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
- Environmental Science (also listed in Department of Earth and Environmental Sciences)

Undergraduate Majors (B.A.)
- Biology
- Biology: Biomedical Emphasis
- Biology: Ecology, Evolution and Organismal Biology Emphasis
- Biology-Teaching
- Combined B.A./M.S. or B.S./M.S. Program Biology
- Environmental Resource Management (also listed in Department of Geography, Department of Earth and Environmental Sciences and Department of Health, Recreation and Community Services)

Minors
- Biology
- Biology-Teaching

Graduate Major (M.S.)
- Biology

Graduate Majors (P.S.M.)
- Biotechnology
- Ecosystem Management

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 or advisor.

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 (840:051) General Biology: Organismal Diversity and BIOL 2052 (840:052) General Biology: Cell Structure and Function) and chemistry (CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II, or CHEM 1130 (860:070) General Chemistry I-II). Liberal Arts Core and/or math classes should be taken by students to complete their schedules.
3. 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. If a student drops a course after the first seven days of classes, in the subsequent semester they will only be allowed to register for that course after all advanced registration is completed.
6. To graduate from UNI with a biology major, 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. To graduate from UNI with a biology major, students must take at least four (4) hours of biology at the 4000 level 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 2.50 or higher, with a grade of C- (1.67) or higher in all courses that are applied to the minor.

Bachelor of Science Degree Program

Emphasis-Honors Research
Students invited to do Honors Research will complete 4 credit hours of BIOL 3190 (840:190) Undergraduate Research in Biology and 1 credit hour of BIOL 3191 (840:191) Senior Thesis.

Biology Major
The B.S. Biology major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 126 hours.

The Bachelor of Science Biology major is designed to prepare students for careers in areas which require a higher degree of concentration in
Department of Biology

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:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 2051 (840:051)</td>
<td>General Biology: Organismal Diversity</td>
</tr>
<tr>
<td>BIOL 2052 (840:052)</td>
<td>General Biology: Cell Structure and Function</td>
</tr>
<tr>
<td>BIOL 3100 (840:100)</td>
<td>Evolution, Ecology and the Nature of Science</td>
</tr>
<tr>
<td>BIOL 3140 (840:140)</td>
<td>Genetics **</td>
</tr>
</tbody>
</table>

Biology: 5-6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 3190 (840:190)</td>
<td>Undergraduate Research in Biology</td>
</tr>
<tr>
<td>BIOL 4157/5157 (840:157g)</td>
<td>Biostatistics</td>
</tr>
</tbody>
</table>

Cognate courses:

Mathematics: 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1420 (800:060)</td>
<td>Calculus I §</td>
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Chemistry and Biochemistry: 16

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>CHEM 1110 (860:044)</td>
<td>General Chemistry I</td>
</tr>
<tr>
<td>CHEM 1120 (860:048)</td>
<td>General Chemistry II ***</td>
</tr>
<tr>
<td>CHEM 2210 (860:120)</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>CHEM 2220 (860:123)</td>
<td>Organic Chemistry II</td>
</tr>
<tr>
<td>CHEM 2230 (860:121)</td>
<td>Organic Chemistry Laboratory</td>
</tr>
</tbody>
</table>

Physics: 8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1511 (880:054)</td>
<td>General Physics I</td>
</tr>
<tr>
<td>PHYSICS 1512 (880:056)</td>
<td>General Physics II</td>
</tr>
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</table>

Electives in Biology: ^ † 19-20

or

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1421 (800:061)</td>
<td>Calculus II</td>
</tr>
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</table>

or

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 4510/5510 (860:154g)</td>
<td>Biochemistry I</td>
</tr>
</tbody>
</table>

Total hours 68

* At least 7-8 hours of BIOL 4xxx (excludes BIOL 4198) is required.

** BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science and BIOL 3140 (840:140) Genetics are not required as prerequisites for 100/3000-level courses.

*** Students with excellent preparation in chemistry may substitute CHEM 1130 (860:070) General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.

^ Not more than four (4) semester hours of credit from BIOL 3185 (840:185) Readings in Biology, BIOL 3190 (840:190) Undergraduate Research in Biology and BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.

† 100/3000-level or above, excluding BIOL 3101 (840:101) Anatomy and Physiology I.

§ Satisfactory score on ALEKS exam or subsequent remediation.

Environmental Science Major

The B.S. Environmental Science major 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.

Required Core

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 2051 (840:051)</td>
<td>General Biology: Organismal Diversity</td>
</tr>
<tr>
<td>BIOL 3100 (840:100)</td>
<td>Evolution, Ecology and the Nature of Science **</td>
</tr>
<tr>
<td>CHEM 1110 (860:044)</td>
<td>General Chemistry I</td>
</tr>
<tr>
<td>CHEM 1120 (860:048)</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>EARTHSCI 1200 (870:021)</td>
<td>Elements of Weather</td>
</tr>
<tr>
<td>EARTHSCI 1300 (870:031)</td>
<td>Introduction to Geology</td>
</tr>
<tr>
<td>GEOG 3310 (970:164)</td>
<td>Geographic Information Systems I</td>
</tr>
<tr>
<td>MATH 1420 (800:060)</td>
<td>Calculus I</td>
</tr>
<tr>
<td>BIOL 3190 (840:190)</td>
<td>Undergraduate Research in Biology **</td>
</tr>
<tr>
<td>or EARTHSCI 4400 (870:180)</td>
<td>Undergraduate Research in Earth Science</td>
</tr>
</tbody>
</table>

Environmental Life Sciences Track 33

Required: 7

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 4157/5157 (840:157g)</td>
<td>Biostatistics **</td>
</tr>
<tr>
<td>BIOL 4168/5168 (840:168g)</td>
<td>Ecology **</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIOL 4105/5105 (840:105g)</td>
<td>Wildlife Ecology and Management ^</td>
</tr>
<tr>
<td>BIOL 4108/5108</td>
<td>Biodiversity Conservation Policy **</td>
</tr>
<tr>
<td>BIOL 4167/5167 (840:167g)</td>
<td>Conservation Biology **</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIOL 3112 (840:112)</td>
<td>Invertebrate Zoology</td>
</tr>
<tr>
<td>BIOL 3120 (840:120)</td>
<td>Plant Diversity and Evolution</td>
</tr>
<tr>
<td>BIOL 3170 (840:170)</td>
<td>Entomology</td>
</tr>
<tr>
<td>BIOL 4154/5154 (840:154g)</td>
<td>Aquatic Ecology</td>
</tr>
<tr>
<td>BIOL 4164/5164 (840:164g)</td>
<td>Mammalogy</td>
</tr>
<tr>
<td>BIOL 4166/5166 (840:166g)</td>
<td>Plant Systematics</td>
</tr>
<tr>
<td>BIOL 4180/5180 (840:180g)</td>
<td>Restoration Ecology</td>
</tr>
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</table>

