



BIOLOGICAL SCIENCES

Description

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

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.

Options in the Major

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

Standard Option

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

Human Health and Disease Option

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

Learning Outcomes

Graduates with a major in biological sciences will be able to:

1. Demonstrate mastery of the concepts, principles, and knowledge for the following sub-disciplines: cell biology, molecular biology, organismal biology, genetics, ecology, and evolution.
2. Interpret and analyze data to make inferences, interpret results and assess the validity of conclusions based on data.
3. Apply scientific methods and cross-disciplinary knowledge to help address grand challenges in biology, such as climate change, the biodiversity crisis, emerging infectious disease, cancer, human genetics, and biotechnology development.
4. Reflect on and communicate skills and knowledge acquired through independent research, field experiences, or practicums to varied audiences.

Graduates with the human health and disease option will also be able to:

- Apply fundamental concepts and principles from across subdisciplines of biology to problems of human health, such as human anatomy and physiology; infectious and genetic diseases; and development of treatments such as vaccines.

Academic and Career Advising

Academic and Career Advising Center

Not sure where to go or who to ask? The Advising Center team in 107 Oldfather Hall can help. The Academic and Career Advising Center is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representatives.

CAS Career Coaches are available by appointment (in-person or Zoom) and located in the CAS Academic and Career Advising Center, 107 Oldfather Hall. They help students explore majors and minors, gain experience, and develop a plan for life after graduation.

Assigned Academic Advisors

Academic advisors are critical resources dedicated to students' academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline specific expertise. They are available for appointments (in-person or Zoom) and through weekly virtual drop-ins. Assigned advisors are listed in MyRED (<https://its.unl.edu/myunl/>) and their offices may be located in or near the department of the major for which they advise.

Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, visit <https://cas.unl.edu/major-advisors> (<https://cas.unl.edu/major-advisors/>), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, casadvising@unl.edu.

Career Coaching

The College believes that **Academics + Experience = Opportunities** and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value. Graduates are prepared to effectively contribute professionally and personally with a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather Hall, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience and

prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

ACE Requirements

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

ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.	• Other courses with a 9 in the middle number (ex. PSYC 292) will not satisfy distribution requirements unless approved by an advisor.
ACE 2: Demonstrate competence in communication skills.	• Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the lead department.
ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.	CDR: Written Communication Select from courses approved for ACE outcome 1.
ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.	CDR: Natural, Physical, and Mathematical Sciences ¹ Select a course from ASTR, BIOS, CHEM, GEOL, LIFE, METR, MATH, PHYS, or ANTH 242, GEOG 155, GEOG 281, POLS 250, or PSYC 273.
ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.	CDR: Laboratory ² Laboratory courses may be embedded in a 4-5 credit course used in CDR Natural, Physical, and Mathematical Science (example GEOG 155), or stand alone (example LIFE 120L).
ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.	CDR: Humanities ³ Select a course from ARAB, CHIN, CLAS, CZE, ENGL, FILM, FREN, GERM, GREK, HIST, JAPN, LATN, PHIL, RELG, RUSS, or SPAN.
ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.	CDR: Social Science ⁴ Select a course from ANTH, COMM, GEOG, NSST, POLS, PSYC, or SOCI.
ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.	CDR: Human Diversity in U.S. Communities Select from the following approved courses also listed in your degree audit: ANTH 130, ANTH 412, ANTH 447, ANTH 473, ARAB/RELG 313, COMM 311, COMM 315, COMM/ETHN 335, COMM 364, COMM/ETHN 365, COMM 465, ENGL/WMNS 212, ENGL/ETHN 245N, ENGL/WMNS 312, ENGL/ETHN 345D, ENGL/ETHN/WMNS 345N, ENGL/ETHN 346, ENGL 376, ENGL 380, ENGL/ETHN 445, ETHN 100, ETHN 201, ETHN 202, ETHN 204, ETHN 484, FILM/ETHN 344, GEOG 271, GEOG 403, GLST/ANTH/MODL 214, GLST 350, HIST/ETHN/WMNS 115, HIST/ETHN 234, HIST/ETHN 246, HIST 251, HIST/ETHN 340, HIST 351/ETHN 341, HIST/ETHN/WMNS 356, HIST/ETHN 357, HIST/WMNS 402, HRHA 350, MODL 260, PHIL 105, PHIL 106, PHIL/WMNS 218, PHIL 323, PHIL 325, POLS/ETHN 333, POLS/WMNS 338, POLS 340, POLS 347, POLS 433, PSYC/ETHN 310, PSYC 330, PSYC/WMNS 421, PSYC/ETHN 425, RELG/HIST 134, RELG/ETHN/HIST 226, RELG/HIST 227, SOCI 101, SOCI 180, SOCI/WMNS 200, SOCI/ETHN 217, SPAN 206, SPAN 486, WMNS 101, WMNS 201, WMNS 202, WMNS 210
ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.	CDR: Language BA Students ⁵
ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.	Fulfilled by the completion of the 4th level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZE, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

College Degree Requirements

College Distribution Requirements

The College of Arts and Sciences distribution requirements are designed to ensure a range of courses across disciplines within the College. Students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Internship (395 or 495), independent study or readings (396 or 496), research (398 or 498), and thesis (399, 399H, 499, or 499H) will not satisfy distribution requirements.

- Other courses with a 9 in the middle number (ex. PSYC 292) will not satisfy distribution requirements unless approved by an advisor.
- Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the lead department.

CDR: Written Communication

Select from courses approved for ACE outcome 1.

CDR: Natural, Physical, and Mathematical Sciences

¹ Select a course from ASTR, BIOS, CHEM, GEOL, LIFE, METR, MATH, PHYS, or ANTH 242, GEOG 155, GEOG 281, POLS 250, or PSYC 273.

CDR: Laboratory

Laboratory courses may be embedded in a 4-5 credit course used in CDR Natural, Physical, and Mathematical Science (example GEOG 155), or stand alone (example LIFE 120L).

CDR: Humanities

Select a course from ARAB, CHIN, CLAS, CZE, ENGL, FILM, FREN, GERM, GREK, HIST, JAPN, LATN, PHIL, RELG, RUSS, or SPAN.

CDR: Social Science

⁴ Select a course from ANTH, COMM, GEOG, NSST, POLS, PSYC, or SOCI.

CDR: Human Diversity in U.S. Communities

Select from the following approved courses also listed in your degree audit: ANTH 130, ANTH 412, ANTH 447, ANTH 473, ARAB/RELG 313, COMM 311, COMM 315, COMM/ETHN 335, COMM 364, COMM/ETHN 365, COMM 465, ENGL/WMNS 212, ENGL/ETHN 245N, ENGL/WMNS 312, ENGL/ETHN 345D, ENGL/ETHN/WMNS 345N, ENGL/ETHN 346, ENGL 376, ENGL 380, ENGL/ETHN 445, ETHN 100, ETHN 201, ETHN 202, ETHN 204, ETHN 484, FILM/ETHN 344, GEOG 271, GEOG 403, GLST/ANTH/MODL 214, GLST 350, HIST/ETHN/WMNS 115, HIST/ETHN 234, HIST/ETHN 246, HIST 251, HIST/ETHN 340, HIST 351/ETHN 341, HIST/ETHN/WMNS 356, HIST/ETHN 357, HIST/WMNS 402, HRHA 350, MODL 260, PHIL 105, PHIL 106, PHIL/WMNS 218, PHIL 323, PHIL 325, POLS/ETHN 333, POLS/WMNS 338, POLS 340, POLS 347, POLS 433, PSYC/ETHN 310, PSYC 330, PSYC/WMNS 421, PSYC/ETHN 425, RELG/HIST 134, RELG/ETHN/HIST 226, RELG/HIST 227, SOCI 101, SOCI 180, SOCI/WMNS 200, SOCI/ETHN 217, SPAN 206, SPAN 486, WMNS 101, WMNS 201, WMNS 202, WMNS 210

CDR: Language

BA Students

⁵ Fulfilled by the completion of the 4th level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZE, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

BS Students

⁶ Fulfilled by the completion of the 2nd level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZE, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

¹ Excluded courses: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MBIO 101, PHYS 201, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, and MATH subject area credit at the 100 level or below.

