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

Total Credits: 13

Humanities and Social Sciences:
- Approved Humanities list: 3
- Approved Social Science list: 3

Ethics: 3 cr.
- 3 cr. from approved Ethics Course list

Mathematical Sciences:
- One of the following: 7-8
  - MATH 1430 Preparation for Calculus
  - & MATH 1600 and Survey of Calculus
  - MATH 1650 Calculus I
  - & MATH 1660 and Calculus II
  - MATH 1600 Survey of Calculus
  - & STAT 3010 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 Physics for the Life Sciences
  & 1150L and Laboratory in Physics for the Life Sciences
- PHYS 1310 General Physics I
  & 1310L and General Physics I Laboratory
  & PHYS 1320 and General Physics II
  & PHYS 1320L 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 Biochemistry I
  & BBMB 4050 and Biochemistry II
  or BBMB 301 Survey of Biochemistry
  or BBMB 316 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
### Microbiology, B.S.

**First Year**

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**Second Year**

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**Third Year**

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| Total Credits         | 15      | 17              |

**Fourth Year**

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| Total Credits         | 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.