Category C - Cognates (select a minimum of 2 courses)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>CHEM 2040</td>
<td>Applied Organic and Biochemistry</td>
</tr>
<tr>
<td>or CHEM 2210</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>EARTHSCI 1320</td>
<td>Earth History</td>
</tr>
<tr>
<td>(870:035)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3210/5210</td>
<td>Meteorology</td>
</tr>
<tr>
<td>(870:121g)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3230/5230</td>
<td>Air Quality</td>
</tr>
<tr>
<td>(870:123g)</td>
<td></td>
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<tr>
<td>EARTHSCI 3310/5310</td>
<td>Structural Geology</td>
</tr>
<tr>
<td>(870:129g)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3325/5325</td>
<td>Sedimentary Geology</td>
</tr>
<tr>
<td>(870:136g)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3330/5330</td>
<td>Geomorphology</td>
</tr>
<tr>
<td>(870:141g)</td>
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<tr>
<td>EARTHSCI 3340/5340</td>
<td>Oceanography</td>
</tr>
<tr>
<td>(870:165g)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3345/5345</td>
<td>Environmental Geology</td>
</tr>
<tr>
<td>(870:171g)</td>
<td></td>
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<tr>
<td>EARTHSCI 3350/5350</td>
<td>Environmental Hydrology</td>
</tr>
<tr>
<td>(870:173g)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3355/5355</td>
<td>Hydrogeology</td>
</tr>
<tr>
<td>(870:175g)</td>
<td></td>
</tr>
<tr>
<td>EARTHSCI 3360/5360</td>
<td>Field and Laboratory Methods in Hydrology</td>
</tr>
<tr>
<td>GEOG 2210 (970:028)</td>
<td>Recent Climate Change</td>
</tr>
<tr>
<td>GEOG 3220 (970:100)</td>
<td>Environmental Geography</td>
</tr>
<tr>
<td>GEOG 4220/5220 (970:126g)</td>
<td>Soils and Landscapes</td>
</tr>
<tr>
<td>GEOG 4230/5230 (970:129g)</td>
<td>Rivers</td>
</tr>
<tr>
<td>GEOG 4240/5240 (970:155g)</td>
<td>Reconstructing Ice Age Environments **</td>
</tr>
<tr>
<td>GEOG 4320/5320 (970:174g)</td>
<td>Geographic Information Systems II</td>
</tr>
<tr>
<td>GEOG 4370/5370 (970:173g)</td>
<td>Remote Sensing of the Environment</td>
</tr>
<tr>
<td>MATH 1421 (800:061)</td>
<td>Calculus II</td>
</tr>
</tbody>
</table>

**Environmental Earth Science Track**

<table>
<thead>
<tr>
<th>Required: 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>EARTHSCI 1400</td>
</tr>
<tr>
<td>EARTHSCI 3230/5230</td>
</tr>
<tr>
<td>EARTHSCI 3345/5345</td>
</tr>
<tr>
<td>EARTHSCI 3350/5350</td>
</tr>
</tbody>
</table>

**Electives: 20**

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

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

| EARTHSCI 1320 (870:035) | Earth History |
| EARTHSCI 3210/5210 | Meteorology (870:121g) |
| EARTHSCI 3240/5240 | Air Quality Modeling (870:124g) |

Total Hours 65

* 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.
Department of Biology

These courses have additional prerequisites as follows:
BIOL 3100 (840:100) has prerequisites of BIOL 2051 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). BIOL 3190 (840:190) has prerequisites of BIOL 2051 (840:051); BIOL 2052 (840:052).
BIOL 4157/5157 (840:157) has prerequisites of MATH 1140 (800:046), or MATH 1120 (800:056) and MATH 1130 (800:044), or MATH 1420 (800:060), or equivalent; BIOL 3100 (840:100); BIOL 3140 (840:140). BIOL 4168/5168 (840:168) has prerequisites of BIOL 3100 (840:100); BIOL 3140 (840:140). BIOL 4105/5105 (840:105g) has prerequisites of BIOL 3100 (840:100); BIOL 3140 (840:140). BIOL 4108/5108 has prerequisites of BIOL 3100 (840:100); BIOL 3140 (840:140).

Bachelor of Arts Degree Programs

Emphasis-Honors Research

Students invited to do Honors Research will complete 4 credit hours of BIOL 3190 (840:190) Undergraduate Research in Biology and 1 credit hour of BIOL 3191 (840:191) Senior Thesis.

Biology Major

The B.A. Biology major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core 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:

Introduction track:
- BIOL 2051 (840:051) General Biology: Organismal Diversity
- BIOL 2052 (840:052) General Biology: Cell Structure and Function
- BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science

Electives in Biology:
- BIOL 3140 (840:140) Genetics
- BIOL 3185 (840:185) Readings in Biology
- BIOL 3190 (840:190) Undergraduate Research in Biology
- BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.

Mathematics:
- MATH 1120 (800:056)
- MATH 1130 (800:044)
- MATH 1420 (800:060)

Select one of the following:
- CHEM 1110 (860:044) General Chemistry I
- CHEM 1120 (860:048) General Chemistry II
- CHEM 2210 (860:120) Organic Chemistry I or CHEM 2230 (860:121) Organic Chemistry II
- CHEM 2240 (860:164) Introduction to Biochemistry

Electives in Biology:
- BIOL 2051 (840:051) General Biology: Organismal Diversity
- BIOL 2052 (840:052) General Biology: Cell Structure and Function
- BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science
- BIOL 3140 (840:140) Genetics
- BIOL 3185 (840:185) Readings in Biology
- BIOL 3190 (840:190) Undergraduate Research in Biology
- BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.

Total hours:
- At least 7-8 hours of BIOL 4xxx (excludes BIOL 4198) is required.
- BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science and BIOL 3140 (840:140) Genetics are not required as prerequisites for 100/300-level courses.
- Students with excellent preparation in chemistry may substitute CHEM 1130 (860:070) General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.
- Not more than four (4) semester hours of credit from BIOL 3185 (840:185) Readings in Biology, BIOL 3190 (840:190) Undergraduate Research in Biology and BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.
† 100/3000-level or above, excluding BIOL 3101 (840:101) Anatomy and Physiology I.

** Biology Major: Biomedical Emphasis **

The B.A. Biology Major: Biomedical Emphasis requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core 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, pediatric 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:
  - BIOL 2051 (840:051) General Biology: Organismal Diversity
  - BIOL 2052 (840:052) General Biology: Cell Structure and Function
  - BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science
  - BIOL 3140 (840:140) Genetics

Anatomy group:

- Select one of the following:
  - BIOL 3106 (840:106) Vertebrate Anatomy
  - BIOL 4146/5146 (840:146g) Developmental Biology of Animals
  - BIOL 4172/5172 (840:172g) Developmental Plant Anatomy

Physiology group:

- Select one of the following:
  - BIOL 4114/5114 (840:114g) Comparative Animal Physiology
  - BIOL 4122/5122 (840:122g) Plant Physiology
  - BIOL 4137/5137 (840:138g) Vertebrate Physiology

Cellular group:

- Select one of the following:
  - BIOL 4128/5128 (840:128g) Cell Biology
  - BIOL 4146/5146 (840:146g) Developmental Biology of Animals
  - BIOL 4150/5150 (840:150g) Immunology

Cognate courses:

- Mathematics: 4-5
  - Select one of the following:
    - MATH 1140 (800:046) Precalculus
    - MATH 1420 (800:060) Calculus I
    - MATH 1130 (800:044) Trigonometry and Mathematics for Biological Sciences

Chemistry and Biochemistry:

- Select one of the following:
  - CHEM 1110 (860:044) General Chemistry I
  - CHEM 1120 (860:048) General Chemistry II

Electives selected from the following (consult with advisor): 2-3

- Biology:
  - BIOL 3102 (840:102) Anatomy and Physiology II
  - BIOL 3106 (840:106) Vertebrate Anatomy
  - BIOL 3108 (840:108) Vertebrate Histology
  - BIOL 3147 (840:147) Cancer and Emerging Infectious Diseases
  - BIOL 3151 (840:151) General Microbiology
  - BIOL 3160 (840:160) Field Zoology of Vertebrates
  - BIOL 3170 (840:170) Entomology
  - BIOL 3190 (840:190) Undergraduate Research in Biology
  - BIOL 4114/5114 (840:114g) Comparative Animal Physiology
  - BIOL 4116/5116 (840:116g) Neurobiology
  - BIOL 4122/5122 (840:122g) Plant Physiology
  - BIOL 4128/5128 (840:128g) Cell Biology
  - BIOL 4131/5131 (840:131g) Animal Behavior
  - BIOL 4137/5137 (840:138g) Vertebrate Physiology
  - BIOL 4142/5142 (840:142g) Evolutionary Biology
  - BIOL 4144/5144 (840:144g) Virology
  - BIOL 4146/5146 (840:146g) Developmental Biology of Animals
  - BIOL 4150/5150 (840:150g) Immunology
  - BIOL 4152/5152 Microbial Molecular Biology
  - BIOL 4153/5153 (840:153g) Recombinant DNA Techniques
  - BIOL 4157/5157 (840:157g) Biostatistics
  - BIOL 4164/5164 (840:164g) Mammalogy
  - BIOL 4168/5168 (840:168g) Ecology
  - BIOL 4172/5172 (840:172g) Developmental Plant Anatomy

Chemistry and Biochemistry:

- CHEM 4510/5510 (860:154g) Biochemistry I

Total hours 58

* At least 7-8 hours of BIOL 4xxx (excludes BIOL 4198) is required.

** BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science and BIOL 3140 (840:140) Genetics are not required as prerequisites for 100/3000-level courses.

*** Students with excellent preparation in chemistry may substitute CHEM 1130 (860:070) General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.

^ BIOL 4146/5146 (840:146g) Developmental Biology of Animals cannot satisfy both requirements.
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 Liberal Arts Core 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. With the guidance of a faculty advisor, students who wish to specialize further may follow one of four separate tracks: Ecology, Applied Ecology, Plant Sciences, or Zoology. 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:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 2051 (840:051)</td>
<td>General Biology: Organismal Diversity</td>
</tr>
<tr>
<td>BIOL 2052 (840:052)</td>
<td>General Biology: Cell Structure and Function</td>
</tr>
<tr>
<td>BIOL 3100 (840:100)</td>
<td>Evolution, Ecology and the Nature of Science *</td>
</tr>
<tr>
<td>BIOL 3140 (840:140)</td>
<td>Genetics **</td>
</tr>
</tbody>
</table>

**Cognate courses:**

<table>
<thead>
<tr>
<th>Mathematics:</th>
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<tbody>
<tr>
<td>MATH 1140 (800:046)</td>
<td>Precalculus</td>
</tr>
<tr>
<td>MATH 1420 (800:060)</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MATH 1130 (800:044) &amp; MATH 1120 (800:056)</td>
<td>Trigonometry and Mathematics for Biological Sciences</td>
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</tbody>
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**Chemistry and Biochemistry:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1110 (860:044) &amp; CHEM 1120 (860:048)</td>
<td>General Chemistry I and General Chemistry II ***</td>
</tr>
<tr>
<td>CHEM 2040</td>
<td>Applied Organic and Biochemistry</td>
</tr>
<tr>
<td>CHEM 2210 (860:120) &amp; CHEM 2230 (860:121)</td>
<td>Organic Chemistry I and Organic Chemistry Laboratory</td>
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**Physical Science**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>EARTHSCI 1300 (870:031) or PHYSICS 1511 (880:054)</td>
<td>Introduction to Geology General Physics I</td>
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**Electives: select from the following (consult with advisor):**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BIOL 3106 (840:106)</td>
<td>Vertebrate Anatomy</td>
</tr>
<tr>
<td>BIOL 3107</td>
<td>Environmental Physiology</td>
</tr>
<tr>
<td>BIOL 3112 (840:112)</td>
<td>Invertebrate Zoology</td>
</tr>
<tr>
<td>BIOL 3118</td>
<td>Marine Biology</td>
</tr>
<tr>
<td>BIOL 3120 (840:120)</td>
<td>Plant Diversity and Evolution</td>
</tr>
<tr>
<td>BIOL 3160 (840:160)</td>
<td>Field Zoology of Vertebrates</td>
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<tr>
<td>BIOL 3170 (840:170)</td>
<td>Entomology</td>
</tr>
<tr>
<td>BIOL 3174 (840:174)</td>
<td>Field Biology: __________</td>
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<tr>
<td>BIOL 3185 (840:185)</td>
<td>Readings in Biology</td>
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<tr>
<td>BIOL 3190 (840:190)</td>
<td>Undergraduate Research in Biology</td>
</tr>
<tr>
<td>BIOL 4105/5105 (840:105g)</td>
<td>Wildlife Ecology and Management</td>
</tr>
<tr>
<td>BIOL 4108/5108</td>
<td>Biodiversity Conservation Policy</td>
</tr>
<tr>
<td>BIOL 4114/5114 (840:114g)</td>
<td>Comparative Animal Physiology</td>
</tr>
<tr>
<td>BIOL 4122/5122 (840:122g)</td>
<td>Plant Physiology</td>
</tr>
<tr>
<td>BIOL 4131/5131 (840:131g)</td>
<td>Animal Behavior</td>
</tr>
<tr>
<td>BIOL 4137/5137 (840:138g)</td>
<td>Vertebrate Physiology</td>
</tr>
<tr>
<td>BIOL 4142/5142 (840:142g)</td>
<td>Evolutionary Biology</td>
</tr>
<tr>
<td>BIOL 4146/5146 (840:146g)</td>
<td>Developmental Biology of Animals</td>
</tr>
<tr>
<td>BIOL 4154/5154 (840:154g)</td>
<td>Aquatic Ecology</td>
</tr>
<tr>
<td>BIOL 4157/5157 (840:157g)</td>
<td>Biostatistics</td>
</tr>
<tr>
<td>BIOL 4164/5164 (840:164g)</td>
<td>Mammalogy</td>
</tr>
<tr>
<td>BIOL 4166/5166 (840:166g)</td>
<td>Plant Systematics</td>
</tr>
<tr>
<td>BIOL 4167/5167 (840:167g)</td>
<td>Conservation Biology</td>
</tr>
<tr>
<td>BIOL 4168/5168 (840:168g)</td>
<td>Ecology</td>
</tr>
<tr>
<td>BIOL 4172/5172 (840:172g)</td>
<td>Developmental Plant Anatomy</td>
</tr>
<tr>
<td>BIOL 4180/5180 (840:180g)</td>
<td>Restoration Ecology</td>
</tr>
<tr>
<td>BIOL 4198 (840:198)</td>
<td>Independent Study</td>
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<tr>
<td>EARTHSCI 3328 (870:125)</td>
<td>Fossils and Evolution</td>
</tr>
<tr>
<td>GEOG 3310 (970:164)</td>
<td>Geographic Information Systems I</td>
</tr>
<tr>
<td>GEOG 4220/5220 (970:126g)</td>
<td>Soils and Landscapes</td>
</tr>
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</table>

Total hours: 58

* At least 7-8 hours of BIOL 4xxx (excludes BIOL 4198) is required.

** BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science and BIOL 3140 (840:140) Genetics are not required as prerequisites for 100/300-level courses.

*** Students with excellent preparation in chemistry may substitute CHEM 1110 (860:044) General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.
Biology Major-Teaching (Extended Program)
The B.A. Biology-Teaching major requires a minimum of 131 total hours to graduate. This total includes Liberal Arts Core requirements, the Professional Education Requirements, and the following specified major requirements to complete the minimum of 131 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.

Required:

<table>
<thead>
<tr>
<th>Required</th>
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<tbody>
<tr>
<td>Introductory track:</td>
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<tr>
<td>BIOL 2051 (840:051)</td>
<td>General Biology: Organismal Diversity</td>
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<tr>
<td>BIOL 2052 (840:052)</td>
<td>General Biology: Cell Structure and Function</td>
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<tr>
<td>BIOL 3100 (840:100)</td>
<td>Evolution, Ecology and the Nature of Science</td>
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<td>BIOL 3140 (840:140)</td>
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<td>BIOL 4142/5142 (840:142g)</td>
<td>Evolutionary Biology</td>
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<tr>
<td>Plant group:</td>
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<tr>
<td>BIOL 3120 (840:120)</td>
<td>Plant Diversity and Evolution</td>
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<tr>
<td>BIOL 4122/5122 (840:122g)</td>
<td>Plant Physiology</td>
</tr>
<tr>
<td>BIOL 4166/5166 (840:166g)</td>
<td>Plant Systematics</td>
</tr>
<tr>
<td>BIOL 4172/5172 (840:172g)</td>
<td>Developmental Plant Anatomy</td>
</tr>
<tr>
<td>Animal group:</td>
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<tr>
<td>BIOL 3102 (840:102)</td>
<td>Anatomy and Physiology II ***</td>
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<tr>
<td>BIOL 3106 (840:106)</td>
<td>Vertebrate Anatomy</td>
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<tr>
<td>BIOL 4114/5114 (840:114g)</td>
<td>Comparative Animal Physiology</td>
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<td>BIOL 4146/5146 (840:146g)</td>
<td>Developmental Biology of Animals</td>
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<td>Cellular group:</td>
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<td>Select one of the following:</td>
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<tr>
<td>BIOL 3151 (840:151)</td>
<td>General Microbiology</td>
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<tr>
<td>BIOL 4128/5128 (840:128g)</td>
<td>Cell Biology</td>
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<td>Cognate courses:</td>
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<td>Chemistry and Biochemistry:</td>
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<td>CHEM 2040</td>
<td>Applied Organic and Biochemistry</td>
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<td>CHEM 1110 (860:044)</td>
<td>General Chemistry I</td>
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<tr>
<td>CHEM 1120 (860:048)</td>
<td>General Chemistry II ^</td>
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<tr>
<td>Earth Science:</td>
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<tr>
<td>EARTHSCI 1320 (870:035)</td>
<td>Earth History</td>
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<tr>
<td>PHYSICS 1511 (880:054)</td>
<td>General Physics I</td>
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<td>Methods:</td>
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<td>Science and Science Education:</td>
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<tr>
<td>SCI ED 3300/5300 (820:190g)</td>
<td>Orientation to Science Teaching</td>
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<td>TEACHING 3129</td>
<td>Secondary and Special-Area Classroom Management</td>
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<td>Biology:</td>
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<td>BIOL 3197 (840:197)</td>
<td>Undergraduate Practicum in Biology Teaching</td>
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<tr>
<td>BIOL 4193/5193 (840:193g)</td>
<td>Methods for Teaching Life Science</td>
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<tr>
<td>Electives in Biology:</td>
<td>4</td>
</tr>
<tr>
<td>Total Hours</td>
<td>63</td>
</tr>
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</table>

