

# MICROBIOLOGY (CASNR)

## Description

**Website:** <http://microbiology.unl.edu>

The microbiology major is an interdepartmental major that offers educational opportunities in various areas of microbiology leading to a bachelor of science degree in microbiology. The training offered is suitable for a professional career in microbiology, which may lead to employment in the food industry, clinical microbiology, biotechnology, and pharmaceuticals; or federal agencies such as the Food and Drug Administration, U.S. Department of Agriculture, U.S. Public Health Service, and Environmental Protection Agency. The program is also suitable as preparation for graduate studies leading to academic careers and professional careers in medicine, dentistry, veterinary medicine, pharmacy, and health-related fields. (Completion of the microbiology baccalaureate degree program does not automatically fulfill the admission requirements for application to a given professional program. Students considering applying to a professional program are strongly encouraged to work with their advisor to ensure that admission requirements are met during the completion of the microbiology degree.)

Students interested in majoring in microbiology are advised to make an appointment with the academic advisor.

Students concerned about their preparation for college-level biology should take LIFE 120 Fundamentals of Biology I and LIFE 120L Fundamentals of Biology I laboratory with an understanding that they will need to use the resource center and plan their time accordingly to allow for increased study time. Please consult your advisor if in doubt.

**Program Assessment.** To gauge the effectiveness of the program, majors within their senior year will be required to complete selected assessment activities. The results of participation in these assessment activities will in no way affect a student's GPA or graduation.

## College Requirements

### College Admission

Requirements for admission into the College of Agricultural Sciences and Natural Resources (CASNR) are consistent with general University admission requirements (one unit equals one high school year): 4 units of English, 4 units of mathematics, 3 units of natural sciences, 3 units of social sciences, and 2 units of world language. Students must also meet performance requirements: a 3.0 cumulative high school grade point average OR an ACT composite of 20 or higher, writing portion not required OR a score of 1040 or higher on the SAT Critical Reading and Math sections OR rank in the top one-half of graduating class; transfer students must have a 2.0 (on a 4.0 scale) cumulative grade point average and 2.0 on the most recent term of attendance.

### Admission Deficiencies/Removal of Deficiencies

Students who are admitted to CASNR with core course deficiencies must remove these deficiencies within the first 30 credit hours at the University of Nebraska–Lincoln, or within the first calendar year at Nebraska, whichever takes longer. College-level coursework taken to remove deficiencies may be used to meet degree requirements in CASNR.

Deficiencies in the required entrance subjects can be removed by the completion of specified courses in the University or by correspondence.

The Office of Admissions, Alexander Building (south entrance), City Campus, provides information to new students on how deficiencies can be removed.

## College Degree Requirements

### Curriculum Requirements

The curriculum requirements of the College consist of three areas: ACE (Achievement-Centered Education), College of Agricultural Sciences and Natural Resources Core, and Degree Program requirements and electives. All three areas of the College Curriculum Requirements are incorporated within the description of the Major/Degree Program sections of the catalog. The individual major/degree program listings of classes ensure that a student will meet the minimum curriculum requirements of the College.

### World Languages/Language Requirement

Two units of a world language are required. This requirement is usually met with two years of high school language.

### Experiential Learning

All undergraduates in the College of Agricultural Sciences and Natural Resources must take an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning.

### Minimum Hours Required for Graduation

The College grants the bachelors degree in programs associated with agricultural sciences, natural resources, and related programs. Students working toward a degree must earn at least 120 semester hours of credit. A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

### Grade Rules

#### Removal of C-, D, and F Grades

Only the most recent letter grade received in a given course will be used in computing a student's cumulative grade point average if the student has completed the course more than once and previously received a grade or grades below C in that course.

The previous grade (or grades) will not be used in the computation of the cumulative grade point average, but it will remain a part of the academic record and will appear on any transcript.

A student can remove from their cumulative average a course grade of C-, D+, D, D-, or F if the student repeats the same course at the University of Nebraska and receives a grade other than P (pass), I (incomplete), N (no pass), W (withdrew), or NR (no report). If a course is no longer being offered, it is not eligible for the revised grade point average computation process.

For complete procedures and regulations, see the Office of the University Registrar website at <http://www.unl.edu/regrec/course-repeats> (<http://www.unl.edu/regrec/course-repeats/>).

