BIOLICAL 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.

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.

Admission
College Admission
The entrance requirements for the College of Arts and Sciences are the same as the UNL General Admission Requirements. Students who are admitted through the Admission by Review process may have certain conditions attached to their enrollment at UNL. These conditions are explained under “Removal of Deficiencies.”

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 UNL, and provide more opportunity to study abroad.

Advising
Academic and Career Advising
The Academic and Career Advising Center in 107 Oldfather is a centrally located and easily accessed resource for students in all majors in the College of Arts and Sciences. The professional academic advisors and career coaches offer 1-1 meetings on a walk-in and appointment basis weekdays. Advisors will provide assistance choosing majors and minors, understanding degree requirements and academic policies, completing paperwork, meeting deadlines, adding/dropping courses, and planning for graduation. In addition, career coaches can help students identify career options related to their interests and connect them with experiences like internships, research, and more that will prepare them for those career options. These specially trained advisors and coaches also serve as first point of contact in the College for all incoming freshmen and transfer students during New Student Enrollment.

Students in the College who have declared a major will be assigned an academic advisor who is their first point of contact for a variety of questions. Academic advisors help students be successful in adjusting to UNL overall as well as making progress toward degree completion. The assigned advisor may be located within the department of their primary major, or in the Advising Center. Students can identify their assigned advisor in MyRED on the academics tab. In addition, faculty advisors are experts in their discipline, including advanced coursework and requirements, opportunities for research, student organizations, and considering graduate school in the discipline. 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 Library 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.

College Degree Requirements
College Distribution Requirements
Bachelor of Arts or Bachelor of Science (16 hours + Language)
The College of Arts and Sciences distribution requirements are designed to ensure a breadth of courses within the liberal arts degree. 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.

- A student may not use a single course to satisfy 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.
- A student may not use a course from their primary major to satisfy the Breadth Requirement (F), but may apply an ancillary requirement of the primary major or a course from their second major toward this requirement.
- Independent study, directed readings, or internship courses cannot be used to satisfy a College Distribution Requirement.
- Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

College Distribution Requirements

| CDR A - Written Communication | 3 |
| Select from courses approved for ACE outcome 1. |
| CDR B and BL - Natural, Physical, and Mathematical Sciences with Lab | 4 |
| Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, physics and statistics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology and physics. |

Some courses from geography and anthropology may also be used to satisfy the lab requirement above. ¹

| CDR C - Humanities | 3 |
| Select from classics, English, history, modern languages and literatures, philosophy, and religious studies. ² |
| CDR D - Social Science | 3 |
| Select from anthropology, communication studies, geography, political science, psychology, or sociology. ³ |
| CDR E - Language | 0-16 |

¹ Some courses from geography and anthropology may also be used to satisfy the lab requirement above. ¹
² Select from classics, English, history, modern languages and literatures, philosophy, and religious studies. ²
³ Select from anthropology, communication studies, geography, political science, psychology, or sociology. ³
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 language requirement, but encouraged to continue on in their language study.

<table>
<thead>
<tr>
<th>CDR F - Additional Breadth</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select from natural, physical and mathematical sciences (Area B), humanities (Area C), or social sciences (Area D). Cannot be a course from the primary major.</td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 16-32

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 210 and below do not fulfill the CDR C.
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.

Scientific Base

Bachelor of Science Only (60 hours)
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, physics and statistics.

See your degree audit or a College of Arts and Sciences 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 approval of a college advisor.

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

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 total 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 UNL 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 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 UNL 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 UNL.

Residency Requirement
Students must complete at least 30 of the 120 total hours for their degree at UNL. 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 UNL.

ACE Requirements
Consistent with the mission and values of the University, ACE is based on a shared set of four institutional objectives and ten student learning outcomes. The ACE program was approved by faculty in all eight undergraduate colleges and endorsed by the Faculty Senate, the student government, and the Academic Planning Committee in January 2008.
for implementation in the fall 2009. ACE aligns with current national initiatives in general education.

