

MAJOR IN MEDICAL MICROBIOLOGY AND INFECTIOUS DISEASE

Microbiology is the study of organisms, many of which are too small to be seen with the naked eye, including fungi, protists, and bacteria, as well as acellular agents such as viruses and prions. Microbiology emerged as a distinct science in the late nineteenth century, with the discovery that microorganisms are the cause of many infectious diseases, and that they play essential roles in ecosystems (such as the microbiome) and in industrial processes. Much work in this field is directed toward the cure, control, or eradication of disease in humans and animals, as well as understanding how microbes support health and life. Genetically engineered microorganisms can also be used for the production of improved foods, new drugs and vaccines, and for removing toxic wastes and spills from the environment. Unfortunately, some microbes have received considerable attention as potential agents of bioterrorism and biowarfare, and consequently much work is being done to counter such threats.

Students completing the undergraduate Microbiology major acquire knowledge and laboratory skills in the structure, physiology, genetics, pathogenicity, ecology, and taxonomy of microorganisms, as well as immunological techniques. Students engage in authentic hypothesis-driven research problems in inquiry-based laboratory courses. Required courses in biological sciences, chemistry, physics, and mathematics support the major. Ample opportunities exist for undergraduates to obtain laboratory research experience and many student researchers have presented at conferences and have been awarded research grants or fellowships.

A Bachelor of Science degree in Medical Microbiology & Infectious Disease prepares graduates well for continued education in a professional or graduate degree program or for employment in the field.

Learning Objectives

Upon successful completion of this major, students will be able to:

1. Demonstrate comprehensive knowledge of microbial biology and diversity, explaining the structure, function, genetics, metabolism, and diversity of microorganisms (bacteria, viruses, fungi, parasites) and their roles in health, disease, and biotechnology.
2. Explain host–pathogen interactions and mechanisms of infectious disease, describing how pathogens adhere, invade, replicate, produce toxins, and evade host defenses, and how these processes relate to clinical disease.
3. Apply principles of immunology to understand defense against infection, explaining innate and adaptive immune components, their roles in recognizing and eliminating pathogens, and how immune dysfunction contributes to infectious and immune-mediated disease.
4. Perform laboratory techniques for microbial identification and analysis, demonstrating proficiency in aseptic technique, cultivation, staining, microscopy, biochemical and serological assays, molecular/diagnostic methods, and safe handling of infectious agents.
5. Analyze and interpret microbiological and immunological data, designing or evaluating experiments, applying appropriate quantitative/statistical methods, interpreting assay results, and

critically evaluating primary literature in microbiology and infectious diseases.

6. Describe the transmission, prevention, and control of infectious diseases, explaining major routes of transmission, basic outbreak/infection concepts, and strategies such as vaccines, antimicrobials, infection control, and antimicrobial stewardship.
7. Communicate microbiological concepts and research findings effectively, producing clear written reports, oral presentations, and visual materials tailored to scientific, clinical, and lay audiences.
8. Apply ethical reasoning and biosafety principles in microbiology practice, following biosafety protocols, regulatory and ethical guidelines (including equity and social determinants of health), and demonstrating professionalism and responsible conduct.