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. Study in the biological sciences prepares students for a variety of careers requiring knowledge of biological processes, such as teaching; environmental resource management and assessment; production and sales of biological materials; research in governmental, industrial, and academic laboratories; as well as preparation for careers in medicine, dentistry, and health-related professions.

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 Requirements

College 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. 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.

Transfer Students
To be considered for admission as a transfer student, Nebraska resident or nonresident, students must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who graduated from high school January 1997 and after must also meet the UNL General Admission Requirements. Those transfer students who graduated before January 1997 must have completed in high school 3 years of English, 2 years of the same foreign language, 2 years of algebra, and 1 year of geometry. Transfer students who have completed less than 12 credit hours of college study must also submit either their ACT or SAT scores.

Ordinarily, hours earned at a similarly accredited college or university are applicable to the UNL degree. The College, however, will evaluate all hours submitted on an application for transfer, and reserves the right to accept or reject any of them, based upon its exclusion and restriction policies. Sixty is the maximum number of hours the University will accept on transfer from a two-year college or international institution. Transfer credit in the major or minor must be approved by the departmental advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major or minor. At least half of the hours in the major field must be completed at the University regardless of the number of hours transferred.

The College of Arts and Sciences will accept no more than 15 semester hours of C- and D grades from other schools. The C- and D grades cannot be applied toward requirements for a major or minor. This policy does not apply to the transfer of grades from UNO or UNK to UNL. All D grades may be transferred from UNO or UNK, but they are not applicable to a major or minor.

Readmitted Students
UNL students who choose not to take courses for more than 2 consecutive terms, must reapply to UNL. Students readmitted to the College of Arts and Sciences will follow the requirements stated in the catalog for the academic year of readmission and re-enrollment as a degree-seeking student in Arts and Sciences. In consultation with advisors, a student may choose to follow a 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.

Admission Deficiencies/Removal of Deficiencies
Students must remove entrance deficiencies in geometry and foreign language as soon as possible, and before graduating from the College of Arts and Sciences. For questions and more information, students should consult a college advisor in the Academic and Career Advising Center in 107 Oldfather Hall.

Removing Foreign Language Deficiencies
Students must complete the second semester of a first year language sequence to clear the deficiency and the second semester of the second year language sequence to complete the college graduation requirement in language.

Removing Geometry Deficiencies
A deficiency of one year of geometry can be removed by taking high school geometry courses through an approved independent study program, or by completing a geometry course from an accredited community college or a four-year institution. Neither of these options will count for college credit.

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 further the purposes of liberal education by encouraging study in several different areas within the College. All requirements are in addition to University ACE requirements. A student may not use a single course to satisfy more than one of the following five distribution requirements. A student cannot use a single course to satisfy both an ACE outcome and a College distribution requirement. A student cannot 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 or reading courses and internships cannot be used to satisfy distribution requirements. To see a complete list of excluded courses, run a degree audit through MyRED.
Courses from interdisciplinary programs will count in the same area as courses from the home/cross-listed department(s).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>College Distribution Requirements</td>
<td></td>
</tr>
<tr>
<td>CDR A</td>
<td>Written Communication</td>
<td>3</td>
</tr>
<tr>
<td>CDR B</td>
<td>Natural, Physical, and Mathematical Sciences with Lab</td>
<td>4</td>
</tr>
<tr>
<td>CDR C</td>
<td>Humanities</td>
<td>3</td>
</tr>
<tr>
<td>CDR D</td>
<td>Social Science</td>
<td>3</td>
</tr>
<tr>
<td>CDR E</td>
<td>Language</td>
<td>0-16</td>
</tr>
<tr>
<td>CDR F</td>
<td>Additional Breadth</td>
<td>3</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 or below apply only for the foreign language requirement.
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 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.

**Foreign Languages/Language Requirement**

**Languages Exemption Policy**

UNL and the College of Arts and Sciences will exempt or waive students from the UNL entrance requirement of two years of the same foreign language or from the College’s language distribution requirement based on documentation only. The following are the options and procedures for documentation:

**High School Transcripts**

For the University entrance requirement, students must show an official high school transcript with two or more years of the same foreign language.

For the College of Arts and Sciences College Distribution Requirement E-Language, students must show an official high school transcript with four or more years of the same foreign language in high school, or show evidence of graduation from a non-English-speaking foreign high school. Students whose native language is not English must show English as a Second Language study on an official high school transcript. Four years of ESL at the high school level (9th, 10th, 11th and 12th grades) will be the basis for a waiver of the CDR E Language requirement.

**Proficiency Examination at UNL**

For the University entrance requirement, students who do not have transcript documentation can request to take a proficiency exam in the language. (This is not the same test as the Modern Languages Placement Exam.) However, UNL will provide testing only in the languages it teaches. Currently, these languages are: Arabic, French, German, Japanese, Latin, Omaha, 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.

For the College of Arts and Sciences College Distribution Requirement E-Language, the Department of Modern Languages will oversee the test at the 202 level. If the student passes the test, the department will sign the College Request for Waiver form and indicate the level of proficiency. The form is then forwarded to the Arts and Sciences Advising Center for approval.

The Department of Modern Languages will oversee the test and provide written documentation to the Arts and Sciences Advising Center the level of proficiency passed.

**Distance Education**

For the University entrance requirement, students without transcript documentation who claim proficiency in a language not taught at UNL, have the option of seeking out a distance education program in languages. If the student completes the equivalent of 102 from an approved distance education program, the student will meet the UNL entrance requirement. The student must have the course work approved before he/she takes/completes the course as equivalent to 102 by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.

For the College of Arts and Sciences College Distribution Requirement E-Language, the student can seek out a distance education program and complete the equivalent of the 202-level course. The student must submit the request on the College Request for Substitution form and have the
course work approved by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.

