MEDICAL MICROBIOLOGY AND IMMUNOLOGY (M M & I)

M M & I 301 – PATHOGENIC BACTERIOLOGY
2 credits.

Medically important bacteria, emphasizing the process of pathogenesis and host/parasite interactions, as well as intervention strategies, immunity and genetics as they apply to the pathogens.
Requisites: (BIOCORE 381 and 382), (ZOOLOGY/BIOLOGY 101 and 102), or ZOOLOGY/BIOLOGY/BOTANY 152
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2022
Learning Outcomes: 1. Identify and label parts of a bacterial cell and parts of bacterial genes and other genetic elements, and explain the function of thosefeatures to bacterial processes.
Audience: Undergraduate

2. Apply bacteriological and immunological concepts to draw conclusions about detection, treatment, and prevention of bacterial infection.
Audience: Undergraduate

3. Apply bacteriological and immunological concepts to draw conclusions about bacterial survival, proliferation, and transmission and humanhost responses including those leading to host damage.
Audience: Undergraduate

4. Demonstrate knowledge about the significance of historical discoveries in bacteriology and molecular biology.
Audience: Undergraduate

5. Demonstrate knowledge about specific bacterial pathogens and the diseases they cause including virulence mechanisms, distinctivebacterial and disease characteristics, and methods of disease prevention.
Audience: Undergraduate

M M & I 341 – IMMUNOLOGY
3 credits.

An introduction to the immune response to infectious disease. Examines the role of the host in host-parasite relationships using select microbial agents or antigens to illustrate the nonspecific and specific mechanisms of host defenses. Includes study of the nonspecific inflammatory response, the nature of microbial antigens, current concepts of antibody and cell-mediated immune reactions to infectious agents and the principles underlying the development of vaccines.
Requisites: ZOOLOGY/BIOLOGY 101 or ZOOLOGY/BIOLOGY/BOTANY 151 or BIOCORE 381
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2022
Learning Outcomes: 1. Identify the common types of immune cells and describe their main functions
Audience: Undergraduate

2. Summarize how innate and adaptive immune cells recognize antigens and other ligands
Audience: Undergraduate

3. Differentiate between cell-mediated and humoral immune responses
Audience: Undergraduate

4. Understand immunological pathways used to respond to specific challenges (e.g. viruses, bacteria, fungi, parasites)
Audience: Undergraduate

M M & I/ENTOM/PATH-BIO/ZOOLOGY 350 – PARASITOLOGY
3 credits.

The biology of water-borne, food-borne, soil-borne and vector-borne parasites of animals including humans. Parasites are explored in the context of transmission, associated disease, diagnosis and treatment options, and environmental, cultural and socioeconomic drivers of disease epidemiology.
Requisites: ZOOLOGY/BIOLOGY 101 and 102, or ZOOLOGY/BIOLOGY/BOTANY 152 or ZOOLOGY 153, or BIOCORE 381
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Be conversant in terminology used in the field of Parasitology.
Audience: Undergraduate

2. Recall scientific and common names for parasites and hosts, and the name of the resulting disease in humans or animals.
Audience: Undergraduate

3. Attribute parasite behavior and characteristics to specific disease features in the host.
Audience: Undergraduate

4. Identify appropriate means to diagnose infections with parasites.
Audience: Undergraduate

5. Describe and identify factors that determine when, where, and why parasitic diseases exist.
Audience: Undergraduate

6. Integrate terminology, scientific nomenclature, diagnostic features and demographics to solve case studies where the parasitic culprit is unknown.
Audience: Undergraduate

7. Compare and contrast commonalities in parasite life cycles to demonstrate how flexibility in those life cycles has resulted in many different potential means of transmission.
Audience: Undergraduate

8. Deconstruct the impact of parasitic diseases on human and animal health, from disease symptoms and pathology in an individual, to socioeconomics in communities and countries.
Audience: Undergraduate

9. Identify reliable resources (primarily internet-based) available for researching the biology and epidemiology parasitic diseases.
Audience: Undergraduate

M M & I/PATH-BIO 528 – IMMUNOLOGY
3 credits.

