BIOLOGICAL SCIENCES

Description
The School of Biological Sciences offers educational opportunities in various areas of biology leading toward either the bachelor of science or the bachelor of arts degree. Our research and teaching cover all levels of biological organization—from molecules to ecosystems—with a focus on integrating across levels. Study in the biological sciences prepares students for a variety of careers, including medicine, allied health, government, industry, education, and research.

Options in the Major
Students may choose to focus their advanced coursework in ways that meet their specific interests and career goals. All students complete a core set of requirements and can determine, in consultation with faculty and their academic advisor, which specific option to follow. The option will be documented on the final transcript.

Standard Option
Allows students to choose their own combination of advanced courses from subareas of cell biology, organismal biology, genetics, ecology, and evolution.

Human Health and Disease Option
Provides students the opportunity to combine a strong biological sciences education with a focus on the health and disease of humans.

Program Assessment. To assist the department in evaluating the effectiveness of its program, after significantly completing the coursework, all majors will be required in their senior year to register for BIOS 99 Assessment of the Major and complete selected assessment activities. Results of participation in these assessment activities will in no way affect a student’s GPA or graduation.

Cedar Point Biological Station. Biological sciences majors are strongly urged to attend the Cedar Point Biological Station for at least one summer session. Majors are also encouraged to do a research project with a faculty member.

College Admission
The entrance requirements for the College of Arts and Sciences (CAS), including any of the majors or minors offered through the college, are the same as the University of Nebraska–Lincoln General Admission Requirements. In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language in high school. Four years of high school coursework in the same language will fulfill the College of Arts and Sciences’ language requirement. It will also allow students to continue language study at a more advanced level at the University of Nebraska–Lincoln and provide more opportunity to study abroad.

ACADEMIC AND CAREER Advising
Academic and Career Advising Center
The Academic and Career Advising Center in 107 Oldfather Hall is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help. Students visit the Advising Center in 107 Oldfather Hall to:

• Choose or change their major, minor, or degree program.
• Check in on policies, procedures, and deadlines.
• Get a college approval signature from the Dean’s representative, Sr. Director of Advising and Student Success.

While the assigned academic advisor should be the student’s primary contact, there are daily walk-ins from 12-3 where a general academic advisor can answer a quick question. In addition, the CAS Career Coaches are located here. They help students explore majors and minors, gain experience, and develop a plan for life after graduation. Not sure where to go or who to ask? The Advising Center team can help.

Assigned Academic Advisors
Academic advisors are critical resources dedicated to students’ academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and discipline-specific expertise.

Assigned advisors are listed in MyRED (https://its.unl.edu/myunl/) and their offices may be located in or near the department of the major for which they advise or in the Academic and Career Advising Center. Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, contact the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, http://cas.unl.edu/advising (http://cas.unl.edu/advising/).

Career Coaching
The College believes that Academics + Experience = Opportunities and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value. Graduates are not only prepared to effectively contribute professionally in the real world, but they have a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience, and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

ACE Requirements
Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE website (http://ace.unl.edu) for the most current list of certified courses.
ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.

ACE 2: Demonstrate competence in communication skills.

ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

College Degree Requirements

College Distribution Requirements – BA and BS

The College of Arts and Sciences distribution requirements are common to both the bachelor of arts and bachelor of science degrees and are designed to ensure a range of courses. By engaging in study in several different areas within the College, students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Independent study or reading courses and internships cannot be used to satisfy distribution requirements.
- Courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

College Distribution Requirements

| CDR: Written Communication | 3 |
| CDR: Natural, Physical, and Mathematical Sciences with Lab | 4 |

Select from courses approved for ACE outcome 1.

Some courses from geography and anthropology may also be used to satisfy the lab requirement above.

CDR: Humanities

Select from classics, English, history, modern languages and literatures, philosophy, and religious studies.

CDR: Social Science

Select from anthropology, communication studies, geography, political science, psychology, or sociology.

CDR: Human Diversity in U.S. Communities

Select from a set of approved courses as listed in the degree audit.

CDR: Language

Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies or modern languages and literatures. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Russian, and Spanish.

A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement, but encouraged to continue on in their language study.

Credit Hours Subtotal: 13-32

1 See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.

2 Language courses numbered 220 and below do not fulfill the CDR Humanities.

3 See Degree Audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

Language Requirement

The University of Nebraska–Lincoln and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The University of Nebraska–Lincoln entrance requirement of two years of the same foreign language or the College’s language distribution requirement (CDR: Language) will rarely be waived and only with relevant documentation. See the main College of Arts and Sciences page for more details.

Scientific Base - BS Only

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences. Approved courses for scientific base credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), computer science (excluding CSCE 10), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBSIO 101), and physics.
See your Degree Audit or your assigned academic advisor for a complete list, including individual classes that fall outside of the disciplines listed above. Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with the approval of the College of Arts and Sciences. See your assigned academic advisor to start the approval process.

Minimum Hours Required for Graduation
A minimum of 120 semester hours of credit is required for graduation from the College of Arts and Sciences. A cumulative grade point average of at least 2.0 is required.

Grade Rules
Restrictions on C- and D Grades
The College will accept no more than 15 semester hours of C- and D grades from other domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No University of Nebraska–Lincoln C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by the College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege
The College of Arts and Sciences adheres to the University regulations for the Pass/No Pass (P/N) privilege with the following additional regulations:

- Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences departments and programs do not allow courses graded Pass/No Pass to apply to the major or minor. Students should refer to the department’s or program’s section of the catalog for clarification. By college rule, departments can allow up to 6 hours of Pass/No Pass in the major or minor.
- Departments may specify that certain courses of theirs can be taken only on a P/N basis.
- The college will permit no more than a total of 24 semester hours of P/N grades to be applied toward degree requirements. This total includes all Pass grades earned at the University of Nebraska–Lincoln and other U.S. schools. NOTE: This 24-hour limit is more restrictive than the University regulation.

Grading Appeals
A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk with the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor’s department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean’s Office, 1223 Oldfather Hall.

Course Level Requirements
Courses Numbered at the 300 or 400 Level
Thirty (30) of the 120 semester hours of credit must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 hours (1/2) must be completed in residence at the University of Nebraska–Lincoln.

Residency Requirement
Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska−Lincoln. Students must complete at least 1/2 of their major coursework, including 6 hours at the 300 or 400 level in their major and 15 of the 30 hours required at the 300 or 400 level, in residence. Credit earned during education abroad may be used toward the residency requirement only if students register through the University of Nebraska–Lincoln.

Catalog to Use
Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991, the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Learning Outcomes
Graduates of with a biological sciences major will be able to:

1. Demonstrate mastery of the concepts, principles, and knowledge for following sub-disciplines: cell biology, organismal biology, genetics, ecology, and evolution.
2. Use scientific methods and knowledge of the natural and physical world to address biological problems through inquiry, experimentation, interpretation, analysis, and the making of inferences from data to determine whether conclusions or solutions are reasonable.
3. Acquire a more in-depth knowledge in a sub-discipline area by generating a scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection, and is representative of a typical scholarly product for the sub-discipline.

Major Requirements
Complete the Biological Sciences Core Requirements, Ancillary Requirements, and one of two options: Standard or Human Health and Disease.

Core Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>BIOS 100</td>
<td>Pathways to Success in the Biological Sciences Major</td>
<td>1</td>
</tr>
<tr>
<td>LIFE 120 &amp; LIFE 120L</td>
<td>Fundamentals of Biology I and Fundamentals of Biology I laboratory</td>
<td>4</td>
</tr>
<tr>
<td>LIFE 121 &amp; LIFE 121L</td>
<td>Fundamentals of Biology II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 205</td>
<td>Genetics, Molecular and Cellular Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Credits</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>BIOS 206</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 207</td>
<td>Ecology and Evolution</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 99</td>
<td>Assessment of the Major</td>
<td>0</td>
</tr>
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<td><strong>Credit Hours Subtotal:</strong></td>
<td><strong>19</strong></td>
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<tr>
<td></td>
<td><strong>Total Credit Hours</strong></td>
<td><strong>19</strong></td>
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### Ancillary Requirements

#### Mathematics and Quantitative Reasoning

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I</td>
<td>5</td>
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<td>Select one of the following:</td>
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<tr>
<td>CSCE 155T</td>
<td>Computer Science I: Informatics Focus</td>
<td>3-4</td>
</tr>
<tr>
<td>ECON 215</td>
<td>Statistics</td>
<td></td>
</tr>
<tr>
<td>EDPS 459</td>
<td>Statistical Methods</td>
<td></td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td></td>
</tr>
<tr>
<td>PSYC 350</td>
<td>Research Methods and Data Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 218</td>
<td>Introduction to Statistics</td>
<td></td>
</tr>
<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Credit Hours Subtotal:</strong></td>
<td><strong>8-9</strong></td>
</tr>
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</table>

