

Microbiology and Immunology

Chair

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Director, Undergraduate Studies

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Undergraduate major: microbiology (B.S.)

Undergraduate minor: microbiology

Graduate degrees: M.S. in microbiology; Ph.D. in microbiology

Faculty: <https://medicine.uiowa.edu/microbiology/people/primary-appointments>

Website: <https://medicine.uiowa.edu/microbiology/>

Study in the Department of Microbiology and Immunology is dedicated to the branch of biological sciences that investigates the smallest living things: microbes that include bacteria, archaea, fungi, algae, protozoa, and viruses. It is coupled with immunology that includes the study of the protective responses of higher organisms to disease-causing microbes and cancers, and mistakes in immune function. Microbiology and immunology often interact in humans at the microbiome, those microbes that live with humans on their skin and mucosal surfaces, and yet must be restricted from causing diseases by the immune system.

Microbiology and immunology are at the forefront of the modern biological revolution. Microbes are experimental subjects of choice for examining genetic and biological phenomena because of their small size, rapid growth rate, relative simplicity, and variety of characteristics that allow them to cause many kinds of infections and alter normal body functions. Immunology often makes use of microbes and cancer cells to study the critical and complex human responses to eliminate microbes and cancers. A significant portion of contemporary biochemical research employs microbiological and immunological methods.

Current research is making theoretical and practical advances concerning microbes that infect animals, including humans, and the immune response to those microbes; the use of comparative genomics, gene expression profiling, and recombinant DNA methods to analyze biological processes and generate valuable products, such as antibiotics and antibodies; genetics and regulation of metabolic processes; and the genetics and regulation of the immune response, including characterization of mechanisms used by microbes to signal one another and characterization of interactions between different types of immune cells and their targets.

The Department of Microbiology and Immunology offers an undergraduate major and a minor, and graduate majors leading to an M.S. and a Ph.D., and determines the curricula for those programs. Undergraduates majoring in microbiology receive their degrees (Bachelor of Science) from the College of Liberal Arts and Sciences and are governed by that college's undergraduate academic policies. The graduate degrees are awarded by the Graduate College.

Programs

Undergraduate Programs of Study

Major

- Major in Microbiology (Bachelor of Science)

Minor

- Minor in Microbiology

Graduate Programs of Study

Majors

- Master of Science in Microbiology
- Doctor of Philosophy in Microbiology

Facilities

The Department of Microbiology and Immunology is situated on the University of Iowa health sciences campus, where it shares the Bowen Science Building with the Departments of Anatomy and Cell Biology, Biochemistry and Molecular Biology, Molecular Physiology and Biophysics, and Neuroscience and Pharmacology. Laboratory space and modern equipment are available for teaching and research.

Courses

Microbiology and Immunology Courses

MICR:2157 General Microbiology **3 s.h.**

Principles of bacterial and viral diversity, structure, genetics, physiology, and metabolism in contexts of molecular biology, immunology, infectious disease, and environmental microbiology. Prerequisites: BIOL:1411 and CHEM:1110.

MICR:2158 General Microbiology Laboratory **2 s.h.**

Practice of basic techniques commonly used today for study of easy-to-grow microorganisms; variety of individual and group lab activities that challenge students to apply observations about bacteria and viruses. Corequisites: MICR:2157, if not taken as a prerequisite.

MICR:3147 Immunology and Human Disease **3 s.h.**

Important principles and key concepts in immunology with a focus on the involvement of the immune system in disease pathogenesis; overview of innate and adaptive immune systems and their functions at cellular and molecular levels. Prerequisites: BIOL:1411 with a minimum grade of C and BIOL:1412 with a minimum grade of C.

MICR:3150 Eukaryotic Pathogens and Human Disease **2 s.h.**

Foundational understanding of the lifecycle, epidemiology, pathogenesis, diagnosis, and treatment of major eukaryotic pathogens/parasites that cause human disease. Prerequisites: MICR:2157 with a minimum grade of C. Recommendations: genetics, biochemistry, and immunology.