Development and functions of immune response in animals; a comprehensive study of experimental humoral and cellular immunity.
Requisites: (CHEM 104 or CHEM 109) and (ZOOLOGY/BIOLOGY 101, ZOOLOGY/BIOLOGY/BOTANY 151 or BIOCORE 383), or graduate/professional standing
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Identify lymphatic tissues and describe their functions
Audience: Undergraduate

2. Differentiate between innate and adaptive immune responses
Audience: Undergraduate

3. State the products of B and T cell activation in adaptive immunity
Audience: Undergraduate

4. Describe the steps in B and T cell activation and the immune mechanisms regulating their activity
Audience: Undergraduate

5. Explain how the adaptive immune system recognizes diverse antigens
Audience: Undergraduate

6. Summarize coordination of innate and adaptive immune responses in host defense against cancer and infectious diseases
Audience: Undergraduate

7. List examples of when the immune system goes awry (hypersensitivity, autoimmunity)
Audience: Undergraduate

8. Apply course concepts to design new therapies for cancer, infectious disease, or organ transplant
Audience: Undergraduate

M M & I 554 – EMERGING INFECTIOUS DISEASES AND BIOTERRORISM
2 credits.

Identification of analysis and solution of emerging infectious disease problems and the problems of bioterrorism.
Requisites: ZOOLOGY/BIOLOGY/BOTANY 152, ZOOLOGY/BIOLOGY 101, (BIOCORE 383 and M M & I 301), MICROBIO 101, MICROBIO 303, or graduate/professional standing.
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022
Learning Outcomes: 1. Explain the problems due to infectious diseases in the pre-antibiotic era and how this has changed today
Audience: Both Grad & Undergrad

2. Describe the factors of infectious disease emergence and provide a disease example for each
Audience: Both Grad & Undergrad

3. Address a new Emerging Infectious Disease outbreak by identifying the problem, the reason this problem arose, and what can be done about it
Audience: Graduate

M M & I/BIOCHEM 575 – BIOLOGY OF VIRUSES
2 credits.

Broad coverage of animal virology taught at molecular level. Topics include virus structure, viral replication/lifecycle, aspects of pathogenesis and prevention.
Requisites: (BIOCORE 381 and 382), ZOOLOGY/BIOLOGY/BOTANY 151, M M & I 301, or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Identify and recognize fundamental members of the predominant families of RNA and DNA viruses that affect animals (humans included) by causing viral diseases, including AIDS, cancer, flu, and COVID-19
Audience: Both Grad & Undergrad

2. Describe and demonstrate the basic concepts of virus particle structure and the biochemical mechanisms for entry and multiplication of diverse RNA and DNA viruses
Audience: Both Grad & Undergrad

3. Recognize and apply the basic principles of virus transmission and viral pathogenicity, combined with the factors that contribute to virus emergence and evolution, to situations involving virus outbreaks that affect global health
Audience: Both Grad & Undergrad

4. Identify and evaluate individual steps in a virus' replication cycle that can be effectively targeted by anti-viral drugs for pharmaceutical intervention of virus diseases
Audience: Both Grad & Undergrad

5. Design effective strategies for a) prevention of infection through development of viral vaccines and b) treatment of diverse human diseases by gene therapy through the design and administration of genetically engineered virus vectors
Audience: Both Grad & Undergrad

6. Use knowledge gained in lecture to critically assess primary literature and data presented in the weekly Molecular Virology Seminar Series
Audience: Graduate

M M & I/ONCOLOGY/PL PATH 640 – GENERAL VIROLOGY-MULTIPLICATION OF VIRUSES
3 credits.

