

# Microbiology and Cell Biology

*Note: MSU's programs in the biological sciences are distributed across multiple departments. MSU does not have a single Department of Biology. For additional options see Biological Sciences (<http://catalog.montana.edu/undergraduate/agriculture/biological-sciences/>) at MSU.*

## Department of Microbiology and Immunology

Programs are designed to prepare students for careers in microbiology with emphasis in medical microbiology, immunology, molecular biology, virology, microbial physiology, microbial ecology, microbial genetics, and environmental microbiology. The Microbiology curriculum has three options: Microbiology (with various tracks), Medical Laboratory Science and Environmental Health. There is also a Biotechnology curriculum with options in Animal Systems and Microbial Systems. Some courses in these options require additional course fees.

## Degree in Microbiology Microbiology Option

In this option, students obtain a thorough education in the fields of medical, ecological, physiological, and environmental microbiology, immunology, virology, and molecular biology. This curriculum is excellent preparation for:

- graduate study in microbiology and other fields of the biological sciences
- medical, dental, veterinary, and other professional schools
- careers in industry, university, institute, and government, laboratories

There are several tracks a student can choose within this option to tailor their studies to their interests. These tracks all lead to a degree in Microbiology and include the:

- Microbiology Track
- Pre-Medical Track
- Pre-Veterinary Track
- Environmental Track.

## Medical Laboratory Science Option

This option is designed to prepare students for careers in Clinical Laboratory Science. There is an urgent demand for professionals certified in this field at the state and national level. Students develop competence in a range of medically-oriented fields including immunology, medical bacteriology, virology parasitology, hematology, mycology, and chemistry. The Department of Microbiology and Immunology has two plans for students seeking a career in Medical Laboratory Science (MLS), Plan "A" and Plan "B."

Plan A (3+1) allows students to attend classes at MSU for three years and apply for a clinical internship during the fourth year. The Montana Medical Laboratory Science Training Program is located at MSU and meets the professional standards. It is approved by the National Accrediting Agency for Clinical Laboratory Sciences, 5600 N. River Rd., Suite 720, Rosemont IL 60018-5119, (773) 714-8880. Students with a 2.5 GPA or greater, who are accepted, will spend their fourth year in this program. Upon completion of the one-year internship, students receive a BS degree in Microbiology from MSU, and take a national examination through the American Society for Clinical Pathologists or the National Certification Agency. They will then be qualified to practice as a Medical Laboratory Scientist.

Plan B is for students who wish to complete a four year degree in Microbiology at MSU. They may then independently seek an approved hospital training program in MLS for a one-year internship. Once training is complete, they will also be qualified to take a national registry exam and become certified as a MLS.

This certification qualifies them for graduate education and careers in:

- clinical analysis (microbiology, hematology, chemistry, and immunohematology)
- medical research
- industry (product development, sales, maintenance of equipment, etc)
- public health laboratories
- health care administration

## Environmental Health Option, Microbiology

This option offers a degree program that is fully accredited by the National Environmental Health Science and Protection Accreditation Council. This accreditation means students will be immediately ready to enter the workforce in a field with a strong need for qualified professionals. They are also well poised to pursue graduate studies or enter into medical training programs.

Environmental Health deals natural and human environments and possible effects on human health. Public health agencies at the local, statewide, national and worldwide levels are concerned with biological, chemical and physical factors upon human health. There is an increasing demand for professionals who are trained to assess and control activities through implementation of environmental health policies to improve public health.

Specialty courses are offered and include general microbiology, principles of environmental health science, medical bacteriology, immunology, microbial physiology and genetics, parasitology, insect biology, anatomy and physiology and soil and environmental microbiology.

## Degree in Biotechnology

Modern research in cellular and molecular biology and its resultant technology offers unparalleled opportunities to provide solutions to our society's most urgent problems in human and animal health, agriculture, and environmental quality. The emerging biotechnology industries are involved in developing products to maintain biodiversity, restore soil and water quality, develop new pharmaceuticals to combat disease, decrease our dependence on nonrenewable resources, and improve food and fiber production. Students interested in microbiology, animal or plant science, biochemistry, and animal or human medicine will find challenging careers in the diverse areas of biotechnology in either an academic or industrial setting. Students successfully completing a biotechnology curriculum will also be prepared to enter graduate or medical professional schools for further study.

The Bachelor of Science in Biotechnology is an interdisciplinary degree that spans two academic departments: Microbiology and Immunology and Plant Sciences/Plant Pathology. Students will choose an area of emphasis in Animal Systems, Microbial Systems or Plant Systems for upper-division coursework.

## Cell Biology & Neuroscience Program

The mission of Cell Biology and Neuroscience is to train students in a wide range of biological areas, with special emphasis on cell biology, neurobiology, developmental biology, physiology, anatomy and biophysics. Together, faculty and students in Cell Biology and Neuroscience study biological processes that span the continuum from single cells to the entire human body. Cell Biology and Neuroscience offers an undergraduate B.S. in Cell Biology and Neuroscience, with Biomedical and Neuroscience

options, as well as M.S. and a Ph.D. graduate degrees in Cell Biology and Neuroscience.

