

# MICROBIOLOGY AND MOLECULAR GENETICS

## Microbiology/Cell and Molecular Biology

Microbiology is the hands-on study of bacteria, viruses, fungi and algae and their many relationships to humans, animals, plants and the environment. Cell and molecular biology bridges the fields of chemistry, biochemistry and biology as it seeks to understand life and cellular processes at the molecular level. Microbiologists apply their knowledge to infectious diseases and pathogenic mechanisms; food production and preservation, industrial fermentations which produce chemicals, drugs, antibiotics, alcoholic beverages and various food products; biodegradation of toxic chemicals and other materials present in the environment; insect pathology; the exciting and expanding field of biotechnology which endeavors to utilize living organisms to solve important problems in medicine, agriculture, and environmental science; infectious diseases; and public health and sanitation.

Microbes live in every imaginable habitat. They generate two-thirds of the oxygen in our atmosphere, drive the geochemical cycles that make life on Earth sustainable and are the basis of every food web. As model organisms used for basic research, microbes have contributed more than any other organisms to the current knowledge of genetics at the molecular level and genomics.

In contrast to the enormous benefits derived from some microbes, other microorganisms and viruses are the causative agents of infectious disease and hence have a devastating impact on humanity. These pathogens are the subjects of research into the mechanisms of infections, with the ultimate goal of combating or preventing diseases.

Departmental courses are designed to provide comprehensive training and the skills required for working with microorganisms in a professional setting, as well as a broad understanding of all aspects of microbial life. The lecture courses are taught by tenured faculty members and the laboratory courses are designed to integrate classroom learning with hands-on research experience.

Opportunities for employment exist at all scholarly levels, in many local, state and national agencies and industry. The record for employment of microbiologists has been excellent for many years and with the increased interest in biotechnology, medicine and the human microbiome, employment opportunities look even brighter for the future.

Microbiology is the strongest possible foundation for students who wish to go to medical, dental, veterinary or graduate schools. We take pride in offering research and internship opportunities that prepare students for careers in the biomedical sciences. Our graduates find jobs in medicine, health care, medical laboratories, teaching, research, industry and government.

## Medical Laboratory Science Option

This option is designed to give students the broad general education and the technical skills that are required for a successful career in medical laboratory science (MLS). The minimum requirement for the BS degree in Microbiology/Cell and Molecular Biology with the (MLS) option is three years of university work that includes general chemistry, organic chemistry, biochemistry, immunology, genetics, anatomy & physiology, physics, upper-division courses in microbiology, and one year of clinical laboratory education (internship).

For certification and completion of the BS degree, students will take one year of clinical internship in program accredited by the National Accrediting Agency for Clinical Laboratory Science (NAACLS) and affiliated with Oklahoma State University. Students have the options of the following hospitals/programs: Comanche County Memorial Hospital, Lawton, OK; St. Francis Hospital, Tulsa, OK; Mercy Hospital, Ada, OK; Mercy Hospital, Ardmore, OK.

Medical Laboratory Science is unique in allowing students to enter the health profession directly after obtaining a BS degree. Clinical laboratory scientists comprise the third-largest segment of the healthcare professions and are an important member of the healthcare team, working alongside doctors and nurses. Students who complete Microbiology/Cell and Molecular Biology with the MLS option enjoy a 100% employment rate upon graduation.

## Courses

### GENE 5102 Molecular Genetics

**Prerequisites:** BIOC 3653 or MICR 3033 and one course in genetics or consent of instructor.

**Description:** An introduction to molecular genetics on the graduate level.

**Credit hours:** 2

**Contact hours:** Lecture: 2

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Graduate College

### MICR 1513 Inquiry-Based Biology

**Description:** Directed inquiry and hands-on study of biological principles. Restricted to elementary education majors or related fields as model course to learn and teach science.

**Credit hours:** 3

**Contact hours:** Lecture: 1 Lab: 4

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Microbiology & Mol Gen

### MICR 2123 Introduction to Microbiology

**Prerequisites:** BIOL 1114 with a grade of "C" or better. Prerequisite or concurrent enrollment: CHEM 1215 or CHEM 1314.