At least 7-8 hours of BIOL 4xxx (excludes BIOL 4198) is required.

BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science and BIOL 3140 (840:140) Genetics are not required as prerequisites for 100/300-level courses.

Students who take BIOL 3101 (840:101) Anatomy and Physiology I will receive university elective credit. BIOL 3102 (840:102) Anatomy and Physiology II will fulfill the Animal Group requirement. BIOL 3102 (840:102) 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 (860:070) General Chemistry I-II plus 3 additional credit hours of biology or chemistry electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.

Not more than four (4) semester hours of credit from BIOL 3185 (840:185) Readings in Biology, BIOL 3190 (840:190) Undergraduate Research in Biology, and BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.

Combined B.A./M.S. or B.S./M.S. Program Biology

The B.A./M.S. or B.S./M.S. degree program is a five-year program offered on the thesis option only, leading to both the B.A./B.S. and M.S. degrees in biology. This program prepares students for doctoral graduate studies in biology and it provides training for work as a biologist in academic, industrial, and government laboratories. Students interested in this program can declare their intent by the end of the junior year, provided they have an overall grade point average (GPA) of 3.00 or above. An Application for Admission to Graduate Study should be completed and the student’s interest in the Combined B.A./M.S. or B.S./M.S. Program in Biology indicated on the application itself. Graduate information and an application for graduate admission can be found at www.grad.unm.edu/admission.

Once admitted to the program, undergraduate students (who are classified as seniors), may register for a maximum of 12 hours of

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* Not more than four (4) semester hours of credit from BIOL 3185 (840:185) Readings in Biology, BIOL 3190 (840:190) Undergraduate Research in Biology, and BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.

** BIOL 3100 (840:100) Evolution, Ecology and the Nature of Science and BIOL 3140 (840:140) Genetics are not required as prerequisites for 100/300-level courses.

*** Students who take BIOL 3101 (840:101) Anatomy and Physiology I will receive university elective credit. BIOL 3102 (840:102) Anatomy and Physiology II will fulfill the Animal Group requirement. BIOL 3102 (840:102) 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 (860:070) General Chemistry I-II plus 3 additional credit hours of biology or chemistry electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.

† Not more than four (4) semester hours of credit from BIOL 3185 (840:185) Readings in Biology, BIOL 3190 (840:190) Undergraduate Research in Biology, and BIOL 4198 (840:198) Independent Study will be accepted for biology elective credit.
graduate credit as a senior, with the approval of the student’s advisor, the instructor of the course(s), and the head(s) of the department(s) offering the course(s). See policies and procedures for Graduate Credit for Undergraduate Students. Actual admission to graduate study and classification as a graduate student commences the term after the student has completed the baccalaureate.

Refer to the M.S. Biology Major for program requirements.

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 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 KAHHS 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.
- 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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>BIOL 2051</td>
<td>General Biology: Organismal Diversity</td>
<td>4</td>
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<tr>
<td>BIOL 3100</td>
<td>Evolution, Ecology and the Nature of Science</td>
<td>3</td>
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<tr>
<td>CHEM 1110</td>
<td>General Chemistry I</td>
<td>4</td>
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<tr>
<td>EARTHSCI 1300</td>
<td>Introduction to Geology</td>
<td>4</td>
</tr>
<tr>
<td>or GEOG 1210 (970:026) &amp; GEOG 1211</td>
<td>Physical Geography and Physical Geography Laboratory</td>
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<tr>
<td>or EARTHSCI 3330/5330 (870:141g)</td>
<td>Geomorphology</td>
<td>4</td>
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<tr>
<td>GEOF 4260</td>
<td>Environmental Resource Management</td>
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<tr>
<td>GEOF 3310</td>
<td>Geographic Information Systems I</td>
<td>3</td>
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Electives:

<table>
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<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>BIOL 4105/5105 (840:105g)</td>
<td>Wildlife Ecology and Management</td>
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<td>BIOL 4108/5108</td>
<td>Biodiversity Conservation Policy</td>
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<tr>
<td>BIOL 4167/5167 (840:167g)</td>
<td>Conservation Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 4180/5180 (840:180g)</td>
<td>Restoration Ecology</td>
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</table>

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

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>BIOL 4168/5168 (840:168g)</td>
<td>Ecology **</td>
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<tr>
<td>CHEM 1120 (860:048)</td>
<td>General Chemistry II</td>
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<tr>
<td>MATH 1140 (800:046)</td>
<td>Precalculus</td>
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Category B - Content Related Courses (pick at least 1 course)

<table>
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<tr>
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<th>Course Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>BIOL 3112 (840:112)</td>
<td>Invertebrate Zoology *</td>
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</tr>
<tr>
<td>BIOL 3118</td>
<td>Marine Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 3170 (840:170)</td>
<td>Entomology *</td>
<td></td>
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<tr>
<td>BIOL 4154/5154 (840:154g)</td>
<td>Aquatic Ecology **</td>
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<td>BIOL 4157/5157 (840:157g)</td>
<td>Biostatistics **</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td></td>
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<tr>
<td>-------------</td>
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<tr>
<td>BIOL 4164/5164</td>
<td>Mammalogy **</td>
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<tr>
<td>BIOL 4166/5166</td>
<td>Plant Systematics **</td>
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</tr>
<tr>
<td>GEOG 4310/5310</td>
<td>GIS Applications: (Variable Topic)</td>
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<tr>
<td>GEOG 4320/5320</td>
<td>Geographic Information Systems II</td>
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** BIOL 4164/5164 (840:164g) **
** BIOL 4166/5166 (840:166g) **

<table>
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<tr>
<th>Category C - Cognates (pick at least 1 course)</th>
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<tbody>
<tr>
<td>EARTHSCI 1200</td>
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<tr>
<td>ENGLISH 4785/5785</td>
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<td>GEOG 2210</td>
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<td>GEOG 3210</td>
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<td>GEOG 3220</td>
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<td>GEOG 3230</td>
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<tr>
<td>GEOG 4210/5210</td>
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<td>GEOG 4220/5220</td>
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<td>GEOG 4240/5240</td>
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<td>GEOG 4250/5250</td>
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<td>GEOG 4370/5370</td>
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<td>LYHS/HISUS 4556</td>
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<td>LYHS 2770</td>
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<td>LYHS 4553/5553</td>
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<td>MGMT 3185</td>
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<tr>
<td>or EARTHSCI 3430</td>
</tr>
<tr>
<td>(870:195)</td>
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<tr>
<td>or LYHS 4095</td>
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<td>(430:147)</td>
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<tr>
<td>or HPE 4768</td>
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<td>(410:168)</td>
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</table>

