**Only graduate courses (course numbers 5000 or above) will apply to a graduate degree, even if the undergraduate course number (4999 or less) is listed. No exceptions will be made.**

This major is available on the **thesis** option only. A **minimum of 30 semester hours** is required, including a minimum of 21 hours of normal course work and a maximum of 9 hours of thesis research. A **minimum of 18 hours of 6000-level course work is required.**

Students are required to pass an oral comprehensive examination in defense of their final thesis.

This program is flexible and designed to allow students, working with their advisory committee, to tailor a program to fit student interests and aspirations in biology.

Required:

Biology:		9
BIOL 6202	Graduate Colloquium and Scientific Skills (2 hr. each semester for four semesters)	
BIOL 6292	Research Methods in Biology (1 hr.)	
Research:		9
BIOL 6299	Research	

Electives: *	12
<b>Total Hours</b>	<b>30</b>

\* 100g/5000-level or above, excluding BIOL 6299 Research.

### **Biology, B.S.**

Goals: Students will gain an understanding of major themes in biology (organization of life, diversity and its causes, genetics, and cellular biology) along with deeper exposure to and advanced competency in biological topics of the student's interest in areas including anatomy, physiology, genetics, organismal development, ecology, evolution, and/or organismal biology. Students will be able to think critically and communicate effectively on these discipline-specific topics.

Students in the BS program will gain deeper exposure to the process of science through Undergraduate Research (BIOL 3190) and through Biostatistics (BIOL 4157).

Outcomes:

1. Students will show proficiency in advanced content from their areas of interest in the fields of anatomy, physiology, development, cellular biology, immunology, genetics, ecology, evolution, and/or organismal biology.
2. Students will communicate effectively using discipline-specific vocabulary and standard scientific communication skills such as graphical representation of data.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to living organisms.
4. Students will gain first-hand experience with the process of scientific inquiry by participating in a specific line of research.
5. Students will become proficient in common statistical methods used in biology.

### **Biology, B.A.**

Goals: Students will gain an understanding of major themes in biology (organization of life, diversity and its causes, genetics, and cellular biology) along with deeper exposure to and advanced competency in biological topics of the student's interest in areas including anatomy, physiology, genetics, organismal development, ecology, evolution, and/or organismal biology. Students will be able to think critically and communicate effectively on these discipline-specific topics.

Outcomes:

1. Students will show proficiency in advanced content from their areas of interest in the fields of anatomy, physiology, development, cellular biology, immunology, genetics, ecology, evolution, and/or evolutionary biology.
2. Students will communicate effectively using discipline-specific vocabulary and standard scientific communication skills such as graphical representation of data.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to living organisms.

### **Biology: Biomedical Major, B.A.**

Goals: Students will gain an understanding of major themes in biology (organization of life, diversity and its causes, genetics, and cellular biology) along with deeper exposure to and advanced competency in topics related to biomedical fields. Students will be able to think critically and communicate effectively on these discipline-specific topics.

Outcomes:

1. Students will show proficiency in advanced content from their areas of interest in the fields of anatomy, physiology, development, cellular biology, immunology, and/or genetics.
2. Students will communicate effectively using discipline-specific vocabulary and standard scientific communication skills such as graphical representation of data.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to living organisms.

### **Biology: Ecology, Evolution and Organismal Biology, B.A.**

Goals: Students will gain an understanding of major themes in biology (organization of life, diversity and its causes, genetics, and cellular biology) along with deeper exposure to and advanced competency in topics in ecology, evolution, and organismal biology. Students will be able to think critically and communicate effectively on these discipline-specific topics.

Outcomes:

1. Students will show proficiency in advanced content from the fields of ecology, evolution, and/or organismal biology that will allow students to explain biodiversity and the relationship of living things with their environment and with each other.
2. Students will communicate effectively using discipline-specific vocabulary and standard written and oral scientific communication skills.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to natural systems.

### **Biology Teaching, B.A.**

Goals: Students will gain an understanding of major themes in biology (organization of life, diversity and its causes, genetics, and cellular biology) along with deeper exposure to and advanced competency in biological topics of the student's interest in areas including anatomy, physiology, genetics, organismal development, ecology, evolution, and/or organismal biology. Students will be able to think critically and communicate effectively on these discipline-specific topics in ways that allow them to become excellent educators.

Outcomes:

1. Students will show proficiency in advanced content from their areas of interest in the fields of anatomy, physiology, development, cellular biology, immunology, genetics, ecology, evolution, and/or evolutionary biology.