#### Chemistry

Select one sequence from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 109A</td>
<td>General Chemistry I</td>
<td>7-8</td>
</tr>
<tr>
<td>&amp; CHEM 109L</td>
<td>and General Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 110A</td>
<td>and General Chemistry II</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 110L</td>
<td>and General Chemistry II Laboratory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>CHEM 113A</td>
<td>Fundamental Chemistry I</td>
<td>4-5</td>
</tr>
<tr>
<td>&amp; CHEM 113L</td>
<td>and Fundamental Chemistry I Laboratory</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 114</td>
<td>and Fundamental Chemistry II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select one sequence from:</td>
<td></td>
</tr>
<tr>
<td>CHEM 251</td>
<td>Organic Chemistry I</td>
<td>4-5</td>
</tr>
<tr>
<td>&amp; CHEM 253</td>
<td>and Organic Chemistry I Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHEM 261</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 263</td>
<td>and Organic Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Credit Hours Subtotal:</strong></td>
<td><strong>11-13</strong></td>
</tr>
</tbody>
</table>

#### Biochemistry

Select one course from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOC 401</td>
<td>Elements of Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 431</td>
<td>Biochemistry I: Structure and Metabolism</td>
<td></td>
</tr>
<tr>
<td>BIOC 431</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 431</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Credit Hours Subtotal:</strong></td>
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#### Physics

Select one sequence from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 141</td>
<td>Elementary General Physics I</td>
<td>8-10</td>
</tr>
<tr>
<td>&amp; PHYS 142</td>
<td>and Elementary General Physics II</td>
<td></td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics I</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 212</td>
<td>and General Physics II</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Credit Hours Subtotal:</strong></td>
<td><strong>8-10</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total Credit Hours</strong></td>
<td><strong>30-35</strong></td>
</tr>
</tbody>
</table>

### Standard Option

#### Biological Sciences Electives

Select 18 hours of BIOS courses, including at least 10 hours at the 300 level or above and at least two courses at the 400 level.  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 213</td>
<td>Human Physiology</td>
<td></td>
</tr>
<tr>
<td>&amp; BIOS 213L</td>
<td>and Human Physiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 214</td>
<td>Human Anatomy</td>
<td></td>
</tr>
<tr>
<td>BIOS 303</td>
<td>Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>or BIOS 337</td>
<td>Applications of Bioinformatics</td>
<td></td>
</tr>
<tr>
<td>BIOS 312</td>
<td>Microbiology</td>
<td></td>
</tr>
<tr>
<td>&amp; BIOS 314</td>
<td>and Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Credit Hours Subtotal:</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

1. No more than 8 hours may be from courses for which the home department is other than biological sciences.
2. The following courses will NOT count toward the biological sciences major: BIOS 101, BIOS 101L, BIOS 110, BIOS 110L, BIOS 117, BIOS 203, or BIOS 395.

### Human Health and Disease Option

#### Foundation Courses

Select three courses or sequences from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 213</td>
<td>Human Physiology</td>
<td></td>
</tr>
<tr>
<td>&amp; BIOS 213L</td>
<td>and Human Physiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 214</td>
<td>Human Anatomy</td>
<td></td>
</tr>
<tr>
<td>BIOS 303</td>
<td>Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>or BIOS 337</td>
<td>Applications of Bioinformatics</td>
<td></td>
</tr>
<tr>
<td>BIOS 312</td>
<td>Microbiology</td>
<td></td>
</tr>
<tr>
<td>&amp; BIOS 314</td>
<td>and Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Credit Hours Subtotal:</strong></td>
<td><strong>11-13</strong></td>
</tr>
</tbody>
</table>

#### Human Health and Disease Electives

Select two courses or sequences from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 300</td>
<td>Toxins in the Environment</td>
<td>6-8</td>
</tr>
<tr>
<td>BIOS 326</td>
<td>Biology of Viruses</td>
<td></td>
</tr>
<tr>
<td>BIOS 368</td>
<td>Plants in Human Medicine: Biological, Social, and Ethical Dimensions</td>
<td></td>
</tr>
<tr>
<td>BIOS 385</td>
<td>Parasitology</td>
<td></td>
</tr>
<tr>
<td>BIOS 408</td>
<td>Functional Histology</td>
<td></td>
</tr>
<tr>
<td>&amp; VBMS 408</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOS 427</td>
<td>Practical Bioinformatics Laboratory</td>
<td></td>
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<tr>
<td>BIOS 440</td>
<td>Microbial Physiology</td>
<td></td>
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<tr>
<td>BIOS 441</td>
<td>Pathogenic Microbiology</td>
<td></td>
</tr>
<tr>
<td>&amp; VBMS 441</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOS 442</td>
<td>Endocrinology</td>
<td></td>
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<tr>
<td>&amp; ASCI 442</td>
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<tr>
<td>BIOS 443</td>
<td>Immunology</td>
<td></td>
</tr>
<tr>
<td>BIOS 445</td>
<td>Food Microbiology</td>
<td></td>
</tr>
<tr>
<td>&amp; BIOS 446</td>
<td>and Food Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 448</td>
<td>Human Growth and Development</td>
<td></td>
</tr>
<tr>
<td>&amp; ANTH 448</td>
<td></td>
<td></td>
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<tr>
<td>BIOS 465</td>
<td>Behavioral Neuroscience</td>
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<tr>
<td>&amp; PSYC 465</td>
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<td>BIOS 477</td>
<td>Bioinformatics and Molecular Evolution</td>
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<td><strong>Credit Hours Subtotal:</strong></td>
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#### Human Health and Disease ACE 10 Course

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOS 402</td>
<td>Cancer Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOS 412</td>
<td>Human Genetics</td>
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<tr>
<td>BIOS 418</td>
<td>Advanced Genetics</td>
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<tr>
<td>BIOS 420</td>
<td>Molecular Genetics</td>
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<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>------------</td>
<td>------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>BIOS 421</td>
<td>Microbial Diversity</td>
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<tr>
<td>BIOS 422</td>
<td>Comparative Physiology</td>
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<tr>
<td>BIOS 422L</td>
<td>and Comparative Physiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 426</td>
<td>Systems Biology</td>
<td></td>
</tr>
<tr>
<td>BIOS 429</td>
<td>Phylogenetic Biology</td>
<td></td>
</tr>
<tr>
<td>BIOS 435</td>
<td>Evolutionary Medicine</td>
<td></td>
</tr>
<tr>
<td>BIOS 452</td>
<td>Field Epidemiology</td>
<td></td>
</tr>
<tr>
<td>BIOS 472</td>
<td>Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOS 487</td>
<td>Field Parasitology</td>
<td></td>
</tr>
</tbody>
</table>

**Credit Hours Subtotal:** 3-4

**Total Credit Hours:** 20-25

1. Research credit is strongly recommended through BIOS 498, BIOS 499, or BIOS 499H.

### Additional Major Requirements

#### Grade Rules

**C- and D Grades**
A grade of C or above is required for all courses in the major, including ancillary requirements.

**Pass/No Pass**
Except for BIOS 100 and BIOS 310, no course taken Pass/No Pass can be counted toward the major.

### Requirements for Minor Offered by Department

Eighteen (18) hours, comprised of the five-course core.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>BIOS 205</td>
<td>Genetics, Molecular and Cellular Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>BIOS 206</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 207</td>
<td>Ecology and Evolution</td>
<td>4</td>
</tr>
<tr>
<td>LIFE 120</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
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<tr>
<td>&amp; LIFE 120L</td>
<td>and Fundamentals of Biology I Laboratory</td>
<td></td>
</tr>
<tr>
<td>LIFE 121</td>
<td>Fundamentals of Biology II</td>
<td>4</td>
</tr>
<tr>
<td>&amp; LIFE 121L</td>
<td>and Fundamentals of Biology II Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credit Hours:** 18

### Grade Rules

**C- and D Grades**
A grade of C or above is required for all courses in the minor.

**Pass/No Pass**
No course taken Pass/No Pass can be counted toward the minor.

### BIOS 100 Pathways to Success in the Biological Sciences Major

**Prerequisites:** Biological Sciences Major and freshman or sophomore standing

**Description:** An orientation to the Biological Sciences Major. Introduction to advising and university services, study skills, professionalism, community building, and career development.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Pass No Pass

**Offered:** FALL/SPR

**Prerequisite for:** BIOS 111; BIOS 213; BIOS 213L

**ACE:** ACE 4 Science

### BIOS 101 General Biology

**Prerequisites:** Parallel registration in BIOS 101L.

**Notes:** High school chemistry strongly recommended. Not intended for most Life Sciences majors; such students should take LIFE 120- LIFE 120L and LIFE 121-LIFE 121L instead. Credit toward the degree cannot be earned in both BIOS 101 and BIOS 110. BIOS 101 does not count in the Biological Sciences major.