² ANTH 242L, ASTR 224, BIOS 101L, BIOS 110L, BIOS 111, BIOS 116, BIOS 213L, BIOS 214, CHEM 105L, CHEM 106L, CHEM 109L,



CHEM 110L, CHEM 113L, GEOG 155, GEOL 101, GEOL 103, LIFE 120L, LIFE 121L, METR 100, PHYS 141, PHYS 142, PHYS 153, PHYS 221, or PHYS 222.

³ ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, and SPAN courses must be numbered 300 or above. ENGL courses must be ENGL 170, ENGL 180, or ENGL 200 level and above. Excluded courses: CLAS 116, ENGL 254, ENGL 300, ENGL 354, SPAN 300A, SPAN 303, and SPAN 304.

⁴ Excluded courses: ANTH 242/ANTH 242L, GEOG 155, GIST 111, GIST 311, POLS 101, POLS 250, PSYC 100, PSYC 273.

⁵ ARAB 202, CHIN 202, CZEC 202, FREN 202 or FREN 210, GERM 202, GREK 301 and GREK 302, JAPN 201 and JAPN 202, LATN 301 and LATN 302, SPAN 202 or SPAN 210 or SPAN 300A or SLPA 202.

⁶ ARAB 102, CHIN 102, CZEC 102, FREN 102, GERM 102, GREK 102 or GREK 151, JAPN 102, LATN 102, SPAN 102 or SPAN 110 or SPAN 300A, or SLPA 102.

Language Requirement

The University of Nebraska–Lincoln and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The University of Nebraska–Lincoln entrance requirement is successful completion of two levels of the same world language, and the College of Arts and Sciences degree requirement (CDR: Language) is proficiency through 4 levels for BA students, or 2 levels for BS students. Levels are defined as years in High School, or semesters in college as documented on an official transcript.

Students who believe they are proficient in a language, but who do not have academic records of that proficiency, should consult with their academic advisor to explore alternative assessments which may include a proficiency examination by a UNL faculty member for languages taught at UNL, or through an approved private service for languages not taught at UNL (expenses for this service would be the student's responsibility.)

Experiential Learning Requirement

All undergraduates in the College of Arts and Sciences must complete an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning. Students should consult their assigned Academic Advisor and Career Coach for assistance identifying experiential learning opportunities relevant to their academic program, interests and goals.

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences from disciplines within the College of Arts and Sciences or required in its majors: ACTS, ASTR, BIOC, BIOS, CHEM, CSCE, GEOL, LIFE, MBIO, METR, MATH, PHYS, STAT or ANTH 242, ANTH 242L, ANTH 341, ANTH 385, ANTH 386, ANTH 389, ANTH 416, ANTH 422, ANTH 430, ANTH 442, ANTH 443, ANTH 444, ANTH 448, ANTH 473, ANTH 484, ANTH 487D, ENVR 201, GEOG 155, GEOG 217, GEOG 281, GEOG 308, GEOG 317, GEOG 408, GEOG 417, GEOG 418, GEOG 419, GEOG 421, GEOG 422, GEOG 425, GEOG 427, GEOG 432, GEOG 444, GEOG 461, GEOG 467, PHIL 211, POLS 250, PSYC 273, PSYC 368, PSYC 370, PSYC 450, PSYC 451, PSYC 456, PSYC 458, PSYC 460, PSYC 461, PSYC 463, PSYC 464, or PSYC 465.

Excluded courses include: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, MBIO 101, PHYS 201 as well as any course numbered 395, 495, 399, 399H, 499, or 499H. MATH subject area credit at the 100 level or below is also excluded.

Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the

College of Arts and Sciences. See your assigned academic advisor to start the approval process.

Minimum Hours Required for Graduation

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

Grade Rules

Restrictions on C- and D Grades

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

Pass/No Pass Privilege

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

- Neither the P nor the N grade factor into your GPA.
- 'P' is interpreted to mean a grade of C or above. A grade of C- or lower results in a "N".
- A change to or from a Pass/No Pass may be made until mid-term (1/2 of the course - see the 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 policy governing the grading options.
- Changing to or from the Pass/No Pass grading option requires using MyRED, or processing a Schedule Adjustment Form.
- For undergraduates, the University maximum of 24 'Pass' credit hours and/or college and department limits will apply. These limits do not include courses offered on a 'Pass/No Pass' basis only. Consult your advisor or the Undergraduate Catalog (<https://catalog.unl.edu/undergraduate/>) for restrictions on the number of 'Pass' hours you can apply toward your degree.
- The 'Pass/No Pass' grading option cannot be used for the removal of 'C-', 'D+', 'D', 'D-', or 'F' grade factors.

NOTE: See Course Repeats (<https://registrar.unl.edu/academic-standards/course-repeats/>)

College of Arts and Sciences policy on the Pass/No Pass (P/N) privilege:

- Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences majors and minors do not permit any courses graded Pass/No Pass to apply, or limit them to no more than 6 hours. Students should refer to the major section of the catalog for clarification.
- Departments may specify that certain courses of theirs can be taken on a P/N-only or on a graded-only basis.

Grading Appeals

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

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

Course Level Requirements

Courses Numbered at the 300 or 400 Level

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

Residency Requirement

The term "Residency" refers to courses taken at UNL. Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska-Lincoln. Students must complete at least 18 hours of their major coursework, and 15 of the 30 hours required at the 300 or 400 level, at UNL.

Catalog to Use

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

Transfer Students: Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska-Lincoln within 1 calendar year from their last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the time frame allowable for that catalog year.

Major Requirements

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

Core Requirements

Required Courses

BIOS 100	Pathways to Success in the Biological Sciences Major	1
LIFE 120 & 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	4

LIFE 121 & 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory	4
BIOS 201	General Genetics	4
BIOS 202	Genetics, Molecular and Cellular Biology Laboratory	2
BIOS 207	Ecology and Evolution	4
BIOS 99	Assessment of the Major	0
Credit Hours Subtotal:		19
Total Credit Hours		19

Ancillary Requirements

Mathematics and Quantitative Reasoning

MATH 106	Calculus I	5
Select one of the following:		3-4
CSCE 155T	Computer Science I: Informatics Focus	
or ECON 215 Statistics		
or EDPS 459 Statistical Methods		
or MATH 107 Calculus II		
or PSYC 350 Research Methods and Data Analysis		
or STAT 218 Introduction to Statistics		
or STAT 380 Statistics and Applications		
Credit Hours Subtotal:		8-9

General Chemistry

Select one sequence from:		7-8
CHEM 109A	General Chemistry I	
& CHEM 109L	and General Chemistry I Laboratory	
& CHEM 110A	and General Chemistry II	
& CHEM 110L	and General Chemistry II Laboratory	
or CHEM 111	Fundamental Chemistry I and Fundamental Chemistry I Laboratory	
& CHEM 113	and Fundamental Chemistry II	
& CHEM 114		
Credit Hours Subtotal:		7-8

Organic Chemistry ¹

Select one of the following:		4-5
CHEM 251	Organic Chemistry I	
& CHEM 253	and Organic Chemistry I Laboratory	
or CHEM 261	Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory	
& CHEM 263		
Credit Hours Subtotal:		4-5

Biochemistry ¹

Select one of the following:		3
BIOC 401	Elements of Biochemistry	
or BIOC 431	Biochemistry I: Structure and Metabolism	
BIOS 431		
Credit Hours Subtotal:		3

Physics

Select one sequence from:		8-10
PHYS 141	Physics for Life Sciences I	
& PHYS 142	and Physics for Life Sciences II	
or PHYS 211	General Physics I and General Physics II	
& PHYS 212		

Credit Hours Subtotal:	8-10
Total Credit Hours	30-35

¹ Students who plan to complete BIOC/BIOS 431 will need an additional Organic Chemistry lecture. BIOC/BIOS/CHEM 431 has a prerequisite of CHEM 252 or CHEM 262.