- MICR:3159 Bacteria and Human Disease** 3 s.h.
Infection and replication strategies of bacteria with an emphasis on human disease; for students interested in microbiology or other biological sciences, epidemiology, and/or health-related occupations. Prerequisites: MICR:2157 with a minimum grade of C.
- MICR:3160 Bacterial Physiology and Cell Biology** 2 s.h.
Bacterial physiology and cell biology with reference to model organisms and adaptations to extreme environments; topics include energy metabolism, growth, cell structure, macromolecular assembly, cell division, microbial development, and microbial interactions; lectures augmented with readings from primary literature to give students a strong foundation in prokaryotic biology and approaches used in modern microbiology research. Prerequisites: (BIOC:3110 or BIOC:3120) and MICR:2157 with a minimum grade of C.
- MICR:3164 Microbiology and Human Health** 4 s.h.
Microbiology for nursing, pharmacy, and pre-health professions. Prerequisites: BIOL:1411 or BIOL:1140 or BIOL:1141.
- MICR:3165 Bacteria and Human Disease Laboratory and Discussion** 3 s.h.
Use of bacterial genetics and molecular biology techniques and methodologies to study bacteria which cause human disease; development of skills in data analysis and presentation, reading scientific literature, and writing scientific abstracts; for students interested in microbiology or other biological sciences, epidemiology, and/or health-related occupations. Prerequisites: MICR:2157 with a minimum grade of C and MICR:2158 with a minimum grade of C. Corequisites: MICR:3159 or MICR:3170, if not taken as a prerequisite.
- MICR:3168 Viruses and Human Disease** 3 s.h.
Infection and replication strategies of viruses with an emphasis on human disease; for microbiology majors as well as students interested in pre-medicine, biological sciences, epidemiology, and/or other health-related occupations. Prerequisites: BIOL:1412 with a minimum grade of C or MICR:2157 with a minimum grade of C. Recommendations: basic understanding of molecular biology and immunology.
- MICR:3170 Microbial Genetics** 2 s.h.
Genetics of bacteria and bacteriophages including classical, molecular, and genome-wide approaches. Prerequisites: BIOL:2512 with a minimum grade of C or MICR:2157 with a minimum grade of C.
- MICR:3177 Virology Discussion** 1 s.h.
Students read and discuss papers from virology literature that address current issues in virology. Prerequisites: MICR:2157 with a minimum grade of C. Corequisites: MICR:3168 (if not taken as a prerequisite).
- MICR:3178 Virology Laboratory** 2 s.h.
Practical approaches to studying viruses; basic techniques in virology including virus detection, virus growth measurement, and virus genetics; introduction to bioinformatic analysis of virus genomes and infections. Prerequisites: MICR:2157 with a minimum grade of C and MICR:2158 with a minimum grade of C. Corequisites: MICR:3168 (if not taken as a prerequisite).
- MICR:4161 Undergraduate Research in Microbiology** arr.
Experimental research under faculty supervision. Prerequisites: BIOL:1411.
- MICR:4163 Seminar: Microbiology** 2 s.h.
Current topics in microbiology, immunology, and virology. Prerequisites: 2 of the following are required: MICR:3147 with a minimum grade of C, MICR:3159 with a minimum grade of C, MICR:3160 with a minimum grade of C, MICR:3168 with a minimum grade of C, MICR:3170 with a minimum grade of C. Requirements: senior standing.
- MICR:4171 Honors Undergraduate Research in Microbiology** arr.
Experimental research under faculty supervision. Prerequisites: BIOL:1411. Requirements: microbiology major, junior or senior standing, 3.33 overall g.p.a., and 3.33 g.p.a. in microbiology courses.
- MICR:4175 Topics in Parasitism** 1 s.h.
Molecular and immunologic mechanisms by which bacteria, viruses, and protozoa cause human diseases; based on manuscript readings and/or student presentations. Requirements: junior or higher standing in microbiology or related discipline, and current or prior research in a microbiology and immunology laboratory.
- MICR:5218 Microscopy for Biomedical Research** arr.
Basic microscopy methods for research including optics, preparation, and analysis of biomedical specimens; light, fluorescence, confocal, transmitting electron, scanning electron, atomic force microscopes, elemental analysis; immunochemistry and stereology techniques; individualized laboratory instruction. Prerequisites: BIOL:2723. Same as ACB:5218, BIOL:5218.
- MICR:5264 Directed Study in Microbiology** arr.
Advanced-level experimental research or teaching under faculty supervision.
- MICR:5875 Perspectives in Biocatalysis** 1-3 s.h.
Applied enzymology, protein design, structure-activity relationships, biosensor technology, microbial transformations, biodegradation of environmental pollutants. Requirements: graduate standing in a participating department supported by the Predoctoral Training Program in Biotechnology. Same as BIOC:5875, CBE:5875, CEE:5875, CHEM:5875, PHAR:5875.
- MICR:6201 Graduate Immunology** 3 s.h.
Ontogeny, activation, and function of T lymphocytes and B lymphocytes; innate immune effector mechanisms; major histocompatibility complex; antigen presentation; thymocyte positive and negative selection; signaling of T lymphocytes, B lymphocytes; emphasis on experimental methods for analysis of these processes. Prerequisites: MICR:3147. Requirements: for IMMU:6201—college biology, general chemistry, and introductory immunology courses; for MICR:6201—courses in college biology, genetics, general chemistry, and introductory immunology. Recommendations: for IMMU:6201—courses in biochemistry and genetics; for MICR:6201—biochemistry course. Same as IMMU:6201.
- MICR:6240 Graduate Eukaryotic Pathogens and Human Disease** 2 s.h.
Foundational understanding of the lifecycle, epidemiology, pathogenesis, diagnosis, and treatment of major eukaryotic pathogens/parasites that cause human disease. Recommendations: genetics, biochemistry, and immunology.