**Description:** Analysis of the structure, functions, and interactions of organisms from the molecular to the ecosystem levels.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** AGRO 216, HORT 216; AGRO 240, RNGE 240, GRAS 240; AGRO 278, HORT 278; ASCI 240, ASCI 271; BIOS 111; BIOS 203; BIOS 213; BIOS 213L; BSEN 317; ENTO 308; GEOG 308, GEOL 308, NRES 308; NRES 320; NRES 322; HORT 302; NRES 310; PLPT 210

**ACE:** ACE 4 Science

### BIOS 101L General Biology Laboratory

**Prerequisites:** Parallel registration in BIOS 101.

**Notes:** Credit toward the degree cannot be earned in both BIOS 101L and BIOS 110L. BIOS 101L does not count in the Biological Sciences major.

**Description:** Laboratory exercises and experiments that complement material covered in BIOS 101.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Prerequisite for:** AGRO 216, HORT 216; BIOS 111; BIOS 203; BIOS 213; BIOS 213L; ENTO 308; GEOG 308, GEOL 308, NRES 308

### BIOS 110 Human Biology

**Prerequisites:** Parallel registration in BIOS 110L.

**Notes:** High school chemistry or equivalent strongly recommended. Not intended for most Life Sciences majors; such students should take LIFE 120-LIFE 120L and LIFE 121-LIFE 121L instead. Credit toward the degree cannot be earned in both BIOS 101 and BIOS 110. BIOS 110 does not count in the Biological Sciences major.

**Description:** Introduction to biology with a focus on organization of molecules and cells to the level of human body systems; basic structure (anatomy) and function (physiology) of human tissues, organs and organ systems; reproduction, genetics; DNA technology and genetic engineering.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**Prerequisite for:** AGRO 216, HORT 216; BIOS 111; BIOS 203; BIOS 213; BIOS 213L; ENTO 308; GEOG 308, GEOL 308, NRES 308

**ACE:** ACE 4 Science
BIOS 110L Human Biology Laboratory  
**Prerequisites:** Parallel registration in BIOS 110.  
**Notes:** Credit toward the degree cannot be earned in both BIOS 101L and BIOS 110L. BIOS 110L does not count in the Biological Sciences major.  
**Description:** Hands-on lab exercises to understand biological concepts of human organization from molecules to cells to the body systems, basic structure and function of human tissues, organs, organ systems, reproduction, genetics, as well as DNA technology and genetic engineering.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Offered:** FALL/SPR  
**Prerequisite for:** BIOS 111; BIOS 213; BIOS 213L  

BIOS 111 Introduction to Microbiology and Human Health  
**Prerequisites:** BIOS 101 and BIOS 101L or BIOS 110 and BIOS 110L or LIFE 120 and LIFE 120L  
**Description:** Comparative study of microorganisms important for human health and disease (bacteria, fungi, viruses, prions), principles and applications of microbiology.  
**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Grading Option:** Graded with Option  

BIOS 115 Insect Biology  
**Crosslisted with:** ENTO 115  
**Description:** Fundamental insect biology (anatomy, development, physiology, behavior, ecology and diversity). Economic and medical importance of insects and principles of insect pest management.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Prerequisite for:** ENTO 200; ENTO 400; PLPT 210  
**ACE:** ACE 4 Science  

BIOS 116 Insect Identification  
**Crosslisted with:** ENTO 116  
**Description:** Identification of representative orders and families of insects by their anatomy, metamorphosis, habits and habitats. Sight recognition emphasized but dichotomous keys also used. Interrelation of insect and habitats stressed.  
**Credit Hours:** 1  
**Max credits per semester:** 1  
**Max credits per degree:** 1  
**Grading Option:** Graded with Option  

BIOS 117 Life in the Universe  
**Crosslisted with:** ASTR 117, GEOL 117  
**Description:** Survey of what modern science tells us about the possibilities of life elsewhere in the universe. Topics include how the Earth formed and became suitable for life, how life arose on the Earth, the conditions under which life can thrive, places in the solar system that might support life, the existence of other solar systems that might provide suitable habitats, and attempts to find evidence of life on other planets.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**ACE:** ACE 4 Science  

BIOS 136 Discovery Research: Virus Hunting  
**Prerequisites:** By permission  
**Description:** Perform original research by using the scientific method to isolate a virus that infects a harmless bacterium (bacteriophage) from local soil samples. Lab skills acquired include pipetting, aseptic technique, and serial dilutions; use basic DNA and electron microscopy analyses to characterize the phage.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded with Option  
**Offered:** FALL  
**Prerequisite for:** BIOS 137  

BIOS 137 Discovery Research: Virus Genome Analyses  
**Prerequisites:** BIOS 136 and by permission.  
**Description:** Build on an original project involving isolation of a virus that infects a harmless bacterium (bacteriophage) using bioinformatic tools to analyze and annotate the sequenced bacteriophage genome.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded with Option  
**Offered:** SPRING  

BIOS 180 Biological Sciences Learning Community Freshman Seminar  
**Prerequisites:** Permission.  
**Notes:** Open to Biological Sciences Learning Community students only.  
**Description:** An exploration of biological sciences for undergraduates in the Biological Sciences Learning Community. Topics vary.  
**Credit Hours:** 1  
**Max credits per semester:** 1  
**Max credits per degree:** 1  
**Grading Option:** Graded with Option  

BIOS 136 and by permission.  
**Offered:** SPRING  

BIOS 189H University Honors Seminar  
**Prerequisites:** Good standing in the University Honors Program.  
**Description:** Topic varies.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded  
**ACE:** ACE 4 Science  

BIOS 203 Bioethics  
**Prerequisites:** Sophomore standing; BIOS 101 and 101L.  
**Description:** Relevance of biological science to society and its environment examined through readings, guest lecturers, and discussion.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  

BIOS 205 Genetics, Molecular and Cellular Biology Laboratory  
**Prerequisites:** BIOS 206 or parallel  
**Description:** Series of lab exercises to introduce principles of genetic, molecular and cellular biology. Experiments done using model systems to identify, map and clone genes; analyze gene products and expression; and fractionate cell components.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded with Option  
**Prerequisite for:** FORS 401
BIOS 206 General Genetics
Prerequisites: LIFE 120 & LIFE 120L and LIFE 121 & LIFE 121L
Description: Inheritance and regulation of genes in organisms and populations. Fundamentals of genomics and bioinformatics.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: ASCI 330; ASCI 486; BIOC 433H; BIOS 99; BIOS 205; BIOS 302; BIOS 303; BIOS 326; BIOS 420; BIOS 820; VBMS 820; MBIO 420; BIOS 421, BIOS 821, MBIO 421; BIOS 443, BIOS 843, VBMS 843, MBIO 443; BIOS 802, BIOS 402; FORS 401; PLPT 418, PLPT 818

BIOS 207 Ecology and Evolution
Prerequisites: LIFE 120 & LIFE 120L and LIFE 121 & LIFE 121L
Description: Introduction to the principles and processes of ecology and evolution. Structure and dynamics of populations and communities; biotic and abiotic interactions; mechanisms of evolutionary change; natural selection; adaptation; and speciation.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOS 99; BIOS 472; NRES 311

BIOS 213 Human Physiology
Prerequisites: BIOS 101 and 101L or BIO 110 and 110L or LIFE 120 and 120L; Parallel registration in BIOS 213L.
Description: Elementary survey of the basic functional systems of the human body: the muscular, nervous, receptor, circulatory, respiratory, digestive, excretory, endocrine, and reproductive systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: ASCI 341; NUTR 355; NUTR 450; VBMS 303; VBMS 403; VBMS 410

BIOS 213L Human Physiology Laboratory
Prerequisites: BIOS 101 and 101L or BIO 110 and 110L or LIFE 120 and 120L; Parallel registration in BIOS 213.
Description: Laboratory exercises and experiments that complement material covered in BIOS 213.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: VBMS 303; VBMS 403