To meet the ACE Program requirement, a student will complete a minimum of 3 credit hours for each of the ten ACE Student Learning Outcomes (a total of 30 ACE credit hours). See the ACE website at: http://ace.unl.edu for the most current information and the most recently certified courses.

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 UNL. 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 UNL 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 biological sciences will be able to:

1. Demonstrate mastery of the concepts, principles and knowledge for following subdisciplines: 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 of in a subdiscipline 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 subdiscipline.

Major Requirements

Core Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</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</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
</tr>
<tr>
<td>LIFE 120L</td>
<td>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>LIFE 121L</td>
<td>Fundamentals of Biology II Laboratory</td>
<td></td>
</tr>
<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>BIOS 99</td>
<td>Assessment of the Major</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Credit Hours: 19

Specific Major Requirements

Additional Biological Sciences Courses

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. 1 2

Credit Hours Subtotal: 18

Total Credit Hours: 18

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, BIOS 232, or BIOS 395.

Ancillary Requirements

Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td></td>
</tr>
<tr>
<td>CSCE 155T</td>
<td>Computer Science I: Informatics Focus</td>
<td></td>
</tr>
<tr>
<td>STAT 218</td>
<td>Introduction to Statistics</td>
<td></td>
</tr>
<tr>
<td>EDPS 459</td>
<td>Statistical Methods</td>
<td></td>
</tr>
<tr>
<td>PSYC 350</td>
<td>Research Methods and Data Analysis</td>
<td></td>
</tr>
<tr>
<td>ECON 215</td>
<td>Statistics</td>
<td></td>
</tr>
<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 8-9

Chemistry

Select one sequence from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 109</td>
<td>General Chemistry I</td>
<td>7-8</td>
</tr>
<tr>
<td>CHEM 110</td>
<td>General Chemistry II</td>
<td></td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Fundamental Chemistry I</td>
<td>4-5</td>
</tr>
<tr>
<td>CHEM 114</td>
<td>Fundamental Chemistry II</td>
<td></td>
</tr>
<tr>
<td>CHEM 251</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 253</td>
<td>Organic Chemistry I Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHEM 261</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 263</td>
<td>Organic Chemistry Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 11-13

Biochemistry

Select one course from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 401</td>
<td>Elements of Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 431</td>
<td>Structure and Metabolism</td>
<td></td>
</tr>
<tr>
<td>BIOS 431</td>
<td>Structure and Metabolism</td>
<td></td>
</tr>
<tr>
<td>CHEM 431</td>
<td>Structure and Metabolism</td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 3

Physics

Select one sequence from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 141</td>
<td>Elementary General Physics I</td>
<td>8-10</td>
</tr>
<tr>
<td>PHYS 142</td>
<td>Elementary General Physics II</td>
<td></td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics I</td>
<td></td>
</tr>
<tr>
<td>PHYS 212</td>
<td>General Physics II</td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 8-10

Total Credit Hours: 30-35

Additional Major Requirements

Grade Rules

C- and D Grades

A grade of C or above is required for all courses in the major.
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:

LIFE 120 & LIFE 120L Fundamentals of Biology I and Fundamentals of Biology I laboratory 4
LIFE 121 & LIFE 121L Fundamentals of Biology II and Fundamentals of Biology II Laboratory 4
BIOS 205 Genetics, Molecular and Cellular Biology Laboratory 2
BIOS 206 General Genetics 4
BIOS 207 Ecology and Evolution 4

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 Science Major
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
Format: LEC
Offered: FALL/SPR

BIOS 101 General Biology
Prerequisites: Parallel registration in BIOS 101L.
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: Comparative study of microorganisms, principles and applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
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 220; NRES 302, HORT 302; NRES 310
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
Format: LAB
Prerequisite for: AGRO 216, HORT 216; AGRO 278, HORT 278; 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: 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
Format: LEC
Offered: FALL/SPR
Prerequisite for: BIOS 111; BIOS 213; BIOS 213L
ACE: ACE 4 Science

