

# Microbiology (MIC) - Graduate Courses

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## Courses

MIC 500 Cr.2

### Microbiology Graduate Program Orientation

This first semester course for all Microbiology MS students is an introduction to student resources, program policies, timelines, responsible conduct of research/ethics, reference management tools, and experimental design. This course also provides a review of core microbiology concepts. Visiting lectures by resident faculty and program affiliates focus on career tracks, professional requirements, and industry standards. Students write, edit, and present a thesis and/or grant proposal. Prerequisite: MIC 230 or equivalent; admission to the Microbiology Graduate Program or Clinical Microbiology Graduate 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 have additional course requirements/expectations. Lect. 2, Dis. 1, Lab 3. Prerequisite: MIC 230 or equivalent; additional 300 or higher level MIC, BIO, or CHM course with a lab or equivalent. 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

This course is 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 have additional course requirements/expectations. Lect. 2, Lab 3. Prerequisite: MIC 230 and three semesters of college chemistry. 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 explores in-depth various ways that plants interact with microbes in the environment, at the macroscopic, cellular, and molecular levels. Case studies 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 have additional course requirements/expectations. Lect. 2, Lab 2. Prerequisite: BIO 203 or 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 458/558 Cr.2

**Research Deconstruction**

This course is an in-depth investigation of current and impactful biomedical, microbiology, or related research. Students listen to a high-level professional research seminar provided by an esteemed investigator. In the weeks following that seminar, students "deconstruct" the research and presentation, exploring topics such as important background information, hypotheses and controls, experimental methodology, and the results and conclusions from that work. Other topics may include discussion of presentation quality and style, graduate school and research experience, and career paths for MS and PhD graduates. All students interested in better understanding how research is performed are welcome and no prior research experience is required. This course is taught largely at an undergraduate level. Graduate students have additional course requirements/expectations. Offered Spring.

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 procaryotic and eucaryotic 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 are presented. Emphasis is 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 are examined. Prerequisite: MIC 407/507 or equivalent course; STAT 145 or PH 755. Offered Fall - Odd Numbered Years.

MIC 755 Cr.2

**Advanced Immunology**

This course is 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) are discussed. Prerequisite: MIC 310 and MIC 410/510, or equivalent. Offered Spring - Even 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.