Standard Option

Biological Sciences Electives

Select 18 hours of BIOS courses, including at least 10 hours at the 300 level or above and at least two courses (6 credits) at the 400 level. ¹	18
--	----

Credit Hours Subtotal:	18
Total Credit Hours	18

¹ The following courses will NOT count toward the biological sciences major: BIOS 101, BIOS 101L, BIOS 110, BIOS 110L, or BIOS 395.

Human Health and Disease Option

Foundation Courses

Select three courses or sequences from:	11-13
---	-------

BIOS 213 & 213L	Human Physiology and Human Physiology Laboratory
-----------------	--

BIOS 214	Human Anatomy
----------	---------------

BIOS 312 & BIOS 314	Microbiology and Microbiology Laboratory
---------------------	--

BIOS 303	Molecular Biology
	or BIOS 337 Applications of Bioinformatics

Credit Hours Subtotal:	11-13
------------------------	-------

Human Health and Disease Electives ^{1,2}

Select two courses or sequences from:	6-8
---------------------------------------	-----

ANTH 448	Human Growth and Development
BIOS 300 / ENTO 300 / NRES 300	Toxins in the Environment

BIOS 326	Biology of Viruses
----------	--------------------

BIOS 368	Plants in Human Medicine: Biological, Social, and Ethical Dimensions
----------	--

BIOS 366	Neurobiology I: Clinical, Experimental, & Theoretical
----------	---

BIOS 385	Parasitology
----------	--------------

BIOS 408 / VBMS 408	Functional Histology
---------------------	----------------------

BIOS 427	Practical Bioinformatics Laboratory
----------	-------------------------------------

BIOS 440	Microbial Physiology
----------	----------------------

BIOS 441 / VBMS 441	Pathogenic Microbiology
---------------------	-------------------------

BIOS 442 / ASCI 442	Endocrinology
---------------------	---------------

BIOS 443 / MBIO 443	Immunology
---------------------	------------

BIOS 445 / FDST 405 & BIOS 446 / FDST 406	Food Microbiology and Food Microbiology Laboratory
BIOS 465 / PSYC 465	Behavioral Neuroscience
BIOS 477	Bioinformatics and Molecular Evolution

Credit Hours Subtotal:	6-8
------------------------	-----

Human Health and Disease ACE 10 Course ²

Select one of the following:	3-4
------------------------------	-----

BIOS 402	Cancer Biology
----------	----------------

BIOS 412	Human Genetics
----------	----------------

BIOS 418	Advanced Genetics
----------	-------------------

BIOS 420 / MBIO 420	Molecular Genetics
---------------------	--------------------

BIOS 421 / MBIO 421	Microbial Diversity
---------------------	---------------------

BIOS 422 & 422L	Comparative Physiology and Comparative Physiology Laboratory
-----------------	--

BIOS 429	Phylogenetic Biology
----------	----------------------

BIOS 435	Evolutionary Medicine
----------	-----------------------

BIOS 452	Field Epidemiology
----------	--------------------

BIOS 472	Evolution
----------	-----------

BIOS 487	Field Parasitology
----------	--------------------

Credit Hours Subtotal:	3-4
------------------------	-----

Total Credit Hours	20-25
---------------------------	--------------

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

² Human Health and Disease ACE 10 courses not used to fulfill ACE 10 may be used as electives.

Additional Major Requirements

Grade Rules

C- and D Grades

A grade of C or above is required for all courses in the major, including ancillary requirements.

Pass/No Pass

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

Requirements for Minor Offered by Department

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

BIOS 201	General Genetics	4
----------	------------------	---

BIOS 202	Genetics, Molecular and Cellular Biology Laboratory	2
----------	---	---

BIOS 207	Ecology and Evolution	4
----------	-----------------------	---

LIFE 120 & 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	4
-----------------	--	---

LIFE 121	Fundamentals of Biology II	4
& 121L	and Fundamentals of Biology II Laboratory	
Total Credit Hours	18	

Grade Rules

C- and D Grades

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

Pass/No Pass

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

BIOS 100 Pathways to Success in the Biological Sciences Major

Prerequisites: Biological Sciences Major and freshman or sophomore standing

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

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Pass No Pass

Offered: FALL/SPR

BIOS 101 General Biology

Prerequisites: Parallel registration in BIOS 101L. Credit toward the degree cannot be earned in both BIOS 101 and BIOS 110.

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

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

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ASCI 240; ASCI 243; BIOS 111; BIOS 213; BIOS 213L; BSEN 317; ENTO 308; GEOG 308, GEOL 308, NRES 308; NRES 220; NRES 302, PLAS 302; NRES 310; PLAS 240, RNGE 240, GRAS 240; PLAS 278; PLPT 210

ACE: ACE 4 Science

BIOS 101L General Biology Laboratory

Prerequisites: Parallel registration in BIOS 101. Credit toward the degree cannot be earned in both BIOS 101L and BIOS 110L.

Notes: BIOS 101L does not count in the Biological Sciences major.

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

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: BIOS 111; BIOS 213; BIOS 213L; ENTO 308; GEOG 308, GEOL 308, NRES 308

Course and Laboratory Fee: \$60

BIOS 110 Human Biology

Prerequisites: Parallel registration in BIOS 110L. Credit toward the degree cannot be earned in both BIOS 101 and BIOS 110.

Notes: High school chemistry or equivalent strongly recommended.

Not intended for most Life Sciences majors; such students should take LIFE 120-LIFE 120L and LIFE 121-LIFE 121L instead. BIOS 110 does not count in the Biological Sciences major.

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

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL/SPR

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

ACE: ACE 4 Science

BIOS 110L Human Biology Laboratory

Prerequisites: Parallel registration in BIOS 110. Credit toward the degree cannot be earned in both BIOS 101L and BIOS 110L.

Notes: BIOS 110L does not count in the Biological Sciences major.

Description: Hands-on lab exercises to understand biological concepts of human organization from molecules to cells to the body systems, basic structure and function of human tissues, organs, organ systems, reproduction, genetics, as well as DNA technology and genetic engineering.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Offered: FALL/SPR

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

Course and Laboratory Fee: \$60

BIOS 111 Introduction to Microbiology and Human Health

Prerequisites: BIOS 101 and BIOS 101L or BIOS 110 and BIOS 110L or LIFE 120 and LIFE 120L

Description: Comparative study of microorganisms important for human health and disease (bacteria, fungi, viruses, prions), principles and applications of microbiology.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Course and Laboratory Fee: \$60

BIOS 115 Insect Biology

Crosslisted with: ENTO 115

Description: Fundamental insect biology (anatomy, development, physiology, behavior, ecology and diversity). Economic and medical importance of insects and principles of insect pest management.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ENTO 200; ENTO 400; PLPT 210