Total Hours 32

^ These courses have additional prerequisites as follows:
ENGLISH 4785/5785 (620:177g) has prerequisites of ENGLISH 2770 (620:077) and one of the following - INSTTECH 4170/5170 (240:170g), ART 3030 (600:125), ENGLISH 4765/5765 (620:102g), ENGLISH 4770/5770 (620:104g), ENGLISH 4775/5775 (620:105g), ENGLISH 4780/5780 (620:107g) or consent of instructor; junior standing.
GEOG 3220 (970:100) has a prerequisite of GEOG 1120 (970:010) or GEOG 1210 (970:026) or GEOG 2210 (970:028) or GEOG 1110 (970:040) or consent of instructor.
GEOG 4240/5240 (970:155g) has prerequisites of GEOG 1210 (970:026); GEOG 2210 (970:028); EARTHSCI 1300 (870:031); or consent of instructor; junior standing.
MGMT 3183 and MGMT 3185 has a prerequisite of MGMT 3153 (150:153).
GEOG 3179 (970:179) has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.
LYHS 4095 (430:187) has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of LYHS 4090 (430:184).
HPE 4768 (410:168) has prerequisites of HPE 3693 (410:193); senior standing; 2.50 cumulative GPA; consent 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.

<table>
<thead>
<tr>
<th>Electeds</th>
<th>Primary Focus - Content Related Courses</th>
<th>Total Hours</th>
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</thead>
<tbody>
<tr>
<td>EARTHSCI 3350/5350</td>
<td>Environmental Hydrology ^ (870:173g)</td>
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<tr>
<td>EARTHSCI 3322</td>
<td>Earth Materials ^</td>
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<tr>
<td>GEOG 2210</td>
<td>Recent Climate Change</td>
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<td>GEOG 3210</td>
<td>Natural Hazards and Disasters</td>
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<tr>
<td>GEOG 3220</td>
<td>Environmental Geography **</td>
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<td>or EARTHSCI 3345/5345</td>
<td>Environmental Geology *** (870:171g)</td>
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<td>GEOG 4220/5220</td>
<td>Soils and Landscapes</td>
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<td>GEOG 4230/5230</td>
<td>Rivers</td>
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<tr>
<td>GEOG 4210/5210</td>
<td>Climatology</td>
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<tr>
<td>or EARTHSCI 1200</td>
<td>Elements of Weather</td>
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<td>GEOG 4250/5250</td>
<td>Laboratory Methods in Environmental Geography</td>
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<td>GEOG 4370/5370</td>
<td>Remote Sensing of the Environment</td>
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<tr>
<td>LYHS 4553/5553</td>
<td>Trends and Issues in Outdoor Recreation</td>
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<tr>
<td>(430:143g)</td>
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<tr>
<td>LYHS 4554/5554</td>
<td>Managing Recreation Impacts on the Natural Environment</td>
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</table>
Department of Biology

** Secondary Focus - Management Cognates 9

- BIOL 4105/5105 (840:105g) Wildlife Ecology and Management **
- BIOL 4180/5180 (840:180g) Restoration Ecology **
- EARTHSCI 3325/5325 (870:136g) Sedimentary Geology ****
- EARTHSCI 3360/5360 Field and Laboratory Methods in Hydrology
- ECON 3225/5225 (920:123g) Environmental Economics ^
- ENGLISH 4785/5785 (620:177g) Applied Writing: Projects, Grants and Careers ^
- GEOG 3230 (970:144) Natural Regions of North America
- GEOG 4170/5170 (970:168g) Regional Analysis and Planning
- GEOG 4240/5240 (970:155g) Reconstructing Ice Age Environments*
- GEOG 4310/5310 (970:170g) GIS Applications: (Variable Topic) ^
- GEOG 4320/5320 (970:174g) Geographic Information Systems II ^
- LYHS 2770 (430:070) Eco, Adventure and Sport Tourism #
- LYHS 4095 (430:187) or EARTHSCI 3430 (870:031)
- MGMT 3185 Project Management ^
- POL AMER 3172/5172 (942:172) Public Budgeting ^
- POL AMER 3172/5172 (942:172) or EARTHSCI 3430 (870:195)
- POL AMER 3172/5172 (942:172) or HPE 4768 (410:168)
- LYHS 2770 (430:070) or HPE 4768 (410:168)
- GEOG 3179 (970:179) Cooperative Education in Geography
- GEOG 4310/5310 (970:170g) or EARTHSCI 3430 (870:195)
- GEOG 4310/5310 (970:170g) or HPE 4768 (410:168)
- BIOL 3179 (840:179) or GEOG 3179 (970:179)
- GEOG 3179 (970:179) or BIOL 3179 (840:179)
- GEOG 3179 (970:179) or EARTHSCI 3430 (870:195)
- GEOG 3179 (970:179) or LYHS 4095 (430:187)
- GEOG 3179 (970:179) or HPE 4768 (410:168)
- Other courses as approved by advisors and program director

Total Hours 30

* For students pursuing the Geosystems Track, the Geography Department will accept GEOG 1210 (970:026) and GEOG 1211 or EARTHSCI 1300 (870:031) as the prerequisite for enrollment into all listed Geography courses except GEOG 4310/5310 (970:170g) and GEOG 4320/5320 (970:174g).

** The Biology Department will waive BIOL 3140 (840:140) as a prerequisite for BIOL 4105/5105 (840:105g) and BIOL 4180/5180 (840:180g).

*** The Earth and Environmental Sciences Department will accept GEOG 1210 (970:026) and GEOG 1211 as substitutes for courses that require EARTHSCI 1300 (870:031).

**** The Earth and Environmental Sciences Department will waive the requirement of EARTHSCI 1320 (870:035) for EARTHSCI 3325/5325 (870:136g).

# The Department of Health, Recreation and Community Services will waive LYHS 2770 (430:070) as a prerequisite for LYHS 4776/5776 (430:170g).

^ These courses have additional prerequisites as follows: EARTHSCI 3322 has a prerequisite of EARTHSCI 1300 (870:031).

EARTHSCI 3350/5350 (870:173g) has prerequisites of EARTHSCI 1300 (870:031); junior standing.

EARTHSCI 4220 (970:100) has a prerequisite of GEOG 1210 (970:010) or GEOG 1211 (970:026) or GEOG 2210 (970:028) or GEOG 1110 (970:040) or consent of instructor.

ECON 3225/5225 (920:123g) has prerequisites of ECON 1041 (920:053), ECON 1051 (920:054); junior standing.

ENGLISH 4785/5785 (620:177g) has prerequisites of ENGLISH 2770 (620:077); one of the following courses - INSITECH 4170/5170 (240:170g), ART 3030 (600:125), ENGLISH 4765/5765 (620:102g), ENGLISH 4770/5770 (620:104g), ENGLISH 4775/5775 (620:105g).

ENGLISH 4780/5780 (620:107g), or consent of instructor; junior standing.

GEOG 4310/5310 (970:170g) has prerequisites of GEOG 3310 (970:164); junior standing.

GEOG 4320/5320 (970:174g) has prerequisites of GEOG 3310 (970:164) or consent of instructor; junior standing.

MGMT 3185 has a prerequisite of MGMT 3153 (150:153).

POL AMER 3172/5172 (942:172) has prerequisites of POL AMER 1014 (942:014); POL AMER 1048 (942:048).

GEOG 3179 (970:179) has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.

LYHS 4095 (430:187) has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of LYHS 4090 (430:184).