**Description:** General principles of the biology of microorganisms, including bacteria, viruses, algae, fungi, protozoa and archaea. Course previously offered as MICR 2125.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

### MICR 2132 Introduction to Microbiology Laboratory

**Prerequisites:** MICR 2123 or concurrent enrollment.

**Description:** Laboratory safety, aseptic technique, microscopy, staining and culture techniques, collection of microbial samples, isolation and identification of microorganisms, microbial growth and basic principles of metabolism, environmental microbiology, other discipline specific laboratory skills.

**Credit hours:** 2

**Contact hours:** Lab: 4

**Levels:** Undergraduate

**Schedule types:** Lab

**Department/School:** Microbiology & Mol Gen

**MICR 2890 Honors Experience in Microbiology**

**Prerequisites:** Honors Program participation and concurrent enrollment in a designated MICR course.

**Description:** A supplemental Honors experience in Microbiology to partner concurrently with designated MICR 2123 and/or MICR 2132 course(s). This course adds a different intellectual dimension to the designated course(s).

**Credit hours:** 1

**Contact hours:** Lecture: 1

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**General Education and other Course Attributes:** Honors Credit

**MICR 3033 Cell and Molecular Biology**

**Prerequisites:** MICR 2123 and MICR 2132 with "C" or better or BOT 1404 or ZOOL 1604 and CHEM 1225 or CHEM 1515 or equivalent with a grade of "C" or better.

**Description:** The cell concept and cell morphology, cell macromolecules, organelles, enzymes, energetics, movement of water and materials across membranes, influence of external environment, cellular synthesis, growth and maintenance, control and integration of function, replication, differentiation, origin, and evolution of cells. Course previously offered as CLML 3014, BIOL 3014, and BISC 3014.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 3103 Microbes: Friends or Foes (N)**

**Description:** Explores the impact of microorganisms on human life, the environment, and world history. This course is designed for non-science majors.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**General Education and other Course Attributes:** Natural Sciences

**MICR 3143 Medical Mycology**

**Prerequisites:** MICR 2123 and MICR 2132 with a grade of "C" or better.

**Description:** Examination of fungi as animal pathogens; laboratory techniques used in the identification of human and animal pathogens, and differentiation from common contaminants.

**Credit hours:** 3

**Contact hours:** Lecture: 1 Lab: 4

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Microbiology & Mol Gen

**MICR 3154 Food Microbiology**

**Prerequisites:** MICR 2123, MICR 2132 and CHEM 3015 or CHEM 3053.

**Description:** Relationship of microorganisms to food manufacture and preservation, to food spoilage and microbial food poisoning and to various aspects of primary food production. Same course as FDSC 3154. Course previously offered as ANSI 3154.

**Credit hours:** 4

**Contact hours:** Lecture: 2 Lab: 4

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Microbiology & Mol Gen

**MICR 3223 Advanced Microbiology**

**Prerequisites:** MICR 2123, MICR 2132 with a grade of "C" or better; Co-requisite(s): CHEM 3015 or CHEM 3053.

**Description:** Subcellular structure and function of microorganisms. Synthesis, translocation, and metabolism of cellular macromolecular constituents. Substrate transport and metabolism. Course previously offered as MICR 3224 and MICR 4224.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 3253 Immunology**

**Prerequisites:** MICR 2123 and MICR 2132 with a grade of "C" or better.

**Description:** Vertebrate host's ability to defend itself against foreign intrusion. Chemistry and biology of the acquired immune response. Course previously offered as MICR 3254 and CLML 3254.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 3333 Molecular Life Science Writing**

**Prerequisites:** BIOL 1444.

**Description:** Students will gain hands-on experience in technical writing and critical reading of scientific texts. Students will write three different documents and will critically review similar texts written by other students enrolled in the course. The topics for these manuscripts will be selected by the students, but should be in the general area of the molecular life sciences. Students will receive instructions on how to write, revise, and review these documents.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 3890 Advanced Honors Experience in Microbiology**

**Prerequisites:** Honors Program participation and concurrent enrollment in a designated MICR course.

**Description:** A supplemental Honors experience in microbiology to partner concurrently with designated upper-division MICR course(s). This course adds a different intellectual dimension to the designated course(s).