BIOS 110L Human Biology Laboratory
Prerequisites: Parallel registration in BIOS 110L.
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
Format: LAB
Offered: FALL/SPR
Prerequisite for: BIOS 111; BIOS 213; BIOS 213L

BIOS 111 The Biology of Microorganisms
Prerequisites: BIOS 101 and BIOS 101L or BIOS 110 and BIOS 110L
Description: Comparative study of microorganisms, principles and applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
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 220; NRES 302, HORT 302; NRES 310
ACE: ACE 4 Science
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  
Format: LEC  
Prerequisite for: ENTO 200; ENTO 400  
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  
Format: LAB  
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  
Format: LEC  
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  
Format: LAB  
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  
Format: LAB  
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  
Format: LEC  
ACE: ACE 4 Science  
BIOS 191 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  
Format: LEC  
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  
Format: LEC  
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  
Format: LEC  
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  
Format: LEC  
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  
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  
Format: LEC  
Prerequisite for: BIOS 99; BIOS 472; NRES 311
BIOS 213 Human Physiology
Prerequisites: BIOS 101 and 101L or BIOS 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
Format: LEC
Prerequisite for: ASCI 341; NUTR 355; NUTR 455; VBMS 303; VBMS 403; VBMS 405

BIOS 213L Human Physiology Laboratory
Prerequisites: BIOS 101 and 101L or BIOS 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
Format: LAB
Prerequisite for: VBMS 303; VBMS 403

BIOS 214 Human Anatomy
Prerequisites: Sophomore standing.
Notes: Cadaver prossections 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
Format: LEC
Prerequisite for: NUTR 384

BIOS 232 Ecological Issues in the Great Plains
Notes: Credit toward the degree cannot be earned in both BIOS 232 and NRES 220. Does not count in the Biological Sciences major.
Description: Basic concepts in ecology, including comparison of major world ecosystems, especially the Great Plains. Interplay of ecological principles and human activities.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 8 Civic/Ethics/Stewardship

BIOS 295 Topics in Biology
Prerequisites: Permission.
Description: Topic varies.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 296 Independent Study in Biology
Prerequisites: Permission
Notes: A maximum of 3 credit hours may be counted toward the major in BIOS.
Description: Opportunity to participate in work in a research laboratory in order to gain some insight into the philosophy and methods of original research.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 3
Format: LAB

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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC
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
Format: LEC
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; CHEM 251 or CHEM 255 or CHEM 261.
Notes: Credit towards the degree may not be earned in both BIOS 313 and 314.
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
Format: LAB
Prerequisite for: BIOS 440, BIOS 840, VBMS 840, MBIO 440

BIOS 314 Microbiology Laboratory
Prerequisites: LIFE 121; CHEM 251 or CHEM 255 or CHEM 261.
Notes: Credit towards the degree may not be earned in both BIOS 313 and 314.
Description: Traditional microbiology techniques without recombinant DNA methods.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB
Prerequisite for: BIOS 440, BIOS 840, VBMS 840, MBIO 440

BIOS 316 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
Format: LAB
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
Format: LEC

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
Format: LEC

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
Format: LEC
Offered: FALL

Groups: Advanced Mathematics Courses
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
Format: LEC
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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC

BIOS 389 Anatomy and/or Physiology Internship
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: 24
Format: LEC

BIOS 394 Seminar in Behavioral Biology
Crosslisted with: PSYC 394
Prerequisites: PSYC 273
Description: Critical reading and discussion of literature on topics dealing with the biological bases of behavior.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 24
Format: LEC

BIOS 395 Internship
Prerequisites: Permission
Notes: Will not count toward a major in BIOS.
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
Format: IND

BIOS 398H Honors Seminar
Prerequisites: Good standing in the University Honors Program.
Description: Special topics in biology.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: IND

BIOS 399H Honors Research
Prerequisites: Good standing in the University Honors program.
Description: Independent research leading to an honors thesis and exam in accordance with the College's degrees with distinction procedure.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 4
Format: IND