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2. Students will communicate effectively using appropriate teaching strategies for a classroom setting.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to living organisms.

### Environmental Resource Management: Ecosystems Track, B.A.

Goals: Students will gain an understanding of major themes in biology related to ecosystems (organization of life, diversity and its causes) along with deeper exposure to and advanced competency in topics related to ecosystems and their management. Students will be able to think critically and communicate effectively on these discipline-specific topics.

Outcomes:

1. Students show proficiency in advanced content from the fields of ecology, evolution, and organismal biology that will allow students to evaluate issues important to modern ecosystem management.
2. Students will communicate effectively using discipline-specific vocabulary and standard written and oral scientific communication skills.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to natural systems.

### Environmental Science, Environmental Life Science Track, B.S.

Goals: Students will gain an understanding of major themes in biology (organization of life, diversity and its causes, genetics, and cellular biology) along with deeper exposure to and advanced competency in topics in environmental science. Students will be able to think critically and communicate effectively on these discipline-specific topics. Students in the BS program will gain deeper exposure to the process of science through Undergraduate Research (BIOL 3190) and through Biostatistics (BIOL 4157).

Outcomes:

1. Students will show proficiency in advanced content in environmental science.
2. Students will communicate effectively as evidenced by use of discipline-specific vocabulary and standard scientific communication skills such as graphical representation of data.
3. Students will think critically about discipline-specific content as evidenced by an ability to interpret data, to effectively critique arguments, and/or to solve problems relating to living organisms.
4. Students will gain first-hand experience with the process of scientific inquiry by participating in a specific line of research.
5. Students will become proficient in common statistical methods used in biology.

### Biology, M.S.

Goals: Students will gain an advanced understanding of a sub-discipline within biology through advanced biology coursework. Students will develop an understanding of the nature of science and learn critical thinking skills by completing a research project that

advances knowledge in their subdiscipline. Students will generate data, analyze and interpret data, and present data in thesis format. Students will improve communication skills through scientific writing and oral communication in formal settings.

Outcomes:

1. Students will show proficiency in content chosen from the student's area of interest in the fields of ecology, evolution, organismal biology, physiology, development, cellular biology, immunology, and/or genetics.
2. Students will communicate effectively on the topic of their research using discipline-specific vocabulary and standard written and oral scientific communication skills.
3. Students will be proficient in discipline-specific research techniques, allowing the student to think critically as needed to solve problems new to science.

## Biology Courses

### BIOL 1012. Life: The Natural World — 3 hrs.

Examines the natural world as a system, emphasizing interactions among living organisms and with their environments, with a focus on human-environmental interactions, and the importance, origins, and maintenance of biodiversity. Content theme is centered on building an appreciation for the ways scientists work with and learn about the natural world. Students will comprehend scientific studies and infer meaning from graphical displays of data and apply knowledge of biological systems to contemporary problems, such as greenhouse gasses, impacts of climate change, the biodiversity crisis, and disease transmission. Discussion, 3 periods. Declared biology majors cannot receive either university or elective credit for this course. (Fall and Spring)

### BIOL 1013. Life: The Natural World - Lab — 1 hr.

This course provides activities illustrating the importance, origins, and maintenance of biodiversity with a focus on the interactions among organisms and between organisms and the environment. The laboratory will emphasize the process of science, and students will practice skills scientists use to answer questions about the natural world. Lab, 2 periods. Declared biology majors cannot receive either university or elective credit for this course. Prerequisite(s) or corequisite(s): BIOL 1012. (Fall and Spring)

### BIOL 1014. Life: Continuity and Change — 3 hrs.

Introduction to contemporary topics in the life sciences with a focus on the biological processes that allow life to continue through generations and those that cause change through time. Emphasis on gene structure and function and applications of biology to human concerns. Content theme is centered on building an appreciation for the ways scientists work with and learn about the processes of life. Students will apply knowledge of biological concepts to contemporary and ethical issues, such as diseases and treatments, genetic engineering, cloning, and inheritance of family traits. Discussion, 3 periods. Declared biology majors cannot receive either university or elective credit for this course. (Fall and Spring)

### BIOL 1015. Life: Continuity and Change - Lab — 1 hr.

Activities illustrating the role of biology in our present society. Emphasis is placed on activities investigating life science concepts related to human concerns, including human genetics and variation. DNA and DNA fingerprinting, human disease and disease transmission, and basic cellular function. The laboratory will

emphasize the process of science, and students will practice skills scientists use to answer questions about the processes of life. Lab, 2 periods. Declared biology majors cannot receive either university or elective credit for this course. Prerequisite(s) or corequisite(s): BIOL 1014 or equivalent. (Fall and Spring)

