

Microbiology (MICR)

MICR 100. Famine, Plague, and Cheese. Microbes: the cause and solution to the world's problems. 3 Credits.

In alignment with the United Nations Sustainable Development Goals for global prosperity, discover how microbes impact health, agriculture, and the environment, and learn about careers in microbiology, biotechnology, and genetic engineering that are changing the world.

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 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 401. The Science Toolkit: Skills for Scientific Success. 3 Credits.

This course builds on the concepts introduced in introductory science classes but broadens the scope to encompass essential skills for success in science-related fields. The course emphasizes critical thinking, scientific literacy, research skills, and professional communication. Students will engage in active learning, group collaboration, and case-based problem-solving to develop practical competencies essential for scientific inquiry and professional growth. Prereq or Coreq: Complete a minimum of 45 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 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. 2 Credits.

Study of the nature, physiology, and interactions of microorganisms in foods. Introduction to foodborne diseases, effects of food processing on the microbiota of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Dual-listing: MICR 653.

MICR 453L. Food Microbiology Laboratory. 1 Credit.

Study of practical aspects of food microbiology, including fermentation, food conservation, sustainable agricultural practices, and biotechnology applications. Tour food processing facilities, including produce, meat, alcohol, and others and food microbiology research at the USDA. It is recommended that students take MICR 453 at the same time as MICR 453L. Dual-listing: MICR 653L.

MICR 454. Biotechnology for Sustainability. 1 Credit.

Biotechnology for Sustainability explores how biotechnology addresses global challenges like climate change, food security, and environmental health. Students will learn about genetic engineering, synthetic biology, and bioremediation, applying these tools to design innovative, sustainable solutions for agriculture, industry, and waste management. Dual-listing: MICR 654.

MICR 455. Microbial Biotechnology. 3 Credits.

Students will explore how microbes are used to solve problems in industry, environment, agriculture, food production, and medicine. Emphasis will be placed on biotechnological techniques utilizing microbes, careers that employ these techniques, and how these techniques are used to impact global problems. Prereq: MICR 350. {Also offered for graduate credit - see MICR 655.}.

MICR 456. Human Microbiome. 1 Credit.

This course explores the dynamic and complex world of the human microbiome, focusing on its role in health, disease, and emerging therapeutic interventions. Topics include the microbiome's influence on the immune system, gut-brain axis, metabolism, and its applications in personalized medicine. Students will analyze recent scientific literature and engage in discussions about the ethical and societal implications of microbiome research. Prereq: MICR 350. Dual-listing: MICR 656.

MICR 457. Microbiomes: Agriculture and Environmental Resilience. 1 Credit.

This course explores the critical role of microbiomes in enhancing agricultural sustainability. Students will examine the interactions between microbial communities, plants, and soil, focusing on how these relationships can improve crop yields, soil health, and ecosystem resilience. The course emphasizes scientific principles, practical applications, and innovative technologies involving microbiomes in sustainable farming practices. Prereq: MICR 350. Dual-listing: MICR 657.

MICR 458. Animal Health and Antimicrobial Resistance (AMR). 1 Credit.

Animal Health and Antimicrobial Resistance (AMR) is designed to teach the fundamental concepts of AMR, its impact on animal health, and its spread from food production animals to humans and the wider environment. The specific topics covered in this course include AMR and One Health, AMR and mechanisms through which pathogenic bacteria acquire AMR genes, antibiotics used in livestock production, Food-producing and pet animal-associated zoonotic pathogens, and tools to study and survey AMR in veterinary medicine, as well as antibiotic alternative approaches. In addition, the relationship between animal microbiome and AMR will also be introduced. Prereq: MICR 350. Dual-listing: MICR 658.

MICR 460. Microbial Pathogenesis. 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 460L. Microbial Pathogenesis Laboratory. 2 Credits.

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

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 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 477. Vaccinology. 3 Credits.

Vaccinology introduces the basic biological principles governing vaccinology, emphasizing vaccine development and testing, immunity, manufacture, and clinical aspects in veterinary and human medicine. Prereq: MICR 350. Cross-listed with PH 477. Dual-listing: MICR 677 and PH 677.

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 I: Reflecting and Planning. 1 Credit.

The capstone experience is the reflection of earlier coursework that will allow students to integrate their knowledge. Students will spend time reflecting on their degree progress, plan and prepare for the transition from undergraduate to their next step, and create a prospectus that outlines their capstone experience.

MICR 486. Capstone Experience II: Reflection and Dissemination. 1 Credit.

Students will support each other through peer mentoring activities and reflect on their capstone experience in relation to the outlined goals. The course culminates in the dissemination of the knowledge gained from their experience at a designated event open to the department. Prereq: MICR 485.

