Microbiology and Immunology

Chair
• Patrick M. Schlievert

Director, Undergraduate Studies
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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. Students who entered a graduate microbiology program prior to fall 2017 can refer to the 2015-16 General Catalog for previous degree requirements.

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

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<tr>
<td>MICR:1000</td>
<td>First-Year Seminar</td>
<td>1 s.h.</td>
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<tr>
<td>MICR:1006</td>
<td>Small Wonders: Microbes in Our Lives</td>
<td>3 s.h.</td>
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<tr>
<td>MICR:2157</td>
<td>General Microbiology</td>
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<tr>
<td>MICR:2158</td>
<td>General Microbiology Laboratory</td>
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MICR:3112 Pharmacy Microbiology 4 s.h.
Medical microbiology: bacteriology, immunology, pathogenic bacteriology, virology, mycology, parasitology. Requirements: pre-pharmacy standing.

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: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 BIOL: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, bioinformatic, 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:3178 Virology Laboratory and Discussion 3 s.h.
Practical approaches to studying viruses; basic techniques in virology including virus detection, virus growth measurement, and virus genetics; students read and discuss papers from virology literature that address current issues in virology. Prerequisites: MICR:2157 with a minimum grade of C and MICR:2158 with a minimum grade of C. Corequisites: MICR:3168.

MICR:3179 Bacterial Diversity and the Human Microbiome 3 s.h.
Discussion-based setting with a focus on the molecular basis of microbial diversity including mechanisms for gene expression, microbial populations, and the microbiome; emphasis on sequencing technologies, bioinformatics, and databases. Prerequisites: MICR:2157.

MICR:3190 Web-Based Nursing Microbiology 4 s.h.
Nursing microbiology, principles of immunology; web-based instruction. Prerequisites: BIOL:1140 or BIOL:1411 or BIOL:1141. Requirements: pre-nursing standing.

MICR:4161 Undergraduate Research in Microbiology 2 s.h.
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 2 s.h.
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:5218 Microscopy for Biomedical Research 2 s.h.
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.
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. 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: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: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: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:6279 Graduate Bacterial Diversity and the Human Microbiome  3 s.h.
Discussion-based setting focused on the molecular basis of microbial diversity including mechanisms for gene expression, microbial populations, and the microbiome; emphasis on sequencing technologies, bioinformatics, and data bases; students will design, present, and evaluate primary research abstracts.

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 exposés 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 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:7225 Advanced Topics in Prokaryotic Biology Module 5  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.