The structure, multiplication, genetics, pathology and control of animal and plant viruses.
Requisites: (GENETICS 466 or 467) and (BIOCHEM 501 or 508) or graduate/professional standing
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Identify the major classes of viruses infecting animals and plants, and summarize their basic replication strategies.
Audience: Both Grad & Undergrad

2. Identify the major innate and adaptive antiviral immunity mechanisms of animals and plants, and examples of viral countermeasures against these.
Audience: Both Grad & Undergrad

3. Summarize the burdens and threats of viruses to public health, agriculture, etc.
Audience: Both Grad & Undergrad

4. Identify the major approaches and challenges to virus control at the single organism and host population levels, including why viruses are generally harder to control than bacteria, and major steps in developing new antiviral agents.
Audience: Both Grad & Undergrad

5. Illustrate beneficial uses of viruses and their genes in research, biotechnology and medicine.
Audience: Both Grad & Undergrad

6. Design and evaluate basic experiments to address specific questions in virology.
Audience: Both Grad & Undergrad

7. Read and evaluate primary literature papers in virology.
Audience: Graduate

M M & I/BOTANY/GENETICS/PL PATH 655 – BIOLOGY AND GENETICS OF FUNGI
3 credits.

Fungal genetics, genomics, and physiology using plant pathogenic fungi and the genetic models Aspergillus nidulans and Neurospora crassa as model systems to explore the current knowledge of fungal genetics and plant/fungal interactions.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2024
Learning Outcomes: 1. Demonstrate a basic understanding of fungal biology and genetics
Audience: Graduate

2. Analyze current research topics in fungal genetics/biology
Audience: Graduate

3. Identify members of the fungal research community
Audience: Graduate

4. Write and critique research grants
Audience: Graduate

5. Critique and discuss peer reviewed manuscripts
Audience: Graduate

6. Develop and deliver oral presentations (research paper and own research)
Audience: Graduate

7. Improve communication skills (oral and written)
Audience: Graduate

M M & I 677 – ADVANCED TOPICS IN MEDICAL MICROBIOLOGY
1-3 credits.

Specialized topics of current interest in medical microbiology.
Requisites: Graduate/professional standing
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2025
Learning Outcomes: 1. Identify and describe key theories, concepts, and methods in medical microbiology and immunology
Audience: Both Grad & Undergrad

2. Apply, analyze, or evaluate advanced theories, concepts, or methods in medical microbiology and immunology
Audience: Graduate

M M & I 691 – FIRST SEMESTER SENIOR THESIS
3 credits.

First semester independent study with the goal to do the preliminary research to write a senior thesis in Medical Microbiology Immunology.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2024
Learning Outcomes: 1. Identify a novel research question from the primary literature
Audience: Undergraduate

2. Develop a testable hypothesis around the novel research question
Audience: Undergraduate

3. Design experiments to test the hypothesis
Audience: Undergraduate

M M & I 692 – SECOND SEMESTER SENIOR THESIS
3 credits.

Second semester independent study with the goal to complete a senior thesis in Medical Microbiology Immunology.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2025
Learning Outcomes: 1. Execute and analyze data from designed experiments
Audience: Undergraduate

2. Develop the next testable hypothesis from the primary data from the experiments
Audience: Undergraduate

3. Write an honors thesis describing the gap in knowledge, the hypothesis addressing the gap in knowledge and the results of the experiments designed to test the hypothesis
Audience: Undergraduate

M M & I 696 – CRITICAL THINKING IN MEDICAL MICROBIOLOGY AND IMMUNIOLOGY
3 credits.

Present assigned research papers from journals for critical evaluation. Write critiques of each paper evaluating the paper's introduction, methods, results, and discussion sections.
Requisites: M M & I 301 and 341
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022
Learning Outcomes: 1. Articulate next-generation, DNA and RNA sequencing approaches and critically review their use in immune system studies
Audience: Both Grad & Undergrad

2. Describe proteomic techniques and their immune applications
Audience: Both Grad & Undergrad

3. Interpret the use of metabolomics in immunometabolism research
Audience: Both Grad & Undergrad

4. Explain technological advances that allow us to analyze complex immune systems at the single-cell level
Audience: Both Grad & Undergrad

5. Design omics experiments for immunology research
Audience: Graduate

M M & I 699 – DIRECTED STUDY
1-3 credits.