MICR:6247 Graduate Immunology and Human Disease 4 s.h.

Important principles and key concepts in immunology with a focus on the involvement of the immune system in disease pathogenesis; overview of innate and adaptive immune systems and their functions at cellular and molecular levels; learning enhanced by case-based, small-group discussion and writing exercises. Same as IMMU:6247.

MICR:6250 Mechanisms of Parasitism Journal Club 1 s.h.

Reviews of recent publications in molecular parasitology research and thesis research by training grant or journal club students. Same as MMED:6250.

MICR:6255 Graduate Experimental Approaches to Molecular Microbiology 2 s.h.

Exposure to common experimental approaches through examination of primary literature and facilitated discussions on application of those approaches to advance scientific inquiry. Requirements: microbiology graduate standing.

MICR:6259 Graduate Bacteria and Human Disease 3 s.h.

Infection and replication strategies of bacteria with an emphasis on human disease; discussion focuses on experimental approaches used to study mechanisms of disease.

MICR:6260 Graduate Bacterial Physiology and Cell Biology 2 s.h.

Bacterial physiology and cell biology with reference to model organisms and adaptations to extreme environments; topics include energy metabolism, growth, cell structure, macromolecular assembly, cell division, microbial development, and microbial interactions; lectures augmented with readings from primary literature to give students a strong foundation in prokaryotic biology and approaches used in modern microbiology research.

MICR:6265 Introduction to Grant Writing 2 s.h.

How to think and write like scientists and become familiar with the elements of a research proposal; writing a grant proposal modeled on a National Institutes of Health Exploratory/Developmental Research Grant Award (NIH R21); students critique proposals written by other students; faculty read proposals and provide constructive criticism; lectures describe elements of a grant proposal and strategies for effective writing. Requirements: enrollment in microbiology graduate program, or enrollment in a graduate program training in a microbiology and immunology department laboratory, or enrollment in a biological science graduate program and not working in a microbiology and immunology department laboratory for thesis project.

MICR:6267 Graduate Viruses and Human Disease 4 s.h.

Infection and replication strategies of viruses with an emphasis on human disease; discussion focuses on topics and techniques used in primary literature and development of specific aims for a mini-proposal.

MICR:6268 Biology and Pathogenesis of Viruses 2 s.h.

Molecular biology of animal DNA and RNA viruses, viral immunology and pathogenesis, and interaction of these viruses with eucaryotic cells; mechanisms of viral latency, persistence, cellular transformation, oncogenesis; virology literature. Prerequisites: MICR:3168 or MICR:6267.

MICR:6269 Graduate Virology Discussion 1 s.h.

Discussion of primary virology literature from a range of topics, may include techniques used for studying viruses, viral entry and replication, evasion of immune responses by viruses, vaccines, and viral pathogenesis; short presentations; development of specific aims for a mock grant proposal on a virology-related topic. Recommendations: completion of a virology course.

MICR:6270 Graduate Microbial Genetics 2 s.h.

Genetics of bacteria and bacteriophages including classical, molecular, and genome-wide approaches.

MICR:7207 Advanced Topics in Immunology 3 s.h.

In-depth analysis of selected areas. Prerequisites: IMMU:6201 or MICR:6201. Same as IMMU:7221.

MICR:7261 Graduate Research in Microbiology arr.

Requirements: microbiology graduate standing.

MICR:7263 Graduate Student Research Seminar 1 s.h.

Presentation of thesis work in progress. Requirements: microbiology graduate standing.

MICR:7265 Topics in Virology Literature 1 s.h.

Papers of current interest in primary virology literature.

MICR:8230 Dental Microbiology 3 s.h.

Medical microbiology: bacteriology, immunology, pathogenic bacteriology, virology, mycology, parasitology. Requirements: D.D.S. enrollment.

Microbiology and Molecular Biology Reviews. journal. 6.358 Q1. Allergy: European Journal of Allergy and Clinical Immunology. journal. 3.363 Q1. Technological revolutions in microbiology, immunology, and molecular biology have significantly expanded and improved the capabilities of diagnostic microbiology. The roots of diagnostic microbiology trace back to over three centuries when van Leeuwenhoek first observed bacteria and protozoa with his primitive microscope. However, it was not until the late 1800s that the work of Pasteur, Koch, and others ushered into modern era of germ theory as well as the use of isolation techniques. Immunology and microbiology encompass the combined study and research of structural and functional aspects of microbes, viz. bacteria, virus, fungi etc. and the immune response elicited by them. It also includes study and innovation of novel methods of stimulating or modifying the immune system to resist and fight against microbial infections. Microbiological and immunological research involves integrative study of bacteriology, immunology, virology, parasitology, mycology and physiology.