Third Language Option
If a student demonstrates knowledge of two foreign languages at the 102 level, the College of Arts and Sciences may consider waiving two semesters of the four semester College Distribution Requirement E-Languages requirement. If this waiver were granted, the student would then be required to complete 101 and 102 in another, 3rd foreign language at UNL.

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 schools except for UNO and UNK. No transfer 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. Pass/No Pass Privilege

University regulations for the Pass/No Pass (P/N) privilege state:

- The Pass/No Pass option is designed for your use by seeking to expand your intellectual horizons by taking courses in areas where you may have had minimal preparation.
- Neither the P nor the N grade contribute to your GPA.
- P is interpreted to mean C or above.
- A change to or from a Pass/No Pass may be made until mid-term (see academic calendar for specific dates per term).
- The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University governing the grading option.
- Changing to or from Pass/No Pass requires use of the MyRED system to change the grading option or filing a Drop/Add form with the Office of the University Registrar, 107 Canfield Administration Building. After mid-term of the course, a student registered for Pass/No Pass cannot change to a grade registration unless the Pass/No Pass registration is in conflict with the policy of the professor, department, college, or University governing Pass/No Pass.
- The Pass/No Pass grading option cannot be used for the removal of C- or D or F grades.

Pass/No Pass privileges in the College of Arts and Sciences are extended to students according to the following additional regulations:

- 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 above 299
Thirty of the 120 semester hours of credit must be in courses numbered above 299. Of the 30 hours above 299, 15 hours (1/2) must be completed in residence at UNL.

Graduate Courses
Seniors in the University who have obtained in advance the approval of the dean for Graduate Studies may receive up to 12 hours credit for graduate courses taken in addition to the courses necessary to complete their undergraduate work, provided that such credits are earned within the calendar year prior to receipt of the baccalaureate. For procedures, inquire at the Office of Graduate Studies.

Course work taken prior to receipt of the baccalaureate may not always be accepted for transfer to other institutions as graduate work.

Residency
Residency Requirement and Open Enrollment and Summer Independent Study Courses
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 course work including 6 hours above 299 in their major, and 15 of the 30 hours required above 299 in residence. Credit earned during education abroad may be used toward the residency requirement if students register through UNL and participate in prior-approved education abroad programs. UNL open enrollment and summer independent study courses count toward residence.

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.

Key characteristics of ACE demonstrate the benefits of the program to students:
• Students receive a broad education with exposure to multiple disciplines, critical life skills and important reasoning, inquiry, and civic capacities.
• ACE is simple and transparent for students, faculty and advisors. Students complete the equivalent of 3 credit hours for each of the ten student learning outcomes.
• Students connect and integrate their ACE experiences with their selected major.
• Students can transfer all ACE certified courses across colleges within the institution to meet the ACE requirement and any course from outside the institution that is directly equivalent to a UNL ACE-certified course. Courses from outside institutions without direct equivalents may be considered with appropriate documentation for ACE credit (see academic advisor).

ACE allows faculty to assess and improve their effectiveness and facilitate students’ learning.

ACE Institutional Objectives and Student Learning Outcomes
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 Rule
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
Majors in 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>LIFE 120</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
</tr>
<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>

Specific Major Requirements

Preparation in Biological Sciences

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<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>BIOS 99</td>
<td>Assessment of the Major</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Credit Hours: 18

Additional Biological Sciences Courses

Select eighteen (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.

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 117, BIOS 160, BIOS 203, BIOS 220, BIOS 222, BIOS 280, 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>3-4</td>
</tr>
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</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<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>&amp; CHEM 110</td>
<td>and General Chemistry II</td>
<td></td>
</tr>
<tr>
<td>or CHEM 111</td>
<td>Fundamental Chemistry I</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 114</td>
<td>and Fundamental Chemistry II</td>
<td></td>
</tr>
</tbody>
</table>

Select one sequence from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<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>or CHEM 254</td>
<td>Biological Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 257</td>
<td>and Biological Organic Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>or CHEM 260</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 263</td>
<td>and 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 321</td>
<td>Elements of Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>or BIOC 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></td>
<td></td>
<td>8-10</td>
</tr>
</tbody>
</table>
Additional Major Requirements

Grade Rules

C- and D Grades
A grade of C or above is required for all courses in the 36 hours for the major (and 18 hours for the minor).

Pass/No Pass
Except for BIOS 310, no course taken Pass/No Pass can be counted toward the 36 hours for the major (and 18 hours for the minor).

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>Credit Hours</th>
</tr>
</thead>
<tbody>
<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>BIO 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>Total Credit Hours</td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

Grade Rules

C- and D Grades
A grade of C or above is required for all courses in the 18 hours for the minor (and 36 hours for the major).

Pass/No Pass
Except for BIOS 310 School of Biological Sciences Seminar, no course taken Pass/No Pass can be counted toward the 18 hours for the minor (and 36 hours for the major).