Independent research in medical microbiology and immunology for undergraduates under the supervision of MMI faculty. Carry out literature reviews and laboratory bench work on an independent project; participate in laboratory meetings; and produce some written presentation of the work, usually in the form of a poster presentation at a local or national meeting.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2026
Learning Outcomes: 1. Apply concepts learned in coursework to real life situations
Audience: Both Grad & Undergrad

2. Read and effectively search scientific literature
Audience: Both Grad & Undergrad

3. Develop critical, analytical, and independent thinking skills
Audience: Both Grad & Undergrad

4. Develop independent scientific research development skills
Audience: Graduate

M M & I 704 – INFECTIOUS DISEASES OF HUMAN BEINGS
3 credits.

Pathogenesis, clinical descriptions, and prevention.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Describe the epidemiology, pathogenesis, and clinical presentation of the key infectious disease syndromes presented and relate these diseases with their causative agents
Audience: Graduate

2. Explain how key infectious diseases are diagnosed and treated
Audience: Graduate

3. Explain how key infectious diseases impact patient health and public health, and describe how they can be prevented
Audience: Graduate

4. Discuss the basic pharmacologic concepts of antimicrobial drug therapy and be able to apply these concepts in clinical infectious disease settings
Audience: Graduate

5. Explain the role of the clinical microbiology laboratory in the identification and treatment of infectious diseases
Audience: Graduate

M M & I 740 – MECHANISMS OF MICROBIAL PATHOGENESIS
3 credits.

Host-pathogen relationships in microbial diseases.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Demonstrate understanding of the fundamentals of conserved strategies for bacterial pathogenesis across human, animal and plan pathogens
Audience: Graduate

2. Be able to critically read and review primary research literature in bacterial pathogenesis
Audience: Graduate

3. Develop grant writing skills
Audience: Graduate

4. Demonstrate understanding of how NIH grant review and study sections work and be able to critically review peer grants
Audience: Graduate

M M & I/PATH-BIO 750 – HOST-PARASITE RELATIONSHIPS IN VERTEBRATE VIRAL DISEASE
3 credits.

Detailed study of the pathogenesis of vertebrate viral disease, stressing viral invasion, dissemination, mechanisms of disease production, immune pathology, persistence, resistance, and transmission.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2025
Learning Outcomes: 1. Demonstrate understanding of mechanisms involved in pathogenesis of viral infections
Audience: Graduate

2. Obtain experience in critically reading scientific research
Audience: Graduate

3. Enhance scientific presentation skills
Audience: Graduate

4. Design and prepare funding applications for research projects in viral pathogenesis
Audience: Graduate

M M & I 760 – QUANTITATIVE SYSTEMS BIOLOGY AND DISEASE
3 credits.

An overview of methods used in quantitative systems biology, with a focus on biochemical systems relevant to the study of host-pathogen interactions, disease and microbial communities.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2025
Learning Outcomes: 1. Recognize biochemical systems and pathways relevant to the study of host-pathogen interactions, disease, and microbes and microbial communities.
Audience: Graduate

2. Develop mathematical models of biochemical systems by integrating basic mathematical and engineering concepts with principals from biochemistry, cellular and molecular biology, and immunology.
Audience: Graduate

3. Translate molecular pathways relevant to immunity and disease into computational models and simulations.
Audience: Graduate

4. Gain a working knowledge of resources and databases available for systems biology modeling and simulation.
Audience: Graduate

5. Use programming tools (e.g., MATLAB, Python) to implement and test a systems biology model.
Audience: Graduate

M M & I 770 – CURRENT TOPICS IN IMMUNOLOGY RESEARCH AND APPLICATIONS FOR HEALTH AND DISEASE
3 credits.