BIOS 214 Human Anatomy
Prerequisites: Sophomore standing.
Notes: Cadaver prosections are studied in the lab. Letter Grade Only.
Description: Introduction to the major organ systems of the human body including skeletal, major muscle, nervous, digestive, circulatory, excretory, and reproductive systems. Anatomical structures as they pertain to clinical anatomy.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Grading Option: Graded
Prerequisite for: NUTR 384

BIOS 291 Special Topics in Biological Sciences
Description: Topics vary.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Graded with Option

BIOS 296 Independent Study in Biology
Prerequisites: Permission
Notes: A maximum of 3 credit hours may be counted toward the major in BIOS. Before registering, arrangements must be made with a faculty member in BIOS to reach an agreement on the scope and determine the amount of credit for the project.
Description: Independent work directed by faculty.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option

BIOS 300 Toxins in the Environment
Crosslisted with: ENTO 300, NRES 300
Prerequisites: One semester BIOS and one semester CHEM
Description: Introduction to the principles of toxicology as they apply to environmental contaminants, agri-chemicals, and industrial and naturally occurring chemicals.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 302 Cell Biology
Prerequisites: BIOS 206; CHEM 251 or CHEM 255 or CHEM 261.
Notes: BIOS 205 and CHEM 252 recommended.
Description: The design, execution, and evaluation of scientific experiments that advance the knowledge of cell and molecular biology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 303 Molecular Biology
Prerequisites: BIOS 206
Description: Molecular biology of prokaryotes and eukaryotes. Review of the experimental basis for the principles of the discipline.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 310 School of Biological Sciences Seminar
Prerequisites: LIFE 120 and LIFE 121
Notes: Pass/No Pass only.
Description: Reviews of current literature of general interest; reports of research activities by staff and guest speakers.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 3
Grading Option: Pass No Pass
BIOS 312 Microbiology
Prerequisites: LIFE 121; LIFE 121L; CHEM 251 or CHEM 255 or CHEM 261.
Notes: BIOS 206 recommended. Parallel registration in BIOS 313 or 314 recommended.
Description: Microbial cell structure, genetics, metabolic and biosynthetic activity, diversity, ecology and evolution including host-microbe interactions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BIOS 421, BIOS 821, MBIO 421; BIOS 440, BIOS 840, VBMS 840, Mbio 440; VBMS 403

BIOS 313 Molecular Microbiology Laboratory
Prerequisites: LIFE 121; LIFE 121L; CHEM 251 or CHEM 255 or CHEM 261.
Notes: Credit towards the degree may not be earned in both BIOS 313 and 314. BIOS 206 and parallel registration in BIOS 312 recommended.
Description: Microbiology techniques which include recombinant DNA methods used in industry, medicine and research.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
Prerequisite for: BIOS 440, BIOS 840, VBMS 840, Mbio 440

BIOS 314 Microbiology Laboratory
Prerequisites: LIFE 121; LIFE 121L; CHEM 251 or CHEM 255 or CHEM 261.
Notes: Credit towards the degree may not be earned in both BIOS 313 and 314. BIOS 206 and parallel registration in BIOS 312 recommended.
Description: Traditional microbiology techniques without recombinant DNA methods.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: BIOS 440, BIOS 840, VBMS 840, Mbio 440

BIOS 316L Case Studies in Theoretical Ecology Lab
Prerequisites: MATH 106 or higher OR LIFE 121. Parallel registration in BIOS 316.
Description: Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to field questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Offered: SUMMER

BIOS 317 The Biology of Plants
Prerequisites: LIFE 120 and LIFE 121
Notes: Field trips are required and may occur outside of scheduled class time.
Description: Introduction to the basic principles and concepts of the biology of plants. Adaptive variation and biodiversity of plants considering the relationships of plant structure to function integrating across succeeding levels of organization: molecule, cell, tissue, organism, organism, population, community, and ecosystem.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 326 Biology of Viruses
Prerequisites: BIOS 206; CHEM 251 or CHEM 255 or CHEM 261.
Description: Fundamental concepts in virology including basic features of structure, evolution, diseases, replication cycles and virus-host interactions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 337 Applications of Bioinformatics
Prerequisites: LIFE 120; LIFE 120L
Description: Provides a broad overview of bioinformatics. Shows how bioinformatics can help solving problems in biological research. Covered topics: biological databases, molecular biology tools, sequence comparison methods, phylogenetic inference, and molecular graphics.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Offered: FALL
BIOS 368 Plants in Human Medicine: Biological, Social, and Ethical Dimensions
Prerequisites: LIFE 121
Description: Introduction to the use of plants in traditional and alternative medicine, nutrition, and wellness. Examination of the biological, historical, and cultural origins of plant medicinal compounds used to enhance wellness or treat human diseases, such as cancer and heart disease. Consideration of the social and ethical consequences of the development of plant-derived drugs, use of herbal remedies in wellness and nutrition and of other emerging issues associated with plants in human medicine.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL

BIOS 369 Introductory Plant Pathology
Crosslisted with: PLPT 369
Prerequisites: AGRO 131/HORT 131, or LIFE 120 and 120L, or BIOS 109.
Description: Relation of plant disease to crop production, the environment, and society. Organisms that cause disease and their interactions with plants. Strategies for plant disease management.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 381 Invertebrate Zoology
Prerequisites: LIFE 121 & LIFE 121L
Description: Comparative study of the morphology and natural history of invertebrate animals; emphasis on phylogenetic relationships.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 385 Parasitology
Prerequisites: LIFE 121 & LIFE 121L
Description: Emphasis on parasitic diseases of humans. Impact of parasitism on societies considered in addition to the clinical consequences for infected individuals. Means of transmission, diagnosis, and treatment considered in respect to recent technological advances in production of monoclonal antibodies and genetic engineering. Nature and biological significance of parasitism are viewed in terms of prospects for control.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 386 Vertebrate Zoology
Crosslisted with: NRES 386
Prerequisites: LIFE 121 & LIFE 121L
Description: Evolutionary origin and relationships, natural history, and ecological adaptations of vertebrates. Comparative form and function, particularly of bone and muscle systems among and the diversity within vertebrate groups.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 395 Internship
Prerequisites: Permission
Description: Combination of work outside the University and academic work in biological sciences arranged through the Career Services Office.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Pass No Pass

BIOS 397 Undergraduate Education Assistant Practicum
Prerequisites: Permission
Notes: Open to students who are interested in life sciences education and want to train to become a Teaching Assistant or Learning Assistant in the School of Biological Sciences. Students must have earned a grade of C or better in the BIOS or LIFE course they will assist in.
Description: A structured training experience in the professional skills used by teaching and learning assistants in life science laboratories, recitations and lectures.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded
Groups: Biology, Psychology & Politics

BIOS 397A Anatomy and/or Physiology Practicum
Prerequisites: Permission
Notes: Open only to students who expect to become teaching assistants in anatomy or physiology
Description: A combination of academic work and instruction in the anatomy or physiology laboratories in biological sciences: cadaver dissection or work with physiological equipment; assist in the instruction of anatomical and physiological concepts.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

BIOS 402 Cancer Biology
Crosslisted with: BIOS 802
Prerequisites: BIOS 206 and Senior standing
Description: Principles of cancer genetics, cancer prevention, and new methods for diagnosis and therapy. Fundamentals of the cell and molecular events that lead to human cancer.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 406 Insect Ecology
Crosslisted with: BIOS 806, ENTO 406, ENTO 806
Prerequisites: BIOS/NRES 220 and 222.
Description: Biotic and abiotic factors as they influence insect development, behavior, distribution, and abundance.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
**BIOS 407** Biology of Cells and Organelles  
**Crosslisted with:** BIOS 807  
**Prerequisites:** BIOS 206  
**Description:** Regulation and timing of macromolecular synthesis during the cell cycle; the genetic autonomy of mitochondria and chloroplasts.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option

**BIOS 408** Functional Histology  
**Crosslisted with:** BIOS 808, VBMS 408, VBMS 808  
**Prerequisites:** BIOS 101 and 101L or LIFE 120 and 120L or BIOS 112; BIOS 213 or ASCI 240 or ASCI 340.  
**Description:** Microscopic anatomy of the tissues and organs of major vertebrate species, including humans. Normal cellular arrangements of tissues and organs as related to their macroscopic anatomy and function, with reference to sub-cellular characteristics and biochemical processes. Functional relationships among cells, tissues, organs and organ systems, contributory to organismal well being. General introduction to pathological processes and principles underlying some diseases.  
**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Grading Option:** Graded with Option