BIOS 101 General Biology
Prerequisites: Must Enroll in both BIOS 101 (lecture) and BIOS 101L (lab)
Notes: This course does not count towards the biology major. 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.
Description: Analysis of the structure, functions, and interactions of organisms from the molecular to the ecosystem levels. BIOS 101 provides the foundation for tomorrow’s citizens to critically think about and evaluate issues in biology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ASCI 240; BIOC 321; BIOS 213; BIOS 213L; ENTO 308; FDST 401, FDST 801; PSYC 370
ACE: ACE 4 Science
BIOS 111 The Biology of Microorganisms
Prerequisites: BIOS 101 and 101L, or equivalent.
Description: Comparative study of microorganisms, principles and applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 112 Introduction to Zoology
Prerequisites: BIOS 101 and 101L, or equivalent.
Notes: Parallel registration in BIOS 112L required.
Description: Survey of the animal kingdom with emphasis on the evolution, ecology, and behavior of major animal groups.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 112L Introduction to Zoology Lab
Prerequisites: BIOS 101 and 101L, or equivalent.
Notes: Parallel registration in BIOS 112 required.
Description: Laboratory exercises and experiments that complement material covered in BIOS 112.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

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; FORS 411
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
Prerequisite for: FORS 411

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 160 Introduction to Clinical Laboratory Science
Description: Introduces the pre-clinical laboratory scientist/medical technologist to the profession of clinical laboratory science. Includes lessons in ethics, organization of the medical team, professionalism, automation, medical terminology, hematology, blood bank, clinical chemistry, and medical microbiology. For students interested in a career in clinical laboratory science/medical technology. BIOS 160 will not count toward a major in biological sciences.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

BIOS 189H University Honors Seminar
Prerequisites: Good standing in the University Honors Program or by invitation.
Notes: University Honors Seminar 189H is required of all students 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:** 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:** BIOS 302; 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; BIOS 302; BIOS 303; BIOS 315; BIOS 326; BIOS 420, BIOS 820, VBMS 820, MBIO 420; BIOS 421, BIOS 821, MBIO 421; 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 472

BIOS 210 Principles of Molecular and Genetic Analysis  
**Prerequisites:** BIOS 206 or equivalent  
**Description:** Introduction to the techniques and methods used in molecular and genetic analysis.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** BIOS 302; BIOS 303; BIOS 315; BIOS 326; BIOS 420, BIOS 820, VBMS 820, MBIO 420; BIOS 421, BIOS 821, MBIO 421; BIOS 843, VBMS 843, MBIO 443; BIOS 802, BIOS 402; FORS 401

BIOS 213 Human Physiology  
**Prerequisites:** BIOS 101 & BIOS 101L or LIFE 120 & LIFE 120L or equivalent; parallel 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; VBMS 303; VBMS 403; VBMS 410

BIOS 213L Human Physiology Laboratory  
**Prerequisites:** BIOS 101 & BIOS 101L or LIFE 120 & LIFE 120L or equivalent; parallel 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 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  
**Format:** LEC  
**Prerequisite for:** NUTR 384

BIOS 216 Plant Breeding Principles and Practice  
**Crosslisted with:** AGRO 216, HORT 216  
**Prerequisites:** High school biology and chemistry. BIOS 101 and 101L, or 102 or equivalent recommended.  
**Description:** Plant breeding theory and technique. Application of genetic principles to plant improvement. Experience with breeding agronomic and horticultural plant species to illustrate plant mating systems and breeding principles.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Format:** LEC  
**Prerequisite for:** NRES 311; NRES 862, NRES 462

BIOS 220 Principles of Ecology  
**Crosslisted with:** NRES 220  
**Prerequisites:** 4 hrs biological sciences, and MATH 101 or 103.  
**Notes:** BIOS 220 is not open to students who have completed BIOS 207. BIOS 220 will not count toward a major in BIOS.  
**Description:** Ecology as a quantitative discipline that integrates the life and earth sciences to understand the dynamics of natural and managed ecosystems.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC  
**Prerequisite for:** NRES 311; NRES 862, NRES 462
BIOS 222 Ecology Laboratory
Crosslisted with: NRES 222
Prerequisites: NRES/BIOS 220 or parallel.
Description: Field and laboratory experiments in terrestrial and aquatic ecology.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB
Prerequisite for: NRES 862, NRES 462, WATS 481, WATS 881, BIOS 481, NRES 481

BIOS 232 Ecological Issues in the Great Plains
Notes: BIOS 232 is not open to students who have completed BIOS 22. BIOS 232 will not count toward a major in biological sciences.
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 237 Basic Applications of Bioinformatics
Prerequisites: LIFE 121 and LIFE 121L
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

BIOS 280 The Pre-Health Experience for Biological Sciences Majors
Prerequisites: Sophomore standing; BIOS major; BIOS 213 or 214.
Description: Exposure for pre-medical and other pre-health science students to career in health sciences. Shadow a professional and research medically-based careers.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

BIOS 296 Independent Study in Biology
Prerequisites: 4 hrs BIOS and 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: 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: IND