#### Pass/No Pass

Students in CASNR may take any course offered on a Pass/No Pass basis within the 24-hour limitation established by the Faculty Senate. However, a department may specify that the Pass/No Pass status of its

courses be limited to non-majors or may choose to offer some courses for letter grades only.

### GPA Requirements

A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

### Transfer Credit Rules

To be considered for admission a transfer student, Nebraska resident or nonresident, 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 have completed less than 12 credit hours of college study must submit either ACT or SAT scores.

Ordinarily, credits earned at an accredited college are accepted by the University. The College, however, will evaluate all hours submitted on an application for transfer and reserves the right to accept or reject any of them. Sixty (60) is the maximum number of hours the University will accept on transfer from a two-year college. Ninety (90) is the maximum number of hours the University will accept from a four-year college. Transfer credit in the degree program must be approved by the degree program advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major. At least 9 hours in the major field, including the capstone course, must be completed at the University of Nebraska–Lincoln regardless of the number of hours transferred.

The College will accept no more than 10 semester hours of C-, D+, D, and D- grades from other schools. The C-, D+, D, and D- grades can only be applied to free electives. This policy does not apply to the transfer of grades from UNO or UNK to the University of Nebraska–Lincoln.

### Joint Academic Transfer Programs

The College of Agricultural Sciences and Natural Resources has agreements with many institutions to support joint academic programs. The transfer programs include dual degree programs and cooperative degree programs. Dual degree programs offer students the opportunity to receive a degree from a participating institution and also to complete the requirements for a bachelor of science degree in CASNR. Cooperative programs result in a single degree from either the University of Nebraska–Lincoln or the cooperating institution.

### Dual Degree Programs

#### A to B Programs

The A to B Program, a joint academic program offered by the CASNR and participating community colleges, allows students to complete the first two years of a degree program at the participating community college and continue their education and study in a degree program leading toward a bachelor of science degree.

The A to B Program provides a basic knowledge plus specialized coursework. Students transfer into CASNR with junior standing.

Depending on the community college, students enrolled in the A to B Program may complete the requirements for an associate of science at the community college, transfer to the University of Nebraska–Lincoln, and work toward a bachelor of science degree.

Participating community colleges include:

- Central Community College
- Metropolitan Community College
- Mid-Plains Community College
- Nebraska College of Technical Agriculture
- Nebraska Indian Community College
- Northeast Community College
- Southeast Community College
- Western Nebraska Community College

### 3+2 Programs

Two specialized degree programs in **animal science** and **veterinary science** are offered jointly with an accredited college or school of veterinary medicine. These two programs permit CASNR animal science or veterinary science students to receive a bachelor of science degree from the University of Nebraska–Lincoln with a degree in animal science or veterinary science after successfully completing two years of the professional curriculum in veterinary medicine at an accredited veterinary school. Students who successfully complete the 3+2 Program, must provide transcripts and complete the Application for Degree form via MyRED. Students without MyRED access may apply for graduation in person at Husker Hub in the Canfield Administration Building, or by mail. Students should discuss these degree programs with their academic advisor.

### Cooperative Degree Programs

Academic credit from the University and a cooperating institution are applied towards a four-year degree from either the University of Nebraska–Lincoln (University degree-granting program) or the cooperating institution (non-University degree-granting program). All have approved programs of study.

### UNL Degree-Granting Programs

A University of Nebraska–Lincoln degree-granting program is designed to provide students the opportunity to complete a two-year program of study at one of the four-year institutions listed below, transfer to CASNR, and complete the requirements for a bachelor of science degree.

**Chadron State College.** Chadron State College offers a 2+2 program leading to a grassland ecology and management degree program and a transfer program leading to a bachelor of science in agricultural education in the teaching option.

**Wayne State College.** Wayne State College offers a 3+1 program leading to a bachelor of science in plant biology in the ecology and management option and a 3+1 program leading to a bachelor of science in Applied Science.

**University of Nebraska at Kearney.** Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

**University of Nebraska at Omaha.** Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

### Non University of Nebraska–Lincoln Degree-Granting Programs

CASNR cooperates with other institutions to provide coursework that is applied towards a degree at the cooperating institution. Pre-professional programs offered by CASNR allow students to complete the first two or three years of a degree program at the University prior to transferring and completing a degree at the cooperating institution.

**Chadron State College—Range Science.** The 3+1 Program in range science allows Chadron State College students to pursue a range science degree through Chadron State College. Students complete three years of coursework at Chadron State College and one year of specialized range science coursework (32 credit hours) at CASNR.