### Microbiology Minor (Non-Teaching)

A Microbiology minor provides interested students an understanding of the microbial basis of health and disease, and environmental microbiology. Eligibility for a minor in Microbiology requires 29 credits in Microbiology and supporting subjects. This minor complements other majors for those pursuing graduate school and professional programs in medical, dental, veterinary, ecological, industrial, pharmaceutical and related areas. This minor also strengthens the background for science majors who wish to become more competitive in the job market.

### Genetics Minor

Genetics is one of the fundamental disciplines that supports the field of biology. The departments that contribute to genetics teaching and research collaborated to develop the Genetics Minor to provide students with a focused experience in microbial, plant and animal genetics, and to permit exploration of specialties ranging from bioinformatics through molecular, evolutionary and quantitative genetics. The Genetics Minor is available in the departments of Animal and Range Sciences, Cell Biology and Neurosciences, Computer Science, Ecology, Microbiology and Immunology, and Plant Sciences and Plant Pathology. Each participating department has a certifying officer for the Genetics Minor to help students decide whether this option is appropriate.

Standards for the Genetics Minor are consistent across all participating departments: a student must receive a grade of C- or better in all courses required for the minor. In consultation with a Genetics Advisor, the student will select a minimum of 16 credits from the list of elective courses.

### Pre-veterinary Medical Certificate (Non-degree Program)

This program is ideal for students who have already obtained their B.S. degree and are seeking a structured approach to coursework necessary to apply to veterinary schools. The certificate may also be obtained by students currently seeking a degree in an unrelated field, as a means of tracking course work needed to complete an application to any AVMA accredited veterinary schools.

### Undergraduate Research Participation

An undergraduate research program, available to students who demonstrate an interest and ability, is open to non-majors as well as majors in Microbiology. The aim of this program is to foster increased creativity, imagination, inquisitiveness, and independence.

### Departmental Honors in Microbiology

When appropriate, majors should consider the opportunities afforded by the departmental honors program. This program has the following components:

- A minimum 3.5 grade-point average (GPA) in Microbiology, 3.0 GPA overall
- A minimum of four credits of undergraduate research credit
- An acceptable, bound senior thesis, and an oral defense of the thesis

Participation in a Microbiology seminar during the senior year is the required capstone course for graduation.

### Undergraduate Programs

- Cell Biology and Neuroscience (<http://catalog.montana.edu/undergraduate/agriculture/cell-biology-neuroscience/>)

- Microbiology Option: Microbiology Track (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/microbiology-option-microbiology-track/>)
- Microbiology Option: Pre-Medical Track (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/microbiology-option-premedical-track/>)
- Microbiology Option: Pre-Veterinary Track (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/microbiology-option-prevet-track/>)
- Microbiology Option: Environmental Microbiology Track (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/microbiology-option-environmental-microbiology-track/>)
- Microbiology Option: Environmental Health Track (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/microbiology-option-environmental-health-track/>)
- Medical Laboratory Science Option (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/medical-laboratory-science-option-31-program-/>)

### Undergraduate Minors

- Genetics Minor (Non-Teaching) (<http://catalog.montana.edu/undergraduate/agriculture/genetics-minor/>)
- Microbiology Minor (Non-Teaching) (<http://catalog.montana.edu/undergraduate/agriculture/microbiology/microbiology-minor-nonteaching/>)
- Astrobiology Minor (Non-Teaching) (<http://catalog.montana.edu/undergraduate/letters-science/microbiology/microbiology-minor-astrobiology/>)

### Certificates Offered

- Pre-veterinary Certificate (<http://catalog.montana.edu/undergraduate/letters-science/microbiology/preveterinary-certificate/>)

The Department of Microbiology and Immunology (MBI) conducts one of the premier infectious disease research programs in the Northwest, as demonstrated by the success of our faculty in competing nationally for extramural grant funding and publishing high-impact papers. Research funding comes from a range of sources such as the National Institutes of Health, US Department of Agriculture, National Science Foundation and the Montana Agricultural Experimental Station among others. Over the past five years, MBI averaged over \$6 million for annual research expenditures. MBI is also home to an NIH Center of Biomedical Research Excellence in Zoonotic and Emerging Infectious Diseases, which provides substantial core facilities and training opportunities for junior investigators. MBI is housed in a state-of-the-art facility with core laboratories for flow cytometry, cell biology, and molecular sciences, as well as pathogen containment facilities for small (BSL-3) and large animal research (ABSL-2). Instrumentation suites house equipment for DNA sequencing, genomic analysis, flow cytometry and cell sorting, and confocal microscopy.

### Graduate Programs

- M.S. in Microbiology and Immunology (Plan A) (<http://catalog.montana.edu/graduate/letters-science/microbiology/ms-microbiology-plan-a/>)
- M.S. in Microbiology and Immunology (Plan B) (<http://catalog.montana.edu/graduate/letters-science/microbiology/ms-microbiology-plan-b/>)
- Ph.D. in Microbiology and Immunology (<http://catalog.montana.edu/graduate/letters-science/microbiology/phd-microbiology/>)