**Credit hours:** 1

**Contact hours:** Lecture: 1

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**General Education and other Course Attributes:** Honors Credit

**MICR 4000 Honors in Microbiology**

**Prerequisites:** Consent of departmental honors committee.

**Description:** Supervised study and research in microbiology. Offered for variable credit, 1-4 credit hours, maximum of 4 credit hours.

**Credit hours:** 1-4

**Contact hours:** Other: 1

**Levels:** Undergraduate

**Schedule types:** Independent Study

**Department/School:** Microbiology & Mol Gen

**General Education and other Course Attributes:** Honors Credit

**MICR 4001 Professional Transitions in Microbiology and Cell and Molecular Biology****Prerequisites:** MICR 2123 or MICR 2132.**Description:** Understanding major areas and employment activities in microbiology, cell biology and molecular biology fields. Evaluating and understanding scientific and professional literature, and making the transition from undergraduate education to postgraduate education or employment.**Credit hours:** 1**Contact hours:** Lecture: 1**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4003 Brewing Microbiology (N)****Description:** Brewing Microbiology is about the science behind beer brewing. Students will learn about the microbiology of yeast (including growth, metabolism, aseptic technique and contamination), biology of grain, biochemistry of malted barley, chemistry of water, preservative nature of hops, and the human physiology of taste and smell. There are no prerequisites for this course, although high school or freshman level biology and chemistry is helpful.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**General Education and other Course Attributes:** Natural Sciences**MICR 4012 Molecular Microbiology Laboratory I****Prerequisites:** MICR 3033 or MICR 3223.**Description:** Emphasis on good laboratory practices in microbiology and molecular biology; isolation and enumeration of microorganisms; physiological, biochemical, and molecular characterization of aerobic and anaerobic microorganisms. May not be used for degree credit with MICR 5012. Course previously offered as CLML 4012.**Credit hours:** 2**Contact hours:** Lab: 4**Levels:** Undergraduate**Schedule types:** Lab**Department/School:** Microbiology & Mol Gen**MICR 4013 Microbial Physiology & Ecology****Prerequisites:** MICR 2123 and CHEM 3015 or CHEM 3053. Co-requisite: MICR 3223.**Description:** Fundamentals of microbial physiology, ecology and genetics of microbial populations under various redox conditions. Basics of genomics and proteomics. Microbial origin and evolution. Microbial diversity and function. Population interactions, competition and ecosystem stability. Metabolic activities in natural and managed systems. Modern molecular tools in microbe identification and evolutionary phylogeny. May not be used for degree credit with MICR 5013.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4052 Pathogenic Microbiology Lab****Prerequisites:** MICR 2123 and MICR 2132 with a grade of "C" or better.**Description:** Overview of laboratory approaches and techniques for the study, characterization, and identification of bacteria involved in pathogenesis.**Credit hours:** 2**Contact hours:** Lab: 4**Levels:** Undergraduate**Schedule types:** Lab**Department/School:** Microbiology & Mol Gen**MICR 4053 Pathogenic Microbiology****Prerequisites:** MICR 2123 and MICR 2132 with a grade of "C" or better.**Description:** Survey of pathogenic bacteria and the diseases they cause as they relate to humans and animals. Morphology, physiology, and pathogenic mechanisms of a specific bacterial pathogens. Same course as MICR 5053. May not be used for degree credit with MICR 4134 and MICR 3134.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4112 Molecular Microbiology Laboratory II****Prerequisites:** MICR 4012 with a grade of "C" or better.**Description:** Continuation of MICR 4012. Molecular characterization of prokaryotic and eukaryotic microorganisms utilizing nucleic acids, proteins, cell fractionation, cytology, and antigen-antibody reactions. Same course as MICR 5112.**Credit hours:** 2**Contact hours:** Lab: 4**Levels:** Undergraduate**Schedule types:** Lab**Department/School:** Microbiology & Mol Gen**MICR 4117 Clinical Microbiology****Prerequisites:** Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except 30 hours clinical laboratory science.**Description:** The theory and laboratory study of pathogenic bacteria, viruses, rickettsiae, fungi, and parasites. Includes isolation, identification, antimicrobial susceptibility testing, and medical significance. Course previously offered as CLLS 4117 and MTCL 4117.**Credit hours:** 7**Contact hours:** Lecture: 1 Lab: 12**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Microbiology & Mol Gen**MICR 4123 Virology****Prerequisites:** MICR 2123, MICR 2132, BIOL 3023, CHEM 3015 or CHEM 3053; Co-requisite(s): MICR 3223.**Description:** The properties of macromolecules, from the structure of proteins and nucleic acids to molecular mechanisms of DNA replication and recombination, transcription, protein synthesis, and gene regulation. Gene transfer mechanisms in bacteria and their viruses. Fundamentals of recombinant DNA technology. No credit for students with credit in MICR 5123.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen

**MICR 4125 Clinical Chemistry I**

**Prerequisites:** Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science.

**Description:** The theory and laboratory methodology of analytical biochemistry, clinical microscopy, routine and special procedures, and medical significance. Course previously offered as CLLS 4125 and MTCL 4125.

**Credit hours:** 5

**Contact hours:** Lecture: 1 Lab: 9

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Microbiology & Mol Gen

**MICR 4142 Microbial Genetics Lab**

**Credit hours:** 2

**Contact hours:** Lecture: 2

**Levels:** Graduate, Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 4153 Emerging Infectious Agents**

**Prerequisites:** MICR 2123.

**Description:** An in-depth discussion of the importance of emerging infectious agents, the molecular basis for their emergence, how they are detected and controlled, and the broad spectrum of host-microbe-environment interactions leading to the evolution of new infectious agents.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 4203 Bioinformatics**

**Prerequisites:** MICR 3033 or BIOC 3653 or equivalent.

**Description:** Fundamental concepts of biological sequence information and inferential techniques to assign structure, function, and evolutionary relationship among genes and proteins. No prior programming necessary, but familiarity with computers assumed. No credit for students with credit in MICR 5203.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 4233 Advanced Cell and Molecular Biology**

**Prerequisites:** MICR 3033 with a grade of "C" or better.

**Description:** Advanced topics in cell and molecular biology including regulatory mechanisms of gene expression, protein function, cell structure and organization, cell division, and development. May not be used for degree credit with MICR 5233. Course previously offered as CLML 4113.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 4236 Clinical Hematology**

**Prerequisites:** Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours of clinical laboratory science.

**Description:** Systematized study of diseases, cell maturation and function, principles of hemostasis; methodology used in routine and special hematology studies; and correlation of hematological findings with physiological conditions. Course previously offered as CLLS 4236 and MTCL 4236.

**Credit hours:** 6

**Contact hours:** Lab: 12

**Levels:** Undergraduate

**Schedule types:** Lab

**Department/School:** Microbiology & Mol Gen

**MICR 4246 Clinical Immunology**

**Prerequisites:** Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science.

**Description:** Immunologic responses and procedures used in serological determinations; immunohematology, fundamentals of antigen-antibody reactions, blood groups and types, compatibility testing, blood components, and the lab methods used as they relate to the medical significance of immunology and infectious diseases. Course previously offered as CLLS 4246 and MTCL 4246.

**Credit hours:** 6

**Contact hours:** Lab: 12

**Levels:** Undergraduate

**Schedule types:** Lab

**Department/School:** Microbiology & Mol Gen

**MICR 4253 Concepts in Medical Genetics**

**Prerequisites:** BIOL 3023.

**Description:** Application of genetic principles in the study of human diseases, including the inheritance, molecular mechanisms, detection, characterization, and discovery of human genes. No credit for students with credit in MICR 5253. Course previously offered as CLML 4253.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 4263 Microbial Genetics: from Genes to Genomes**

**Prerequisites:** MICR 3033 with a grade of "C" or better.

**Description:** Integration of genetics and genomics principles, the basic processes of gene transmission, molecular biology of gene expression and evolutionary genetics by gaining social and historical context in which genetics are developed. Participants are expected to comprehend the dramatic change in our understanding of genetics and the role such information has in our view of disability and disease. May not be used for degree credit with MICR 5263. Course previously offered as CLML 4263 and CLML 4264.