ACE: ACE 4 Science

Course and Laboratory Fee: \$10

BIOS 116 Insect Identification**Crosslisted with:** ENTO 116**Description:** Identification of representative orders and families of insects by their anatomy, metamorphosis, habits and habitats. Sight recognition emphasized but dichotomous keys also used. Interrelation of insect and habitats stressed.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$15**BIOS 136 Discovery Research: Virus Hunting****Prerequisites:** By permission**Description:** Perform original research by using the scientific method to isolate a virus that infects a harmless bacterium (bacteriophage) from local soil samples. Lab skills acquired include pipetting, aseptic technique, and serial dilutions; use basic DNA and electron microscopy analyses to characterize the phage.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** FALL**Prerequisite for:** BIOS 137**Course and Laboratory Fee:** \$70**BIOS 137 Discovery Research: Virus Genome Analyses****Prerequisites:** BIOS 136 and by permission.**Description:** Build on an original project involving isolation of a virus that infects a harmless bacterium (bacteriophage) using bioinformatic tools to analyze and annotate the sequenced bacteriophage genome.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** SPRING**BIOS 180 Biological Sciences Learning Community Freshman Seminar****Prerequisites:** Permission.**Notes:** Open to Biological Sciences Learning Community students only.**Description:** An exploration of biological sciences for undergraduates in the Biological Sciences Learning Community. Topics vary.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**BIOS 189H University Honors Seminar****Prerequisites:** Good standing in the University Honors Program.**Description:** Topic varies.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ACE:** ACE 4 Science**BIOS 201 General Genetics****Prerequisites:** A grade of C, P, or better in LIFE 120 & LIFE 120L and LIFE 121 & LIFE 121L**Description:** Inheritance and regulation of genes in organisms and populations. Fundamentals of genomics and bioinformatics.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** AGRO 810, BIOC 810, HORT 810, BIOC 410, PLAS 410; AGRO 815, PLAS 415; ASCI 330; BIOC 433H; BIOS 99; BIOS 202; BIOS 302; BIOS 303; BIOS 326; BIOS 420, BIOS 820, VBMS 820, MBIO 420; BIOS 421, BIOS 821, MBIO 421; BIOS 443, BIOS 843, VBMS 843, MBIO 443, VBMS 443; BIOS 802, BIOS 402; FORS 401; NUTR 820, NUTR 420; PLPT 418, PLPT 818, MBIO 418**BIOS 202 Genetics, Molecular and Cellular Biology Laboratory****Prerequisites:** BIOS 201 or parallel**Description:** Series of lab exercises to introduce principles of genetic, molecular and cellular biology. Experiments done using model systems to identify, map and clone genes; analyze gene products and expression; and fractionate cell components.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Prerequisite for:** FORS 401**Course and Laboratory Fee:** \$100**BIOS 207 Ecology and Evolution****Prerequisites:** A grade of C, P, or better in LIFE 120 & LIFE 120L and LIFE 121 & LIFE 121L**Description:** Introduction to the principles and processes of ecology and evolution. Structure and dynamics of populations and communities; biotic and abiotic interactions; mechanisms of evolutionary change; natural selection; adaptation; and speciation.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** BIOS 99; BIOS 472; NRES 311; NRES 374**Course and Laboratory Fee:** \$35**BIOS 213 Human Physiology****Prerequisites:** A grade of C, P, or better in BIOS 101 and 101L or BIOS 110 and 110L or LIFE 120 and 120L; Parallel registration in BIOS 213L**Description:** Elementary survey of the basic functional systems of the human body: the muscular, nervous, receptor, circulatory, respiratory, digestive, excretory, endocrine, and reproductive systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** ASCI 341; ASCI 342; NUTR 355; NUTR 450; NUTR 455; SLPA 455; VBMS 303; VBMS 403; VBMS 410

BIOS 213L Human Physiology Laboratory

Prerequisites: A grade of C, P, or better in BIOS 101 and 101L or BIOS 110 and 110L or LIFE 120 and 120L; Parallel registration in BIOS 213.

Description: Laboratory exercises and experiments that complement material covered in BIOS 213.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: VBMS 303; VBMS 403

Course and Laboratory Fee: \$25

BIOS 214 Human Anatomy

Prerequisites: Sophomore standing.

Notes: Cadaver prosections are studied in the lab. Letter Grade Only.

Description: Introduction to the major organ systems of the human body including skeletal, major muscle, nervous, digestive, circulatory, excretory, and reproductive systems. Anatomical structures as they pertain to clinical anatomy.

Credit Hours: 5

Max credits per semester: 5

Max credits per degree: 5

Grading Option: Graded

Prerequisite for: NUTR 246; NUTR 384; SLPA 455

Course and Laboratory Fee: \$35

BIOS 291 Special Topics in Biological Sciences

Description: Topics vary.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Graded with Option

BIOS 296 Independent Study in Biology

Prerequisites: Permission

Notes: A maximum of 3 credit hours may be counted toward the major in BIOS. Before registering, arrangements must be made with a faculty member in BIOS to reach an agreement on the scope and determine the amount of credit for the project.

Description: Independent work directed by faculty.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option

BIOS 300 Toxins in the Environment

Crosslisted with: ENTO 300, NRES 300

Prerequisites: One semester BIOS and one semester CHEM

Description: Introduction to the principles of toxicology as they apply to environmental contaminants, agri-chemicals, and industrial and naturally occurring chemicals.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

BIOS 302 Cell Biology

Prerequisites: BIOS 201; CHEM 251 or CHEM 261.

Notes: BIOS 202 and CHEM 252 recommended.

Description: The design, execution, and evaluation of scientific experiments that advance the knowledge of cell and molecular biology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

BIOS 303 Molecular Biology

Prerequisites: BIOS 201

Description: Molecular biology of prokaryotes and eukaryotes. Review of the experimental basis for the principles of the discipline.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: PLPT 801, AGRO 801, HORT 801

BIOS 310 School of Biological Sciences Seminar

Prerequisites: LIFE 120 and LIFE 121

Notes: Pass/No Pass only.

Description: Reviews of current literature of general interest; reports of research activities by staff and guest speakers.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 3

Grading Option: Pass No Pass

BIOS 312 Microbiology

Prerequisites: A grade of C, P, or better in LIFE 121 and LIFE 121L; CHEM 251 or CHEM 261.

Notes: BIOS 201 recommended. Parallel registration in BIOS 314 recommended.

Description: Microbial cell structure, genetics, metabolic and biosynthetic activity, diversity, ecology and evolution including host-microbe interactions.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: BIOS 421, BIOS 821, MBIO 421; BIOS 440, BIOS 840, VBMS 840, MBIO 440, VBMS 440; FDST 455, FDST 855, MBIO 455; VBMS 403

BIOS 314 Microbiology Laboratory

Prerequisites: A grade of C, P, or better in LIFE 121 and LIFE 121L; CHEM 251 or CHEM 261.

Notes: Credit towards the degree may not be earned in both BIOS 313 and 314. BIOS 201 and parallel registration in BIOS 312 recommended.

Description: Traditional microbiology techniques without recombinant DNA methods.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Prerequisite for: BIOS 440, BIOS 840, VBMS 840, MBIO 440, VBMS 440; MBIO 498

