

# MIC - Microbiology Graduate Program

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## Microbiology Program

Microbiology: Clinical Microbiology Emphasis

Director: Paul Schweiger

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[www.uwlax.edu/grad/microbiology/](http://www.uwlax.edu/grad/microbiology/) (<https://www.uwlax.edu/grad/microbiology/>)

The Master of Science in Microbiology Program allows students advanced study in multiple areas of microbiology. Students have the option of a general M.S. degree in microbiology or an M.S. degree in microbiology with an emphasis in clinical microbiology.

Admission to the program is based, in part, on undergraduate course work, undergraduate grade point average (GPA), scores on the GRE general exam, letters of recommendation, and an application letter. Each student will choose a major advisor and an advisory committee during the first semester of residence. This committee will assist the student in drafting the student's plan of study, which will dictate the student's curriculum for the ensuing semesters.

All students complete a capstone experience. Students obtaining the M.S. in microbiology complete a thesis while students in the clinical microbiology emphasis complete either a thesis or seminar paper.

## Program length

The Master of Science (M.S.) in microbiology programs are typically two-year programs. Number of credits required varies by program. The program length is based on how long the required UWL coursework would take to complete for a full-time student who does not need to complete any prerequisite coursework. Program length may be extended if students attend part-time (if approved by program) or due to the requirements of an individual student's plan of coursework, research or capstone project.

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## 2023-24 Faculty/Staff

*The following is the graduate faculty as of the publication date of this catalog. This list will not be updated again until the next catalog is published in July.*

### Professor

Michael Hoffman

Gregory Sandland

William Schwan

Todd Weaver

### Associate Professor

Bonnie Bratina

Anne Galbraith

Xinhui Li

Bernadette Taylor

Peter Wilker

### Assistant Professor

Daniel Bretl

Paul Schweiger

### Teaching Professor

Marisa Barbknecht

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## Graduate degrees

- Microbiology - MS (<http://catalog.uwlax.edu/graduate/programrequirements/microbiology/microbiology-ms/>)
- Microbiology - MS: clinical microbiology emphasis (<http://catalog.uwlax.edu/graduate/programrequirements/microbiology/microbiology-clinical-microbiology-emphasis-ms/>)

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## Courses

MIC 500 Cr.2

### Orientation to Clinical Microbiology

This course will explore career opportunities within clinical microbiology including public health, diagnostic testing, basic and industrial research and development, and pharmaceutical sales. Discussion will focus on academic and professional requirements for each career track. The course will also cover clinical laboratory management, infection control, diagnostic techniques, and communication skills. Offered by resident faculty and visiting lecturers. Prerequisite: MIC 230 or equivalent; admission to the Clinical Microbiology Program. Offered Fall.

MIC 407/507 Cr.4

### Pathogenic Bacteriology

The study of pathogenic bacteria and their relationships to disease; principles of infection and pathogenesis, and unique properties of pathogens. Laboratory emphasis is on techniques for isolation and identification of pathogenic bacteria. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 4. Prerequisite: MIC 230. Offered Fall, Spring.

MIC 410/510 Cr.2

### Immunology Laboratory

Designed as an introduction to immunology techniques used in clinical and research laboratories. Includes antibody-based diagnostic tests such as ELISA and Western blot. Cell-based techniques include lymphocyte culture and flow cytometry. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lab 4. Prerequisite: MIC 310 or concurrent enrollment. Offered Fall, Spring.

MIC 416/516 Cr.4

**Prokaryotic Molecular Genetics**

This course provides an in-depth study of the Central Dogma including DNA replication, transcription, and translation. In addition, specific focus is on mechanisms of gene exchange in prokaryotes including transformation (natural and artificial), conjugation, and transduction (including bacteriophage biology). Other topics covered include genetic terminology, recombination and transposition, mutagenesis and repair, and gene regulation. Laboratory emphasis is on bacterial mutagenesis, genetic exchange and cloning techniques. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Dis. 1, Lab 3. Prerequisite: MIC 230; additional 300 or higher level MIC course with a lab. Consent of instructor. Offered Fall.

MIC 420/520 Cr.3

**Introductory Virology**

An introduction to viruses and their interactions with host organisms. Special emphasis is placed on the structure and replication cycles of virus families with medical importance. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: MIC 230; MIC 416/516 or BIO 306 or BIO 435/535; three semesters of college chemistry to include organic chemistry. Offered Spring.

MIC 421/521 Cr.2

**Virology Laboratory**

A laboratory course designed to introduce fundamental techniques used to study viruses in medicine, biotechnology and research. Emphasis is on procedures used to safely handle viruses, grow them in tissue culture, and the molecular biological, biochemical and immunological techniques used to detect and analyze viruses. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lab 4. Prerequisite: MIC 230; MIC 416/516 or concurrent enrollment, or BIO 306, or equivalent course work; three semesters of college chemistry to include organic chemistry. Offered Fall.

