

# Microbiology (MICR)

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**MICR 189. Skills for Academic Success. 1 Credit.**

This course is designed to ease the transition for new students at NDSU. Students will learn skills and techniques used by successful college students. In addition to introducing the students to campus resources and governance, topics will include study techniques, time management, test taking, note taking, goal setting, wellness, stress management, and career orientation.

**MICR 194. Individual Study. 1-5 Credits.****MICR 196. Field Experience. 1-15 Credits.****MICR 199. Special Topics. 1-5 Credits.****MICR 202. Introductory Microbiology. 2 Credits.**

Study of the characteristics and importance of microorganisms with emphasis on their identification, control, and relationships to health and disease. Not for microbiology majors.

**MICR 202L. Introductory Microbiology Lab. 1 Credit.**

Study of the characteristics and importance of microorganisms with emphasis on their identification, control, and relationships to health and disease. Not for microbiology majors.

**MICR 291. Seminar. 1-3 Credits.****MICR 292. Global Practicum: Study Abroad. 1-15 Credits.**

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

**MICR 294. Individual Study. 1-5 Credits.****MICR 299. Special Topics. 1-5 Credits.****MICR 350. General Microbiology. 3 Credits.**

Principles of microbiology for students requiring a rigorous professionally oriented course. This course is a prerequisite to most microbiology courses. Topics, as applied to an overview of microorganisms, include structure, physiology, metabolism, growth, genetics, ecology, pathogenesis, immunology, immunization, and infectious disease treatment/prevention. Prereq: BIOL 151 and CHEM 122.

**MICR 350L. General Microbiology Lab. 2 Credits.**

Principles of microbiology for students requiring a rigorous professionally-oriented course. Prereq: BIOL 150 and CHEM 122.

**MICR 352L. General Microbiology Lab II. 2 Credits.**

Application of principles of microbiology introduced in General Microbiology II using advanced microbiology techniques and tools. Prereq: MICR 350L. Coreq: MICR 352.

**MICR 352. General Microbiology II. 3 Credits.**

Further exploration and application of microbiological concepts introduced in MICR 350 in a manner that develops skills important for successful completion of a microbiology degree and success in careers related to microbiology. Prereq: MICR 350.

**MICR 354. Scientific Writing. 3 Credits.**

This course will emphasize the qualities of sound logic, good structure, and honesty in writing journal articles and science pieces for popular press. Prereq: ENGL 120, MICR 350, junior standing. Satisfies upper-division writing requirement.

**MICR 373. Equine Health Management. 1 Credit.**

This course introduces the student to learning through a case-based approach to equine disease. Case material highlights equine health problems seen in the Midwest. Case questions encourage students to think about disease prevention, management and eradication. Prereq: ANSC 114 and VETS 135.

**MICR 379. Global Seminar. 1-6 Credits.**

NDSU instructed experience or field study in a foreign country. Conducted in English for residence credit. Pre-requisite: Prior approval by International Student and Study Abroad Services and major department. May be repeated. Standard Grading.

**MICR 391. Seminar. 1-3 Credits.****MICR 392. Global Practicum: Study Abroad. 1-15 Credits.**

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

**MICR 394. Individual Study. 1-5 Credits.**

**MICR 397. Fe/Coop Ed/Internship. 1-4 Credits.**

**MICR 399. Special Topics. 1-5 Credits.**

**MICR 445. Animal Cell Culture Techniques. 2 Credits.**

Methods of animal cell culture propagation and uses for cell culture systems. {Also offered for graduate credit - see MICR 645.}

**MICR 450L. Infectious Disease Pathogenesis Laboratory. 2 Credits.**

This course will explore laboratory-based activities specifically designed for the microbiology major. {Also offered at the graduate level as MICR 650L.}

**MICR 450. Infectious Disease Pathogenesis. 3 Credits.**

Students will study mechanisms of bacterial, viral, fungal, and parasitic pathogenesis and the immune response to pathogens. Prereq: MICR 350 or 460/660 or 470/670. {Also offered for graduate credit - see MICR 650.}

**MICR 452. Microbial Ecology. 3 Credits.**

Study of the relationships between microbes and the physical, chemical, and biotic components of their environments. The role of microbes in nutrient cycling, bioremediation, biocontrol, biological waste treatment, fuel production, and energy recovery. Prereq: MICR 350, MICR 350L. {Also offered for graduate credit - see MICR 652.}