HPE 4768 (410:168) has prerequisites of HPE 3693 (410:193); senior standing; 2.50 cumulative GPA; consent 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 (970:028) Recent Climate Change
- GEOG 4170/5170 (970:168g) Regional Analysis and Planning
**Secondary Focus - Cognates**

- GEOG 3210 (970:137)  **Natural Hazards and Disasters**
- HPE 4666/5666 (410:166g) **Environmental and Occupational Health Regulations**
- LYHS 2335 (430:060) **Principles of Nonprofit Organizations**
- LYHS 3337 (430:154) **Human Resource Development for Leisure, Youth and Human Services**
- LYHS 4115/5115 (430:168g) **Areas and Facilities for Leisure, Youth and Human Services**
- LYHS 4554/5554 (430:146g) **Managing Recreation Impacts on the Natural Environment**
- LYHS/HISUS 4556 **History of Outdoor Recreation**
- LYHS 4776/5776 (430:170g) **Eco, Adventure and Sport Tourism ^**

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**Secondary Focus - Cognates** (9)

- BIOL 4167/5167 (840:167g) **Conservation Biology **
- GEOG 3230 (970:144) **Natural Regions of North America**
- GEOG 4220/5220 (970:126g) **Soils and Landscapes**
- GEOG 4230/5230 (970:129g) **Rivers**
- GEOG 4210/5210 (970:127g) **Climatology**
- GEOG 4250/5250 (970:185g) **Laboratory Methods in Environmental Geography**
- GEOG 4310/5310 (970:170g) **GIS Applications: (Variable Topic)**
- GEOG 4320/5320 (970:174g) **Geographic Information Systems II**
- GEOG 4370/5370 (970:173g) **Remote Sensing of the Environment**
- ENGLISH 4775/5775 (620:105g) **Applied Writing: Technical Communication**
- or ENGLISH 4785/5785 (620:177g) **Applied Writing: Projects, Grants and Careers**
- HPE 4665/5665 (410:165g) **Environmental Health Science**
- LYHS 2770 (430:070) **Principles of Tourism**
- LYHS 4552/5552 (430:130g) **Theory and Practice of Experiential Education**
- LYHS 4553/5553 (430:143g) **Trends and Issues in Outdoor Recreation**
- LYHS 4779/5779 (430:138g) **Community Planning Workshop**
- MGMT 3185 **Project Management ^**
- POL AMER 3172/5172 (942:172) **Public Budgeting ^**
- GEOG 3179 (970:179) **Cooperative Education in Geography ^**
- or BIOL 3179 (840:179) **Cooperative Education in Zoology**
- or EARTHSCI 3430 (870:195) **Internship**
- or LYHS 4095 (430:187) **Internship**
- or HPE 4768 (410:168) **Field Experience in Health Promotion**

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**Other courses as approved by advisors and program director**

| Total Hours | 30 |

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* * The Biology Department will waive BIOL 3140 (840:140) as a prerequisite for BIOL 4167/5167 (840:167g).

** ** The Geography Department and the Department of Health, Recreation and Community Services will waive LYHS 3060 (430:110) as a prerequisite for enrollment into LYHS 4115/5115 (430:168g).

^ * These courses have additional prerequisites as follows:
- LYHS 4776/5776 (430:170g) has prerequisites of LYHS 2770 (430:070) or consent of instructor; junior standing.
- ENGLISH 4775/5775 (620:105g) has prerequisites of MGMT 2080 (150:080) or ENGLISH 2770 (620:077) or consent of instructor; junior standing.
- ENGLISH 4775/5775 (620:177g) has prerequisites of ENGLISH 2770 (620:077); one of the following courses - INSITTECH 4170/5170 (240:170g), ART 3030 (600:125), ENGLISH 4765/5765 (620:102g), ENGLISH 4770/5770 (620:104g), ENGLISH 4775/5775 (620:105g).
- ENGLISH 4780/5780 (620:107g), or consent of instructor; junior standing.
- MGMT 3185 has a prerequisite of MGMT 3153 (150:153).
- POL AMER 3172/5172 (942:172) has prerequisites of POL AMER 1014 (942:014); POL AMER 1048 (942:048). GEOG 3179 (970:179) has prerequisites of 15 hours of geography at UNI; cumulative GPA of 2.50; junior standing; consent of department.
- LYHS 4095 (430:187) has prerequisites of senior standing; consent of Internship Coordinator and a corequisite of MGMT 4090 (430:384).
- HPE 4768 (410:168) has prerequisites of HPE 3693 (410:193); senior standing; 2.50 cumulative GPA; consent of Health Promotion and Education Coordinator of Student Field Experiences.

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**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 (920:053) **Principles of Macroeconomics**
- ECON 1051 (920:054) **Principles of Microeconomics**
- ECON 3225/5225 (920:123g) **Environmental Economics**
- MGMT 3185 **Project Management ^**
- POL AMER 3172/5172 (942:172) **Public Budgeting ^**
- GEOG 3179 (970:179) **Cooperative Education in Geography ^**
- BIOL 3179 (840:179) **Cooperative Education in Zoology**
- EARTHSCI 3430 (870:195) **Internship**
- LYHS 4095 (430:187) **Internship**
- HPE 4768 (410:168) **Field Experience in Health Promotion**
- EARTHSCI 1200 (870:021) **Elements of Weather**
- EARTHSCI 1400 **Introduction to Environmental Earth Science**
- EARTHSCI 3230/5230 (870:123g) **Air Quality ^**
- EARTHSCI 3345/5345 (870:171g) **Environmental Geology ^**

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**Primary Focus - Content Related Courses**

| 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. | 10 |
Department of Biology

or

GEOG 3220 (970:100) Environmental Geography
EARTHSCI 3350/5350 (870:173g) Environmental Hydrology *

Secondary Focus - Cognates

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>EARTHSCI 3240/5240 (870:124g)</td>
<td>Air Quality Modeling ^</td>
</tr>
<tr>
<td>EARTHSCI 3250/5250 (870:177g)</td>
<td>Measurement and Analysis of Air Quality ** ^</td>
</tr>
<tr>
<td>EARTHSCI 3325/5325 (870:136g)</td>
<td>Sedimentary Geology ***</td>
</tr>
<tr>
<td>EARTHSCI 3355/5355 (870:175g)</td>
<td>Hydrogeology *</td>
</tr>
<tr>
<td>GEOG 4220/5220 (970:126g)</td>
<td>Soils and Landscapes</td>
</tr>
<tr>
<td>GEOG 4230/5230 (970:173g)</td>
<td>Remote Sensing of the Environment</td>
</tr>
<tr>
<td>HPE 4665/5665 (410:165g)</td>
<td>Environmental Health Science</td>
</tr>
<tr>
<td>LYHS 4554/5554 (430:146g)</td>
<td>Managing Recreation Impacts on the Natural Environment</td>
</tr>
<tr>
<td>MGMT 3153 (150:153)</td>
<td>Organizational Management *</td>
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<tr>
<td>MGMT 3185</td>
<td>Project Management</td>
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<tr>
<td>POL AMER 1048 (942:048)</td>
<td>Introduction to Public Administration</td>
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<tr>
<td>GEOG 3179 (970:179)</td>
<td>Cooperative Education in Geography ^</td>
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<tr>
<td>or BIOL 3179 (840:179)</td>
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<tr>
<td>or HPE 4768 (410:168)</td>
<td>Field Experience in Health Promotion</td>
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Minors

Biology Minor

Required:

Introductory track: 8

- BIOL 2051 (840:051) General Biology: Organismal Diversity
- BIOL 2052 (840:052) General Biology: Cell Structure and Function

Chemistry and Biochemistry: 8

- CHEM 1110 (860:044) and CHEM 1120 (860:048) General Chemistry I and General Chemistry II *

Electives in Biology: ** 10-12

Total Hours 26-28

- Students with excellent preparation in chemistry may substitute CHEM 1130 (860:070) General Chemistry I-II plus 3 additional credit hours of biology electives for CHEM 1110 (860:044) General Chemistry I and CHEM 1120 (860:048) General Chemistry II.

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.

Required:

Introductory track: 15

- The Earth and Environmental Sciences Department will accept GEOG 1210 (970:026) and GEOG 1211 as a substitute for courses that require EARTHSCI 1300 (870:031).
- The Earth and Environmental Sciences Department will waive EARTHSCI 3230/5230 (870:123g) as a prerequisite for enrollment into EARTHSCI 3240/5240 (870:124g) and EARTHSCI 3250/5250 (870:177g).
- The Earth and Environmental Sciences Department will waive the requirement for EARTHSCI 1320 (870:035) for EARTHSCI 3325/5325 (870:136g).
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 www.grad.uni.edu/admission.