MIC 425/525 Cr.4

**Bacterial Physiology**

An in-depth study of bacterial structure and function, catabolic and anabolic pathways, regulation, and macromolecular synthesis. Laboratory emphasizes techniques used to examine bacterial structure and metabolism, such as macromolecular separations and quantification, use of radioisotopic tracers and quantification of enzyme activity. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 3, Disc. 1. Prerequisite: MIC 230; additional level 300 or higher MIC course with a lab; CHM 300 or CHM 303. Offered Spring.

MIC 427/527 Cr.3

**Industrial and Fermentation Microbiology**

A study of microbiology and biochemistry of food fermentations; bioconversions; production of antibiotics, vitamins, amino acids and organic acids. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: MIC 230 and two semesters of college chemistry. Offered Fall - Odd Numbered Years.

MIC 428/528 Cr.2

**Fermentation Microbiology Laboratory**

Principles of fermentation science and biotechnology with emphasis on industrial and food fermentation processes. Laboratory emphasis is on the use of various fermentation systems that generate useful products including fermented food and beverages, pharmaceuticals, chemicals and other gene products. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lab. 4. Prerequisite: MIC 230 and two semesters of college chemistry. Offered Occasionally.

MIC 434/534 Cr.3

**Aquatic Microbial Ecology**

An ecological study of bacteria, cyanobacteria and algae of aquatic ecosystems. Topics include microbial strategies for survival under various environmental conditions, the role of microorganisms in biogeochemical cycling of elements, interactions of microorganisms with other aquatic biota, the role of microorganisms in pollution problems, and applications of microbial ecology to biotechnology. Laboratory emphasis is on experimental design and sampling techniques, quantification of microbial biomass, and measurement of microbial activities in aquatic habitats. One weekend field trip required. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 3. Prerequisite: MIC 230 and three semesters of college chemistry. BIO 341 strongly recommended. Offered Fall - Even Numbered Years.

MIC/BIO 440/540 Cr.2

**Bioinformatics**

In this course, students will use computers to study and compare the sequence of nucleotides in DNA or RNA, or the amino acids in a protein. Computers also are used to examine the three dimensional structure of protein. Being able to manipulate and study this information is the basis for the current revolution in biotechnology. Topics include evolution, taxonomy, genomics and understanding disease. This course provides students an opportunity to explore the relationships between biology, microbiology, chemistry, and computer science. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 1, Lab 2. Prerequisite: BIO 306 or MIC 416/516. (Cross-listed with BIO/MIC; may only earn credit in one department.) Offered Spring, Winter.

MIC/BIO 442/542 Cr.3

**Plant Microbe Interactions**

This course will explore in-depth various ways that plants interact with microbes in the environment, at the macroscopic, cellular, and molecular levels. Case studies will include both parasitic and mutualistic (symbiotic) interactions. Microbes include fungi, bacteria, nematodes, and viruses. Includes plant pathology and studies of the beneficial relationships between plants and microbes. Inquiry-based labs are integrated into the lecture and discussion sessions. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 2. Prerequisite: BIO 203 or BIO 304; MIC 230. (Cross-listed with BIO/MIC; may only earn credit in one department.) Offered Fall - Odd Numbered Years.

MIC 454/554 Cr.2

**Mechanisms of Microbial Pathogenicity**

The study of mechanisms of microbial pathogenicity including both overt microbial factors and complex interactions with the host that produce symptoms of disease. The cellular, biochemical, molecular, and genetic bases for modern understanding of microbial disease will be included. This course is taught largely at a graduate level. Prerequisite: MIC 310 or equivalent; MIC 407/507 or equivalent. Offered Spring - Odd Numbered Years.

MIC 460/560 Cr.1-3

**Symposium in Microbiology**

Varying topics in microbiology with a specific title assigned to each. Offered by resident faculty or visiting lecturers. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Repeatable for credit - maximum six. Prerequisite: MIC 230. Offered Occasionally.

MIC/BIO 714 Cr.3

**Advanced Genetics**

The application of molecular-genetic analysis to problems in modern biology. The course will cover the fundamentals of genetic analysis in both prokaryotic and eukaryotic systems. Assigned readings from current literature will be discussed and evaluated. A variety of topic areas will be considered including ecology, biotechnology, bioremediation, food science, medicine and basic research. Prerequisite: a previous course in genetics, microbial genetics, or molecular biology. (Cross-listed with BIO/MIC; may only earn credit in one department.) Offered Spring - Odd Numbered Years.