**BIOS 412** Human Genetics  
**Crosslisted with:** BIOS 812  
**Prerequisites:** BIOS 206 and Senior standing  
**Description:** Genetic basis of human variation, with emphasis on methods of applying genetic principles to humankind. Genetic ratios in pooled data; population and quantitative genetics; consanguinity; polygenic inheritance; blood types; sex linkage; linkage and crossing over; sex determination; visible chromosome variation; mutation; heredity and environment; eugenics; anthropological genetics; molecular genetics and molecular basis of disease; human genome project.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**ACE:** ACE 10 Integrated Product

**BIOS 415** Developmental Biology  
**Crosslisted with:** BIOS 815  
**Prerequisites:** BIOS 206  
**Description:** Survey of topics in developmental biology, both animal and plant development.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option

**BIOS 416** Biodiversity Conservation  
**Crosslisted with:** BIOS 816  
**Prerequisites:** BIOS 207 or NRES 220  
**Description:** Basic conservation science theory and conservation decision making tools which are essential for making effective decisions for biodiversity conservation. Topics include systematic conservation planning, population viability analysis, risk assessment, and applying those tools to real conservation problems.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option

**BIOS 418** Advanced Genetics  
**Crosslisted with:** BIOS 818  
**Prerequisites:** BIOS 206 and Senior standing  
**Description:** In-depth study of the principles and methodology of genetics, with emphasis on Drosophila: multiple alleles and complex loci, linkage and recombination, chromosome rearrangements, fine structure analysis, sex determination, recombinant DNA, and gene function in development.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**ACE:** ACE 10 Integrated Product

**BIOS 420** Molecular Genetics  
**Crosslisted with:** BIOS 820, VBMS 820, Mbio 420  
**Prerequisites:** BIOS 206 and Senior standing  
**Description:** Molecular basis of genetics. Gene structure and regulation, transposable elements, chromosome structure, DNA replication, and repair mechanisms and recombination.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Prerequisite for:** AGRO 963, HORT 963, PLPT 963; BIOS 945; BIOS 964, VBMS 964, FDST 908B  
**ACE:** ACE 10 Integrated Product

**BIOS 421** Microbial Diversity  
**Crosslisted with:** BIOS 821, Mbio 421  
**Prerequisites:** BIOS 206 and BIOS 312 and Senior Standing.  
**Description:** Diversity of microbial cell composition, structure, and function enabling movement, metabolism, symbiosis, and adaptation using bacterial, fungal, algal, and viral examples. A physiological, biochemical and molecular approach used throughout.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**ACE:** ACE 10 Integrated Product
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Notes</th>
<th>Credits</th>
<th>Grading Option</th>
<th>ACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 422</td>
<td>Comparative Physiology</td>
<td>BIOS 822</td>
<td>BIOS 213</td>
<td>Comprehensive survey of comparative physiology with emphasis on the diversity of adaptations in basic physiological systems and the effects of environmental parameters upon such systems. Comparative physiology of osmoregulation, temperature regulation, metabolism, muscle, central nervous function, and sensory function.</td>
<td></td>
<td>3</td>
<td>Graded with Option</td>
<td>ACE 10 Integrated Product</td>
</tr>
<tr>
<td>BIOS 422L</td>
<td>Comparative Physiology Laboratory</td>
<td></td>
<td>Parallel registration in BIOS 422/822</td>
<td>Physiological adaptations in ecological and evolutionary context.</td>
<td>Letter grade only.</td>
<td>1</td>
<td>Graded</td>
<td></td>
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<tr>
<td>BIOS 423</td>
<td>Quaternary Paleoclimatology and Paleoeology</td>
<td>BIOS 823, GEOL 423, GEOL 823</td>
<td>12 hrs GEOL or BIOS.</td>
<td>Analysis and interpretation of the Quaternary period's paleoenvironmental data. Patterns of long-term climate variation. Distribution patterns and responses of organisms and ecosystems to Quaternary environmental change.</td>
<td></td>
<td>3</td>
<td>Graded with Option</td>
<td></td>
</tr>
<tr>
<td>BIOS 424</td>
<td>Biogeochemical Cycles</td>
<td>BIOS 824, GEOL 424, GEOL 824</td>
<td>CHEM 109 or CHEM 109A and 109L or CHEM 113 or CHEM 113A and 113L; 12 hrs GEOL or BIOS.</td>
<td>Chemical cycling at or near the earth's surface, emphasizing interactions among the atmosphere, biosphere, geosphere and hydrosphere. Modern processes, the geological record, and human impacts on elemental cycles.</td>
<td></td>
<td>3</td>
<td>Graded with Option</td>
<td></td>
</tr>
<tr>
<td>BIOS 425</td>
<td>Plant Biotechnology</td>
<td>BIOS 825</td>
<td>BIOS 206</td>
<td>Introduction to the use of plants for basic and applied purposes by deliberate manipulation of their genomes; techniques in plant genetic engineering; manipulations of plant development and metabolism; engineering pest, disease, and stress resistance; plants as bioreactors; and environmental and social impacts of plant biotechnology.</td>
<td>No computer programming skill is required.</td>
<td>3</td>
<td>Graded with Option</td>
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<tr>
<td>BIOS 426</td>
<td>Systems Biology</td>
<td>BIOS 826</td>
<td>LIFE 120 and LIFE 121 or BIOS 101; STAT 218 or STAT 380 or EDPS 459 or PSYC 350 or ECON 215.</td>
<td>Fundamentals of the analysis of high throughput experiments to understand complex biological systems. Principles and methods such as next generation sequencing, protein-protein interaction networks, regulatory networks, and biological data mining and integration. Emerging research in new biotechnology and data analysis in biomedical and life sciences.</td>
<td>BIOS 206 and CSCE 155T are recommended, but not required.</td>
<td>3</td>
<td>Graded with Option</td>
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<tr>
<td>BIOS 427</td>
<td>Practical Bioinformatics Laboratory</td>
<td>BIOS 827</td>
<td>BIOS 206</td>
<td>Basic knowledge and skills needed for general bioinformatics, genomics and proteomics analyses. Various computational analyses including database search, sequence alignment, phylogenetic reconstruction, gene prediction/mining, microarray data analyses and protein structure analyses.</td>
<td>No computer programming skill is required.</td>
<td>3</td>
<td>Graded with Option</td>
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<tr>
<td>BIOS 428</td>
<td>Perl Programming for Biological Applications</td>
<td>BIOS 828</td>
<td>LIFE 120 and LIFE 121</td>
<td>Computer programming, using Perl, as applied to biological sciences, bioinformatics, computational biology, and genomics.</td>
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<td>3</td>
<td>Graded with Option</td>
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<tr>
<td>BIOS 429</td>
<td>Phylogenetic Biology</td>
<td>BIOS 829</td>
<td>BIOS 207 and Senior standing</td>
<td>Principles of phylogenetic inference and emphasis on the application of phylogenetic hypotheses in biology and the biomedical sciences. How inferences derived from phylogenetic trees can be applied in different areas of biological investigation including systematics, biogeography, conservation biology, molecular evolution, genome structure, epidemiology, population biology, ecology, character evolution, behavior, and macroevolution.</td>
<td></td>
<td>4</td>
<td>Graded with Option</td>
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BIOS 422 Comparative Physiology
Crosslisted with: BIOS 822
Prerequisites: BIOS 213
Description: Comprehensive survey of comparative physiology with emphasis on the diversity of adaptations in basic physiological systems and the effects of environmental parameters upon such systems. Comparative physiology of osmoregulation, temperature regulation, metabolism, muscle, central nervous function, and sensory function.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

BIOS 422L Comparative Physiology Laboratory
Prerequisites: Parallel registration in BIOS 422/822
Notes: Letter grade only.
Description: Physiological adaptations in ecological and evolutionary context.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded