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
Format: LEC
ACE: ACE 10 Integrated Product
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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC
ACE: ACE 10 Integrated Product

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
Format: LEC

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
Format: LEC
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
Format: LEC
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
Format: LEC
ACE: ACE 10 Integrated Product
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
Format: LEC
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
Format: LAB

BIOS 423 Quaternary Paleoclimatology and Paleoecology
Crosslisted with: BIOS 823, GEOL 423, GEOL 823
Prerequisites: 12 hrs GEOL or BIOS.
Description: Analysis and interpretation of the Quaternary period's paleoclimatological 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
Format: LEC

BIOS 424 Biogeochemical Cycles
Crosslisted with: BIOS 824, GEOL 424, GEOL 824
Prerequisites: CHEM 109 or 113; 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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC
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  
**Format:** LEC  
**Offered:** FALL/SPR

**BIOS 431 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  
**Format:** LEC  
**Offered:** FALL/SPR  
**Prerequisite for:** AGRO 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOS 834, CHEM 834, BIOS 433, BIOS 833, BIOS 834, CHEM 833, CHEM 834, BIOS 835, BIOS 432, BIOC 432, BIOC 832, BIOS 832, CHEM 832, BIOS 833, BIOS 834, BIOS 433, BIOS 434, BIOS 833, CHEM 832, CHEM 834, CHEM 432, CHEM 433, CHEM 833, BIOS 431, BIOS 831, BIOS 432, BIOS 832

**BIOS 432 Metabolism and Biological Information**  
**Crosslisted with:** BIOC 432, BIOC 832, CHEM 432, CHEM 832, BIOS 432  
**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  
**Format:** LEC  
**Prerequisite for:** ASCI 949, BIOC 949, BIOS 949, NUTR 949; BIOC 435; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 934, BIOS 934, CHEM 934; BIOC 935, BIOS 935, CHEM 935; BIOC 992K, CHEM 992K; BIOC 998; BIOS 950, VBMS 950; VBMS 919; VBMS 951

**BIOS 433 Biochemistry Laboratory**  
**Crosslisted with:** BIOC 433, BIOS 833, BIOS 834, 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  
**Format:** LEC  
**Offered:** FALL/SPR  
**Prerequisite for:** BIOC 437, BIOC 837, BIOS 437, BIOS 837; BIOS 898; CHEM 498

**BIOS 434 Plant Biochemistry**  
**Crosslisted with:** AGRO 434, BIOC 434, CHEM 434, AGRO 834, BIOS 834, CHEM 834  
**Prerequisites:** BIOS/CHEM/AGRO 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  
**Format:** LEC  
**Prerequisite for:** AGRO 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOS 834, CHEM 834  

**BIOS 435 Evolutionary Medicine**  
**Crosslisted with:** BIOS 835  
**Prerequisites:** BIOS 207  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Offered:** SPRING  
**ACE:** ACE 10 Integrated Product

**BIOS 437 Research Techniques in Biochemistry**  
**Crosslisted with:** BIOC 437, BIOS 837, BIOS 837  
**Prerequisites:** BIOS/CHEM/AGRO 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  
**Format:** LEC  
**Prerequisite for:** VBMS 919
BIOS 439 Dynamics of Biochemical and Biological Networks
Crosslisted with: BIOC 439, BIOC 839, BIOS 839
Prerequisites: BIOS 206 or AGRO 215; BIOS 401 or BIOS 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
Format: LEC
Offered: SPRING
Prerequisite for: ASCI 949, BIOC 949, BIOS 949, NUTR 949; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 992K, CHEM 992K; BIOC 998

BIOS 440 Microbial Physiology
Crosslisted with: BIOS 840, VBMS 840, M BIO 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
Format: LEC

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
Format: LEC
Prerequisite for: VBMS 805; VBMS 949

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
Format: LEC

BIOS 443 Immunology
Crosslisted with: BIOS 843, VBMS 843, M BIO 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
Format: LEC
Prerequisite for: BIOS 966, VBMS 966; VBMS 908; VBMS 910; VBMS 948; VBMS 949