**Dordt College (Iowa)—Agricultural Education: Teaching Option.** This program allows students to pursue an Agricultural Education Teaching Option degree leading toward a bachelor of science in agricultural education. Students at Dordt College will complete 90 credit hours in the Agricultural Education: Teaching Option Transfer Program.

### Residency

Students must complete at least 30 of the total hours for their degree using University of Nebraska—Lincoln credits. At least 18 of the 30 credit hours must be in courses offered through CASNR<sup>1</sup> (>299) including the appropriate ACE 10 degree requirement or an approved ACE 10 substitution offered through another Nebraska college and excluding independent study regardless of the number of hours transferred. Credit earned during education abroad may be used toward the residency requirement if students register through the University of Nebraska—Lincoln and participate in prior-approved education abroad programs. The University of Nebraska—Lincoln open enrollment and summer independent study courses count toward residence.

<sup>1</sup> Includes courses taught by CASNR faculty through interdisciplinary prefixes (e.g., LIFE, MBIO, ENVR, SCIL, EAEP, HRTM, ENSC) and CASNR crosslisted courses taught by non-CASNR faculty.

### Online and Distance Education

There are many opportunities to earn college credit online through the University of Nebraska—Lincoln. Some of these credits may be applicable not only as elective credits but also toward the fulfillment of the College's education requirements. Credits earned online may count toward residency. However, certain offerings may not be counted toward scholarship requirements or academic recognition criteria.

#### For further information, contact:

Office of Online and Distance Education  
University of Nebraska—Lincoln  
305 Brace Labs  
Lincoln, NE 68588-0109  
402-472-4681  
<http://online.unl.edu/>

### Independent Study Rules

Students wishing to take part in independent studies must obtain permission; complete and sign a contract form; and furnish copies of the contract to the instructor, advisor, departmental office, and the Dean's Office. The contract should be completed before registration. Forms are available in 103 Agricultural Hall or online at the CASNR website.

Independent study projects include research, literature review or extension of coursework under the supervision and evaluation of a departmental faculty member.

Students may only count 12 hours of independent study toward their degrees and no more than 6 hours can be counted during their last 36 hours earned, excluding senior thesis, internships, and courses taught under an independent study number.

## Other College Degree Requirements

### Capstone Course Requirement

A capstone course is required for each CASNR degree program. A capstone course is defined as a course in which students are required to integrate diverse bodies of knowledge to solve a problem or formulate a policy of societal importance.

## ACE Requirements

All students must fulfill the Achievement Centered Education (ACE) requirements. Information about the ACE program may be viewed at [ace.unl.edu](https://ace.unl.edu/) (<https://ace.unl.edu/>).

The minimum requirements of CASNR reflect the common core of courses that apply to students pursuing degrees in the college. Students should work with an advisor to satisfy ACE outcomes 1, 2, 3, 4, 6, and 10 with the college requirements.

## Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to the University of Nebraska—Lincoln or when they were first admitted to a Joint Academic Transfer Program. Students transferring from a community college, but without admission to a Joint Academic Transfer Program, 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. 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 Agricultural Sciences and Natural Resources. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

## Learning Outcomes

Graduates of microbiology will be able to:

1. Examine and evaluate evidence on how microbes have changed over time allowing them to adapt, survive, and evolve into complex life.
2. Compare how cell structures and functions are different across the domains of life.
3. Compare the various ways that microbes interact and survive in different environments and hosts (humans, animals, and plants).
4. Evaluate the control of genes on microbial life and explain how genes can be altered for biotechnology.
5. Explain how microbes are essential for all planetary life and describe how microbes are connected human health and society.
6. Design scientific experiments related to microbes using the scientific method while

integrating ethical issues and communicating scientific discoveries to diverse audiences.

7. Demonstrate safe lab practices and apply computer skills to study microbes.

## Major Requirements

The core courses and 12-18 hours of elective microbiology courses (a minimum of 12 hours at the 300 level or above) must be completed.