BIOS 423 Quaternary Paleoclimatology and Paleoeology
Crosslisted with: BIOS 823, GEOL 423, GEOL 823
Prerequisites: 12 hrs GEOL or BIOS.
Description: Analysis and interpretation of the Quaternary period's paleoenvironmental data. Patterns of long-term climate variation. Distribution patterns and responses of organisms and ecosystems to Quaternary environmental change.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 424 Biogeochemical Cycles
Crosslisted with: BIOS 824, GEOL 424, GEOL 824
Prerequisites: CHEM 109 or CHEM 109A and 109L or CHEM 113 or CHEM 113A and 113L; 12 hrs GEOL or BIOS.
Description: Chemical cycling at or near the earth's surface, emphasizing interactions among the atmosphere, biosphere, geosphere and hydrosphere. Modern processes, the geological record, and human impacts on elemental cycles.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 425 Plant Biotechnology
Crosslisted with: BIOS 825
Prerequisites: BIOS 206
Description: Introduction to the use of plants for basic and applied purposes by deliberate manipulation of their genomes; techniques in plant genetic engineering; manipulations of plant development and metabolism; engineering pest, disease, and stress resistance; plants as bioreactors; and environmental and social impacts of plant biotechnology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 426 Systems Biology
Crosslisted with: BIOS 826
Prerequisites: LIFE 120 and LIFE 121 or BIOS 101; STAT 218 or STAT 380 or EDPS 459 or PSYC 350 or ECON 215.
Notes: BIOS 206 and CSCE 155T are recommended, but not required.
Description: Fundamentals of the analysis of high throughput experiments to understand complex biological systems. Principles and methods such as next generation sequencing, protein-protein interaction networks, regulatory networks, and biological data mining and integration. Emerging research in new biotechnology and data analysis in biomedical and life sciences.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 427 Practical Bioinformatics Laboratory
Crosslisted with: BIOS 827
Prerequisites: BIOS 206
Notes: No computer programming skill is required.
Description: Basic knowledge and skills needed for general bioinformatics, genomics and proteomics analyses. Various computational analyses including database search, sequence alignment, phylogenetic reconstruction, gene prediction/mining, microarray data analyses and protein structure analyses.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 428 Perl Programming for Biological Applications
Crosslisted with: BIOS 828
Prerequisites: LIFE 120 and LIFE 121
Description: Computer programming, using Perl, as applied to biological sciences, bioinformatics, computational biology, and genomics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 429 Phylogenetic Biology
Crosslisted with: BIOS 829
Prerequisites: BIOS 207 and Senior standing
Description: Principles of phylogenetic inference and emphasis on the application of phylogenetic hypotheses in biology and the biomedical sciences. How inferences derived from phylogenetic trees can be applied in different areas of biological investigation including systematics, biogeography, conservation biology, molecular evolution, genome structure, epidemiology, population biology, ecology, character evolution, behavior, and macroevolution.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product
**BIOS 430 Communicating Science through Outreach**

**Crosslisted with:** BIOS 830  
**Prerequisites:** BIOS 207  
**Notes:** Students must have at least one afternoon available for running a middle school science club (typically between 3-5pm). Background checks required.  
**Description:** Introduction to science communication, formal versus informal science education, and best practices in informal science education. Review of state and national science standards and how students learn. Introduction to informal science practitioners and facilities in Nebraska. Role playing and development and implementation of hands on, inquiry-based science activities. Training in evaluation and assessment.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Offered:** FALL/SPR

**BIOS 431 Biochemistry I: Structure and Metabolism**

**Crosslisted with:** BIOC 431, BIOC 831, BIOS 431, CHEM 431, CHEM 831  
**Prerequisites:** LIFE 120 with a grade of C or better; CHEM 252 or CHEM 262 with a grade of C or better.  
**Notes:** BIOS 206 or AGRO 215 is recommended.  
**Description:** Structure and function of proteins, nucleic acids, carbohydrates and lipids; nature of enzymes; major metabolic pathways of catabolism; and biochemical energy production.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Offered:** FALL/SPR  
**Prerequisite for:** AGRO 434, BIOC 434, CHEM 434, AGRO 834, BIOS 834, CHEM 834  
**ACE:** ACE 10 Integrated Product

**BIOS 432 Biochemistry II: Metabolism and Biological Information**

**Crosslisted with:** BIOC 432, BIOC 832, CHEM 432, CHEM 832, BIOS 832  
**Prerequisites:** BIOC 431/831 with a grade of C or better; BIOS 206 or AGRO 215 with a grade of C or better.  
**Notes:** Continuation of BIOC 431/831.  
**Description:** Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Offered:** FALL/SPR  
**Prerequisite for:** ASCI 949, BIOC 949, CHEM 949; BIOC 435; BIOS 932, CHEM 932; BIOC 933, CHEM 933; BIOC 934, CHEM 934; BIOC 935, CHEM 935; BIOC 998; BIOS 950; VBMS 950; VBMS 919; VBMS 951

**BIOS 433 Biochemistry Laboratory**

**Crosslisted with:** BIOC 433, BIOC 833, BIOS 833, CHEM 433, CHEM 833  
**Prerequisites:** BIOC 431/831 or parallel; or CHEM 435/835.  
**Description:** Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded with Option  
**Offered:** FALL/SPR  
**Prerequisite for:** BIOC 437, BIOC 837, BIOC 837, BIOS 837, BIOS 898

**BIOS 434 Plant Biochemistry**

**Crosslisted with:** AGRO 434, BIOC 434, CHEM 434, AGRO 834, BIOS 834, CHEM 834  
**Prerequisites:** BIOS/BIOC/CHEM 431/831.  
**Description:** Biochemical metabolism unique to plants. Relationships of topics previously acquired in general biochemistry to biochemical processes unique to plants. Biochemical mechanisms behind physiological processes discussed in plant or crop physiology.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Offered:** FALL/SPR

**BIOS 435 Evolutionary Medicine**

**Crosslisted with:** BIOS 835  
**Prerequisites:** BIOS 207 and senior standing  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded with Option  
**Offered:** SPRING  
**ACE:** ACE 10 Integrated Product

**BIOS 436 Macroecology**

**Crosslisted with:** BIOS 836  
**Prerequisites:** BIOS 207  
**Description:** Species-area relationships, latitudinal gradients in species richness, abundance diversity relationships, ecological scaling relationships with body size, community assembly, evolutionary dynamics, climate change, and human impacts on the ecology of the Anthropocene.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded with Option
BIOS 437 Research Techniques in Biochemistry
Crosslisted with: BIOC 437, BIOC 837, BIOS 837
Prerequisites: BIOC/BIOS/CHEM 433/833.
Description: Methods approach to systems biology analysis. Molecular identification and quantification employing techniques such as mass spectrometry, chromatography, electrophoretic fractionation, transcriptomics, proteomics and metabolomics. Data and pathway analysis with computational methods.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: VBMS 919

BIOS 439 Dynamics of Biochemical and Biological Networks
Crosslisted with: BIOS 439, BIOC 839, BIOS 839
Prerequisites: BIOS 206 or AGRO 215; BIOS 401 or BIOC 431
Notes: Letter grade only.
Description: To introduce and integrate, students in biochemistry and other life sciences, to the field of computational modeling of biochemical and biological network systems into a seamless curriculum.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: SPRING
Prerequisite for: ASCI 949, BIOC 949, BIOS 949, NUTR 949; BIOS 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOS 998

BIOS 440 Microbial Physiology
Crosslisted with: BIOS 840, VBMS 840, MBIO 440
Prerequisites: BIOS 312; BIOS 313 or BIOS 314.
Description: Molecular approaches to the study of prokaryotic cell structure and physiology, including growth, cell division, metabolism, and alternative microbial life styles.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 441 Pathogenic Microbiology
Crosslisted with: BIOS 841, VBMS 441, VBMS 441H, VBMS 841
Prerequisites: BIOS 312
Description: Fundamental principles involved in host-microorganism interrelationships. Identification of pathogens, isolation, propagation, mode of transmission, pathogenicity, symptoms, treatment, prevention of disease, epidemiology, and methods of control.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 442 Endocrinology
Crosslisted with: ASCI 442, ASCI 842, BIOS 842, VBMS 842
Prerequisites: A course in vertebrate physiology and/or biochemistry.
Description: Mammalian endocrine glands from the standpoint of their structure, their physiological function in relation to the organism, the chemical nature and mechanisms of action of their secretory products, and the nature of anomalies manifested with their dysfunction.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 443 Immunology
Crosslisted with: BIOS 843, VBMS 843, MBIO 443
Prerequisites: BIOS 206; CHEM 251 or CHEM 255 or CHEM 261.
Description: Fundamental consideration of cellular and humoral mechanisms of immunity, the structure and function of immunoglobulins, antigen-antibody interactions; hypersensitivity; transplantation and tumor immunity; immune and autoimmune disorders.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BIOS 966, VBMS 966; VBMS 852; VBMS 908; VBMS 910; VBMS 948; VBMS 949