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 32 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 200/6000-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:

- 200/6000-level Biology courses: 6
  Take one course in at least two of the content areas (prerequisites vary)

** Content Areas:
- I. BIOL 6240 (840:240) Advanced Cellular and Molecular Biology
- II. BIOL 6250 (840:250) Advanced Physiology and Development
- III. BIOL 6260 (840:260) Advanced Ecology
- IV. BIOL 6270 (840:270) Advanced Systematics and Evolutionary Biology

Professional Science Master’s Degree Programs

Major in Biotechnology

This P.S.M. degree prepares students for career opportunities in biotechnology-related businesses and industries. Emphasis is placed on combining molecular and genetic engineering skills with an understanding of business and the degree includes an internship experience. Admission is restricted to students with a GPA of 3.00 or higher and a B.A. or B.S. in Biotechnology, Biology, Biochemistry or a related discipline. Students must have taken an Introductory General Biology sequence, Genetics and one or more courses in Molecular Biology or equivalents to be considered.

Students interested in this 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. Graduate information and application for graduate admission can be found at www.grad.uni.edu/admission.

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 non-thesis option only. A minimum of 30 semester hours is required. A minimum of 12 semester hours of 200/6000-level course work is required.

**SUSPENDING PROGRAM. NO ADMITS HAVE BEEN ACCEPTED SINCE FALL 2014.**

**Required:**

**Biology:**
- BIOL 4153/5153 (840:153g) Recombinant DNA Techniques 4
- BIOL 6215 Advanced Molecular Cloning 3
- BIOL 6240 (840:240) Advanced Cellular and Molecular Biology 3
- BIOL 6280 (840:280) Advanced Analytical Techniques 2

**Science and Science Education:**
- PSM 6289 (820:289) Professional Science Master’s Seminar (1 hr.)
- PSM 6950 (820:295) Professional Science Master’s Internship (4-6 hrs.)

**Business and Marketing:**
- Business fundamentals course (approved by advisor) 3
- MKTG 3586/5586 (130:175g) Entrepreneurial Strategy 3

**Electives (must be 100g/5000-level or above):**
- Select from the following or other graduate level courses as approved by advisor.

**Biology:**
- BIOL 4108/5108 Biodiversity Conservation Policy 3
- BIOL 4166/5166 (840:166g) Plant Systematics 4
- BIOL 4180/5180 (840:180g) Restoration Ecology 4
- BIOL 6260 (840:260) Advanced Ecology 3

**Science and Science Education:**
- PSM 6100 (820:209) Business Management for Science Professionals 3
- PSM 6300 (820:215) Team-Based Problem Solving 3
- PSM 6289 (820:289) Professional Science Master’s Seminar 2
- PSM 6950 (820:295) Professional Science Master’s Internship 4

**Electives (must be 100g/5000-level or above):**
- Select from the following or other graduate level courses as approved by advisor.

**Total Hours 30**

### Major in Ecosystem Management

This P.S.M. degree prepares students for career opportunities in conservation and restoration-related businesses, government agencies, and nonprofit organizations. Emphasis is placed on blending ecosystem analysis, management and restoration skills with an understanding of conservation policy, and the degree includes a team project and an internship experience. Admission is restricted to students with a GPA of 3.00 or higher and a B.A. or B.S. in Biology, Ecology or related field. Majors in Agriculture, Geography and other related applied disciplines must take or have taken an introductory biology sequence to be considered.

Students interested in this 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 other application requirements. Graduate information and application for graduate admission can be found at [www.grad.uni.edu/admission](http://www.grad.uni.edu/admission).

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 non-thesis option only. A minimum of 30 semester hours is required. A minimum of 15 semester hours of 200/6000-level course work is required.

**SUSPENDING PROGRAM. NO ADMITS HAVE BEEN ACCEPTED SINCE FALL 2014.**

**Required:**

**Biology:**
- BIOL 4108/5108 Biodiversity Conservation Policy 3
- BIOL 4166/5166 (840:166g) Plant Systematics 4
- BIOL 4180/5180 (840:180g) Restoration Ecology 4
- BIOL 6260 (840:260) Advanced Ecology 3

**Science and Science Education:**
- PSM 6100 (820:209) Business Management for Science Professionals 3
- PSM 6300 (820:215) Team-Based Problem Solving 3
- PSM 6289 (820:289) Professional Science Master’s Seminar 2
- PSM 6950 (820:295) Professional Science Master’s Internship 4

**Electives (must be 100g/5000-level or above):**
- Select from the following or other graduate level courses as approved by advisor.

**Biology:**
- BIOL 4105/5105 (840:105g) Wildlife Ecology and Management 3
- BIOL 4131/5131 (840:131g) Animal Behavior 4
- BIOL 4142/5142 (840:142g) Evolutionary Biology 4
- BIOL 4154/5154 (840:154g) Aquatic Ecology 4
- BIOL 4157/5157 (840:157g) Biostatistics or STAT 3771/5771 (800:121g) Applied Statistical Methods for Research 2
- BIOL 4164/5164 (840:164g) Mammalogy 3
- BIOL 4167/5167 (840:167g) Conservation Biology 3

**Earth Science:**
**Biology Courses**

**BIOL 1012 (840:012). Life: The Natural World — 3 hrs.**
Examines living organisms with an emphasis on how the natural world functions as a system and how plants and animals, including humans, interact. Declared biology majors cannot receive either university or elective credit for this course. Prerequisite(s): student must have satisfied university entrance requirements in English and Mathematics. Prerequisite(s) or corequisite(s): BIOL 1014 (840:014) or equivalent. (Fall and Spring)

**BIOL 1013 (840:013). Life: The Natural World - Lab — 1 hr.**
Activities illustrating the importance, origins, and maintenance of biodiversity with a focus on the interactions among organisms and between organisms and the environment. Declared biology majors cannot receive either university or elective credit for this course. Prerequisite(s): student must have satisfied university entrance requirements in English and Mathematics. Prerequisite(s) or corequisite(s): BIOL 1012 (840:012). (Fall and Spring)

**BIOL 1014 (840:014). Life: Continuity and Change — 3 hrs.**
Introduction to contemporary topics in biology. Emphasis on study of gene structure and function and applications of biology to human concerns. Declared biology majors cannot receive either university or elective credit for this course. Prerequisite(s): student must have satisfied university entrance requirements in English and Mathematics. (Fall and Spring)

**BIOL 1015 (840:015). Life: Continuity and Change - Lab — 1 hr.**
Process of science and application of biology to human concerns stressed through student activities involving basic life science concepts encompassing cell structure and function, human genetics, and disease transmission. Emphasis on assisting students in understanding role of biology in our present society. Lab, 2 periods. Declared biology majors cannot receive either university or elective credit for this course. Prerequisite(s): student must have satisfied university entrance requirements in English and Mathematics. Prerequisite(s) or corequisite(s): BIOL 1014 (840:014) or equivalent. (Fall and Spring)

**BIOL 1033 (840:033). 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 1070. Bioscientific Terminology — 1 hr.**
A study of common biological terms based on Latin and Greek roots, prefixes, and suffixes. Students will learn to interpret and remember novel scientific words, construct new biological terminology, and use scientific dictionaries. (Variable)

**BIOL 2051 (840:051). 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. (Fall and Spring)

**BIOL 2052 (840:052). 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. (Fall and Spring)

**BIOL 3100 (840:100). 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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Fall and Spring)

**BIOL 3101 (840:101). 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. Prerequisite(s): BIOL 2051 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070), or consent of department head. (Fall, Spring, Summer)

**BIOL 3102 (840:102). Anatomy and Physiology II — 4 hrs.**
Continuation of 840:101. 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 (840:101) or BIOL 3106 (840:106). (Fall, Spring, Summer)

**BIOL 3106 (840:106). 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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Fall and Spring)

**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 (840:051); BIOL 2052 (840:052);
CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Variable)

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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Variable)

BIOL 3112 (840:112). Invertebrate Zoology — 4 hrs.
Morphology, physiology, phylogeny, taxonomy, and ecology of the invertebrates. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 2051 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Variable)

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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Variable)