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; one semester organic chemistry, BIOS 205 or equivalent, and two semesters organic chemistry 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: P/N 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
| Course Code | Course Name                                     | Description                                                                                                                                  | Prerequisites                                                                 | Notes                                                                 | Credit Hours | Max credits per semester | Max credits per degree | Format | Crosslisted with          | Prerequisites      | Notes                                                                 | Description                                                                                   | Credit Towards the Degree May Not Be Earned In Both | Permissions Required | Format | Groups | Crosslisted with: |
|-------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------|----------------|--------------------------|------------------------|--------|-------------------------|---------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------|---------------------|----------------|---------------------|
| BIOS 312    | Microbiology                                   | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | LIFE 120 and LIFE 121, one year general chemistry, and one semester organic chemistry or one semester biochemistry | Permission.                                                | 3             | 3                        | 3                      | LEC                | Advanced Mathematics Courses | BIOS 498 or MATH 496 | Case studies are structured around preparation for subsequent independent research (BIOS 498 or MATH 496). | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | BIOS 313                                                      | BIOS 314                                                   | BIOS 312 | BIOS 313 |
| BIOS 314    | Microbiology Laboratory                         | Traditional microbiology techniques without recombinant DNA methods, used in industry, medicine, and research.                                      | LIFE 120 and LIFE 121, one year general chemistry, one semester organic chemistry or one semester biochemistry | Parallel registration in BIOS 312 recommended. | 2             | 2                        | 2                      | LAB                | Advanced Mathematics Courses | BIOS 498 or MATH 496 | | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | BIOS 313                                                      | BIOS 314                                                   | BIOS 312 | BIOS 313 |
| BIOS 315    | Vertebrate Embryology                           | Comparative study of the morphology and natural history of invertebrate animals; emphasis on phylogenetic relationships.                           | LIFE 121 & LIFE 121L          | Permission.                                                | 4             | 4                        | 4                      | LEC                | Advanced Mathematics Courses | BIOS 101 and 101L, or 109 | | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | BIOS 313                                                      | BIOS 314                                                   | BIOS 312 | BIOS 313 |
| BIOS 316    | Case Studies in Theoretical Ecology             | | | Permission.                                                | 3             | 3                        | 3                      | LEC                | Advanced Mathematics Courses | BIOS 498 or MATH 496 | | Case studies are structured around preparation for subsequent independent research (BIOS 498 or MATH 496). | Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to particular questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability. | BIOS 313                                                      | BIOS 314                                                   | BIOS 312 | BIOS 313 |
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 388 Comparative Anatomy of the Vertebrates
Prerequisites: LIFE 121 & LIFE 121L
Description: Evolutionary development and comparative structure of the chordate organ systems, including dissections of the dogfish, salamander, and cat.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 389 Anatomy and/or Physiology Internship
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. Open only to students who expect to become teaching assistants in anatomy or physiology
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

BIOS 390 Seminar in Behavioral Biology
Crosslisted with: PSYC 394
Prerequisites: PSYC 273 OR PSYC 373/BIOS 373
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
Description: Combination of work outside the University and academic work in biological sciences arranged through the Career Services Office. Specifics of requirements to be arranged with supervising faculty member. BIOS 395 will not count toward a major in BIOS.
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: Enrollment in the biological sciences honors program
Description: Special topics in biology.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

BIOS 399H Honors Research
Prerequisites: Open to candidates for degrees with distinction or enrollment in the biological sciences 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
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Max credits per semester</th>
<th>Max credits per degree</th>
<th>Format</th>
<th>ACE: 10 Integrated Product</th>
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<tbody>
<tr>
<td>BIOS 408</td>
<td>Functional Histology</td>
<td>BIOS 808, VBMS 408, VBMS 808</td>
<td>BIOS 101 and 101L or LIFE 120 and 120L or BIOS 112; BIOS 213 or ASCI 240. BIOS 315 recommended.</td>
<td>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.</td>
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<tr>
<td>BIOS 412</td>
<td>Human Genetics</td>
<td>BIOS 812</td>
<td>BIOS 206 and Senior standing</td>
<td>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.</td>
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<td>ACE: 10 Integrated Product</td>
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<tr>
<td>BIOS 415</td>
<td>Developmental Biology</td>
<td>BIOS 815</td>
<td>BIOS 206</td>
<td>Survey of topics in developmental biology, both animal and plant development.</td>
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<td>BIOS 416</td>
<td>Biodiversity Conservation</td>
<td>BIOS 816</td>
<td>BIOS 207 or BIOS 220/NRES 220 and BIOS 222/NRES 222</td>
<td>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.</td>
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<tr>
<td>BIOS 418</td>
<td>Advanced Genetics</td>
<td>BIOS 818</td>
<td>BIOS 206 and Senior standing</td>
<td>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.</td>
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<tr>
<td>BIOS 419</td>
<td>Behavioral Neuroscience</td>
<td>BIOS 819, PSYC 465, PSYC 865</td>
<td>PSYC 273 or PSYC 373 or BIOS 373.</td>
<td>Relationship of physiological variables to behavior, an introduction to laboratory techniques in neuropsychology.</td>
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<tr>
<td>BIOS 420</td>
<td>Molecular Genetics</td>
<td>BIOS 820, VBMS 820, Mbio 420</td>
<td>BIOS 206 and Senior standing</td>
<td>Molecular basis of genetics. Gene structure and regulation, transposable elements, chromosome structure, DNA replication, and repair mechanisms and recombination.</td>
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<tr>
<td>BIOS 421</td>
<td>Microbial Diversity</td>
<td>BIOS 821, Mbio 421</td>
<td>BIOS 206 and BIOS 312 and Senior Standing.</td>
<td>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.</td>
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<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>
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<td>3</td>
<td>LEC</td>
<td>ACE: 10 Integrated Product</td>
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</tbody>
</table>
BIOS 422L Comparative Physiology Laboratory
Prerequisites: Co-enrollment with BIOS 422
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 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 or equivalent; STAT 218 or equivalent.
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 or equivalent.
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 431 Structure and Metabolism
Crosslisted with: BIOC 431, BIOS 831, CHEM 431, CHEM 831
Prerequisites: CHEM 252 or CHEM 262 with a grade of C or better. LIFE 120 and BIOS 206 are recommended
Notes: First course of a two-semester, comprehensive biochemistry course sequence.
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
Prerequisite for: VBMS 410

BIOS 432 Metabolism and Biological Information
Crosslisted with: BIOC 432, BIOS 832, CHEM 432, CHEM 832, BIOS 832
Prerequisites: BIOC 431/831 with a grade of C or better, BIOS 206 or AGRO 215.
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: BIOC 435; BIOC 934, BIOS 934, CHEM 934

BIOS 433 Biochemistry Laboratory
Crosslisted with: BIOC 433, BIOS 833, CHEM 433, CHEM 833
Prerequisites: BIOC 431/831 (or concurrent enrollment) 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
BIOS 434 Plant Biochemistry  
Crosslisted with: AGRO 434, BIOC 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834  
Prerequisites: BIOC/BIOS/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  
Format: LEC