### College Integrative Course

SCIL 101	Science and Decision-Making for a Complex World	3
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Credit Hours Subtotal: 3

### Core Requirements

MBIO 101	Introduction to the Microbiology Major	1
BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
MBIO 420 / BIOS 420	Molecular Genetics (ACE 10)	3
MBIO 440 / BIOS 440	Microbial Physiology	3
MBIO 443 / BIOS 443	Immunology	3
Credit Hours Subtotal:		14

### Natural Sciences

#### CASNR Approved Life Sciences

BIOS 206	General Genetics	4
LIFE 120 & LIFE 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory (ACE 4)	4
LIFE 121 & LIFE 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory (ACE 4)	4

#### Chemistry

Select one sequence from the following: 8-11

CHEM 109A & CHEM 109L & CHEM 110A & CHEM 110L General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory

CHEM 113A & CHEM 113L & CHEM 114 & CHEM 221A & CHEM 221L Fundamental Chemistry I and Fundamental Chemistry I Laboratory and Fundamental Chemistry II and Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory

#### Organic Chemistry

Select from the following: 4-8

If you plan to take BIOC 401 & BIOC 401L, select one sequence from the following:

CHEM 251 & CHEM 253 Organic Chemistry I and Organic Chemistry I Laboratory

CHEM 261 & CHEM 263 Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory

If you plan to take BIOC 431, select one sequence from the following:

CHEM 251 & CHEM 253 & CHEM 252 Organic Chemistry I and Organic Chemistry I Laboratory and Organic Chemistry II

CHEM 261 & CHEM 263 & CHEM 262 Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory and Mechanistic Organic Chemistry II

#### Biochemistry

Select one of the following: 3-4

BIOC 401 & BIOC 401L Elements of Biochemistry and Laboratory for Elements of Biochemistry

BIOC 431 / BIOS 431 / CHEM 431 Biochemistry I: Structure and Metabolism

#### Physics

Select one sequence from the following: 10

PHYS 141 & PHYS 142 Physics for Life Sciences I and Physics for Life Sciences II

PHYS 211 & PHYS 221 & PHYS 212 & PHYS 222 General Physics I and General Physics Laboratory I and General Physics II and General Physics Laboratory II

Credit Hours Subtotal: 37

#### Mathematics and Statistics

MATH 106 Calculus I (ACE 3) 5

Select one of the following: 3

ECON 215 Statistics

EDPS 459 Statistical Methods

STAT 218 Introduction to Statistics

STAT 380 Statistics and Applications

Credit Hours Subtotal: 8

#### Communication

##### Written Communication (ACE 1)

Select one of the following: 3

ENGL 150 Writing and Inquiry

ENGL 151 Writing for Change

ENGL 254 Writing and Communities

JGEN 120 Basic Business Communication

JGEN 200 Technical Communication I

JGEN 300 Technical Communication II

##### Communication and Interpersonal Skills (ACE 2)

Select one of the following: 3

ALEC 102 Interpersonal Skills for Leadership

COMM 101 Communication in the 21st Century

COMM 209 Public Speaking

COMM 210 Communicating in Small Groups

COMM 283 Interpersonal Communication

COMM 286 Business and Professional Communication

JGEN 300 Technical Communication II

Credit Hours Subtotal: 6

#### Economics, Humanities, and Social Sciences

Select one of the following (ACE 6): 3



AECN 141	Introduction to the Economics of Agriculture	
ECON 200	Economic Essentials and Issues	
ECON 211	Principles of Macroeconomics	
ECON 212	Principles of Microeconomics	
Select one course each from ACE outcomes 5, 7, 8, and 9		12
Credit Hours Subtotal:		15
<b>Upper Division Microbiology Electives</b>		
Select 12-18 hours from the following: <sup>1</sup>		12-18
BIOC 432 / BIOS 432 / CHEM 432	Biochemistry II: Metabolism and Biological Information	
BIOC 433 / BIOS 433 / CHEM 433	Biochemistry Laboratory	
BIOC 437 / BIOS 437	Research Techniques in Biochemistry	
BIOS 302	Cell Biology	
BIOS 303	Molecular Biology	
BIOS 326	Biology of Viruses	
BIOS 402	Cancer Biology	
BIOS 426	Systems Biology	
BIOS 435	Evolutionary Medicine	
BIOS 444 / GEOL 444	Earth and Environmental Microbiology	
BIOS 452	Field Epidemiology	
BIOS 477	Bioinformatics and Molecular Evolution	
BIOS 487	Field Parasitology	
FDST 405 / BIOS 445	Food Microbiology	
FDST 406 / BIOS 446	Food Microbiology Laboratory	
FDST 415	Food Mycology	
FDST 442	My Gut, My Health, My Food	
FDST 455 / MBIO 455	Microbiology of Fermented Foods	
FDST 455L / MBIO 455L	Microbiology of Fermented Foods Laboratory (Offered even years only)	
MBIO 418 / PLPT 418	Microbial Genetics & Genomics	
MBIO 421 / BIOS 421	Microbial Diversity	
MBIO 498	Independent Research	
PLAS 460 / BIOS 460 / NRES 460 / SOIL 460	Soil Microbial Ecology	
PLPT 400 / BIOS 400	Intermediate Plant Pathology	
PLPT 400L	Intermediate Plant Pathology Lab	
STAT 442 / BIOC 442	Computational Biology	
VBMS 303	Principles and Prevention of Livestock Diseases	