Designed to provide an overview of current immunology research and applications. Explores current advances and applications in immunology research including: adaptive immunity, innate immunity, mucosal immunology, autoimmunity, host-microbe interactions, and cancer immunology.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Develop knowledge of current immunology research areas and advances in both health and disease
Audience: Graduate

2. Describe common mechanisms by which immune dysfunction contributes to the pathophysiology of disease, including autoimmunity and cancer.
Audience: Graduate

3. Develop knowledge of cutting-edge research findings and common approaches to developing new treatments for immune related disorders.
Audience: Graduate

4. Evaluate primary immunology-related research articles and demonstrate critical reasoning with regards to methods and conclusions.
Audience: Graduate

5. Design new and feasible research directions at the cutting edge of immunology research by integrating instruction material and personally-researched scientific texts to formulate individual thoughts on topics not directly covered in lecture.
Audience: Graduate

M M & I 901 – SEMINAR
1 credit.

Seminar series led by MMI faculty members.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2026
Learning Outcomes: 1. Gain overall breadth of knowledge in microbiology
Audience: Graduate

2. Provide a platform for student interaction with invited faculty from UW-Madison and other institutions
Audience: Graduate

3. Develop skills for communicating complex ideas in a clear and understandable manner
Audience: Graduate

M M & I 902 – THE ROLE OF THE HUMAN MICROBIOME IN HEALTH AND DISEASE
2 credits.

The human microbiome can profoundly influence the balance between health and disease. Advances in next-generation sequencing technology and bioinformatics enabled the detailed study of the trillions of microorganisms living in us and on us and their associations with both healthy and disease conditions. Current state of the art approaches to study the microbiome through examples of human diseases with a known microbiome component. Critically assess the microbiome literature and design clinical studies aiming to include the microbiome as a variable. Bioinformatics tools required to study complex microbial communities by reproducing published datasets from human patients and learn ecological concepts to interpret results in a clinically meaningful way.
Requisites: MED SC-M 810, 811, 812, and 813
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Demonstrate a clear understanding of the current literature regarding the human microbiome and its role in health.
Audience: Graduate

2. Compare and contrast current state-of-the art methodologies to study the human microbiome and further demonstrate the ability to apply this knowledge to critically assess clinical study outcomes involving microbiome data.
Audience: Graduate

3. Describe and explain how basic bioinformatic pipelines are used to analyze and interpret microbiome data.
Audience: Graduate

4. Apply learned ecological concepts to the analysis of a real human microbiome dataset generated by researchers at the UW-Madison.
Audience: Graduate

5. Design a human microbiome study, clearly defining possible endpoints and inherent limitations.
Audience: Graduate

M M & I 911 – MICROBIOLOGY DIAGNOSTICS IN PUBLIC HEALTH
2 credits.

Learn firsthand how a public health lab handles testing. Learn about the different areas of testing in the lab from the experts and how we work with the CDC and clinical labs for surveillance, diagnostics, and outbreak response. Useful training for diagnostic testing and those that will order these tests in their practice.
Requisites: MED SC-M 810, 811, 812, and 813
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Describe the different testing areas of the Communicable Disease Division at the Wisconsin State Laboratory of Hygiene (WSLH).
Audience: Graduate

2. Describe the basics of common diagnostic test methods like PCR, sequencing, culture, and serology. Interpret test results and understand the limitations of those tests.
Audience: Graduate

3. Describe how the WSLH works with epidemiologists to identify outbreaks of disease.
Audience: Graduate

4. Describe how the WSLH works between clinical labs and the CDC for public health.
Audience: Graduate

M M & I 990 – RESEARCH AND THESIS
1-12 credits.

Carry out an independent research project that represents novel science in the chosen area under the guidance of an MMI faculty member. Evidence of success is measured by publication of results as first-authored papers in peer-reviewed papers.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2026
Learning Outcomes: 1. Exhibit a broad understanding of general medical microbiology and/or immunology principles
Audience: Graduate

2. Conduct independent research using a variety of approaches
Audience: Graduate

3. Think critically to address research challenges
Audience: Graduate

4. Exhibit and foster professional and ethical conduct in research
Audience: Graduate

5. Collaborate with other investigators within or outside the thesis lab
Audience: Graduate