BIOS 436 Quaternary Paleoclimatology and Paleoeocology  
Crosslisted with: BIOS 836, GEOG 423, GEOG 823  
Prerequisites: 12 hrs GEOG 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 437 Research Techniques in Biochemistry  
Crosslisted with: BIOG 437, BIOG 837, BIOS 837  
Prerequisites: BIOG/BIOS/CHEM 433/833, or permission  
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

BIOS 438 Biogeochemical Cycles  
Crosslisted with: BIOS 838, GEOG 424, GEOG 824  
Prerequisites: CHEM 109 or 113; 12 hrs geology or biological sciences.  
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 439 Dynamics of Biochemical and Biological Networks  
Crosslisted with: BIOG 439, BIOG 839, BIOS 839  
Prerequisites: BIOS 206, BIOG 321 or BIOG 431 (or equivalent)  
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

BIOS 440 Microbial Physiology  
Crosslisted with: BIOS 840, VBMS 840, Mbio 440  
Prerequisites: BIOS 312 and either 313 or 314, or permission  
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 and either 313 or 314, or permission.  
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

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, Mbio 443  
Prerequisites: BIOS 206 and one semester organic chemistry  
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: VBMS 910

BIOS 444 Geomicrobiology  
Crosslisted with: BIOS 844, VBMS 844, GEOG 844  
Prerequisites: 3 hours biological sciences and 3 hours chemistry.  
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; CHEM 251; BIOL 321.
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
Prerequisite for: FDST 460, FDST 860; 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
Format: LAB

BIOS 447 Soil Microbiology
Crosslisted with: AGRO 460, NRES 460, SOIL 460, AGRO 860, BIOS 847, 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: LAB

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

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 452 Field Epidemiology
Crosslisted with: BIOS 852
Prerequisites: LIFE 120 and LIFE 121 and one additional 200-level life science course; or permission
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
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

BIOS 454 Ecological Interactions
Crosslisted with: BIOS 854, NRES 454, NRES 854
Prerequisites: LIFE 121 & 121L, BIOS 207 or BIOS 220 and 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 455 Great Plains Flora
Crosslisted with: BIOS 855
Prerequisites: LIFE 120 and LIFE 121
Description: Plant identification. Field study of the flora in various habitats. Field trips include grassland and woodland vegetation of this region.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

Groups: Biological Anthropology
BIOS 456 Mathematical Models in Biology
Crosslisted with: BIOS 856, NRES 456
Prerequisites: Junior standing; major in the biological sciences; MATH 106 or 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
ACE: ACE 10 Integrated Product

BIOS 458 Wetlands
Crosslisted with: NRES 468, NRES 868, WATS 468
Prerequisites: 12 hrs biological sciences; BIOS 220; CHEM 109 and 110.
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; eutroplication and its effects.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
ACE: ACE 10 Integrated Product

