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., Ph.D., see Graduate Major) 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 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
SPCM 2120	Fundamentals of Public Speaking	3
One course from the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	
LIB 1600	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 1430 & MATH 1600	Preparation for Calculus and Survey of Calculus	
MATH 1650 & MATH 1660	Calculus I and Calculus II	
MATH 1600 & STAT 3010	Survey of Calculus and Intermediate Statistical Concepts and Methods	
One of the following:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
Total Credits		**10-12**

Physical Sciences:

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
One of the following:		5-10
PHYS 1150 & 1150L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	
PHYS 1310 & 1310L & PHYS 1320 & PHYS 1320L	General Physics I and General Physics I Laboratory and General Physics II and General Physics II Laboratory	
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
CHEM 3320	Organic Chemistry II	3
One of the following:		3-6
BBMB 4040 & BBMB 4050	Biochemistry I and Biochemistry II	
or BBMB 3010	Survey of Biochemistry	
or BBMB 3160	Principles of Biochemistry	
Total Credits		**23-31**

Biological Sciences:

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3130	Principles of Genetics	3
BIOL 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
Total Credits		**15**

Microbiology:

Core courses:

MICRO 1100	Professional and Educational Preparation in Microbiology	1
MICRO 3020	Biology of Microorganisms	3
MICRO 3020L	Microbiology Laboratory	1
MICRO 3100	Medical Microbiology	3
One of the following:		1
MICRO 3100L	Medical Microbiology Laboratory	
MICRO 4750L	Immunology Laboratory	
MICRO 3200	Molecular and Cellular Bacteriology	4
MICRO 4400	Laboratory in Microbial Physiology, Diversity, and Genetics	4
MICRO 4500	Undergraduate Capstone Colloquium	2
MICRO 4510	Survey in Microbiology	
One of the following:		3
MICRO 4300	Procaryotic Diversity and Ecology	
MICRO 4560	Principles of Mycology	

MICRO 4770	Bacterial-Plant Interactions	
Additional nine credit hours from the following:		9
MICRO 3530	Introductory Parasitology	
MICRO 3740	Insects and Our Health	
MICRO 3740L	Insects and Our Health Laboratory	
MICRO 4020	Microbial Genetics and Genomics	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	
MICRO 4080	Virology	
MICRO 4200	Food Microbiology	
MICRO 4210	Food Microbiology Laboratory	
MICRO 4300	Procaryotic Diversity and Ecology	
MICRO 4560	Principles of Mycology	
MICRO 4750	Immunology	
MICRO 4750L	Immunology Laboratory	
MICRO 4770	Bacterial-Plant Interactions	
MICRO 4850	Soil and Environmental Microbiology	
MICRO 4870	Microbial Ecology	
MICRO 4900	Independent Study	
Microbiology elective - only 3 cr. lab courses allowed		
Total Credits		**31**

Microbiology, B.S.

First Year

Fall	Credits	Spring	Credits
ENGL 1500 or 2500	3	MICRO 3020	3
MICRO 1100	1	MICRO 3020L	1
MICRO 1010	3	BIOL 2120	3
BIOL 2110	3	BIOL 2120L	1
BIOL 2110L	1	CHEM 1780	3
CHEM 1770	4	STAT 1040	3
CHEM 1770L	1	Social Science choice	3
LIB 1600	1		
	17		**17**

Second Year

Fall	Credits	Spring	Credits
MICRO 3100	3	MICRO Environmental or Elective	3
MICRO 3100L	1	BIOL 3130	3
CHEM 3310	3	BIOL 3130L	1
CHEM 3310L	1	CHEM 3320	3
MATH 1430, 1600, or 1650	4	MATH 1600, STAT 3010, or MATH 1660	4
ENGL 2500	3	Humanities choice	3
	15		**17**

Third Year

Fall	Credits	Spring	Credits
MICRO Environmental or Elective	3	MICRO 3200	4
PHYS 1310 or 1150	4	PHYS 1320 (if PHYS 1310 previously taken)	4
PHYS 1310L or 1150L	1	PHYS 1320L (if PHYS 1310L previously taken)	1
BIOL 3140 or 3280	3	Advanced English	3
SPCM 2120	3	International Perspectives	3
Gen Elective	3		
	17		**15**

Fourth Year

Fall	Credits	Spring	Credits
MICRO 4400	4	MICRO elective	3
MICRO elective	3	MICRO 4500	2
MICRO 4510	R	BBMB 4050	3
ETHICS choice	3	Social Science choice	3
BBMB 4040	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 2010 Introduction to Microbiology and MICRO 2010L Introductory Microbiology Laboratory **or** MICRO 3020 Biology of Microorganisms and MICRO 3020L 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 3000+ 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.