**BIOL 1033. Principles of Microbiology — 4 hrs.**

Basic concepts and practical applications of microbiology in daily life; health and disease including basic aspects of immunology and host-microbe interactions. Designed for students majoring in areas other than the sciences. For biology majors and minors counts only for university elective credit. Sections may be offered exclusively for nurses in training. Discussion, 3 periods; lab, 2 periods. (Fall)

**BIOL 2051. General Biology: Organismal Diversity — 4 hrs.**

Study of organismic biology emphasizing evolutionary patterns and diversity of organisms and interdependency of structure and function in living systems. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 2051 and BIOL 2052 cannot be taken concurrently. (Fall and Spring)

**BIOL 2052. General Biology: Cell Structure and Function — 4 hrs.**

Introduction to the properties and functions of biological molecules, organization of living cells, production and utilization of energy, and development of multicellular organisms. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 2051 and BIOL 2052 cannot be taken concurrently. (Fall and Spring)

**BIOL 3100. Evolution, Ecology and the Nature of Science — 3 hrs.**

Unifying principles of biology: how organisms interact with each other and the environment, the genetic continuity of life, and how past history affects life. Readings and student-led discussions explore concepts in detail. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. BIOL 3100 and BIOL 3140 cannot be taken concurrently. (Fall and Spring)

**BIOL 3101. Anatomy and Physiology I — 4 hrs.**

Structure and function of organ systems of human body. For students in allied health fields or other university-approved programs. Others must have consent of department head. For Biology majors and minors, counts only for university elective credit. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130, or consent of department head. (Fall and Spring)

**BIOL 3102. Anatomy and Physiology II — 4 hrs.**

Continuation of BIOL 3101. For students in allied health fields or other university-approved programs. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): C- or better in BIOL 3101 or BIOL 3106. (Fall and Spring)

**BIOL 3106. Vertebrate Anatomy — 4 hrs.**

Consideration of the origin and evolution of vertebrates and comparison of vertebrate structure and function. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Fall)

**BIOL 3107. Environmental Physiology — 3 hrs.**

Introduction to how animals physiologically adapt to the various unique environmental conditions in which they live. Lecture, 3 hours. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Variable)

**BIOL 3108. Vertebrate Histology — 4 hrs.**

Microscopic study of cells and tissues from various vertebrate organ systems. Integration of gross anatomy and physiology through

illustrating how microscopic ultrastructure is related to organ function. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Variable)

**BIOL 3112. Invertebrate Zoology — 4 hrs.**

Morphology, physiology, phylogeny, taxonomy, and ecology of the invertebrates. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Variable)

**BIOL 3118. Marine Biology — 3 hrs.**

Study of the diversity of life in the ocean, including marine ecology, physiology, and current issues in oceanography. Discussion, 3 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Variable)

**BIOL 3120. Plant Diversity and Evolution — 4 hrs.**

Form and function in vegetative and reproductive organs in all plant divisions, from algae to flowering plants, and their importance in evolutionary thought and plant classification. Lecture, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Spring)

**BIOL 3140. Genetics — 4 hrs.**

Analytical approach to classical, molecular, and population genetics. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. BIOL 3100 and BIOL 3140 cannot be taken concurrently. (Fall and Spring)

**BIOL 3147. Cancer and Emerging Infectious Diseases — 3 hrs.**

Cellular and molecular study of cancer, its epidemiology, standard and novel cancer treatments, examination of emerging and re-emerging infectious diseases, their causative organisms, and human immune responses to them. Discussion, 3 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Spring)

**BIOL 3151. General Microbiology — 4 hrs.**

Physiology, morphology, taxonomy, immunology, and pathogenicity of microbes, with applications to medicine, agriculture, sanitation, and industry. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Fall and Spring)

**BIOL 3160. Field Zoology of Vertebrates — 4 hrs.**

Identification and natural history of Iowa vertebrates. Emphasis on field trips. Discussion, 2 periods; lab and field work, 6 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Spring)

**BIOL 3170. Entomology — 3 hrs.**

Introduction to biology of insects. Discussion, 2 periods; lab, 2 periods. Prerequisite(s): BIOL 2051; BIOL 2052; CHEM 1110 and CHEM 1120, or CHEM 1130. (Even Falls)