**Credit hours:** 3

**Contact hours:** Lecture: 1 Lab: 4

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Microbiology & Mol Gen

**MICR 4323 Biological Energy Transduction****Prerequisites:** MICR 3033 or BIOC 3653.**Description:** An exploration of the principals and mechanisms of energy transduction in plants, animals, and microbial systems. The course emphasizes electron transport and ATP production in both chemotrophic and phototrophic organisms and considers the cellular and molecular bases for these processes. May not be used for degree credit with MICR 5323.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4325 Clinical Chemistry II****Prerequisites:** Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science.**Description:** The theory and laboratory methodology of analytical biochemistry, instrumentation, lab mathematics, routine and special procedures and medical significance. Course previously offered as CLLS 4325 and MTCL 4325.**Credit hours:** 5**Contact hours:** Lecture: 1 Lab: 9**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Microbiology & Mol Gen**MICR 4351 Topics in Clinical Laboratory Science****Prerequisites:** Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science.**Description:** Principles and practices of the medical laboratory including basic management, quality assurance, education methodology, computer applications, laboratory safety, and special projects in selected areas. Course previously offered as CLLS 4351 and MTCL 4351.**Credit hours:** 1**Contact hours:** Lecture: 1**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4423 Bacterial Cell Walls****Prerequisites:** MICR 2123, MICR 2132, and MICR 3223.**Description:** Topics will include structure and synthesis of membrane and cell wall components (including lipids, peptidoglycan and membrane proteins), mechanisms of transport across the cell wall, roles components of the cell wall play in the survival of the cell (and in the case of pathogens, the ability to cause disease), and antimicrobial agents that affect the cell wall and the mechanisms used to eliminate these agents from the cell. No credit for students with credit in MICR 5423.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4524 Biological Laboratory Instrumentation****Prerequisites:** CHEM 1515 or equivalent and P BIO 1404 or MICR 2123 or BIOL 1604 or equivalents or consent of instructor.**Description:** Lecture and laboratory course in biological instrumentation use, theory, experimental design, maintenance, and troubleshooting. Topics include liquid handling systems, pH/ISE meters, electrophoresis, microcontrollers, spectrophotometers, centrifuges, chromatography, thermocyclers, and DNA sequencers. May not be used for degree credit with BIOL 5524, MICR 5524, P BIO 5524. Same course as BIOL 4524 and P BIO 4524.**Credit hours:** 4**Contact hours:** Lecture: 2 Lab: 4**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Microbiology & Mol Gen**MICR 4531 Chemical Biology****Prerequisites:** CHEM 3053, MICR 3112, MICR 3153.**Description:** Chemistry explains many properties of biological macromolecules and also provides research tools to study these molecules. This course will examine how both of these aspects help explain the molecular processes at the basis of life, and will cover (1) basic knowledge of chemistry needed to understand life, (2) chemical reactions as they occur in the cell, (3) chemical methods that are valuable to research in the life sciences.**Credit hours:** 1**Contact hours:** Lecture: 1**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4543 Microbial Genomics and Bioinformatics****Prerequisites:** MICR 2123; MICR 3033 or MICR 3223 or equivalents.**Description:** Basic approaches and strategies for microbial genome analysis, and hands-on training on the subject. May not be used for degree credit with MICR 5543.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 4990 Special Problems****Prerequisites:** Consent of instructor.**Description:** Investigations in the field of microbiology. Offered for variable credit, 1-3 credit hours, maximum of 12 credit hours.**Credit hours:** 1-3**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Microbiology & Mol Gen**MICR 4993 Senior Honors Project****Prerequisites:** Departmental invitation, senior standing, Honors Program participation.**Description:** A research project under the direction of a faculty member resulting in a written report to be judged by a second faculty member as well. Required for graduation with departmental honors in microbiology.**Credit hours:** 3**Contact hours:** Other: 3**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Microbiology & Mol Gen**General Education and other Course Attributes:** Honors Credit