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 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 equivalent.
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
<table>
<thead>
<tr>
<th>BIOS 472 Evolution</th>
<th>BIOS 477 Bioinformatics and Molecular Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong> BIOS 207 and Senior standing</td>
<td><strong>Crosslisted with:</strong> BIOS 877</td>
</tr>
<tr>
<td><strong>Description:</strong> The principles and processes of micro- and macroevolution. Mechanisms behind evolutionary change and examples of these processes in a wide variety of organisms.</td>
<td><strong>Prerequisites:</strong> BIOS 206 or parallel and CHEM 251 or equivalent</td>
</tr>
<tr>
<td><strong>Credit Hours:</strong> 3</td>
<td><strong>Description:</strong> 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.</td>
</tr>
<tr>
<td><strong>Max credits per semester:</strong> 3</td>
<td><strong>Credit Hours:</strong> 3</td>
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<td><strong>Max credits per degree:</strong> 3</td>
<td><strong>Max credits per semester:</strong> 3</td>
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<td><strong>Format:</strong> LEC</td>
<td><strong>Max credits per degree:</strong> 3</td>
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<tr>
<td>ACE: ACE 10 Integrated Product</td>
<td><strong>Format:</strong> LEC</td>
</tr>
<tr>
<td>BIOS 474 Herpetology</td>
<td>BIOS 478 Plant Anatomy</td>
</tr>
<tr>
<td><strong>Crosslisted with:</strong> BIOS 874, NRES 474, NRES 874</td>
<td><strong>Crosslisted with:</strong> BIOS 878</td>
</tr>
<tr>
<td><strong>Prerequisites:</strong> BIOS/NRES 386 and permission. BIOS 388 recommended.</td>
<td><strong>Prerequisites:</strong> 8 hrs biological sciences, BIOS 109 recommended.</td>
</tr>
<tr>
<td><strong>Description:</strong> Fossil and living amphibians and reptiles. Anatomy, classification, ecology and evolution.</td>
<td><strong>Description:</strong> Development, structure, and function of tissues and organs of the higher plants. Relationships of structure to physiology and ecology of plants.</td>
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<td><strong>Credit Hours:</strong> 4</td>
<td><strong>Credit Hours:</strong> 4</td>
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<td><strong>Max credits per semester:</strong> 4</td>
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<td><strong>Format:</strong> LEC</td>
<td><strong>Format:</strong> LEC</td>
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<tr>
<td>BIOS 475 Avian Biology</td>
<td>BIOS 480 Ecology and Evolution of Arachnids</td>
</tr>
<tr>
<td><strong>Crosslisted with:</strong> BIOS 875</td>
<td><strong>Crosslisted with:</strong> BIOS 880</td>
</tr>
<tr>
<td><strong>Prerequisites:</strong> LIFE 121 &amp; LIFE 121L</td>
<td><strong>Prerequisites:</strong> BIOS 207 or BIOS 220</td>
</tr>
<tr>
<td><strong>Notes:</strong> May also be offered at Cedar Point Biological Station.</td>
<td><strong>Description:</strong> Ecology and evolutionary biology of living arachnids.</td>
</tr>
<tr>
<td><strong>Description:</strong> Biology of birds emphasizing the behavior and ecology of this group. Topics include avian diversity, systematics &amp; evolutionary history, flight, foraging, migration, communication, reproductive biology, population ecology and conservation biology.</td>
<td><strong>Credit Hours:</strong> 4</td>
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<td><strong>Credit Hours:</strong> 3</td>
<td><strong>Max credits per semester:</strong> 4</td>
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<td><strong>Format:</strong> LEC</td>
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<tr>
<td><strong>Format:</strong> LEC</td>
<td>BIOS 481 Stream and River Ecology</td>
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<tr>
<td>BIOS 475L Avian Biology Laboratory</td>
<td><strong>Crosslisted with:</strong> WATS 481, WATS 881, NRES 481</td>
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<tr>
<td><strong>Crosslisted with:</strong> BIOS 875L</td>
<td><strong>Prerequisites:</strong> NRES 222 or equivalent</td>
</tr>
<tr>
<td><strong>Prerequisites:</strong> Parallel BIOS 475/875 and permission</td>
<td><strong>Description:</strong> 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.</td>
</tr>
<tr>
<td><strong>Notes:</strong> An immersive field biology experience at Cedar Point Biological Station.</td>
<td><strong>Credit Hours:</strong> 4</td>
</tr>
<tr>
<td><strong>Description:</strong> Avian field identification in diverse prairie, riparian, and montane habitats. Individual studies of foraging behavior, territoriality, anti-predator behavior, mating systems, or nesting ecology.</td>
<td><strong>Max credits per semester:</strong> 4</td>
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<tr>
<td><strong>Credit Hours:</strong> 1</td>
<td><strong>Max credits per degree:</strong> 4</td>
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<td><strong>Max credits per semester:</strong> 1</td>
<td><strong>Format:</strong> LEC</td>
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<tr>
<td><strong>Max credits per degree:</strong> 1</td>
<td>BIOS 482 Field Entomology</td>
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<tr>
<td><strong>Format:</strong> LAB</td>
<td><strong>Crosslisted with:</strong> BIOS 882, ENTO 411, ENTO 811</td>
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<tr>
<td>BIOS 476 Mammalogy</td>
<td><strong>Prerequisites:</strong> 12 hrs biological sciences.</td>
</tr>
<tr>
<td><strong>Crosslisted with:</strong> BIOS 876, NRES 476, NRES 876</td>
<td><strong>Description:</strong> Field course in insect taxonomy and biology emphasizing field collection, specimen preparation, classification, and insect natural history.</td>
</tr>
<tr>
<td><strong>Prerequisites:</strong> 8 hrs BIOS; BIOS/NRES 386 or NRES 311.</td>
<td><strong>Credit Hours:</strong> 4</td>
</tr>
<tr>
<td><strong>Notes:</strong> 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.</td>
<td><strong>Max credits per semester:</strong> 4</td>
</tr>
<tr>
<td><strong>Description:</strong> Evolution, natural history, ecology, and functional morphology of planetary mammals and mammals of the Northern Great Plains.</td>
<td><strong>Max credits per degree:</strong> 4</td>
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<td><strong>Credit Hours:</strong> 4</td>
<td><strong>Format:</strong> LEC</td>
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<tr>
<td><strong>Max credits per semester:</strong> 4</td>
<td>BIOS 483 Animal Behavior</td>
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<tr>
<td><strong>Max credits per degree:</strong> 4</td>
<td><strong>Crosslisted with:</strong> WATS 461, WATS 861, NRES 461</td>
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<tr>
<td><strong>Format:</strong> LEC</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<td>BIOS 484 Animal Behavior Laboratory</td>
<td><strong>Description:</strong> Avian behavior and evolution.</td>
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<tr>
<td><strong>Crosslisted with:</strong> WATS 861</td>
<td><strong>Credit Hours:</strong> 1</td>
</tr>
<tr>
<td><strong>Prerequisites:</strong> 8 hrs WATS, WATS/NRES 370 or WATS 370.</td>
<td><strong>Max credits per semester:</strong> 4</td>
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<tr>
<td><strong>Notes:</strong> Undergraduate and graduate students. Field trips are required and may occur outside of scheduled class time.</td>
<td><strong>Max credits per degree:</strong> 4</td>
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<tr>
<td><strong>Description:</strong> Avian behavior and evolution.</td>
<td><strong>Format:</strong> LEC</td>
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<tr>
<td><strong>Credit Hours:</strong> 1</td>
<td>BIOS 485 Animal Behavior Seminar</td>
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<td><strong>Max credits per semester:</strong> 1</td>
<td><strong>Crosslisted with:</strong> WATS 461, WATS 861, NRES 461</td>
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<tr>
<td><strong>Max credits per degree:</strong> 1</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<tr>
<td><strong>Format:</strong> LEC</td>
<td><strong>Description:</strong> Seminar course in animal behavior.</td>
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<td>BIOS 486 Animal Behavior Seminar Laboratory</td>
<td><strong>Credit Hours:</strong> 1</td>
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<td><strong>Crosslisted with:</strong> WATS 861</td>
<td><strong>Max credits per semester:</strong> 1</td>
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<tr>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
<td><strong>Max credits per degree:</strong> 1</td>
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<tr>
<td><strong>Description:</strong> Laboratory course in animal behavior.</td>
<td><strong>Format:</strong> LEC</td>
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<td><strong>Credit Hours:</strong> 1</td>
<td>BIOS 487 Animal Behavior Seminar Laboratory</td>
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<td><strong>Max credits per semester:</strong> 1</td>
<td><strong>Crosslisted with:</strong> WATS 461, WATS 861, NRES 461</td>
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<tr>
<td><strong>Max credits per degree:</strong> 1</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<tr>
<td><strong>Description:</strong> Laboratory course in animal behavior.</td>
<td><strong>Credit Hours:</strong> 1</td>
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<tr>
<td><strong>Format:</strong> LEC</td>
<td>BIOS 488 Animal Behavior Seminar Laboratory</td>
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<tr>
<td>BIOS 489 Animal Behavior Seminar Laboratory</td>
<td><strong>Crosslisted with:</strong> WATS 461, WATS 861, NRES 461</td>
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<tr>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
</tr>
<tr>
<td><strong>Description:</strong> Laboratory course in animal behavior.</td>
<td><strong>Description:</strong> Seminar course in animal behavior.</td>
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<td><strong>Credit Hours:</strong> 1</td>
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<tr>
<td>BIOS 490 Field Science</td>
<td><strong>Max credits per semester:</strong> 1</td>
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<td><strong>Crosslisted with:</strong> WATS 490</td>
<td><strong>Max credits per degree:</strong> 1</td>
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<tr>
<td><strong>Prerequisites:</strong> 12 hrs biological sciences</td>
<td><strong>Format:</strong> LEC</td>
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<tr>
<td><strong>Description:</strong> Field course in various natural science areas.</td>
<td>BIOS 491 Field Science Laboratory</td>
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<td><strong>Credit Hours:</strong> 1</td>
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<tr>
<td><strong>Max credits per semester:</strong> 1</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<tr>
<td><strong>Max credits per degree:</strong> 1</td>
<td><strong>Description:</strong> Laboratory course in various natural science areas.</td>
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<td><strong>Format:</strong> LEC</td>
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<td>BIOS 492 Field Science Seminar</td>
<td>BIOS 493 Field Science Seminar</td>
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<td><strong>Crosslisted with:</strong> WATS 492, WATS 892</td>
<td><strong>Crosslisted with:</strong> WATS 493, WATS 893</td>
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<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<td><strong>Credit Hours:</strong> 1</td>
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<td>BIOS 494 Field Science Seminar Laboratory</td>
<td>BIOS 495 Field Science Seminar Laboratory</td>
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<td><strong>Crosslisted with:</strong> WATS 494, WATS 894</td>
<td><strong>Crosslisted with:</strong> WATS 495, WATS 895</td>
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<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<td><strong>Description:</strong> Laboratory course in various natural science areas.</td>
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<td><strong>Credit Hours:</strong> 1</td>
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<td>BIOS 496 Field Science Seminar Laboratory</td>
<td>BIOS 497 Field Science Seminar Laboratory</td>
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<td><strong>Crosslisted with:</strong> WATS 496, WATS 896</td>
<td><strong>Crosslisted with:</strong> WATS 497, WATS 897</td>
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<tr>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
<td><strong>Prerequisites:</strong> WATS 222 or equivalent</td>
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<tr>
<td><strong>Description:</strong> Laboratory course in various natural science areas.</td>
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</tr>
<tr>
<td><strong>Credit Hours:</strong> 1</td>
<td><strong>Credit Hours:</strong> 1</td>
</tr>
</tbody>
</table>
BIOS 484 Physiology of Exercise
Crosslisted with: BIOS 884, NUTR 484, NUTR 884
Prerequisites: 12 hrs biological sciences, including BIOS 213 or equivalent; BIOS 214 or equivalent
Description: Effects of physical activity on the circulatory, respiratory, and other physiological processes.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: NUTR 486, NUTR 886