**MICR 453. Food Microbiology. 3 Credits.**

Study of the nature, physiology, and interactions of microorganisms in foods. Introduction to foodborne diseases, effects of food processing on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Prereq: MICR 350L. {Also offered for graduate credit - see MICR 653.}

**MICR 460L. Pathogenic Microbiology Laboratory. 2 Credits.**

Isolation and identification of pathogenic microorganisms. Prereq: MICR 350L. {Also offered for graduate credit - see MICR 661.}

**MICR 460. Pathogenic Microbiology. 3 Credits.**

Study of the microorganisms that cause disease and of disease processes. Prereq: MICR 202 or 350. {Also offered for graduate credit - see MICR 660.}

**MICR 463. Clinical Parasitology. 2 Credits.**

A study of protozoan and helminthic parasites of humans, with an emphasis on clinical identification, life histories, and control. Prereq: BIOL 150, BIOL 150L. {Also offered for graduate credit - see MICR 663.}

**MICR 470. Basic Immunology. 3 Credits.**

An overview of the role of the immune system including the functions of humoral and cell-mediated immunity in health and disease. Prereq: MICR 350. {Also offered for graduate credit - see MICR 670.}

**MICR 471. Immunology and Serology Laboratory. 2 Credits.**

Basic immunological and serological procedures. Prereq or Co-req: MICR 350 and MICR 350L. {Also offered for graduate credit - see MICR 671.}

**MICR 472. Clinical Immunology. 3 Credits.**

Concepts in immunology including special attention to clinical conditions that may appear as a result of immune system activity. Prereq: MICR 470. {Also offered for graduate credit - see MICR 672.}

**MICR 475. Virology. 3 Credits.**

The biology of viruses with emphasis on virus replication and pathogenesis. Co-req: MICR 470. {Also offered for graduate credit - see MICR 675.}

**MICR 480. Microbial Physiology. 3 Credits.**

This class will explore the composition and function of eubacterial and archaeobacterial cell structure. Further functional exploration will go into nutrient transport in bacteria, principles of energy-yielding carbohydrate metabolism, bacterial fermentation, respiration, and gene regulations of metabolic pathways. Topics such as biofilms, quorum sensing, and the microbiome will be used to apply physiological concepts. Prereq: MICR 350, MICR 350L. Co-req: BIOC 460. {Also offered for graduate credit - see MICR 680.}

**MICR 481. Microbial Genomics with Computational Laboratory. 3 Credits.**

Microbial genome science with additional emphasis on microbial evolution and environmental science. Topics include: i) genomic diversity, ii) the consequences of horizontal gene transfer, iii) single cell and population genomics, and iv) environmental metagenomics. Recommended: STAT 330. Prereq: BIOL/PLSC 315. {Also offered for graduate credit - see MICR 681.}

**MICR 482. Microbial Genetics. 3 Credits.**

Microbial genetics will explore gene identification, mutation, DNA repair, gene transfer, recombination, bacteriophage genetics, and gene regulation. Topics such as bacterial antibiotic resistance, genetic testing and manipulation for biotechnological applications will be used to apply genetic concepts. Prereq: MICR 350. Coreq: BIOC 460. {Also offered for graduate credit - see MICR 682.}

**MICR 485. Capstone Experience in Microbiology - Experimental Design. 1 Credit.**

The capstone experience is the culmination of earlier course work that will allow students to integrate their knowledge of microbiology. The experimental design course will focus on using the scientific method to design and propose a group research project. Prereq: MICR 352, MICR 352L and Microbiology majors only.

**MICR 486. Capstone Experience in Microbiology - Research Project. 2 Credits.**

The capstone experience is the culmination of earlier course work that will allow students to integrate their knowledge of microbiology. The research project course will focus on implementation of the experiments proposed in the experimental design course. Prereq: MICR 485 and Microbiology majors only.