**MICR 5000 Thesis****Prerequisites:** Consent of major professor.**Description:** A student studying for the M.S. degree enrolls in this course for six hours credit. Offered for variable credit, 2-6 credit hours, maximum of 6 credit hours.**Credit hours:** 2-6**Contact hours:** Other: 2**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Microbiology & Mol Gen**MICR 5002 Professionalism for the Microbiologist****Prerequisites:** Microbiology graduate student or permission of instructor.**Description:** Introduces the microbiology graduate student to the standards of the microbiology professional and to basic skills in communication and data retrieval needed by all microbiologists. It is required of all and limited to MS and PhD students in Microbiology & Molecular Genetics. Course previously offered as MICR 5001.**Credit hours:** 2**Contact hours:** Lecture: 2**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5012 Molecular Microbiology Laboratory I****Prerequisites:** MICR 3223, MICR 4233.**Description:** Emphasis on good laboratory practices in microbiology and molecular biology; isolation and enumeration of microorganisms; physiological, biochemical, and molecular characterization of aerobic and anaerobic microorganisms. Must be taken in conjunction with MICR 5112 the following semester. No credit for students with credit in MICR 4012.**Credit hours:** 2**Contact hours:** Lab: 4**Levels:** Graduate**Schedule types:** Lab**Department/School:** Microbiology & Mol Gen**MICR 5013 Microbial Physiology and Ecology****Prerequisites:** MICR 2123 and MICR 2132, and CHEM 3015 or CHEM 3053. Co-requisite: MICR 3223.**Description:** Fundamentals of microbial physiology, ecology and genetics of microbial populations under various redox conditions. Basics of genomics and proteomics. Microbial origin and evolution. Microbial diversity and function. Population interactions, competition and ecosystem stability. Metabolic activities in natural and managed systems. Modern molecular tools in microbe identification and evolutionary phylogeny. May not be used for degree credit with MICR 4013.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5052 Techniques In Molecular Biolog****Prerequisites:** Graduate student and permission of instructor.**Description:** Provides the basic skills for scientific thinking and analysis in molecular microbiological research.**Credit hours:** 2**Contact hours:** Lecture: 1 Lab: 2**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Microbiology & Mol Gen**MICR 5053 Pathogenic Microbiology****Prerequisites:** MICR 2123 and MICR 2132. Co-requisite(s): MICR 3223.**Description:** Survey of pathogenic bacteria and the diseases they cause as they relate to humans and animals. Morphology, physiology, and pathogenic mechanisms of specific bacterial pathogens. May not be used for degree credit with MICR 4053. Course previously offered as MICR 5134.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5112 Molecular Microbiology Laboratory II****Prerequisites:** MICR 5012.**Description:** Continuation of MICR 5012. Molecular characterization of prokaryotic and eukaryotic microorganisms utilizing nucleic acids, proteins, cell fractionation, cytology, and antigen-antibody reactions. No credit for students with credit in MICR 4112.**Credit hours:** 2**Contact hours:** Lab: 4**Levels:** Graduate**Schedule types:** Lab**Department/School:** Microbiology & Mol Gen**MICR 5113 Advanced Immunology****Prerequisites:** MICR 3253.**Description:** Advanced studies with emphasis on the regulation of vertebrate immune responses.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5123 Virology****Prerequisites:** MICR 3033 or BIOC 3653, BIOL 3023. Co-requisite(s): MICR 3223.**Description:** Virus-host interactions including structure-function of animal, plant, and bacterial viruses. Discussion of the molecular biology of virus infection and development. No credit for students with credit in MICR 4123.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5142 Techniques in Molecular Biology****Prerequisites:** Consent of instructor.**Description:** Comprehensive laboratory course in research techniques involving classical genetics and molecular biology. Course previously offered as MICR 4142.**Credit hours:** 2**Contact hours:** Lab: 4**Levels:** Graduate**Schedule types:** Lab**Department/School:** Microbiology & Mol Gen

**MICR 5153 Emerging Infectious Agents**

**Prerequisites:** MICR 4123 or MICR 4134 or consent of instructor.

**Description:** An in-depth discussion of the importance of emerging infectious agents, the molecular basis for their emergence, and the broad spectrum of host-microbe interactions favoring the evolution of new infectious agents.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5160 Seminar**

**Prerequisites:** Consent of instructor.

**Description:** Required of and limited to all MS and PhD students majoring in microbiology, cell and molecular biology. Offered for fixed credit, 1 credit hour, maximum of 2 credit hours.