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

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

BIOS 486 Advanced Topics in Biophysical Chemistry
Crosslisted with: BIOC 486, BIOC 886, BIOS 486, CHEM 486, CHEM 886
Prerequisites: CHEM 471/871 or 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 and LIFE 121
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 488 Natural History of the Invertebrates
Crosslisted with: BIOS 888
Prerequisites: LIFE 120 and LIFE 121
Description: Field course in invertebrate community relations stressing on-site observation of community components, natural history, and interactions.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 489 Ichthyology
Crosslisted with: BIOS 889, NRES 489, NRES 889
Prerequisites: LIFE 120 and LIFE 121
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

BIOS 497 Special Topics in Biological Sciences
Crosslisted with: BIOS 897
Prerequisites: LIFE 120 and LIFE 121; and permission
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: LIFE 120 and LIFE 121; and 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.)

15 HR TERM 1

Calculus
complete MATH 106

MATH 106 will fulfill the ACE 3 requirement.

General Chemistry
complete CHEM 109
CHEM 109 will fulfill the ACE 4 requirement.

**ACE 1 Written Texts**

complete 1 from ACE1

3hr

---

**CDR E: Language**

recommend 1 or more courses

3hr

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

---

**14 HR TERM 2**

**General Chemistry**

complete CHEM 110

4hr

CHEM 110 will fulfill the CDR F requirement.

**Life Science**

complete LIFE 120, LIFE 120L

4hr

LIFE 120 and 120L become critical to your success in the major if not completed by the second term of enrollment. These courses will fulfill the CDR B and CDR BL requirements.

---

**CDR A: Writing**

complete 1 from ACE1

3hr

Complete an additional course approved as ACE 1.

---

**CDR E: Language**

recommend 1 or more courses

3hr

If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.