BIOS 444 Earth and Environmental Microbiology
Crosslisted with: BIOS 844, GEOL 444, GEOL 844
Prerequisites: 3 hours of BIOS or 3 hours of LIFE; 3 hours of CHEM
Description: An introduction into the role that microorganisms play and have played in natural and man-made environments. Topics covered include microbial diversity and physiology in soil, sediment, and water; microbes in Earth history; biogeochemical cycling; mineral formation and dissolution; biodegradation and bioremediation; biotechnology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 445 Food Microbiology
Crosslisted with: BIOS 845, FDST 405, FDST 805
Prerequisites: BIOS 312
Notes: BIOS 401 or BIOC 431 recommended
Description: Nature, physiology, and interactions of microorganisms in foods. Introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Food plant sanitation and criteria for establishing microbial standards for food products.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL/SPRING
Prerequisite for: BIOS 446, BIOS 846, FDST 406, FDST 806; FDST 824, FDST 425, FDST 825, FDST 455, FDST 855, MBIO 455, FDST 455L, FDST 855L, MBIO 455L; FDST 460, FDST 860; FDST 875; FDST 877; FDST 887; FDST 908B

BIOS 446 Food Microbiology Laboratory
Crosslisted with: BIOS 846, FDST 406, FDST 806
Prerequisites: Parallel in FDST 405/805/BIOS 446/846.
Description: The microorganisms in foods and the methods used to study them.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
BIOS 448 Human Growth and Development
Crosslisted with: ANTH 448, ANTH 848, BIOS 848
Prerequisites: ANTH 242 and 242L, or BIOS 101 and 101L.
Description: Biological diversity from an evolutionary perspective. The history of the study of human physical growth and biological principles of growth. Genetic, epigenetic and hormonal effects on human and other mammal growth patterns, and environmental factors that influence growth. Effects of nutrition, disease, socio-economic status, pollution, etc. Unique features of human growth in its various stages. How anthropologists interpret variation in growth patterns among human populations and the possible adaptive significance of this variation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Groups: Biological Anthropology

BIOS 450 Biology of Wildlife Populations
Crosslisted with: BIOS 850, NRES 450, NRES 850
Prerequisites: NRES 311; MATH 104 or above, STAT 218 or equivalent
Description: Principles of population dynamics. Management strategies (for consumptive and nonconsumptive fish and wildlife species) presented utilizing principles developed.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Offered: SPRING

BIOS 451 Invertebrate Paleobiology
Crosslisted with: GEOL 451, BIOS 851, GEOL 851
Prerequisites: At least one of: GEOL 103, GEOL 105, LIFE 121
Description: Overview of the key traits, relationships and evolutionary dynamics of invertebrate animals over Earth’s history, particularly over the Phanerozoic (i.e., the last 540 million years). Emphasis on the use of invertebrate fossil record to test ideas about long term evolutionary patterns as well as learning the histories and basic anatomies of major invertebrate taxa.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: SPRING

BIOS 452 Field Epidemiology
Crosslisted with: BIOS 852
Prerequisites: LIFE 121; LIFE 121L; three hours of BIOS
Notes: Offered summers only at Cedar Point Biological Station.
Description: Principles of epidemiology and the role in modern medicine. Combination of theory and practice with living populations.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: VBMS 949
ACE: ACE 10 Integrated Product

BIOS 453 Predator Ecology
Crosslisted with: BIOS 853
Prerequisites: BIOS 207 or NRES 220
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

BIOS 454 Ecological Interactions
Crosslisted with: BIOS 854, NRES 454, NRES 854
Prerequisites: LIFE 121; LIFE 121L; BIOS 207 or NRES 220; Senior Standing
Description: Nature and characteristics of populations and communities. Interactions within and between populations in community structure and dynamics. Direct and indirect interactions and ecological processes, competition, predation, parasitism, herbivory, and pollination. Structure, functioning and persistence of natural communities, foodweb dynamics, succession, and biodiversity.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
ACE: ACE 10 Integrated Product

BIOS 456 Mathematical Models in Biology
Crosslisted with: BIOS 856, NRES 456, NRES 856
Prerequisites: LIFE 120; LIFE 120L; LIFE 121; LIFE 121L; MATH 107
Description: Biological systems, from molecules to ecosystems, are analyzed using mathematical techniques. Strengths and weaknesses of mathematical approaches to biological questions. Brief review of college level math; introduction to modeling; oscillating systems in biology; randomness in biology; review of historically important and currently popular models in biology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 457 Ecosystem Ecology
Crosslisted with: BIOS 857, GEOL 457, GEOL 857
Prerequisites: BIOS 207 and CHEM 110 or CHEM 110A and 110L and Senior standing
Description: Processes controlling the cycling of energy and elements in ecosystems and how both plant and animal species influence them. Human-influenced global and local changes that alter these cycles and ecosystem functioning.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BSEN 954, NRES 954
ACE: ACE 10 Integrated Product
BIOS 458 Wetlands
Crosslisted with: NRES 468, NRES 868, WATS 468, BSEN 468, BSEN 868
Prerequisites: CHEM 109 or CHEM 109A and 109L and CHEM 110 or CHEM 110A and 110L, or CHEM 105 or CHEM 105A and 105L and CHEM 106 or CHEM 106A and 106L; Junior or Senior Standing.
Description: Study of wetlands: the hydrology and soils of wetlands systems; organisms occurring in wetlands and their ecology, wetland creation, delineation, management and ecotoxicology.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 459 Limnology
Crosslisted with: BIOS 859, NRES 459, NRES 859, WATS 459
Prerequisites: 12 hrs BIOS, including BIOS/NRES 220/BIOS220x; two semesters CHEM.
Description: Physical, chemical, and biological processes that occur in fresh water. Organisms occurring in fresh water and their ecology; biological productivity of water and its causative factors; eutrophication and its effects.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOS 866, NRES 866
ACE: ACE 10 Integrated Product

BIOS 460 Soil Microbial Ecology
Crosslisted with: AGRO 460, NRES 460, SOIL 460, AGRO 860, BIOS 860, NRES 860
Prerequisites: Senior standing.
Notes: Recommend having a strong science background, including courses from the agronomic, environmental, microbiology, engineering or medicine disciplines.
Description: Soil from a microbe’s perspective-growth, activity and survival strategies; principles governing methods to study microorganisms and biochemical processes in soil; mechanisms controlling organic matter cycling and stabilization with reference to C, N, S, and P; microbial interactions with plants and animals; and agronomic and environmental applications of soil microorganisms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 464 Fisheries Biology
Crosslisted with: BIOS 864, NRES 464, NRES 864
Prerequisites: BIOS/NRES 489/889 or equivalent.
Description: Biology of fishes. Factors that affect fishes in the natural environment. Techniques used in the analysis and management of fish populations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 465 Behavioral Neuroscience
Crosslisted with: BIOS 865, PSYC 465, PSYC 865
Prerequisites: PSYC 273
Description: Relationship of physiological variables to behavior, an introduction to laboratory techniques in neuropsychology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 468 Field Animal Behavior
Crosslisted with: BIOS 868
Prerequisites: LIFE 120 and LIFE 121
Notes: BIOS 207 or BIOS 220 recommended. Offered summers only at Cedar Point Biological Station.
Description: Behavior of animals. Stresses methods for testing evolutionary hypotheses under field conditions with emphasis on foraging behavior, animal communication, and animal social systems.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 470 Prairie Ecology
Crosslisted with: BIOS 870
Prerequisites: BIOS 207 or NRES 220
Notes: Extensive field work is required.
Description: Structure, function, and distribution of communities. Interaction of different species with their biotic and abiotic environments.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 471 Plant Systematics
Crosslisted with: BIOS 871
Prerequisites: LIFE 121 and LIFE 121L
Description: Overview of the diversity of plants and algae, with emphasis on phylogenetic relationships, the evolution of important physical and genomic characteristics, principles of plant classification and identification, and modern methods of plant molecular systematics. Lab work on taxonomic analysis and plant identification.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

ACE 10 Integrated Product
BIOS 472 Evolution
Prerequisites: BIOS 207 and Senior standing
Description: The principles and processes of micro- and macroevolution. Mechanisms behind evolutionary change and examples of these processes in a wide variety of organisms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

BIOS 474 Herpetology
Crosslisted with: BIOS 874, NRES 474, NRES 874
Prerequisites: BIOS/NRES 386 and permission.
Notes: BIOS 388 recommended.
Description: Fossil and living amphibians and reptiles. Anatomy, classification, ecology and evolution.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 475 Avian Biology
Crosslisted with: BIOS 875
Prerequisites: LIFE 121 & LIFE 121L
Notes: May also be offered at Cedar Point Biological Station.
Description: Biology of birds emphasizing the behavior and ecology of this group. Topics include avian diversity, systematics & evolutionary history, flight, foraging, migration, communication, reproductive biology, population ecology and conservation biology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 475L Avian Biology Laboratory
Crosslisted with: BIOS 875L
Prerequisites: Parallel registration in BIOS 475/875
Description: Avian field identification in diverse prairie, riparian, and montane habitats. Individual studies of foraging behavior, territoriality, anti-predator behavior, mating systems, or nesting ecology.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