**MICR 491. Seminar. 1-5 Credits.****MICR 492. Global Practicum: Study Abroad. 1-15 Credits.**

Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P' or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

**MICR 493. Undergraduate Research. 1-5 Credits.****MICR 494. Individual Study. 1-5 Credits.****MICR 496. Field Experience. 1-15 Credits.****MICR 497. FE/Coop Ed/Internship. 1-15 Credits.****MICR 499. Special Topics. 1-5 Credits.****MICR 645. Animal Cell Culture Techniques. 2 Credits.**

Methods of animal cell culture propagation and uses for cell culture systems. {Also offered for undergraduate credit - see MICR 445.}

**MICR 650L. Infectious Disease Pathogenesis Laboratory. 2 Credits.**

This course will explore laboratory-based activities specifically designed for the microbiology major. {Also offered at the undergraduate level as MICR 450L.}

**MICR 650. Infectious Disease Pathogenesis. 3 Credits.**

Students will study mechanisms of bacterial, viral, fungal, and parasitic pathogenesis and the immune response to pathogens. Prereq: MICR 660 or MICR 670. {Also offered for undergraduate credit - see MICR 450.}

**MICR 652. Microbial Ecology. 3 Credits.**

Study of the relationships between microbes and the physical, chemical, and biotic components of their environments. The role of microbes in nutrient cycling, bioremediation, biocontrol, biological waste treatment, fuel production, and energy recovery. {Also offered for undergraduate credit - see MICR 452.}

**MICR 653. Food Microbiology. 3 Credits.**

Study of the nature, physiology, and interactions of microorganisms in foods. Introduction to foodborne diseases, effects of food processing on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. {Also offered for undergraduate credit - see MICR 453.}

**MICR 660. Pathogenic Microbiology. 3 Credits.**

Study of the microorganisms that cause disease and of disease processes. {Also offered for undergraduate credit - see MICR 460.}

**MICR 661. Pathogenic Microbiology Lab. 2 Credits.**

Isolation and identification of pathogenic microorganisms. {Also offered for undergraduate credit - see MICR 460L.}

**MICR 663. Clinical Parasitology. 2 Credits.**

A study of protozoan and helminthic parasites of humans, with an emphasis on clinical identification, life histories, and control. {Also offered for undergraduate credit - see MICR 463.}

**MICR 670. Basic Immunology. 3 Credits.**

An overview of the role of the immune system including the functions of humoral and cell-mediated immunity in health and disease. {Also offered for undergraduate credit - see MICR 470.}

**MICR 671. Immunology and Serology Laboratory. 2 Credits.**

Basic immunological and serological procedures. {Also offered for undergraduate credit - see MICR 471.}

**MICR 672. Clinical Immunology. 3 Credits.**

Concepts in immunology including special attention to clinical conditions that may appear as a result of immune system activity. {Also offered for undergraduate credit - see MICR 472.}

**MICR 675. Virology. 3 Credits.**

The biology of viruses with emphasis on virus replication and pathogenesis. {Also offered for undergraduate credit - see MICR 475.}

**MICR 680. Microbial Physiology. 3 Credits.**

This class will explore the composition and function of eubacterial and archaeobacterial cell structure. Further functional exploration will go into nutrient transport in bacteria, principles of energy-yielding carbohydrate metabolism, bacterial fermentation, respiration, and gene regulations of metabolic pathways. Topics such as biofilms, quorum sensing, and the microbiome will be used to apply physiological concepts. {Also offered for undergraduate credit - see MICR 480.}

**MICR 681. Microbial Genomics with Computational Laboratory. 3 Credits.**

Microbial genome science with additional emphasis on microbial evolution and environmental science. Topics include: i) genomic diversity, ii) the consequences of horizontal gene transfer, iii) single cell and population genomics, and iv) environmental metagenomics. {Also offered for undergraduate credit - see MICR 481.}.

**MICR 682. Microbial Genetics. 3 Credits.**

Microbial genetics will explore gene identification, mutation, DNA repair, gene transfer, recombination, bacteriophage genetics, and gene regulation. Topics such as bacterial antibiotic resistance, genetic testing and manipulation for biotechnological applications will be used to apply genetic concepts. {Also offered for undergraduate credit - see MICR 482.}.

**MICR 690. Graduate Seminar. 1-3 Credits.**

**MICR 695. Field Experience. 1-15 Credits.**

**MICR 696. Special Topics. 1-5 Credits.**

**MICR 722. International Health Systems, Policy and Biosecurity. 2 Credits.**

This course will provide students with the necessary information to understand international health regulations and the potential implications on animal health, human health, global trade and food safety.