VBMS 408 / BIOS 408	Functional Histology	
VBMS 424	Basic Molecular Infectious Diseases	
VBMS 441 / BIOS 441	Pathogenic Microbiology	
Credit Hours Subtotal:		12
<b>Free Electives</b>		
Select 11-25 hours		11-25
Credit Hours Subtotal:		25
<b>Total Credit Hours</b>		<b>120</b>

<sup>1</sup> Within the same subject matter area, students may request substitution for an elective course at the 300 level or above.

## Additional Major Requirements

### Grade Rules

#### C- and D Grades

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

#### Pass/No Pass

No course taken Pass/No Pass will be counted toward the major or minor, except for courses involving independent study, research, and seminars.

## 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

- Understand and utilize a variety of research methodologies
- Understand fundamental life processes
- Communicate results of scientific experiments to scientific and non-scientific audiences
- Design and implement research experiments
- Apply mathematical and scientific skills to solve real-world problems
- Comprehend and critically evaluate complex information
- Analyze and explain data
- Conduct and present research to large and small groups
- Read, understand, and critically review scientific information
- Understand and practice proper laboratory safety procedures
- Use quantitative analysis techniques
- Demonstrate ethical conduct in research activities
- Collaborate with a team to develop solutions
- Develop and defend evidence based arguments
- Develop basic techniques of statistical analysis

### Jobs of Recent Graduates

- Animal Care Technician, Benchmark Biolabs – Lincoln, NE
- Clinical Research Associate, University of Nebraska Medical Center – Omaha, NE
- Lab Assistant, Neogen Corporation – Lincoln, NE
- Lab Technician, University of Nebraska - Lincoln – Lincoln, NE
- Medical Scribe, EMR Scribes – Omaha, NE
- Middle School Science Teacher, Alma Public Schools – Alma, NE

- Phlebotomist, Bryan Medical Center – Lincoln, NE
- Science Writer, LI-COR Biosciences – Lincoln, NE
- Scientist I, Aerotek – Chicago, IL
- Plant Research Biologist, Midwest Research Inc. – York, NE

## **Internships**

- R&D Summer Intern, Estee Lauder Companies - Melville NY
- Project Manager Assistant/Engineering Assistant, LI-COR Biosciences - Lincoln NE
- Construction Management Intern, Nemaha Landscape Construction - Lincoln NE
- Undergrad Student Research Intern, UNL Mid-America Transportation Center - Lincoln NE
- Certified Nursing Assistant, Delmar Gardens Retirement Home - CNA Program - O'Fallon MO
- Intern, Monsanto - Gothenburg NE
- Beckman Research Scholar, UNL College of Arts and Sciences Beckman Scholars - Lincoln NE
- Associate Management Intern, Cargill - Kansas City, MO
- Advanced Research Intern, LI-COR Biosciences - Lincoln NE
- Distinguished Life Sciences Scholar, College of Arts and Sciences - Lincoln NE

## **Graduate & Professional Schools**

- Master's in Bioinformatics, Northeastern University – Boston, MA
- Master's in Global Health, Emory University – Atlanta, GA
- Doctor of Dental Surgery, UNMC College of Dentistry – Lincoln, NE
- Doctor of Medicine, University of Nebraska Medical Center – Omaha, NE
- Doctor of Medicine, Uniformed Services University of the Health Sciences – Bethesda, MD
- Doctor of Pharmacy, University of Nebraska Medical Center – Omaha, NE
- Doctor of Physical Therapy, University of Nebraska Medical Center – Omaha, NE
- Ph.D., Biomedical Sciences, University of California - San Diego – San Diego, CA
- Ph.D., Ecology and Evolution, University of Chicago – Chicago, IL
- Ph.D., Neuroimmunology (M.D.– Ph.D.), University of Nebraska Medical Center – Omaha, NE