**BIOL 3174. Field Biology: \_\_\_\_\_ — 1-3 hrs.**

Selected topics in field biology, emphasizing hands-on techniques for field observation, and testing of evolutionary and ecological hypotheses. Offered both on- and off-campus in flexible format. Topics and hours listed in Schedule of Classes. May be repeated for credit on different topic. Prerequisite(s): vary with topic. (Variable)

**BIOL 3179. Cooperative Education — 1-6 hrs.**

Up to 12 hours of ungraded credit (credit/no credit basis) may be taken as university electives. (Fall, Spring, Summer)

## Department of Biology

### **BIOL 3181. Investigations in Life Science — 4 hrs.**

Introduction to significant life science concepts and models of effective teaching related to elementary school life science. Topics include cellular structure and function, inheritance, plant systems, and human systems. Discussion and/or lab, 5 periods. Prerequisite(s): SCI ED 1200. (Odd Falls)

### **BIOL 3185. Readings in Biology — 1-3 hrs.**

Independent readings in biology from selected list approved in advance. Maximum of 3 hours for biology major or minor. Prerequisite(s): consent of department. (Fall, Spring, Summer)

### **BIOL 3189. Seminar — 1-2 hrs.**

(Variable)

### **BIOL 3190. Undergraduate Research in Biology — 1-3 hrs.**

Research activities under direct supervision of Biology faculty members. Credit determined prior to registration based upon student proposal with agreement of faculty advisor. May be repeated. Prerequisite(s): BIOL 2051; BIOL 2052; sophomore standing; consent of department. (Fall, Spring, Summer)

### **BIOL 3191. Senior Thesis — 1 hr.**

Senior research thesis. Open only to and required for students pursuing the B.S. Biology or B.A. Biology Honors Emphasis. Prerequisite(s): consent of department head. (Fall, Spring, Summer)

### **BIOL 4105/5105. Wildlife Ecology and Management — 4 hrs.**

Applied population management of game and nongame wildlife. Lab emphasizes field techniques, population modeling, and habitat management planning. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Odd Falls)

### **BIOL 4108/5108. Biodiversity Conservation Policy — 3 hrs.**

Review of laws and policies affecting endangered species, ecosystem management, and biodiversity conservation in the United States. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Even Springs)

### **BIOL 4114/5114. Comparative Animal Physiology — 4 hrs.**

Physical and chemical basis of cellular/organ functions across various animal phyla. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; CHEM 2040 or CHEM 2210; junior standing. (Even Falls)

### **BIOL 4116/5116. Neurobiology — 3 hrs.**

Survey of vertebrate nervous systems. Examination of several levels of organization ranging from molecules to neurons to larger systems in the brain. Discussion, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; CHEM 2040 or CHEM 2210; junior standing. (Spring)

### **BIOL 4121/5121. Plant Biotechnology — 4 hrs.**

Highlights the theory and applications of plant tissue cultures, genetic engineering (including use of plants for production of antibodies and vaccines), marker-assisted selection, and genomics. Lab component gives students practical experience with the biotechnology applications discussed in lecture. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Odd Falls)

### **BIOL 4122/5122. Plant Physiology — 4 hrs.**

How plants work: uptake and use of water and materials, synthesis and transport of organic compounds, growth and development, and responses to environment. Lecture, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; CHEM 2040 or CHEM 2210; junior standing. (Variable)

### **BIOL 4127/5127. Bioinformatics Applications for Biology — 3 hrs.**

Introduction to computer based analyses and management applications for molecular biological data. Topics include bioinformatics

history, instrumentation, PC applications, resources, data bases, and discussions of genomics and proteomics applications. Discussion, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Variable)

### **BIOL 4128/5128. Cell Biology — 4 hrs.**

Foundation in cell structure, organization, and function, with emphasis on signal transduction, cell trafficking and cell cycle control. Lab will emphasize developing laboratory skills and improving analytical and writing abilities. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; CHEM 2040 or CHEM 2210; junior standing. (Spring)

### **BIOL 4129/5129. Genomics — 3 hrs.**

Genome sequencing, analysis of sequence variation, sequencing for disease diagnosis, comparative genomics, personal genomics, the epigenome in disease development, analysis of gene expression. Discussion, 2 periods; lab, 2 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Even Falls)

### **BIOL 4130/5130. Genetic Technologies in Medicine — 3 hrs.**

Study of genetic technologies in medicine, including causes of human genetic disorders, screening and diagnosis, genomic profiling, personalized medicine, genetic therapies, and ethics. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Odd Springs)

