

MICROBIOLOGY

Undergraduate Microbiology Major

Interested in the study of small things that have a big impact? Then Microbiology may be the place for you.

Our mission in the Microbiology Program is to instill a comprehensive understanding of microbiology and its relevance to human society and global health, and to cultivate the concepts and skills necessary to succeed in microbiology-related careers.

Iowa State University's Microbiology Undergraduate Program offers:

- Extensive hands-on laboratory experiences that develop problem solving & technical skills used in a variety of professional careers
- Application of science to issues in the modern world
- Excellent preparation for human medicine and veterinary medicine
- Preparation for employment in a variety of professional settings
- Research opportunities and interaction with professors from across Iowa State University Departments of Animal Science, Plant Pathology and Microbiology, Biochemistry & Molecular Biology, Biology, Veterinary Microbiology, Veterinary Pathology, Food Science, Entomology, and Geology
- Degrees in microbiology at both the undergraduate (B.S.) level and graduate (M.S., PhD., see Graduate Major (<http://catalog.iastate.edu/previouscatalogs/2022-2023/collegeofagricultureandlifesciences/microbiology/#graduatetext>)) level

Career opportunities:

Opportunities after graduation include the following:

- Biomedical research scientist
- Biotechnology firms
- Biorenewables industry
- Forensic scientist
- Pharmaceutical and vaccine development companies
- Immunologist
- Agricultural microbiology and plant pathology
- International agricultural research centers
- Government laboratories (CDC, NADC, USDA)
- Infectious disease
- Food safety and food technology
- Water quality
- Ecology and environmental microbiology
- Botanical gardens & nurseries
- Technical brewer

- Science writer
- Public health agencies
- Public policy organizations

Interested in Human medicine or Veterinary medicine? A microbiology degree prepares students for advanced study in Dentistry, Medical Laboratory Science, Optometry, Pharmacy, Physician Assistant Programs, and Physician or Veterinary education. Go to micro.iastate.edu (<https://www.micro.iastate.edu/>) to find more information about the Microbiology Program.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Research and critically evaluate topics in microbiology; understand and communicate results from primary and secondary literature to a variety of audiences.
2. Utilize appropriate quantitative and qualitative microbiological laboratory techniques and equipment, including microscopy, biochemical tests, serological assays, and genetic manipulation.
3. Explain how evolution unifies and explains the diversity of microbes in terms of microbial structure, function, metabolism, and genetics.
4. Describe common adaptations that enable organisms to survive in an ecological niche, such as how microbiota can impact plants, animals/humans, food, and soil health in beneficial, neutral, or negative ways.
5. Develop and follow lab protocols, interpret data, maintain an accurate lab notebook, and create illustrative graphs and tables.
6. Communicate and collaborate across disciplines about fundamental concepts in microbiology and discuss the relationship of science, society, and ethical issues in microbiology.

Curriculum in Microbiology

www.micro.iastate.edu (<http://www.micro.iastate.edu>)

Administered by an interdepartmental committee.

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.

International Perspectives Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

U.S. Diversity: 3 cr.

U.S. Diversity Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

Electives: 7-12**Communications Proficiency:**

English composition - with a C or better	6
Speech fundamentals - with a C or better	3

Communication/Library:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
One course from the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 312	Communicating Science and Public Engagement	
ENGL 314	Technical Communication	
LIB 160	Introduction to College Level Research	1

Total Credits **13**

Humanities and Social Sciences:

Approved Humanities list ¹	3
Approved Social Science list ²	3

¹ Humanities Course list (<https://www.cals.iastate.edu/student-services/humanities/>)

² Social Sciences Course list (<https://www.cals.iastate.edu/student-services/social-sciences/>)

Ethics: 3 cr.

3 cr. from approved Ethics Course list (<https://www.cals.iastate.edu/student-services/ethics/>)

Mathematical Sciences:

One of the following:	7-8	
MATH 143 & MATH 160	Preparation for Calculus and Survey of Calculus	
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 160 & STAT 301	Survey of Calculus and Intermediate Statistical Concepts and Methods	
One of the following:	3-4	
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	

Total Credits **10-12**

Physical Sciences:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
One of the following:		5-10
PHYS 115 & 115L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	
PHYS 131 & 131L	General Physics I and General Physics I Laboratory	
& PHYS 132 & PHYS 132L	and General Physics II and General Physics II Laboratory	
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
One of the following:		3-6
BBMB 404 & BBMB 405	Biochemistry I and Biochemistry II	
or BBMB 301	Survey of Biochemistry	
or BBMB 316	Principles of Biochemistry	

Total Credits **23-31**

Biological Sciences:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3

Total Credits **15**

Microbiology:

Core courses:

MICRO 110	Professional and Educational Preparation in Microbiology	1
MICRO 302	Biology of Microorganisms	3
MICRO 302L	Microbiology Laboratory	1
MICRO 310	Medical Microbiology	3
One of the following:		1
MICRO 310L	Medical Microbiology Laboratory	
MICRO 475L	Immunology Laboratory	
MICRO 320	Molecular and Cellular Bacteriology	4
MICRO 440	Laboratory in Microbial Physiology, Diversity, and Genetics	4
MICRO 450	Undergraduate Capstone Colloquium	2

MICRO 451	Survey in Microbiology	R	
One of the following:		3	
MICRO 430	Prokaryotic Diversity and Ecology		
MICRO 456	Principles of Mycology		
MICRO 477	Bacterial-Plant Interactions		
Additional nine credit hours from the following:		9	
MICRO 353	Introductory Parasitology		
MICRO 374	Insects and Our Health		
MICRO 374L	Insects and Our Health Laboratory		
MICRO 402	Microbial Genetics and Genomics		
MICRO 407	Microbiological Safety of Foods of Animal Origins		
MICRO 408	Virology		
MICRO 420	Food Microbiology		
MICRO 421	Food Microbiology Laboratory		
MICRO 430	Prokaryotic Diversity and Ecology		
MICRO 456	Principles of Mycology		
MICRO 475	Immunology		
MICRO 475L	Immunology Laboratory		
MICRO 477	Bacterial-Plant Interactions		
MICRO 485	Soil and Environmental Microbiology		
MICRO 487	Microbial Ecology		
MICRO 490	Independent Study		
Microbiology elective - only 3 cr. lab courses allowed			
Total Credits		31	

Microbiology, B.S.

First Year

Fall	Credits	Spring	Credits
ENGL 150 or 250		3 MICRO 302	3
MICRO 110		1 MICRO 302L	1
MICRO 101		3 BIOL 212	3
BIOL 211		3 BIOL 212L	1
BIOL 211L		1 CHEM 178	3
CHEM 177		4 STAT 104	3
CHEM 177L		1 Social Science choice	3
LIB 160		1	
		17	17

Second Year

Fall	Credits	Spring	Credits
MICRO 310		3 MICRO Environmental or Elective	3
MICRO 310L		1 BIOL 313	3

CHEM 331	3 BIOL 313L	1
CHEM 331L	1 CHEM 332	3
MATH 143, 160, or 165	4 MATH 160, STAT 301, or MATH 166	4
ENGL 250	3 Humanities choice	3
		15
		17

Third Year

Fall	Credits	Spring	Credits
MICRO Environmental or Elective		3 MICRO 320	4
PHYS 131 or 115		4 PHYS 132 (if PHYS 131 previously taken)	4
PHYS 131L or 115L		1 PHYS 132L (if PHYS 131L previously taken)	1
BIOL 314 or 328		3 Advanced English	3
SP CM 212		3 International Perspectives	3
Gen Elective		3	
		17	15

Fourth Year

Fall	Credits	Spring	Credits
MICRO 440		4 MICRO elective	3
MICRO elective		3 MICRO 450	2
MICRO 451		R BBMB 405	3
ETHICS choice		3 Social Science choice	3
BBMB 404		3 Gen Electives	5
US Diversity		3	
		16	16

Minor

The program offers a minor in microbiology which may be earned by accumulating a minimum of 15 credits of microbiology courses.

Students requesting a minor in Microbiology must take the following:

1) MICRO 201 Introduction to Microbiology and MICRO 201L Introductory Microbiology Laboratory **or** MICRO 302 Biology of Microorganisms and MICRO 302L Microbiology Laboratory

2) Additional lecture credits and no more than 3 additional lab credits to reach 15 credits. For a list of acceptable courses see https://www.micro.iastate.edu/files/inline-files/minor_in_microbiology_21-22_1.pdf

3) At least 6 credits at the 300+ level and must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Graduate Study

The program offers work for the degrees master of science and doctor of philosophy in microbiology and for a minor for students majoring in other programs. The interdepartmental microbiology major is offered through faculty housed in twelve departments, including Agronomy; Animal Science; Biochemistry, Biophysics and Molecular Biology; Civil, Construction and Environmental Engineering; Entomology; Food Science and Human Nutrition; Genetics, Developmental and Cell Biology; Geological and Atmospheric Sciences; Plant Pathology and Microbiology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology. Faculty coordinate graduate education and research in a wide range of topics fundamental to the discipline of microbiology. Specific information about individual faculty and their research areas is available at www.micrograd.iastate.edu. (<http://www.micrograd.iastate.edu/>)

Prerequisites to graduate study include a sound undergraduate background in chemistry, mathematics and biology, including microbiology and genetics.

Graduates in the Microbiology Graduate program have a broad-based knowledge in the fundamentals of microbiology as well as advanced knowledge in specific areas as determined by their areas of research focus. Students completing the thesis have the technical, research, critical-thinking, problem-solving, and computer skills to design, implement, and conduct research using a variety of current techniques and equipment. They are also able to communicate research results effectively with scientific peer groups in both oral and written formats.