BIOS 444 Geomicrobiology
Crosslisted with: BIOS 844, GEOL 444, GEOL 844
Prerequisites: 3 hours of BIOS or 3 hours of LIFE; 3 hours of CHEM
Description: Lectures and discussions of primary literature regarding microorganisms and their role transforming Earth through geologic time.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 445 Food Microbiology
Crosslisted with: BIOS 845, FDST 405, FDST 805
Prerequisites: BIOS 312
Notes: BIOC 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
Format: LEC
Offered: FALL/SPR
Prerequisite for: BIOS 446, BIOS 846, FDST 406, FDST 806; FDST 415, FDST 815; FDST 425, FDST 825; FDST 455, FDST 855; FDST 455L, FDST 855L; FDST 460, FDST 860; FDST 875; FDST 977; FDST 908B

BIOS 446 Food Microbiology Laboratory
Crosslisted with: BIOS 845, 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
Format: LAB
Prerequisite for: FDST 415, FDST 815
**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  
*Format:* LEC  
*Offered:* SPRING  

**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  
*Format:* LEC  
*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  
*Format:* LEC  
*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  
*Format:* LEC  
*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  
*Format:* LEC  
*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  
*Format:* LEC  
*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  
*Format:* LEC  

**BIOS 457 Ecosystem Ecology**

*Crosslisted with:* BIOS 857, GEOL 457, GEOL 857  
*Prerequisites:* BIOS 207 and CHEM 110 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  
*Format:* LEC  
*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 and CHEM 110, or CHEM 105 and CHEM 106; Junior or Senior Standing.
Notes: Offered even-numbered calendar years.
Description: Physical, chemical and biological processes that occur in wetlands; the hydrology and soils of wetland 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
Format: LEC

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; eutropiation and its effects.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: BIOS 866, NRES 866
ACE: ACE 10 Integrated Product

BIOS 460 Soil Microbiology
Crosslisted with: AGRO 460, NRES 460, SOIL 460, AGRO 860, BIOS 860, NRES 860
Prerequisites: One semester microbiology; one semester biochemistry or organic chemistry.
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
Format: LEC
Offered: SPRING

BIOS 462 Animal Behavior
Crosslisted with: BIOS 862
Prerequisites: BIOS 206, 207 and Senior Standing
Description: Introduction to animal behavior stressing the ethological approach. Anatomical and physiological bases of behavior, ontogenetic and phylogenetic observations, and the relations of animal behavior studies to genetics, ecology, taxonomy, and evolution.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product

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
Format: LEC

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
Format: LEC

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
Format: LEC
ACE: ACE 10 Integrated Product

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
Format: LEC

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
Format: LEC
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
Format: LEC
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
Format: LEC

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
Format: LEC

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
Format: LAB

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
Format: LEC

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
Format: LEC

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
Format: LEC
Prerequisite for: BIOS 879

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
Format: LEC

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
Format: LEC
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
Format: LEC
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
Format: LEC
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
Format: LAB
Prerequisite for: BIOS 485, BIOS 885, ENTO 402, ENTO 802, NRES 402, NRES 802

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
Format: LEC

BIOS 487 Field Parasitology
Crosslisted with: BIOS 887
Prerequisites: LIFE 120; LIFE 120L; LIFE 121; LIFE 121L
Notes: BIOS 207 or NRES 220 recommended.
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
Format: LEC
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
Format: LEC
Prerequisite for: BIOS 464, BIOS 864, NRES 464, NRES 864; NRES 871

BIOS 497 Special Topics in Biological Sciences
Crosslisted with: BIOS 897
Prerequisites: BIOS 206 or BIOS 207
Description: Topics vary by term.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 24
Format: LEC

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: 1-8
Min credits per semester: 1
Max credits per semester: 8
Max credits per degree: 8
Format: IND

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 (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
- Advisor, Vector Marketing - Denver CO
- Campaign Intern, Clark for Legislature - Lincoln NE
- Biological Intern, Biology Department - 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