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 601. The Science Toolkit: Skills for Scientific Success. 3 Credits.**

This course broadens the scope of understanding science to encompass essential skills for success in science-related fields. The course emphasizes critical thinking, scientific literacy, research skills, and professional communication. Students will engage in active learning, group collaboration, and case-based problem-solving to develop practical competencies essential for scientific inquiry and professional growth. Dual-listing: MICR 401.

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 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 653L. Food Microbiology Laboratory. 1 Credit.

Study of practical aspects of food microbiology, including fermentation, food conservation, sustainable agricultural practices, and biotechnology applications. Tour food processing facilities, including produce, meat, alcohol, and others and food microbiology research at the USDA. Coreq: MICR 653. Dual-listing: MICR 453L.

MICR 653. Food Microbiology. 2 Credits.

Study of the nature, physiology, and interactions of microorganisms in foods. Introduction to foodborne diseases, effects of food processing on the microbiota of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Dual-listing: MICR 453.

MICR 654. Biotechnology for Sustainability. 1 Credit.

Biotech for Sustainability explores how biotechnology addresses global challenges like climate change, food security, and environmental health. Students will learn about genetic engineering, synthetic biology, and bioremediation, applying these tools to design innovative, sustainable solutions for agriculture, industry, and waste management. Dual-listing: MICR 454.

MICR 655. Microbial Biotechnology. 3 Credits.

Students will explore how microbes are used to solve problems in industry, environment, agriculture, food production, and medicine. Emphasis will be placed on biotechnological techniques utilizing microbes, careers that employ these techniques, and how these techniques are used to impact global problems. {Also offered for graduate credit - see MICR 655.}.

MICR 656. Human Microbiome. 1 Credit.

This course explores the dynamic and complex world of the human microbiome, focusing on its role in health, disease, and emerging therapeutic interventions. Topics include the microbiome's influence on the immune system, gut-brain axis, metabolism, and its applications in personalized medicine. Students will analyze recent scientific literature and engage in discussions about the ethical and societal implications of microbiome research. Prereq: MICR 350. Dual-listing: MICR 456.

MICR 657. Microbiomes: Agriculture and Environmental Resilience. 1 Credit.

This course explores the critical role of microbiomes in enhancing agricultural sustainability. Students will examine the interactions between microbial communities, plants, and soil, focusing on how these relationships can improve crop yields, soil health, and ecosystem resilience. The course emphasizes scientific principles, practical applications, and innovative technologies involving microbiomes in sustainable farming practices. Dual-listing: MICR 457.

MICR 658. Animal Health and Antimicrobial Resistance (AMR). 1 Credit.

Animal Health and Antimicrobial Resistance (AMR) is designed to teach the fundamental concepts of AMR, its impact on animal health, and its spread from food production animals to humans and the wider environment. The specific topics covered in this course include AMR and One Health, AMR and mechanisms through which pathogenic bacteria acquire AMR genes, antibiotics used in livestock production, Food-producing and pet animal-associated zoonotic pathogens, and tools to study and survey AMR in veterinary medicine, as well as antibiotic alternative approaches. In addition, the relationship between animal microbiome and AMR will also be introduced. Dual-listing: MICR 458.

MICR 660. Microbial Pathogenesis. 3 Credits.

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

MICR 661. Microbial Pathogenesis 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 675. Virology. 3 Credits.

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

MICR 677. Vaccinology. 3 Credits.

Vaccinology introduces the basic biological principles governing vaccinology, emphasizing vaccine development and testing, immunity, manufacture, and clinical aspects in veterinary and human medicine. Cross-listed with PH 677. Dual-listing: MICR 477.

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 701. Introduction to Graduate Research. 1-3 Credits.

This course is designed to help students transition to their graduate careers in microbiological sciences. Emphasis is placed on planning for success in graduate school, career planning, familiarity with the process of research, rotations with faculty in the department, cohort building, self-efficacy, and mental health.

MICR 720. Scientific Integrity. 1 Credit.

A survey of contemporary issues relating to responsible conduct in research including academic integrity, mentoring, scientific record keeping, and genetic technology. Class sessions will involve student discussion of case studies that emphasizes a particular scientific ethical dilemma.

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 782. Molecular Microbiological Techniques. 3 Credits.

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

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 892. Graduate Teaching Experience. 1-6 Credits.

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

MICR 894. Practicum/Internship. 1-8 Credits.

MICR 898. Continuing Enrollment. 1-9 Credits.

For graduate students who have completed all necessary credits of course work including thesis (798) and dissertation (899) on their approved Plan of Study, but who have not yet completed and submitted their thesis or dissertation. This course does not count towards the credit requirements for the degree and is not financial aid eligible. Department consent required to enroll.

MICR 899. Doctoral Dissertation. 1-15 Credits.