Course and Laboratory Fee: \$60

BIOS 317 The Biology of Plants**Prerequisites:** LIFE 120 and LIFE 121**Notes:** Field trips are required and may occur outside of scheduled class time.**Description:** Introduction to the basic principles and concepts of the biology of plants. Adaptive variation and biodiversity of plants considering the relationships of plant structure to function integrating across succeeding levels of organization: molecule, cell, tissue, organism, organism, population, community, and ecosystem.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$30**BIOS 326 Biology of Viruses****Prerequisites:** BIOS 201; CHEM 251 or CHEM 261.**Description:** Fundamental concepts in virology including basic features of structure, evolution, diseases, replication cycles and virus-host interactions.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 337 Applications of Bioinformatics****Prerequisites:** LIFE 120; LIFE 120L**Description:** Provides a broad overview of bioinformatics. Shows how bioinformatics can help solving problems in biological research. Covered topics: biological databases, molecular biology tools, sequence comparison methods, phylogenetic inference, and molecular graphics.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Offered:** FALL**BIOS 366 Neurobiology I: Clinical, Experimental, & Theoretical****Prerequisites:** LIFE 120**Notes:** BIOS 201 and BIOS 213 are recommended.**Description:** Introduction to behavioral neurobiology research, theory, and practice as well as to the scientists and the ongoing research conducted across this field.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL**BIOS 368 Plants in Human Medicine: Biological, Social, and Ethical****Dimensions****Prerequisites:** LIFE 121**Description:** Introduction to the use of plants in traditional and alternative medicine, nutrition, and wellness. Examination of the biological, historical, and cultural origins of plant medicinal compounds used to enhance wellness or treat human diseases, such as cancer and heart disease. Consideration of the social and ethical consequences of the development of plant-derived drugs, use of herbal remedies in wellness and nutrition and of other emerging issues associated with plants in human medicine.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL**BIOS 381 Invertebrate Zoology****Prerequisites:** LIFE 121 & LIFE 121L**Description:** Comparative study of the morphology and natural history of invertebrate animals; emphasis on phylogenetic relationships.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$40**BIOS 385 Parasitology****Prerequisites:** LIFE 121 & LIFE 121L**Description:** Emphasis on parasitic diseases of humans. Impact of parasitism on societies considered in addition to the clinical consequences for infected individuals. Means of transmission, diagnosis, and treatment considered in respect to recent technological advances in production of monoclonal antibodies and genetic engineering. Nature and biological significance of parasitism are viewed in terms of prospects for control.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$40**BIOS 386 Vertebrate Zoology****Crosslisted with:** NRES 386**Prerequisites:** LIFE 121 & LIFE 121L**Description:** Evolutionary origin and relationships, natural history, and ecological adaptations of vertebrates. Comparative form and function, particularly of bone and muscle systems among and the diversity within vertebrate groups.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded**Offered:** SPRING**Course and Laboratory Fee:** \$35**BIOS 395 Internship****Prerequisites:** Permission**Description:** Combination of work outside the University and academic work in biological sciences arranged through the Career Services Office.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Pass No Pass

BIOS 397 Undergraduate Education Assistant Practicum**Prerequisites:** By permission.**Notes:** Open to students who are interested in life sciences education and want to train to become a Teaching Assistant or Learning Assistant in the School of Biological Sciences. Must have completed LIFE 120 and 120L, or LIFE 121 and LIFE 121L with C or better. Students must have earned a grade of C or better in the BIOS or LIFE course they will assist in.**Description:** A structured training experience in the professional skills used by teaching and learning assistants in life science laboratories, recitations and lectures.**Credit Hours:** 0-1**Min credits per semester:****Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded**Experiential Learning:** Student Teaching/Education Practicum**BIOS 397A Anatomy and/or Physiology Practicum****Prerequisites:** Permission**Notes:** Open only to students who expect to become teaching assistants in anatomy or physiology**Description:** A combination of academic work and instruction in the anatomy or physiology laboratories in biological sciences: cadaver dissection or work with physiological equipment; assist in the instruction of anatomical and physiological concepts.**Credit Hours:** 0-1**Min credits per semester:****Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded**Experiential Learning:** Student Teaching/Education Practicum**BIOS 402 Cancer Biology****Crosslisted with:** BIOS 802**Prerequisites:** BIOS 201 and Senior standing**Description:** Principles of cancer genetics, cancer prevention, and new methods for diagnosis and therapy. Fundamentals of the cell and molecular events that lead to human cancer.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**BIOS 406 Insect Ecology****Crosslisted with:** BIOS 806, ENTO 406, ENTO 806**Prerequisites:** NRES 220 and NRES 222**Description:** Biotic and abiotic factors as they influence insect development, behavior, distribution, and abundance.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 408 Functional Histology****Crosslisted with:** BIOS 808, VBMS 408, VBMS 808**Prerequisites:** BIOS 101 and 101L or LIFE 120 and 120L; BIOS 213 or ASCI 240 or ASCI 340.**Description:** Microscopic anatomy of the tissues and organs of major vertebrate species, including humans. Normal cellular arrangements of tissues and organs as related to their macroscopic anatomy and function, with reference to sub-cellular characteristics and biochemical processes. Functional relationships among cells, tissues, organs and organ systems, contributory to organismal well being. General introduction to pathological processes and principles underlying some diseases.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$15**BIOS 412 Human Genetics****Crosslisted with:** BIOS 812**Prerequisites:** BIOS 201 and Senior standing**Description:** Genetic basis of human variation, with emphasis on methods of applying genetic principles to humankind. Genetic ratios in pooled data; population and quantitative genetics; consanguinity; polygenic inheritance; blood types; sex linkage; linkage and crossing over; sex determination; visible chromosome variation; mutation; heredity and environment; eugenics; anthropological genetics; molecular genetics and molecular basis of disease; human genome project.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**BIOS 415 Developmental Biology****Crosslisted with:** BIOS 815**Prerequisites:** BIOS 201**Description:** Exploration of how organisms grow and develop. Topics include fertilization and early growth, patterning of tissue layers and organ systems, comparisons of human development to various model systems, and bioethics in the context of human health and reproductive technologies.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** SPRING**BIOS 416 Biodiversity Conservation****Crosslisted with:** BIOS 816**Prerequisites:** BIOS 207 or NRES 220**Description:** Basic conservation science theory and conservation decision making tools which are essential for making effective decisions for biodiversity conservation. Topics include systematic conservation planning, population viability analysis, risk assessment, and applying those tools to real conservation problems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option

BIOS 418 Advanced Genetics**Crosslisted with:** BIOS 818**Prerequisites:** BIOS 201 and Senior standing**Description:** In-depth study of the principles and methodology of genetics, with emphasis on *Drosophila*: multiple alleles and complex loci, linkage and recombination, chromosome rearrangements, fine structure analysis, sex determination, recombinant DNA, and gene function in development.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**BIOS 420 Molecular Genetics****Crosslisted with:** BIOS 820, VBMS 820, MBIO 420**Prerequisites:** BIOS 201 and Senior standing**Description:** Molecular basis of genetics. Gene structure and regulation, transposable elements, chromosome structure, DNA replication, and repair mechanisms and recombination.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** AGRO 963, HORT 963, PLPT 963; BIOS 945; BIOS 964, VBMS 964; FDST 908B; PLPT 801, AGRO 801, HORT 801**ACE:** ACE 10 Integrated Product**BIOS 421 Microbial Diversity****Crosslisted with:** BIOS 821, MBIO 421**Prerequisites:** BIOS 201 and BIOS 312 and Senior Standing.**Description:** Diversity of microbial cell composition, structure, and function enabling movement, metabolism, symbiosis, and adaptation using bacterial, fungal, algal, and viral examples. A physiological, biochemical and molecular approach used throughout.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**BIOS 422 Comparative Physiology****Crosslisted with:** BIOS 822**Prerequisites:** BIOS 213**Description:** Comprehensive survey of comparative physiology with emphasis on the diversity of adaptations in basic physiological systems and the effects of environmental parameters upon such systems. Comparative physiology of osmoregulation, temperature regulation, metabolism, muscle, central nervous function, and sensory function.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**Course and Laboratory Fee:** \$10**BIOS 422L Comparative Physiology Laboratory****Prerequisites:** Parallel registration in BIOS 422/822**Notes:** Letter grade only.**Description:** Physiological adaptations in ecological and evolutionary context.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded**BIOS 423 Quaternary Paleoclimatology and Paleoecology****Crosslisted with:** BIOS 823, GEOL 423, GEOL 823**Prerequisites:** 12 hrs GEOL or BIOS.**Description:** Analysis and interpretation of the Quaternary period's paleoecological data. Patterns of long-term climate variation. Distribution patterns and responses of organisms and ecosystems to Quaternary environmental change.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 424 Biogeochemical Cycles****Crosslisted with:** BIOS 824, GEOL 424, GEOL 824**Prerequisites:** CHEM 109A and 109L or CHEM 113A and 113L; 12 hrs GEOL or BIOS.**Description:** Chemical cycling at or near the earth's surface, emphasizing interactions among the atmosphere, biosphere, geosphere and hydrosphere. Modern processes, the geological record, and human impacts on elemental cycles.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 425 Plant Biotechnology****Crosslisted with:** BIOS 825**Prerequisites:** BIOS 201**Description:** Introduction to the use of plants for basic and applied purposes by deliberate manipulation of their genomes; techniques in plant genetic engineering; manipulations of plant development and metabolism; engineering pest, disease, and stress resistance; plants as bioreactors; and environmental and social impacts of plant biotechnology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 426 Systems Biology****Crosslisted with:** BIOS 826**Prerequisites:** LIFE 120 and LIFE 121 or BIOS 101; STAT 218 or STAT 380 or EDPS 459 or PSYC 350 or ECON 215.**Notes:** BIOS 201 and CSCE 155T are recommended, but not required.**Description:** Fundamentals of the analysis of high throughput experiments to understand complex biological systems. Principles and methods such as next generation sequencing, protein-protein interaction networks, regulatory networks, and biological data mining and integration. Emerging research in new biotechnology and data analysis in biomedical and life sciences.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option