### **BIOL 4137/5137. Vertebrate Physiology — 4 hrs.**

Study of functional mechanisms for cellular processes in select vertebrate organ systems. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; CHEM 2040 or CHEM 2210; junior standing. (Odd Falls)

### **BIOL 4142/5142. Evolutionary Biology — 3 hrs.**

Conceptual overview of evolutionary theory, mechanisms of evolutionary process, speciation and major evolutionary events. Discussion, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Spring)

### **BIOL 4144/5144. Virology — 4 hrs.**

Introduction to virus structure, replication, genetics, pathogenicity, host interactions, detection, epidemiology, evolution, and virology methods. Health, agriculture, research and industry applications. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Even Springs)

### **BIOL 4146/5146. Developmental Biology of Animals — 4 hrs.**

Major concepts and central questions of animal development and controlling mechanisms. Laboratory emphasis on experimental inquiry and developmental anatomy. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Spring)

### **BIOL 4150/5150. Immunology — 4 hrs.**

Focus on multiple levels of human immunity, from organs/cells to molecular events. Basic immunology and relationships between immunology and various disease states. Laboratory experiences include many commonly-used immunology techniques. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Fall)

### **BIOL 4157/5157. Biostatistics — 3 hrs.**

Introduction to methods used to analyze and interpret quantitative biological data. Emphasis on parametric statistics; use of "R" software for data analysis and presentation. Lecture, 2 hours; lab, 2 hours. Prerequisite(s): MATH 1140, or MATH 1120 and MATH 1130, or MATH 1420, or equivalent; BIOL 3100; BIOL 3140; junior standing. (Fall)



**BIOL 4164/5164. Mammalogy — 4 hrs.**

Biology of mammals, including evolutionary history, zoogeography, ecology, and diversity. Laboratory emphasis on identifications, natural history, and field techniques. Lecture, 3 periods; lab and field, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Fall)

**BIOL 4166/5166. Plant Systematics — 4 hrs.**

Classification and identification of vascular plants, with emphasis on evolution of species and larger groups. Discussion, 2 periods; lab and field work, 4 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Odd Falls)

**BIOL 4167/5167. Conservation Biology — 3 hrs.**

Biodiversity and threats to it, extinction, conservation of endangered species, protected areas, ex situ conservation, private land conservation, ecological economics. Lecture/discussion, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Spring)

**BIOL 4168/5168. Ecology — 4 hrs.**

Principles of organismal adaptation, species interactions, and population, community, and ecosystem structure/dynamics. Lab emphasizes student-led experiments, data analysis, and scientific writing. Lecture/discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Fall)

**BIOL 4172/5172. Developmental Plant Anatomy — 4 hrs.**

Structure and function of flowering plants, with emphasis on cell and organ development. Lecture, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Even Falls)

**BIOL 4180/5180. Restoration Ecology — 4 hrs.**

Ecological principles applied to restoration of degraded ecosystems. Lab covers hands-on techniques in regional restoration and reconstruction. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100; BIOL 3140; junior standing. (Odd Springs)

**BIOL 4198. Independent Study — 1-6 hrs.**

(Fall, Spring, Summer)

**BIOL 6202. Graduate Colloquium and Scientific Skills — 2 hrs.**

Regular presentations by students, faculty members, or visitors on biological topics combined with instructional guidance to build scientific literacy, writing, and statistical skills. Taken each semester for four semesters for maximum of 8 hours. Discussion, 2 periods. (Fall and Spring)

**BIOL 6230. Special Problems in Biology — 1-6 hrs.**

Credit determined at registration. (Problems in biology other than those for theses or in regular curricular offerings.) May be repeated. Prerequisite(s): BIOL 6292 recommended; consent of department. (Fall, Spring, Summer)

**BIOL 6240. Advanced Cellular and Molecular Biology — 3 hrs.**

Selected topics concerning understanding of function of living organisms at molecular and cellular level: regulatory mechanisms, recombinant DNA techniques, gene expression, and genetics of diseases. Lecture/discussion, 3 periods. May be repeated on different topic. Prerequisite(s): consent of instructor. (Odd Springs)

**BIOL 6250. Advanced Physiology and Development — 3 hrs.**

Selected topics concerning understanding of organ, organ system, and organism structure and function: immune system, cellular signaling mechanisms, photosynthesis, and cell motility and development. Lecture/discussion, 3 periods. May be repeated on different topic. Prerequisite(s): consent of instructor. (Odd Falls)

