

MICROBIOLOGY (CAS)

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.)

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

College Admission

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

Academic and Career Advising

Academic and Career Advising Center

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 website (<http://ace.unl.edu>) for the most current list of certified courses.

ACE Student Learning Outcomes

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

ACE 2: Demonstrate competence in communication skills.

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

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

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

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

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

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

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

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

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

CDR: Humanities 3

Select from classics, English, film studies, history, modern languages and literatures, philosophy, and religious studies.²

CDR: Social Science 3

Select from anthropology, communication studies, geography, national security studies, political science, psychology, or sociology.³

CDR: Human Diversity in U.S. Communities 0-3

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

CDR: Language 0-16

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

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

Credit Hours Subtotal: 13-32

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

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

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

College Degree Requirements

College Distribution Requirements – BA and BS

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

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

College Distribution Requirements

CDR: Written Communication 3

Select from courses approved for ACE outcome 1.

CDR: Natural, Physical, and Mathematical Sciences with Lab 4

Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, and physics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology, and physics.

Language Requirement

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

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.

Scientific Base - BS Only

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences. Approved courses for scientific-based credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBI0 101), and physics (excluding PHYS 201.)

See your Degree Audit or your assigned academic advisor for a complete list, including individual classes that fall outside of the disciplines listed above. Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the College of Arts and Sciences. See your assigned academic advisor to start the approval process.

Minimum Hours Required for Graduation

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

Grade Rules

Restrictions on C- and D Grades

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

Pass/No Pass Privilege

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

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

Grading Appeals

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

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

Course Level Requirements

Courses Numbered at the 300 or 400 Level

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

Residency Requirement

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

Catalog to Use

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

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.

Learning Outcomes

Graduates with a major in microbiology will:

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

Core Requirements

Required Courses

MBIO 101	Introduction to the Microbiology Major	1
LIFE 120 & LIFE 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	4
LIFE 121 & LIFE 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory	4
BIOS 206	General Genetics	4
BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
MBIO 420 / BIOS 420	Molecular Genetics	3
MBIO 440 / BIOS 440	Microbial Physiology	3
MBIO 443 / BIOS 443	Immunology	3
Credit Hours Subtotal:		26
Total Credit Hours		26

Ancillary Requirements

Mathematics and Statistics

MATH 106	Calculus I	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

Chemistry

General Chemistry

Select one sequence from the following:		8-12
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	

Or

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 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	Organic Chemistry 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	Organic Chemistry and Mechanistic Organic Chemistry I Laboratory and Organic Chemistry	
--------------------------------------	-------------------------------------------------------------------------------------------------	--

Credit Hours Subtotal: 12-20

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	
--------------------------------------	------------------------------------------	--

Credit Hours Subtotal: 3-4

Physics

Select one sequence from the following: 10

PHYS 141 & PHYS 142	Elementary General Physics I and Elementary General Physics 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: 10

Total Credit Hours 33-42

Specific Major Requirements

Advanced Microbiology Courses

Select at least 12 hours from the following advanced microbiology-related courses: 12

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	
------------------------	-------------------------------------	--

BIOC 442 / STAT 442	Computational Biology	
------------------------	-----------------------	--

BIOS 302	Cell Biology	
----------	--------------	--

BIOS 303	Molecular Biology	
----------	-------------------	--

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

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

BIOS 426	Systems Biology	
----------	-----------------	--

BIOS 444 / GEOL 444	Earth and Environmental Microbiology	
------------------------	--------------------------------------	--

BIOS 460 / NRES 460 / PLAS 460 / SOIL 460	Soil Microbial Ecology	
----------------------------------------------------	------------------------	--

BIOS 477	Bioinformatics and Molecular Evolution	
----------	----------------------------------------	--

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

BIOS 491	Special Topics in Biological Sciences	
----------	---------------------------------------	--

FDST 405 / BIOS 445	Food Microbiology
FDST 406 / BIOS 446	Food Microbiology Laboratory
FDST 415	Molds and Mycotoxins in Food, Feed, and the Human Environment
FDST 455	Microbiology of Fermented Foods
FDST 455L	Microbiology of Fermented Foods Laboratory (offered even years only)
MBIO 421 / BIOS 421	Microbial Diversity
PLPT 369 / BIOS 369	Introductory Plant Pathology
PLPT 369L	Introductory Plant Pathology Lab
VBMS 303	Principles and Prevention of Livestock Diseases
VBMS 408 / BIOS 408	Functional Histology
VBMS 424	Basic Molecular Infectious Diseases (offered odd years only)
VBMS 441 / BIOS 441	Pathogenic Microbiology
Credit Hours Subtotal:	12

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 courses.

Pass/No Pass

With the exception of MBIO 101, no course taken Pass/No Pass will be counted toward the major, except for independent study, research, and seminars.

PLEASE NOTE

This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Microbiology (B.S.) Career Information

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

Transferable Skills

- 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