BIOS 427 Practical Bioinformatics Laboratory**Crosslisted with:** BIOS 827**Prerequisites:** BIOS 201**Notes:** No computer programming skill is required.**Description:** Basic knowledge and skills needed for general bioinformatics, genomics and proteomics analyses. Various computational analyses including database search, sequence alignment, phylogenetic reconstruction, gene prediction/mining, microarray data analyses and protein structure analyses.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 429 Phylogenetic Biology****Crosslisted with:** BIOS 829**Prerequisites:** BIOS 207 and Senior standing**Description:** Principles of phylogenetic inference and emphasis on the application of phylogenetic hypotheses in biology and the biomedical sciences. How inferences derived from phylogenetic trees can be applied in different areas of biological investigation including systematics, biogeography, conservation biology, molecular evolution, genome structure, epidemiology, population biology, ecology, character evolution, behavior, and macroevolution.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**BIOS 430 Communicating Science through Outreach****Crosslisted with:** BIOS 830**Prerequisites:** BIOS 207**Notes:** Students must have at least one afternoon available for running a middle school science club (typically between 3-5pm). Background checks required.**Description:** Introduction to science communication, formal versus informal science education, and best practices in informal science education. Review of state and national science standards and how students learn. Introduction to informal science practitioners and facilities in Nebraska. Role playing and development and implementation of hands on, inquiry-based science activities. Training in evaluation and assessment.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**BIOS 431 Biochemistry I: Structure and Metabolism****Crosslisted with:** BIOC 431, BIOC 831, BIOS 831, CHEM 431, CHEM 831**Prerequisites:** LIFE 120 with a grade of C or better; CHEM 252 or CHEM 262 with a grade of C or better.**Notes:** BIOS 201 or PLAS 215 is recommended. 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**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ASCI 820; ASCI 917; ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 390; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; BIOC 433H; BIOC 440; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820, NUTR 420; NUTR 821; PLAS 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834; VBMS 410; VBMS 805; VBMS 950**BIOS 432 Biochemistry II: Metabolism and Biological Information****Crosslisted with:** BIOC 432, BIOC 832, CHEM 432, CHEM 832, BIOS 832**Prerequisites:** BIOC 431/831 with a grade of C or better; BIOS 201 or PLAS 215 with a grade of C or better.**Notes:** Continuation of BIOC 431/831.**Description:** Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ASCI 949, BIOC 949, NUTR 949; BIOC 435; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 934, BIOS 934, CHEM 934; BIOC 935, BIOS 935, CHEM 935; BIOC 998; VBMS 919; VBMS 950; VBMS 951**BIOS 433 Biochemistry Laboratory****Crosslisted with:** BIOC 433, BIOC 833, BIOS 833, CHEM 433, CHEM 833**Prerequisites:** BIOC 431/831 or parallel; or CHEM 435/835.**Description:** Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** BIOC 437, BIOC 837, BIOS 437, BIOS 837; BIOC 898**Course and Laboratory Fee:** \$50

BIOS 434 Plant Biochemistry

Crosslisted with: PLAS 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

Grading Option: Graded with Option

BIOS 435 Evolutionary Medicine

Crosslisted with: BIOS 835

Prerequisites: BIOS 207 and senior standing

Description: Application of evolutionary tools to biomedical questions. Managing the evolution of drug resistance and pathogen virulence. Evolutionary principles of vaccine design. Emerging infectious disease. Human evolutionary history. Life-history trade-offs in human evolution. Parent-offspring and parent-parent conflict. Mismatch hypothesis. Hygiene hypothesis.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: SPRING

ACE: ACE 10 Integrated Product

BIOS 436 Macroecology

Crosslisted with: BIOS 836

Prerequisites: BIOS 207

Description: Species-area relationships, latitudinal gradients in species richness, abundance diversity relationships, ecological scaling relationships with body size, community assembly, evolutionary dynamics, climate change, and human impacts on the ecology of the Anthropocene.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

BIOS 437 Research Techniques in Biochemistry

Crosslisted with: BIOC 437, BIOC 837, BIOS 837

Prerequisites: BIOC/BIOS/CHEM 433/833.

Description: Methods approach to systems biology analysis. Molecular identification and quantification employing techniques such as mass spectrometry, chromatography, electrophoretic fractionation, transcriptomics, proteomics and metabolomics. Data and pathway analysis with computational methods.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Prerequisite for: VBMS 919

Course and Laboratory Fee: \$50

BIOS 439 Dynamics of Biochemical and Biological Networks

Crosslisted with: BIOC 439, BIOC 839, BIOS 839

Prerequisites: BIOS 201 or PLAS 215; BIOC 401 or BIOC 431

Notes: Letter grade only.

Description: To introduce and integrate, students in biochemistry and other life sciences, to the field of computational modeling of biochemical and biological network systems into a seamless curriculum.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: SPRING

Prerequisite for: ASCI 949, BIOC 949, NUTR 949; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 998

BIOS 440 Microbial Physiology

Crosslisted with: BIOS 840, VBMS 840, MBIO 440, VBMS 440

Prerequisites: BIOS 312; BIOS 314.

Description: Molecular approaches to the study of prokaryotic cell structure and physiology, including growth, cell division, metabolism, and alternative microbial life styles.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Course and Laboratory Fee: \$20

BIOS 441 Pathogenic Microbiology

Crosslisted with: BIOS 841, VBMS 441, VBMS 841

Prerequisites: BIOS 312

Description: Fundamental principles involved in host-microorganism interrelationships. Identification of pathogens, isolation, propagation, mode of transmission, pathogenicity, symptoms, treatment, prevention of disease, epidemiology, and methods of control.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: SPRING

Prerequisite for: VBMS 805; VBMS 949

Course and Laboratory Fee: \$25

BIOS 442 Endocrinology

Crosslisted with: ASCI 442, ASCI 842, BIOS 842, VBMS 842

Prerequisites: A course in vertebrate physiology and/or biochemistry.