BIOL 3147 (840:147). 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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Fall and Spring)

BIOL 3151 (840:151). 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 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Spring)

Identification and natural history of Iowa vertebrates. Emphasis on field trips. Discussion, 2 periods; lab and field work, 6 periods. Prerequisite(s): BIOL 2051 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Fall and Spring)

Introduction to biology of insects. Discussion, 2 periods; lab, 2 periods. Prerequisite(s): BIOL 2051 (840:051); BIOL 2052 (840:052); CHEM 1110 (860:044) and CHEM 1120 (860:048), or CHEM 1130 (860:070). (Variable)

BIOL 3174 (840:174). 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 (840:179). 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)

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 (820:032). (Odd Falls)

BIOL 3185 (840:185). 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)

(Variable)

BIOL 3190 (840:190). 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 for maximum of 4 hours. Prerequisite(s): BIOL 2051 (840:051); BIOL 2052 (840:052); sophomore standing; consent of department. (Fall, Spring, Summer)

BIOL 3191 (840:191). 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 3197 (840:197). Undergraduate Practicum in Biology Teaching — 1 hr.
Examination of teaching strategies and practical experience in laboratory teaching through observation and assistance in introductory biology laboratories. Offered on credit/no credit basis only. Prerequisite(s) or corequisite(s): BIOL 4193/5193 (840:193g); consent of instructor. (Variable)

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 (840:100); BIOL 3140 (840:140); 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. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Even Falls)

BIOL 4114/5114 (840:114g). 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 (840:100); BIOL 3140 (840:140); CHEM 2040 or CHEM 2210 (860:120); junior standing. (Even Falls)
BIOL 4116/5116 (840:116g). 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 (840:100); BIOL 3140 (840:140); CHEM 2040 or CHEM 2210 (860:120); junior standing. (Spring)

BIOL 4121/5121 (840:121g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Odd Falls)

BIOL 4122/5122 (840:122g). 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 (840:100); BIOL 3140 (840:140); CHEM 2040 or CHEM 2210 (860:120); junior standing. (Spring)

BIOL 4127/5127 (840:127g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Even Springs)

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 (840:100); BIOL 3140 (840:140); CHEM 2040 or CHEM 2210 (860:120); junior standing. (Spring)

BIOL 4129/5129 (840:129g). Genomics and Proteomics — 3 hrs.  
Genome sequencing and analysis, sequence variation, sequencing for disease diagnosis, the epigenome in disease development, analysis of gene expression. Discussion, 2 periods; lab, 2 periods. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Even Springs)

Mechanisms, adaptive significance, evolution, and ecology of behavior and sociality. Discussion, 3 periods; lab, 2 periods. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Variable)

Study of functional mechanisms for cellular processes in select vertebrate organ systems. Discussion, 3 periods; lab, 3 periods. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); CHEM 2040 or CHEM 2210 (860:120); junior standing. (Odd Falls)

BIOL 4142/5142 (840:142g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Spring)

BIOL 4144/5144 (840:144g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Even Springs)

BIOL 4146/5146 (840:146g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Fall and Spring)

BIOL 4150/5150 (840:150g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Fall)

BIOL 4152/5152. Microbial Molecular Biology — 4 hrs.  
Microbial gene action. Laboratory emphasizes methods used to study mechanisms of microbial gene function at the molecular level. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); CHEM 2040, or CHEM 2210 (860:120); junior standing. (Odd Falls)

BIOL 4153/5153 (840:153g). Recombinant DNA Techniques — 4 hrs.  
Study of techniques for analyzing and manipulating DNA and RNA, including polymerase chain reaction, genomic library construction, gene expression, and genomic analysis with computers. Discussion, 2 periods; lab, 4 periods. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Even Falls)

BIOL 4154/5154 (840:154g). Aquatic Ecology — 3 hrs.  
Introduction to geological, physical, chemical, and biological factors that interact to determine functional characteristics of inland waters. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Variable)

BIOL 4157/5157 (840:157g). 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 (800:046), or MATH 1120 (800:056) and MATH 1130 (800:044), or MATH 1420 (800:060), or equivalent; BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Fall)

BIOL 4164/5164 (840:164g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Fall)

BIOL 4166/5166 (840:166g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Odd Falls)
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 (840:100); BIOL 3140 (840:140); junior standing. (Odd Springs)

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 (840:100); BIOL 3140 (840:140); junior standing. (Fall)

BIOL 4172/5172 (840:172g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Even Falls)

The history, theory, and fundamental operating principles of light, stereo, and confocal microscopes. Labs will focus on the use of these microscopes, specimen preparation, and digital processing techniques of fixed and live specimens. Discussion, 1 period, laboratory, 2 periods, plus 1 period arranged. Prerequisite(s): BIOL 3100 (840:100); BIOL 3140 (840:140); junior standing. (Variable)

BIOL 4180/5180 (840:180g). 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 (840:100); BIOL 3140 (840:140); junior standing. (Odd Springs)

Teaching approaches, instructional and assessment strategies, curricular and laboratory materials, and issues related to grades 5-12 life science and biology. Field experiences in secondary school science classrooms. Discussion, 3 periods. Prerequisite(s): TEACHING 3128; EDPSYCH 3148 (200:148); MEASRES 3150 (250:150); SCI ED 3300/5300 (820:190g); SCI ED 3200; junior standing. (Fall, Spring, Summer)

(Fall, Spring, Summer)

BIOL 6202 (840:202). Graduate Colloquium — 1 hr.
Weekly presentation by a student, faculty member, or visitor on biological topic. Taken each semester for four semesters for maximum of 4 hours. Discussion, 1 period. (Fall and Spring)

BIOL 6215. Advanced Molecular Cloning — 3 hrs.
Student teams will experiment with, analyze and trouble shoot real world cloning projects. Techniques used may include RT-PCR, Q-PCR, DNA sequence analysis, site-directed mutagenesis and gene design. Discussion, 2 periods; lab, 3 periods. Prerequisite(s): BIOL 4153/5153 (840:153g) or equivalent; consent of instructor. (Variable)

Credit determined at registration. (Problems in biology other than those for theses or in regular curricular offerings.) May be repeated. Prerequisite(s): BIOL 6292 (840:292) recommended; consent of department. (Fall, Spring, Summer)

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)

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)

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 (840:270). 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)

Discussion of advanced modern methods of biological data collection and analysis, including the use of computer algorithms to help understand experimental results obtained from laboratory or field. Discussion and/or lab, 2 periods. Prerequisite(s): consent of instructor. (Variable)

BIOL 6289 (840:289). Seminar — 1 hr.
May be repeated for credit. (Variable)

BIOL 6292 (840:292). 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)

May be repeated. (Variable)

BIOL 6299 (840:299). Research.
Prerequisite(s): consent of department. (Fall, Spring, Summer)

(Fall, Spring, Summer)

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

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)
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
U. Sketching Nature (Variable)

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 plans 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 (890:040). 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)

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)

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

IA LL 2045 (890:050). 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 (890:100g). 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)

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 (890:103g). 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 (890:105g). 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)

Structure and taxonomy of freshwater algae based on field-collected material. Emphasis on genus-level identifications, habitats; visited locations include lakes, fens, streams, and rivers; algal ecology. (Summer)

IA LL 3111/5111 (890:111g). 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 (890:121g). 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)

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)

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 (890:126g). 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 (890:127g). 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 (890:128g). 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 (890:132). 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 (890:134g). 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 (890:135g). 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 (890:140g). 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 (890:142g). 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 (890:160g). 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 3163 (890:163). 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 (890:165g). 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. 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 (890:175g). 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 (890:142g); junior standing. (Summer)

**IA LL 4178 (890:178g). 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 (890:193). Undergraduate Research — 1-4 hrs.**
Prerequisite(s): junior standing; consent of instructor. (Variable)

**IA LL 4198 (890:198). Undergraduate Independent Study — 1-4 hrs.**
Prerequisite(s): junior standing; consent of instructor. (Variable)

**IA LL 6210 (890:210). 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 (890:215). 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)
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)

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)

IA LL 6240 (890:240). 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 (890:291). 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)