MIC/BIO 721 Cr.1-2

**Directed Studies**

Directed readings or presentation of material not available in formal departmental courses. Repeatable for credit - maximum four between BIO and MIC. (Cross-listed with BIO/MIC.) Consent of instructor. Offered Occasionally.

MIC 730 Cr.2

**Biodegradation and Bioremediation of Environmental Contaminants**

Microbes are able to breakdown, or biodegrade, a wide variety of compounds including some considered hazardous to human health and/or the environment. The use of microbes as biological agents to reclaim polluted soils and waters is called bioremediation. This course will explore some of the better-studied mechanisms used by microbes to degrade and detoxify contaminants. Practical aspects for the use of microbes in bioremediation and some specific examples will also be covered. In addition, the students will present and discuss a series of special topics such as nuclear waste bioremediation or current clean-up efforts in the news. Prerequisite: one semester organic chemistry; MIC 230 or equivalent microbiology course. Offered Fall - Odd Numbered Years.

MIC/BIO 751 Cr.1

**Graduate Seminar**

Oral presentation and discussion of student-selected topics in biology and microbiology. Repeatable for credit - maximum two. (Cross-listed with BIO/MIC.) Offered Fall, Spring.

MIC 753 Cr.2

**Epidemiology of Infectious Disease**

This course examines the causes, distribution, control, and prevention of infectious disease in human populations. Basic epidemiological concepts, including study design, analysis and modeling of infectious disease data, establishing causal relationships, detecting confounding factors, and assessing risk will be presented. Emphasis will be placed on issues of special interest to the clinical epidemiologist including laboratory diagnosis used in outbreak investigations by microbiological, serological and molecular techniques. In addition, methods to evaluate the accuracy and usefulness of diagnostic tests will be examined. Prerequisite: MIC 407/507 or equivalent course. STAT 145 or PH 755. Offered Spring - Even Numbered Years.

MIC 755 Cr.2

**Advanced Immunology**

An in-depth study of advanced topics in immunology, primarily focusing on the genetics, mechanisms, and regulation of the immune system. Aspects of the immune response in a variety of disease conditions (infectious and non-infectious) will be discussed. Prerequisite: MIC 310 and MIC 410/510, or equivalent. Offered Fall - Odd Numbered Years.

MIC 761 Cr.1-2

**Research and Seminar in Microbiology**

This course is an in-depth literature review of a current research topic in microbiology. As part of the requirements for this course and for the degree each student must complete an acceptable seminar paper under the direction of an assigned faculty member. Not applicable to students pursuing a Plan A thesis. Offered Fall, Winter, Spring, Summer.

MIC 770 Cr.4

**Clinical Microbiology Practicum I**

Students spend at least 6 full-time weeks (40 hrs/wk) in a clinical laboratory where they receive training and hands-on experience in clinical microbiology, immunology, parasitology, mycology, and virology. In addition, students will actively participate with physicians, residents, and medical students in weekly infectious disease rounds and journal club. A special course fee applies. Prerequisite: acceptance into Clinical Microbiology MS Program. Consent of instructor. Offered Fall, Spring, Summer.

MIC 780 Cr.2-4

**Clinical Microbiology Practicum II**

Students spend at least 6 full-time weeks (40 hrs/wk) in the clinical laboratories at Marshfield Laboratories/St. Joseph's Hospital/Marshfield Clinic. Training will include hands-on experience with state-of-the-art molecular biology techniques. Specific exercises involving molecular epidemiology and infection control will be emphasized. Students will also participate in weekly infectious disease rounds and journal club. A special course fee applies. Students in the Clinical Laboratory Science BS/Clinical Microbiology MS Dual Degree Program will spend 3 full-time weeks (40 hrs/wk) in the clinical laboratories at Marshfield Laboratories/St. Joseph's Hospital/Marshfield Clinic with training adjusted to reflect their prior internship training. Prerequisite: acceptance into Clinical Microbiology MS Program or the Clinical Laboratory Science BS/Clinical Microbiology MS Dual Degree Program. Offered Fall, Spring, Summer.

MIC 790 Cr.2

**Clinical Microbiology Practicum III**

Students will spend 2-3 full-time weeks (40 hrs/wk) at the Wisconsin State Laboratory of Hygiene for public health training in mycobacteriology, sexually transmitted diseases, food-and water-borne diseases, and community respiratory illness surveillance. Emphasis will be on prevention and control programs and outbreak responses currently in place at the Wisconsin Department of Health. Prerequisite: MIC 770 and MIC 780. Offered Fall, Winter, Spring, Summer.

MIC 799 Cr.1-15

**Research: Master's Thesis**

Independent research in microbiology on a problem selected for a thesis under the direction of an assigned faculty major adviser. For students following Plan A. Repeatable for credit - maximum 15; maximum six applicable to degree. Consent of instructor. Offered Fall, Winter, Spring, Summer.