Description: Mammalian endocrine glands from the standpoint of their structure, their physiological function in relation to the organism, the chemical nature and mechanisms of action of their secretory products, and the nature of anomalies manifested with their dysfunction.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

BIOS 443 Immunology**Crosslisted with:** BIOS 843, VBMS 843, MBIO 443, VBMS 443**Prerequisites:** BIOS 201; CHEM 251 or CHEM 261.**Description:** Fundamental consideration of cellular and humoral mechanisms of immunity, the structure and function of immunoglobulins, antigen-antibody interactions; hypersensitivity; transplantation and tumor immunity; immune and autoimmune disorders.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** VBMS 908; VBMS 910; VBMS 948; VBMS 949**BIOS 444 Earth and Environmental Microbiology****Crosslisted with:** BIOS 844, GEOL 444, GEOL 844**Prerequisites:** 3 hours of BIOS or 3 hours of LIFE; 3 hours of CHEM**Description:** An introduction into the role that microorganisms play and have played in natural and man-made environments. Topics covered include microbial diversity and physiology in soil, sediment, and water; microbes in Earth history; biogeochemical cycling; mineral formation and dissolution; biodegradation and bioremediation; biotechnology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**BIOS 445 Food Microbiology****Crosslisted with:** BIOS 845, FDST 405, FDST 805**Prerequisites:** BIOS 312**Notes:** BIOC 401 or BIOC 431 recommended**Description:** Nature, physiology, and interactions of microorganisms in foods. Introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Food plant sanitation and criteria for establishing microbial standards for food products.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** BIOS 446, BIOS 846, FDST 406, FDST 806; FDST 424, FDST 824; FDST 425, FDST 825; FDST 460, FDST 860; FDST 867; FDST 875; FDST 877; FDST 908B**BIOS 446 Food Microbiology Laboratory****Crosslisted with:** BIOS 846, FDST 406, FDST 806**Prerequisites:** Parallel in FDST 405/805/BIOS 445/845.**Description:** The microorganisms in foods and the methods used to study them.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$40**BIOS 450 Biology of Wildlife Populations****Crosslisted with:** BIOS 850, NRES 450, NRES 850**Prerequisites:** NRES 311; MATH 104 or above; STAT 218 or equivalent**Description:** Principles of population dynamics. Management strategies (for consumptive and nonconsumptive fish and wildlife species) presented utilizing principles developed.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Offered:** SPRING**BIOS 451 Invertebrate Paleobiology****Crosslisted with:** GEOL 451, BIOS 851, GEOL 851**Prerequisites:** At least one of: GEOL 103, GEOL 105, LIFE 121**Description:** Overview of the key traits, relationships and evolutionary dynamics of invertebrate animals over Earth's history, particularly over the Phanerozoic (i.e., the last 540 million years). Emphasis on the use of invertebrate fossil record to test ideas about long term evolutionary patterns as well as learning the histories and basic anatomies of major invertebrate taxa.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** SPRING**BIOS 452 Field Epidemiology****Crosslisted with:** BIOS 852**Prerequisites:** LIFE 121; LIFE 121L; three hours of BIOS**Notes:** Offered summers only at Cedar Point Biological Station.**Description:** Principles of epidemiology and the role in modern medicine. Combination of theory and practice with living populations.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Offered:** SUMMER**Prerequisite for:** VBMS 949**ACE:** ACE 10 Integrated Product**Experiential Learning:** Fieldwork**BIOS 453 Predator Ecology****Crosslisted with:** BIOS 853**Prerequisites:** BIOS 207 or NRES 220**Description:** Conservation and management of native and invasive predators. Functional and numerical responses. Evolution of predator-prey interactions. Optimal foraging. Modeling predator-prey population dynamics. Trophic cascades. Prey defenses against predation.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Offered:** SUMMER**ACE:** ACE 10 Integrated Product**Experiential Learning:** Fieldwork

BIOS 454 Ecological Interactions

Crosslisted with: BIOS 854, NRES 454, NRES 854

Prerequisites: LIFE 121; LIFE 121L; BIOS 207 or NRES 220; Senior Standing

Description: Nature and characteristics of populations and communities. Interactions within and between populations in community structure and dynamics. Direct and indirect interactions and ecological processes, competition, predation, parasitism, herbivory, and pollination. Structure, functioning and persistence of natural communities, foodweb dynamics, succession, and biodiversity.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

ACE: ACE 10 Integrated Product

BIOS 456 Mathematical Models in Biology

Crosslisted with: BIOS 856, NRES 456, NRES 856

Prerequisites: LIFE 120; LIFE 120L; LIFE 121; LIFE 121L; MATH 107

Description: Biological systems, from molecules to ecosystems, are analyzed using mathematical techniques. Strengths and weaknesses of mathematical approaches to biological questions. Brief review of college level math; introduction to modeling; oscillating systems in biology; randomness in biology; review of historically important and currently popular models in biology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

BIOS 457 Ecosystem Ecology

Crosslisted with: BIOS 857, GEOL 457, GEOL 857

Prerequisites: BIOS 207 and CHEM 110A and 110L and Senior standing

Description: Processes controlling the cycling of energy and elements in ecosystems and how both plant and animal species influence them. Human-influenced global and local changes that alter these cycles and ecosystem functioning.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Prerequisite for: BSEN 954, NRES 954

ACE: ACE 10 Integrated Product

BIOS 458 Wetlands

Crosslisted with: NRES 468, NRES 868, BSEN 468, BSEN 868

Prerequisites: CHEM 109A and 109L and CHEM 110A and 110L, or CHEM 105A and 105L and CHEM 106A and 106L; Junior or Senior Standing.

Notes: Offered even-numbered calendar years.

Description: Physical, chemical and biological processes that occur in wetlands; the hydrology and soils of wetland systems; organisms occurring in wetlands and their ecology wetland creation, delineation, management and ecotoxicology.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Course and Laboratory Fee: \$40

BIOS 459 Limnology

Crosslisted with: BIOS 859, NRES 459, NRES 859

Prerequisites: BIOS 207 or NRES 220; CHEM 106A & CHEM 106L or CHEM 110A & CHEM 110L

Description: Physical, chemical, and biological processes that occur in fresh water. Organisms occurring in fresh water and their ecology; biological productivity of water and its causative factors; eutrophication and its effects.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Offered: SPRING

ACE: ACE 10 Integrated Product

Course and Laboratory Fee: \$85

BIOS 460 Soil Microbial Ecology

Crosslisted with: PLAS 460, NRES 460, SOIL 460, AGRO 860, BIOS 860, NRES 860

Prerequisites: Senior standing.

Notes: Recommend having a strong science background, including courses from the agronomic, environmental, microbiology, engineering or medicine disciplines.

Description: Soil from a microbe's perspective-growth, activity and survival strategies; principles governing methods to study microorganisms and biochemical processes in soil; mechanisms controlling organic matter cycling and stabilization with reference to C, N, S, and P; microbial interactions with plants and animals; and agronomic and environmental applications of soil microorganisms.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: SPRING

BIOS 462 Animal Behavior

Crosslisted with: BIOS 862

Prerequisites: BIOS 201, 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

Grading Option: Graded with Option

ACE: ACE 10 Integrated Product

BIOS 465 Behavioral Neuroscience

Crosslisted with: BIOS 865, PSYC 465, PSYC 865

Prerequisites: PSYC 273

Description: Relationship of physiological variables to behavior, an introduction to laboratory techniques in neuropsychology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