**MICR 723. International Animal Production, Disease Surveillance and Public Health. 3 Credits.**

The course will enable students to appreciate tropical animal production, food safety & public health from a developing country's perspective, prepare them for global career opportunities, foster an international perspective and understanding of diverse systems.

**MICR 724. Applied Epidemiology and Biostatistics. 3 Credits.**

This course will enable the students to get an understanding of how to apply epidemiological tools in study designs data management and analysis. Students will create or use existing databases and learn data management and analysis using software such as EPIINFO.

**MICR 752. Advanced Topics in Food Safety Microbiology. 3 Credits.**

Overview of food systems and in-depth evaluation of microbiological food safety concerns with an emphasis on public health aspects of detecting, tracking, and controlling pathogens in the food supply.

**MICR 756. Advanced Topics in Public Health Microbiology. 3 Credits.**

Through the use of case-based learning, students explore several key areas of public health microbiology. Case questions encourage students to think about disease prevention, management and eradication. Students will be expected to read and research information on each case and answer discussion questions.

**MICR 762. Advanced Pathogenic Bacteriology. 3 Credits.**

Biophysical and biochemical mechanisms by which microorganisms cause infectious disease and host reactions to the disease.

**MICR 767. Critical Thinking for the Life Sciences. 3 Credits.**

This course is designed to impart critical thinking skills to graduate students in the life sciences. Topics such as information retrieval, problem-solving, Socratic questioning and logical fallacies in sciences will be covered by in-class work shops and application-based assignments.

**MICR 770. Immunology of Chronic Infections. 3 Credits.**

A study of the host's response to chronic infections, which is illustrated using a framework of diseases of worldwide importance that present different pathologies and outcomes. Prereq: MICR 670.

**MICR 775. Molecular Virology. 3 Credits.**

An in-depth study of current areas of research on human and animal viruses. The replication, pathogenesis, diagnosis, prevention, and control of viruses using contemporary molecular and cellular biology approaches will be examined. Prereq: MICR 660, MICR 670, MICR 675.

**MICR 781. Advanced Bacterial Physiology. 3 Credits.**

In-depth consideration of various topics in bacterial physiology such as autotrophy, bacterial growth and growth yields, energy-yielding metabolism, and regulation of catabolic pathways. Prereq: MICR 680.

**MICR 782. Molecular Microbiological Techniques. 3 Credits.**

Familiarize students with current molecular and immunologic strategies and techniques commonly used to study infectious disease processes.

**MICR 783. Advanced Bacterial Genetics and Phage. 3 Credits.**

Mechanisms of genetic rearrangement and regulation in bacteria and phage. Recombinant DNA. Prereq: MICR 682.

**MICR 785. Pathobiology. 3 Credits.**

A comprehensive understanding of the molecular mechanisms that underlie disease pathogenesis and lesion development. Investigation and presentation on mechanisms underlying a specific disease entity of either human or animal origin. Prereq: MICR 660.

**MICR 790. Graduate Seminar. 1-3 Credits.**

**MICR 791. Temporary/Trial Topics. 1-5 Credits.**

**MICR 792. Graduate Teaching Experience. 1-6 Credits.**

**MICR 793. Individual Study/Tutorial. 1-5 Credits.**

**MICR 794. Practicum/Internship. 1-8 Credits.**

**MICR 795. Field Experience. 1-15 Credits.**

**MICR 796. Special Topics. 1-5 Credits.**

**MICR 797. Master's Paper. 1-3 Credits.**

**MICR 798. Master's Thesis. 1-10 Credits.**

**MICR 801. Foundation in Microbiology Research I. 4 Credits.**

A study of the scientific process and the principles and applications of microbiology in the areas of cell structure and function, pathways and transformations, and information flow.

**MICR 802. Foundation in Microbiology Research II. 4 Credits.**

A study of the principles and applications of microbiology in the areas of genomics, evolution, ecology, and infectious disease.

**MICR 892. Graduate Teaching Experience. 1-6 Credits.**

**MICR 893. Individual Study/Tutorial. 1-5 Credits.**

**MICR 899. Doctoral Dissertation. 1-15 Credits.**