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**15 HR TERM 3**

**Life Science**

complete LIFE 121, LIFE 121L

4hr

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**Organic Chemistry And Lab**

complete 2 from CHEM 251, CHEM 253, CHEM 255, CHEM 257, CHEM 261, CHEM 263

5hr

Complete one set - lecture and lab.

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**ACE 2 Communication Skill**

complete 1 from ACE2

3hr

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**Electives**

complete Any Course

3hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

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**16 HR TERM 4**

**Biological Sciences Core**

complete BIOS 205

2hr

BIOS 206

4hr

C

BIOS 206 is ideally completed by the fourth term of enrollment. It becomes critical to your success in the major if not completed by the sixth term of enrollment.

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**Genetics**

complete BIOS 206

4hr

C

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**Additional Math/Stats**

complete 1 from CSCE 155T, EDPS 459, ECON 215, MATH 107, PSYC 350, STAT 218, STAT 380

4hr

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**ACE 6 Social Sciences**

complete 1 from ACE6

3hr

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**Electives**
In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

15 HR TERM 5

Biological Science Course

complete 1 from Any Biological Science Course at the 100 Level, Any Biological Science Course at the 200 Level, Any Biological Science Course at the 300 Level, Any Biological Science Course at the 400 Level

Complete an approved BIOS course at any level.

General Physics

complete either PHYS 141 or PHYS 211

ACE 8 Ethical Principles

complete 1 from ACE8

Electives

complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

16 HR TERM 6

Biological Sciences Core

complete BIOS 207

Biol Science Upper Level

complete either Any Biological Science Course at the 300 Level or Any Biological Science Course at the 400 Level

BIOS 310 is recommended for this term.

Biochemistry Course

complete BIOC 321

General Physics

complete either PHYS 142 or PHYS 212

CDR D: Social Sciences

complete 1 from Any Anthropology Course, Any Communications Course, Any Geography Course, Any National Securities Studies Course, Any Political Science Course, Any Psychology Course, Any Sociology Course

Complete an approved course from a Social Science discipline: ANTH, COMM, GEOG, NSST, POLS, PSYC, SOCI.

15 HR TERM 7

Biol Science Upper Level

complete either Any Biological Science Course at the 300 Level or Any Biological Science Course at the 400 Level

Biol Science 400 Level

complete Any Biological Science Course at the 400 Level

CDR C: Humanities

complete 1 from Any Arabic Course at the 300 Level, Any Classics Course, Any Czech Course at the 300 Level, Any Czech Course at the 400 Level, Any English Course, FREN 282, Any French Course at the 300 Level, Any French Course at the 400 Level, GERM 282, Any German Course at the 300 Level, Any German Course at the 400 Level, Any Greek Course at the 300 Level, Any Greek Course at the 400 Level, Any Hebrew Course at the 300 Level, Any Hebrew Course at the 400 Level, Any History Course, Any Japanese Course at the 300 Level, Any Japanese Course at the 400 Level, Any Latin Course at the 300 Level, Any Latin Course at the 400 Level, Any Hebrew Course at the 300 Level, Any Hebrew Course at the 400 Level, Any History Course, Any Japanese Course at the 300 Level, Any Japanese Course at the 400 Level, Any Latin Course at the 300 Level, Any Latin Course at the 400 Level, Any Philosophy Course, Any Religious Studies Course at any Level, Any Russian Course at the 300 Level, Any Russian Course at the 400 Level, SPAN 264, SPAN 265, Any Spanish Course at the 300 Level, Any Spanish Course at the 400 Level

Electives

complete Any Course
In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

**16 HR TERM 8**

**Biol Science 400 Level**

complete Any Biological Science Course at the 400 Level

3hr

C

Complete an approved BIOS 400 level course that will meet the ACE 10 requirement.

**Biological Science Course**

complete 1 from Any Biological Science Course at the 100 Level, Any Biological Science Course at the 200 Level, Any Biological Science Course at the 300 Level, Any Biological Science Course at the 400 Level

4hr

C

Complete an approved BIOS course at any level.

**Assessment Course**

complete BIOS99#

0hr

C

**ACE 7 Arts**

complete 1 from ACE7

3hr

**ACE 9 Global/Human Divers**

complete 1 from ACE9

3hr

**Electives**

complete Any Course

3hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

**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**

- Comprehend and critically evaluate complex information
- Use quantitative analytical computational techniques
- Make predictions using mathematical, statistical, and scientific modeling methods
- Understand and use proper laboratory and technical skills and instruments
- Define problems and identifying causes
- Support and communicate claims using clear evidence
- Simplify complex information and present it to others
- Apply mathematical and scientific skills to solve real-world problems
- Document and replicate processes and procedures
- Design and implement research experiments

**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

**Internships**

- Beckman Research Scholar, UNL College of Arts Sciences Beckman Scholars - Lincoln NE
- Optician, Shopko Optical - Lincoln NE
- Anatomy Intern, UNL School of Biological Sciences - Lincoln NE
- Dental Intern, UNMC Dental College - Lincoln NE
- Intern, Southwestern -
- 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, UNL Biology Department - Lincoln NE

**Grad Schools**

- MD, University of Nebraska Medical School - Omaha NE
- Veterinary Medicine, Iowa State University - Ames IA
- College of Pharmacy, University of Nebraska Medical Center - Omaha NE
- Physical Therapy, Briar Cliff University - Iowa NE
- Clinical Laboratory Science, St. Luke's - Kansas City MO
- Master of Public Health, University of Nebraska Medical Center - Omaha NE
- Optometry, Southern College of Optometry - Memphis TN
- Masters-Food Science, University of Nebraska-Lincoln - Lincoln NE
- Masters of Business Administration, Bellevue University - Bellevue NE
- Physician Assistant, University of Nebraska Medical Center - Omaha NE