Microbiology and Immunology

Chair
• Li Wu

Director, Undergraduate Studies
• Richard J. Roller

Director, Graduate Studies
• Timothy L. Yahr

Undergraduate major: microbiology (B.S.)
Undergraduate minor: 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 disease by the immune system.

Microbiology and immunology are at the forefront of the modern biological revolution. Microbes and the microbiome are often the 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 response 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 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.

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

Students interested in doctoral studies in microbiology should apply under the umbrella program in Biomedical Science (select microbiology subprogram). Direct applications to the M.S. and Ph.D. in microbiology are not currently being considered.

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, Molecular Physiology and Biophysics, and Pharmacology. Laboratory space and modern equipment are available for teaching and research.

Courses

Microbiology and Immunology Courses

MICR:1000 First-Year Seminar 1 s.h.
Small discussion class taught by a faculty member; topics chosen by instructor.

MICR:1006 Small Wonders: Microbes in Our Lives 3 s.h.
Basic principles of microbial world for non-science majors; introduction to bacteria, viruses, and fungi; how they differ from more complex cells, how they are found in every environment on earth and on every human body, their uses to benefit humans, their ability to cause illness in humans and animals. GE: Natural Sciences without Lab.

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.

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:2112 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 Molecular Microbiology 3 s.h.
Microbes colonize a wide range of diverse environments from deep sea thermal vents to ice covered arctic lakes to the human body; students explore the genetics, molecular, and cell biology of a range of microorganisms, including microbial cell organization, macromolecular assembly, molecular structure and function, cell division and DNA replication, fundamentals of gene regulation, bacterial differentiation, antibiotic resistance, and microbial interactions; provides a strong foundation in molecular microbiology with an emphasis on familiarizing students with the techniques commonly used in modern microbiology research. Prerequisites: MICR:2157 with a minimum grade of C and (BIOL:3120 or BIOI:3110).

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.
Experimental design and methodologies used to study bacteria with emphasis on human disease; students read and discuss papers from bacteriology literature that address current issues in bacteriology; 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, if not taken as a prerequisite.

MICR:3166 Microbiology Literature Discussion 1 s.h.
Students read and discuss papers from microbiology literature that address current issues in microbiology; 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: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:1411 with a minimum grade of C or MICR:2157 with a minimum grade of C.

MICR:3170 Microbial Genetics 3 s.h.
Genetics of bacteria, bacteriophages. Prerequisites: BIOL:2512 with a minimum grade of C or MICR:2157 with a minimum grade of C.

MICR:3175 Molecular Microbiology and Genetics Laboratory 3 s.h.
Introductory research experience in bacterial genetics (including classical, molecular, bioinformatics, and biostatistical approaches); students tackle real (not cookbook) research projects designed to foster critical thinking skills and generate original data, formulate hypotheses, design and interpret experiments, read primary literature, present their findings, and develop scientific writing skills. Prerequisites: MICR:2157 or BIOL:2512. Recommendations: MICR:3170.

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. 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:3190 Web-Based Nursing, Pharmacy, and Allied Health Microbiology 4 s.h.
Microbiology for nursing and other health sciences; principles of immunology; web-based instruction. Prerequisites: BIOL:1140 or BIOL:1411 or BIOL:1141. Recommendations: introductory biology, or pathology and general chemistry.

MICR:4161 Undergraduate Research in Microbiology yarr.
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:4169 Topics in Viral Biology and Pathogenesis 1 s.h.
Topics include viral life cycles, immune response, antiviral treatments, potential for vaccine, animal models; lectures introducing subject matter; discussion of literature relevant to each week's topic. Prerequisites: MICR:3168 with a minimum grade of C.

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 graduate standing.

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; immunochromeny and stereology techniques; individualized laboratory instruction. Prerequisites: BIOL:2723. Same as ACB:5218, BIOL:5218.
**MICR:5264 Directed Study in Microbiology**  
arr.  
**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 Molecular Microbiology**  
3 s.h.  
Microbes colonize a wide range of diverse environments from deep sea thermal vents to ice covered arctic lakes to the human body; students explore the genetics, molecular, and cell biology of a range of microorganisms including microbial cell organization, macromolecular assembly, molecular structure and function, cell division and DNA replication, fundamentals of gene regulation, bacterial differentiation, antibiotic resistance, and microbial interactions; the course provides a strong foundation in molecular microbiology with an emphasis on familiarizing students with the techniques commonly used in modern microbiology research.

**MICR:6265 Principles of Writing a Scientific Proposal**  
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.

**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:6270 Graduate Microbial Genetics**  
3 s.h.  
Genetics of bacteria, bacteriophages.

**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:7217 Integrated Topics in Infectious Diseases**  
1 s.h.  
Clinical cases used to raise questions in host-microbe interactions; case/scientific exposes followed by related journal club discussions at next class session. Same as IMMU:7217.

**MICR:7221 Advanced Topics in Prokaryotic Biology Module 1**  
1-2 s.h.  
Development of critical thinking, experimental approach and design, writing, and oral presentation skills through primary literature and course specific assignments (proposal writing, writing manuscript reviews, oral presentations, small group discussions). Requirements: graduate standing in microbiology.

**MICR:7222 Advanced Topics in Prokaryotic Biology Module 2**  
1-2 s.h.  
Development of critical thinking, experimental approach and design, writing, and oral presentation skills through exposure to primary literature and assignments (proposal writing, writing manuscript reviews, oral presentations, small group discussions). Requirements: graduate standing in microbiology.

**MICR:7223 Advanced Topics in Prokaryotic Biology Module 3**  
1-2 s.h.  
Development of critical thinking, experimental approach and design, writing, and oral presentation skills through exposure to selected topics in microbiology and assignments (proposal writing, writing manuscript reviews, oral presentations, small group discussions). Requirements: graduate standing in microbiology.
MICR:7224 Advanced Topics in Prokaryotic Biology
Module 4  1-2 s.h.
Development of critical thinking, experimental approach and design, writing, and oral presentation skills through exposure to selected topics in microbiology and assignments (proposal, writing manuscript reviews, oral presentations, small group discussions). Requirements: graduate standing in microbiology.

MICR:7226 Advanced Topics in Prokaryotic Biology
Module 6  1-2 s.h.
Development of critical thinking, experimental approach and design, writing, and oral presentation skills through exposure to selected topics in microbiology and assignments (proposal, writing manuscript reviews, oral presentations, small group discussions). Requirements: graduate standing in microbiology.

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:7269 Graduate Topics in Viral Biology and Pathogenesis  1 s.h.
Topics include viral life cycles, immune response, antiviral treatments, potential for vaccine, animal models; lectures introducing subject matter; discussion of literature relevant to each week’s topic. Prerequisites: MICR:6267.

MICR:8230 Dental Microbiology  3 s.h.