BIOS 476 Mammalogy
Crosslisted with: BIOS 876, NRES 476, NRES 876
Prerequisites: 8 hrs BIOS; BIOS/NRES 386 or NRES 311.
Notes: May also be offered at Cedar Point Biological Station. Field trips are required and may occur outside of scheduled class time. Lab and field time emphasize diversity of mammalian families and species identification of Nebraska mammals.
Description: Evolution, natural history, ecology, and functional morphology of planetary mammals and mammals of the Northern Great Plains.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 477 Bioinformatics and Molecular Evolution
Crosslisted with: BIOS 877
Prerequisites: BIOS 206 or parallel; CHEM 251 or CHEM 255 or CHEM 261.
Notes: Statistics course recommended.
Description: Pairwise and multiple alignments, sequence similarity and domain search, distance estimation, phylogenetic methods, gene mining, protein classification and structure. Algorithms used in bioinformatics as well as fundamental concepts of molecular evolution that underlie various bioinformatics methods.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

BIOS 478 Plant Anatomy
Crosslisted with: BIOS 878, AGRO 478, AGRO 878, HORT 478, HORT 878
Prerequisites: 8 hrs biological sciences
Notes: BIOS 109 recommended.
Description: Development, structure, and function of tissues and organs of the higher plants. Relationships of structure to physiology and ecology of plants.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 480 Ecology and Evolution of Arachnids
Crosslisted with: BIOS 880
Prerequisites: BIOS 207 or NRES 220
Description: Ecology and evolutionary biology of living arachnids.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option

BIOS 481 Stream and River Ecology
Crosslisted with: WATS 481, WATS 881, NRES 481
Prerequisites: NRES 222 or equivalent
Description: Fundamental physical drivers operating in stream and river ecosystems and how those vary in space and time. Major classes of organisms associated with stream ecosystems and their functional roles. Fundamental controls on biotic diversity in stream and river ecosystems and its variance. Major aspects of stream ecosystem function including energy flow and nutrient cycling. Ecosystem services provided by stream and river ecosystems and causes and consequences of human impacts on streams and rivers. Underlying principles of bioassessment and current methods of stream restoration.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded
BIOS 482 Field Entomology
Crosslisted with: BIOS 882, ENTO 482, ENTO 882
Prerequisites: 12 hrs biological sciences.
Notes: Offered only at Cedar Point Biological Station.
Description: Field course in insect taxonomy and biology emphasizing field collection, specimen preparation, classification, and insect natural history.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Offered: SUMMER
BIOS 485 Aquatic Insects
Crosslisted with: BIOS 885, ENTO 402, ENTO 802, NRES 402, NRES 802
Prerequisites: 12 hrs biological sciences.
Description: Biology and ecology of aquatic insects.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
Prerequisite for: BIOS 485L, BIOS 885L, ENTO 402L, ENTO 802L, NRES 402L, NRES 802L
BIOS 485L Identification of Aquatic Insects
Crosslisted with: BIOS 885L, ENTO 402L, ENTO 802L, NRES 402L, NRES 802L
Prerequisites: Parallel ENTO 802, NRES 402/802, BIOS 485/885.
Description: Identification of aquatic insects to the family level.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
BIOS 486 Advanced Topics in Biophysical Chemistry
Crosslisted with: BIOC 486, BIOC 886, BIOS 886, CHEM 486, CHEM 886
Prerequisites: CHEM 471/871 or CHEM 481/881.
Description: Applications of thermodynamics to biochemical phenomena, optical properties of proteins and polynucleotides, and kinetics of rapid reactions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
BIOS 487 Field Parasitology
Crosslisted with: BIOS 887
Prerequisites: LIFE 120; LIFE 120L; LIFE 121; LIFE 121L
Notes: BIOS 207 or NRES 220 recommended. Offered summers only at Cedar Point Biological Station.
Description: Animal host-parasite relationships, epizootiology, ecology, host distribution, classification, and life cycle stages of animal parasites.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product
BIOS 489 Ichthyology
Crosslisted with: BIOS 889, NRES 489, NRES 889
Prerequisites: LIFE 120 and LIFE 121
Notes: May also be offered at Cedar Point Biological Station.
Description: Fishes, their taxonomy, physiology, behavior, and ecology. Dynamics of fish stocks and factors regulating their production.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOS 464, BIOS 864, NRES 464, NRES 864
BIOS 491 Special Topics in Biological Sciences
Crosslisted with: BIOS 891
Prerequisites: BIOS 206 or BIOS 207
Description: Topics vary.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 9
Grading Option: Graded with Option
Groups: Composition
BIOS 498 Independent Research in Biological Sciences
Crosslisted with: BIOS 898
Prerequisites: Permission.
Notes: Four credit hours may be counted toward the undergraduate BIOS major. Before registering, arrangements must be made with a School of Biological Sciences faculty member to reach an agreement on the scope and to determine the amount of credit for the project.
Description: Independent study and laboratory or field investigation of a specific problem.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 12
Grading Option: Graded with Option
BIOS 499 Undergraduate Thesis
Prerequisites: Permission.
Description: Independent research leading to a thesis.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option
BIOS 499H Honors Undergraduate Thesis
Prerequisites: Permission
Description: Independent research leading to an honors thesis.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option
PLEASE NOTE
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.
Biological Sciences - Standard (B.S.)
Career Information
The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

Transferable Skills
• Communicate results of scientific experiments to scientific and non-scientific audiences
• Read, understand, and critically review scientific information
• Design and implement research experiments
• Define problems and identifying causes
• Understand and use proper laboratory and technical skills and instruments
• Apply mathematical and scientific skills to solve real-world problems
• Collaborate with a team to develop solutions
• Confidently navigate complex, ambiguous projects and environments
• Document and replicate processes and procedures
• Examine problems from multiple perspectives
• Implement appropriate technological interventions to help solve problems
• Interpret, compare, and contrast ideas
• Conduct and present research to large and small groups
• Simplify complex information and present it to others
• Understand and operate within ethical framework for professional work in the field

Jobs of Recent Graduates
• Clinical Assistant, Bryan Health - Lincoln NE
• Mental Health Technician, TouchStone - Lincoln NE
• Physical Therapy Technician, Lincoln Physical Therapy Associates - Lincoln NE
• DNA Lab Tech, GeneSeek - Lincoln NE
• Veterinary Assistant, Animal Care Clinic - Lincoln NE
• Zookeeper, Omaha Henry Doorly Zoo - Omaha NE
• Forestry Aid, United States Forest Service - Ogden UT
• Hospital Generalist, Pathology Medical Services - Lincoln NE
• Hematology Technician I, Streck - La Vista NE
• Clinical Data Quality Specialist, Celerion Inc. - Lincoln NE
• Pharmacy Technician, Kroger Pharmacy - Dayton OH
• Contract Coordinator, QuarterLine Consulting Services - Herndon VA
• School Technology Support Specialist I, Educational Service Unit 6 - Milford NE
• Executive Team Leader, Target Corporation - Lincoln NE
• Aquatics Coordinator, YMCA - Lincoln NE

Internships
• Beckman Research Scholar, College of Arts & Sciences - Lincoln NE
• Sales/Marketing Intern, Li-Cor Biosciences - Lincoln NE
• Anatomy Intern, School of Biological Sciences - Lincoln NE
• Dental Intern, UNMC Dental College - Lincoln NE
• Intern, Southwestern - Nationwide
• Intern, NE Dept of Health & Human Services - Lincoln NE
• Intern, Pregnancy Center - Lincoln NE

Graduate & Professional Schools
• Medical Doctor, University of Nebraska Medical School - Omaha NE
• Doctor of Veterinary Medicine, Iowa State University - Ames IA
• Doctor of Pharmacy, University of Nebraska Medical Center - Omaha NE
• Doctor of Physical Therapy, Briar Cliff University - Iowa NE
• Master’s Degree, Clinical Laboratory Science, St. Luke’s - Kansas City MO
• Master’s Degree, Public Health, University of Nebraska Medical Center - Omaha NE
• Doctor of Optometry, Southern College of Optometry - Memphis TN
• Master’s Degree, Food Science, University of Nebraska-Lincoln - Lincoln NE
• Master’s Degree, Business Administration, Bellevue University - Bellevue NE
• Master’s Degree, Physician Assistant, University of Nebraska Medical Center - Omaha NE
• Master’s Degree, Environmental Sciences, Florida Atlantic University - Boca Raton FL
• Master’s Degree, Entomology, University of Nebraska-Lincoln - Lincoln NE