BIOS 466 Neurobiology II: Cutting-Edge Methodology**Crosslisted with:** BIOS 866**Prerequisites:** LIFE 121**Notes:** BIOS 201, BIOS 213 and BIOS 366 are recommended.**Description:** Examination of current technologies and methodologies used in neuroscience pertaining to medical, laboratory, and industrial applications across several organisms.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** SPRING**BIOS 471 Plant Systematics****Crosslisted with:** BIOS 871**Prerequisites:** LIFE 121 and LIFE 121L**Description:** Overview of the diversity of plants and algae, with emphasis on phylogenetic relationships, the evolution of important physical and genomic characteristics, principles of plant classification and identification, and modern methods of plant molecular systematics. Lab work on taxonomic analysis and plant identification.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$15**BIOS 472 Evolution****Prerequisites:** BIOS 207 and Senior standing**Description:** The principles and processes of micro- and macroevolution. Mechanisms behind evolutionary change and examples of these processes in a wide variety of organisms.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**BIOS 474 Herpetology****Crosslisted with:** BIOS 874, NRES 474, NRES 874**Prerequisites:** NRES/BIOS 386**Description:** Fossil and living amphibians and reptiles. Anatomy, classification, ecology and evolution.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Offered:** FALL**Course and Laboratory Fee:** \$50**BIOS 475 Avian Biology****Crosslisted with:** BIOS 875, NRES 471, NRES 871**Prerequisites:** LIFE 121 & LIFE 121L**Notes:** May also be offered at Cedar Point Biological Station.**Description:** Biology of birds emphasizing the behavior and ecology of this group. Topics include avian diversity, systematics & evolutionary history, flight, foraging, migration, communication, reproductive biology, population ecology and conservation biology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Experiential Learning:** Fieldwork**BIOS 475L Avian Biology Laboratory****Crosslisted with:** BIOS 875L**Prerequisites:** Parallel registration in BIOS 475/875**Description:** Avian field identification in diverse prairie, riparian, and montane habitats. Individual studies of foraging behavior, territoriality, anti-predator behavior, mating systems, or nesting ecology.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**BIOS 476 Mammalogy****Crosslisted with:** BIOS 876, NRES 476, NRES 876**Prerequisites:** 8 hrs BIOS; BIOS/NRES 386 or NRES 311.**Notes:** May also be offered at Cedar Point Biological Station. Field trips are required and may occur outside of scheduled class time. Lab and field time emphasize diversity of mammalian families and species identification of Nebraska mammals.**Description:** Evolution, natural history, ecology, and functional morphology of planetary mammals and mammals of the Northern Great Plains.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$25**BIOS 477 Bioinformatics and Molecular Evolution****Crosslisted with:** BIOS 877**Prerequisites:** BIOS 201 or parallel; CHEM 251 or CHEM 261.**Notes:** Statistics course recommended.**Description:** Pairwise and multiple alignments, sequence similarity and domain search, distance estimation, phylogenetic methods, gene mining, protein classification and structure. Algorithms used in bioinformatics as well as fundamental concepts of molecular evolution that underlie various bioinformatics methods.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** PLPT 801, AGRO 801, HORT 801**BIOS 478 Plant Anatomy****Crosslisted with:** BIOS 878, PLAS 478, AGRO 878, HORT 878**Prerequisites:** 8 hrs biological sciences**Description:** Development, structure, and function of tissues and organs of the higher plants. Relationships of structure to physiology and ecology of plants.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**BIOS 480 Ecology and Evolution of Arachnids****Crosslisted with:** BIOS 880**Prerequisites:** BIOS 207 or NRES 220**Description:** Ecology and evolutionary biology of living arachnids.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option

BIOS 481 Stream and River Ecology

Crosslisted with: WATS 881K, NRES 481K, NRES 881K

Prerequisites: NRES 222 or equivalent

Description: Fundamental physical drivers operating in stream and river ecosystems and how those vary in space and time. Major classes of organisms associated with stream ecosystems and their functional roles. Fundamental controls on biotic diversity in stream and river ecosystems and its variance. Major aspects of stream ecosystem function including energy flow and nutrient cycling. Ecosystem services provided by stream and river ecosystems and causes and consequences of human impacts on streams and rivers. Underlying principles of bioassessment and current methods of stream restoration.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded

Course and Laboratory Fee: \$20

Experiential Learning: Fieldwork

BIOS 485 Aquatic Insects

Crosslisted with: BIOS 885, ENTO 402, ENTO 802, NRES 402, NRES 802

Prerequisites: 12 hrs biological sciences.

Description: Biology and ecology of aquatic insects.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Prerequisite for: BIOS 485L, BIOS 885L, ENTO 402L, ENTO 802L, NRES 402L, NRES 802L

BIOS 485L Identification of Aquatic Insects

Crosslisted with: BIOS 885L, ENTO 402L, ENTO 802L, NRES 402L, NRES 802L

Prerequisites: Parallel ENTO 802, NRES 402/802, BIOS 485/885.

Description: Identification of aquatic insects to the family level.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Course and Laboratory Fee: \$25

BIOS 487 Field Parasitology

Crosslisted with: BIOS 887

Prerequisites: LIFE 120; LIFE 120L; LIFE 121; LIFE 121L

Notes: BIOS 207 or NRES 220 recommended. Offered summers only at Cedar Point Biological Station.

Description: Animal host-parasite relationships, epizootiology, ecology, host distribution, classification, and life cycle stages of animal parasites.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

ACE: ACE 10 Integrated Product

Experiential Learning: Fieldwork

BIOS 489 Ichthyology

Crosslisted with: BIOS 889, NRES 489, NRES 889

Prerequisites: LIFE 120 and LIFE 121

Notes: May also be offered at Cedar Point Biological Station.

Description: Fishes, their taxonomy, physiology, behavior, and ecology. Dynamics of fish stocks and factors regulating their production.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Course and Laboratory Fee: \$20

Experiential Learning: Research

BIOS 491 Special Topics in Biological Sciences

Crosslisted with: BIOS 891

Prerequisites: BIOS 201 or BIOS 207

Description: Topics vary.

Credit Hours: 1-4

Min credits per semester: 1

Max credits per semester: 4

Max credits per degree: 9

Grading Option: Graded with Option

BIOS 498 Independent Research in Biological Sciences

Prerequisites: Permission.

Notes: Four credit hours may be counted toward the undergraduate BIOS major. Before registering, arrangements must be made with a School of Biological Sciences faculty member to reach an agreement on the scope and to determine the amount of credit for the project.

Description: Independent study and laboratory or field investigation of a specific problem.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 12

Grading Option: Graded with Option

Experiential Learning: Research

BIOS 499 Undergraduate Thesis

Prerequisites: Permission.

Description: Independent research leading to a thesis.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option

BIOS 499H Honors Undergraduate Thesis

Prerequisites: Permission. Credit toward the degree cannot be earned in both BIOS 499 and BIOS 499H.

Description: Independent research leading to an honors thesis.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option

Career Information

The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

Transferable Skills

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

- Master's Degree, Business Administration in Health Care Delivery and Sciences, University of Tulsa – Tulsa, OK
- Master's Degree, Emerging Infectious Disease and Microbiology, George Washington University – Washington D.C.
- Master's Degree, Geosciences and Paleontology, East Tennessee State University – Johnson City, TN
- Master's Degree, Public Health, University of Nebraska Medical Center – Omaha, NE
- Doctor of Medicine, University of Nebraska Medical Center – Omaha, NE
- Doctor of Dentistry, University of Nebraska Medical Center College of Dentistry – Lincoln, NE
- Doctoral Degree, Molecular Biology, Princeton University – Princeton, NJ

Jobs of Recent Graduates

- Hospital Lab Assistant, Labcorp – Lincoln, NE
- Data Analyst, Neogen Geneseeek – Lincoln, NE
- Medical Research Assistant, Celerion – Lincoln, NE
- Home Health Aide, Caretech – Hastings, NE
- Zookeeper, Omaha Henry Doorly Zoo – Omaha, NE
- Clinical Research Assistant – The Medical College of Wisconsin
- Veterinary Assistant, Yankee Hill Veterinary Hospital – Lincoln, NE
- Patient Care Technician, Vanderbilt Children's Hospital – Nashville, TN
- Associate Scientist, Catalent – Kansas City, MO
- Recruiter, Prolink Healthcare – Chicago, IL

Internships

- Beckman Research Scholar, College of Arts & Sciences - Lincoln NE
- Sales/Marketing Intern, Li-Cor Biosciences - Lincoln NE
- Anatomy Intern, School of Biological Sciences - Lincoln NE
- Dental Intern, UNMC Dental College - Lincoln NE
- Intern, Southwestern - Nationwide
- Intern, NE Dept of Health & Human Services - Lincoln NE
- Intern, Pregnancy Center - Lincoln NE
- Advisor, Vector Marketing - Denver CO
- Campaign Intern, Clark for Legislature - Lincoln NE
- Biological Intern, Biology Department - Lincoln NE

Graduate & Professional Schools

- Master's Degree, Health Informatics, University of Michigan – Ann Arbor, MI
- Master's Degree, Ecology and Evolutionary Biology, Queen Mary University of London – London, United Kingdom
- Master's Degree, Sustainability Planning and Management, University of Colorado at Boulder – Boulder, CO