**BIOL 6260. Advanced Ecology — 3 hrs.**

Selected topics of ecology, concerning the understanding of relationships among organisms, and between organisms and their environments (natural or artificial): physiological ecology, conservation biology, and aquatic ecology. Lecture/discussion, 3 periods. May be repeated on different topic. Prerequisite(s): consent of instructor. (Even Springs)

**BIOL 6270. Advanced Systematics and Evolutionary Biology — 3 hrs.**

Selected topics concerning understanding of systematic and evolutionary relationships among organisms and evolutionary biology: evolutionary theory, systematics, and origin of life. Lecture/discussion, 3 periods. May be repeated on different topic. Prerequisite(s): consent of instructor. (Even Falls)

**BIOL 6289. Seminar — 1 hr.**

May be repeated for credit. (Variable)

**BIOL 6292. Research Methods in Biology — 1 hr.**

Introduction to research methods in biology. Emphasis on literature review, proposal preparation, and manuscript style. Discussion, 1 period. (Fall and Spring)

**BIOL 6297. Practicum — 2 hrs.**

May be repeated. (Variable)

**BIOL 6299. Research.**

Prerequisite(s): consent of department. (Fall, Spring, Summer)

**BIOL 629R. Directed Research.**

(Fall, Spring, Summer)

**Iowa Lakeside Laboratory Courses**

**IA LL 1010. Earth, Air and Sky — 2 hrs.**

Introduction to the essentials of earth science (astronomy, meteorology, geology, and paleontology). (Summer)

**IA LL 2019. Soils and Environmental Quality — 4 hrs.**

Role of soils in the environment; relationship between soil quality and plant growth. Field studies on soil identification, degradation and restoration as well as identifying tools useful in effective land and water stewardship. (Summer)

**IA LL 2030. Natural History Workshop — 1-2 hrs.**

Offered as demand warrants. Five day-long, non-technical introductions to a specific aspect of the natural history of the upper Midwest or techniques for studying natural history. Prerequisite: junior standing. (Variable)

A. Amphibians and Reptiles

B. Birds and Birding

C. Nature Photography

D. Mushrooms and Other Fungi

E. Iowa's Trees and Forests

F. Fish Biology

G. Prairies

I. Common Insects

J. Aquatic Plants

K. Life in Rivers

L. Life in Lakes

M. Mosses and Liverworts

N. Natural History of Iowa Great Lakes Region

P. Field Archaeology

Q. Common Algae

S. Scuba Diving

T. Astronomy

## Department of Biology

U. Sketching Nature (Variable)

### **IA LL 2031. Ecology — 4 hrs.**

Introduction to the evolutionary and basic principles of ecology at the organismal, population, community, and ecosystem levels. Integrates lectures and field studies to examine the distribution and abundance of plants and animals in native ecosystems. (Summer)

### **IA LL 2034. Topics in Ecology and Sustainability — 1-4 hrs.**

Scientific introduction to ecology and evolution of important groups of organisms. Topics include: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. May be repeated. (Summer)

### **IA LL 2040. Field Archaeology — 4 hrs.**

Nature of cultural and environmental evidence in archaeology and how they are used to model past human behavior and land use; emphasis on Iowa prehistory; basic reconnaissance surveying and excavation techniques. (Summer)

### **IA LL 2043. Illustrating Nature-Sketching — 2 hrs.**

Sketching plants, animals, and terrain. Visual communication, development of a personal style, and integration of typographic and visual elements on a page will be emphasized. (Summer)

### **IA LL 2044. Illustrating Nature - Photography — 2 hrs.**

Beginning to intermediate technical and compositional aspects of color photography of natural areas and their plants and animals. (Summer)

### **IA LL 2045. Undergraduate Internships — 1-5 hrs.**

Placement with county conservation boards, camps, parks, etc., for experience as interpreters, rangers, and technicians. (Summer)

### **IA LL 3100/5100. Techniques For Biology Teaching — 1-2 hrs.**

Development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips. A. (Summer)

### **IA LL 3102/5102. Plant-Animal Interactions — 4 hrs.**

Introduction to ecology and co-evolution of plants and animals. Emphasis on dispersal, pollination, and plant-herbivore interactions; field and laboratory work, reading, and discussion. Prerequisite(s): one course in the biological sciences; junior standing. (Variable)

### **IA LL 3103/5103. Aquatic Ecology — 4 hrs.**

Analysis of aquatic ecosystems. Emphasis on basic ecological principles; ecological theories tested in the field, and identification of common plants and animals. Prerequisite(s): courses in ecology, chemistry, and physics or consent of instructor; junior standing. (Summer)

### **IA LL 3105/5105. Plant Taxonomy — 4 hrs.**

Principles of classification and evolution of vascular plants; taxonomic tools and collection techniques; use of keys. Field and laboratory studies emphasizing identification of local flowering plants and recognition of major plant families. Prerequisite(s): two semesters of introductory biology or consent of instructor; junior standing. (Summer)

### **IA LL 3107/5107. Field Parasitology — 4 hrs.**

Ecology and life history of parasites, protozoans, helminths, arthropods; field and laboratory investigations including preparation, identification, and morphology of representative types and stages; general and comparative concepts of parasitology. (Variable)

### **IA LL 3109/5109. Ecology and Systematics of Algae: Cyanobacteria and Green Algae — 4 hrs.**

Ecology and Systematics of Algae: Cyanobacteria and Green Algae (Summer)

### **IA LL 3111/5111. Summer Writing Festival at Iowa Lakeside Laboratory — 1 hr.**

One-week workshop designed for young adult to adult writers of all levels, helps participants apply their imagination to their life experiences and become more effective writers. Writing exercises invite imaginative leaps and thoughtful reflections and humor, as well as seriousness. Participants work in various forms of expression, including the personal essay, poetry, and short fiction. Prerequisite(s): junior standing. (Summer)

### **IA LL 3121/5121. Plant Ecology — 4 hrs.**

Principles of plant population, community, and ecosystem ecology illustrated through studies of native vegetation in local prairies, wetlands, and forests. Group or individual projects. Prerequisite(s): two semesters of introductory biology or consent of instructor; junior standing. (Summer)

### **IA LL 3122/5122. Prairie Ecology — 4 hrs.**

Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects. Prerequisite(s): two semesters of introductory biology or consent of instructor; junior standing. (Summer)

### **IA LL 3124/5124. Wetland Ecology — 4 hrs.**

Ecology, classification, creation, restoration, and management of wetlands. Field studies examine the composition, structure, and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects. Prerequisite(s): junior standing. (Summer)

### **IA LL 3126/5126. Ornithology — 2-4 hrs.**

The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies. Prerequisite(s): two semesters of introductory biology or consent of instructor; junior standing. (Summer)

### **IA LL 3127/5127. Introduction to Insect Ecology — 4 hrs.**

Field and laboratory study of insects, their diversity, and life history. Emphasis on ecology and behavior. Prerequisite(s): junior standing. (Variable)

### **IA LL 3128/5128. Fish Ecology — 2-4 hrs.**

Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa. Prerequisite(s): junior standing. (Summer)

### **IA LL 3132. Ecology — 4 hrs.**

Introduction to the evolutionary and basic principles of ecology at the organismal, population, community, and ecosystem levels. Integrates lectures and field studies to examine the distribution and abundance of plants and animals in native ecosystems. Prerequisite(s): two semesters of introductory biology or consent of instructor. (Summer)

### **IA LL 3134/5134. Animals and their Ecosystems — 4 hrs.**

Focus on the vertebrate and invertebrate animals of the Midwest. Animals are observed in nature either through passive observational techniques or active trapping exercises. Once identified, animals are placed in their proper taxonomic position (i.e., put onto the "Tree of Life"). They also are put into ecological perspective, including habitat

preferences (i.e., wetland, lake prairie, forest, river, edge), trophic position, and activity patterns. Conservation status is discussed and in many cases emphasized. Prerequisite(s): an introductory biology course; junior standing. (Summer)

**IA LL 3135/5135. Aquatic Toxicology and Wetland Dynamics in Freshwater Systems — 2 hrs.**

Fundamental knowledge and understanding of scientific concepts related to the physio-chemical and biological environment; problems and issues (global, national, regional, and local) of freshwater systems; how wetland restoration is used to ameliorate problems; basic tools used to assess aquatic toxicological problems. Prerequisite(s): one year of biology and one year of chemistry; junior standing. (Summer)

**IA LL 3140/5140. Water Policy & Politics — 1 hr.**

Historical, legal, economic, cultural, and political dimensions of water resources; public perception and enjoyment of this abundant and important natural resource; how public policy developed; private rights; differences between the previous appropriation system in the western U.S. and Eastern riparian rights law; public rights regarding water for navigation, recreation, and environmental protection; water-related institutions such as suppliers of municipal water and irrigation water; interbasin transport of water. Prerequisite(s): junior standing. (Summer)

**IA LL 3142/5142. Watershed Hydrology and Surficial Processes — 4 hrs.**

Effects of geomorphology, soils, and land use on transport of water and materials (nutrients and contaminants) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed. Prerequisite(s): four courses in the physical or biological sciences or engineering; junior standing. (Summer)

**IA LL 3160/5160. Restoration Ecology — 4 hrs.**

Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, and planting techniques) and management (fire, mowing, and weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation. Prerequisite(s): a course in ecology; junior standing. (Summer)

**IA LL 3162. Restoration Ecology — 2 hrs.**

Ecological principles for restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations; emphasis on prairie restoration and wetland vegetation. (Summer)

**IA LL 3163. Conservation Biology — 4 hrs.**

Population- and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; and design and management of preserves. Prerequisite(s): general biology. (Summer)

**IA LL 3165/5165. Behavioral Ecology — 4 hrs.**

Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior. Prerequisite(s): two courses in the biological sciences; junior standing. (Summer)

**IA LL 3166/5166. Amphibians & Reptiles — 2-4 hrs.**

Ecology, behavior, and conservation biology of amphibians and reptiles. Emphasis on their anatomy and morphology, temperature and water regulation, locomotion, life history, reproduction, population and community ecology, and conservation. (Summer)

**IA LL 3175/5175. Soil Formation & Landscape Relationships — 2-4 hrs.**

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Prerequisite(s): introductory soils course or IA LL 3142/5142; junior standing. (Summer)

**IA LL 4178/5178. Analysis of Environmental Data — 2 hrs.**

Provides students with training in the theory and application of a range of statistical techniques useful for the analysis of ecological and paleoecological data. Topics include data management, exploratory data analysis, regression analysis, direct and indirect ordination methods, classification techniques, transfer functions and the analysis of temporal data. Lectures and practical classes with hands-on-training. Directed towards advanced undergraduate, graduate, and working professionals in ecology and paleoecology. Prerequisite(s): an undergraduate course in statistics, understanding of basic concepts such as correlation and regression, and familiarity with PC-based software for data analysis; junior standing. (Summer)

**IA LL 4193. Undergraduate Research — 1-4 hrs.**

Prerequisite(s): junior standing; consent of instructor. (Variable)

**IA LL 4198. Undergraduate Independent Study — 1-4 hrs.**

Prerequisite(s): junior standing; consent of instructor. (Variable)

**IA LL 6210. Global Climate Change: Causes, Connections and Cures — 2 hrs.**

Underlying causes of global climate change, both natural and human; web of interrelated links affecting the physical and living world, including human society; cause-and-effect relationships and interventions that may reduce negative consequences; for teachers of grades 7-12 and students enrolled in teacher education programs for those grades. Prerequisite(s): bachelor's degree. (Summer)

**IA LL 6215. Field Mycology — 4 hrs.**

Identification and classification of the common fungi; techniques for identification, preservation, and culture practiced with members of the various fungi groups. (Summer)

**IA LL 6217. Ecology and Systematics of Diatoms — 4 hrs.**

Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, and taxonomic characters; project design and execution, including construction of reference and voucher collections and data organization and analysis. Prerequisite(s): two semesters of introductory biology or geology, and consent of instructor. (Summer)

**IA LL 6225. Physical Limnology — 2-4 hrs.**

Mechanisms of physical transport of heat and contaminants in lakes; temperature cycle and stratification; disturbances to seasonal temperature structure, including the diurnal mixed layer, waves, upwelling, differential heating; turbulence, mixing, transport; field measurements of physical processes, computer models of transport. (Summer)

**IA LL 6234. Topics in Ecology and Sustainability — 1-4 hrs.**

Scientific introduction to ecology and evolution of important groups of organisms. Topics include: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. May be repeated. (Summer)

## **Department of Biology**

### **IA LL 6240. Natural History Workshop — 1-3 hrs.**

Offered as demand warrants. Graduate workshop on some aspect of the natural history of the Upper Midwest or on techniques for studying natural history. Prerequisite(s): consent of instructor. (Variable)

### **IA LL 6263. Conservation Biology — 4 hrs.**

Population- and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; and design and management of preserves. (Summer)

### **IA LL 6291. Graduate Internships — 1-5 hrs.**

Placement with county conservation boards, camps, parks, schools, etc., for experience as interpreters, rangers, technicians, and teachers. Prerequisite(s): consent of instructor. (Variable)