**Credit hours:** 1

**Contact hours:** Other: 1

**Levels:** Graduate

**Schedule types:** Independent Study

**Department/School:** Microbiology & Mol Gen

**MICR 5203 Bioinformatics**

**Prerequisites:** MICR 3033 or BIOC 3653 or equivalent.

**Description:** Fundamental concepts of biological sequence information and inferential techniques to assign structure, function, and evolutionary relationship among genes and proteins. No prior programming necessary, but familiarity with computer desktop assumed. No credit for students with credit in MICR 4203. Course previously offered as CLML 5203.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5233 Advanced Cell and Molecular Biology**

**Prerequisites:** MICR 3033.

**Description:** Advanced topics in cell and molecular biology including regulatory mechanisms of gene expression, protein function, cell structure and organization, cell division, and development. No credit for students with credit in MICR 4233.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5253 Concepts in Medical Genetics**

**Prerequisites:** BIOL 3023.

**Description:** Application of genetic principles in the study of human diseases, including the inheritance, molecular mechanisms, detection, characterization, and discovery of human genes. No credit for students with credit in MICR 4253.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5263 Microbial Genetics: from Genes to Genomes**

**Description:** Integration of genetics and genomics principles, the basic processes of gene transmission, molecular biology of gene expression and evolutionary genetics by gaining social and historical context in which genetics are developed. Participants are expected to comprehend the dramatic change in our understanding of genetics and the role such information has in our view of disability and disease. May not be used for degree credit with MICR 4263.

**Credit hours:** 3

**Contact hours:** Lecture: 1 Lab: 4

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Microbiology & Mol Gen

**MICR 5273 Advanced Principles of Microbial Pathogenesis**

**Description:** Advanced study of the pathogenic mechanisms used by microbial pathogens to cause disease. Principles of pathogen and pathogen-host interactions that lead to disease pathology.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5323 Biological Energy Transduction**

**Prerequisites:** MICR 3033 or BIOC 3653.

**Description:** An exploration of the principals and mechanisms of energy transduction in plants, animals, and microbial systems. The course emphasizes electron transport and ATP production in both chemotrophic and phototrophic organisms and considers the cellular and molecular bases for these processes. May not be used for degree credit with MICR 4323.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5333 Controversies in Vaccinology**

**Prerequisites:** OSU graduate student status or permission of instructor.

**Description:** Public misconceptions about science abound, however, these misconceptions have a major impact on perception of research and public policy. Examples of themes in science as portrayed, for example, in film will be explored and critically discussed. Ways to improve communication between the scientist and the general public will be evaluated.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 5423 Bacterial Cell Walls: Form and Function****Prerequisites:** MICR 2123, MICR 2132, and MICR 3223.**Description:** Topics will include structure and synthesis of membrane and cell wall components (including lipids, peptidoglycan and membrane proteins), mechanisms of transport across the cell wall and the roles components of the cell wall play in the survival of the cell (and in the case of pathogens, the ability to cause disease). In addition, antimicrobial agents that affect the cell wall and the mechanisms used to eliminate these agents from the cell will also be discussed. No credit for students with credit in MICR 4423.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5513 Grant Proposal Preparation****Prerequisites:** Admission into Microbiology graduate program. Formats, strategies, and styles of research grant proposal writing.**Description:** Activities include hypothesis development and critical evaluation of research proposals.**Credit hours:** 3**Contact hours:** Lecture: 2 Other: 1**Levels:** Graduate**Schedule types:** Discussion, Combined lecture & discussion, Lecture**Department/School:** Microbiology & Mol Gen**MICR 5524 Biological Laboratory Instrumentation****Prerequisites:** CHEM 1515 or equivalent and PBIO 1404 or MICR 2123 or BIOL 1604 or equivalents or consent of instructor.**Description:** Lecture and laboratory course in biological instrumentation use, theory, experimental design, maintenance, and troubleshooting. Topics include liquid handling systems, pH/ISE meters, electrophoresis, spectrophotometers, centrifuges, chromatography, thermocyclers, and DNA sequencers. May not be used for degree credit with BIOL 4524; MICR 4524; PBIO 4524. Previously offered as BIOL 5524; PBIO 5524.**Credit hours:** 4**Contact hours:** Lecture: 2 Lab: 4**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Microbiology & Mol Gen**MICR 5543 Microbial Genomics and Bioinformatics****Prerequisites:** MICR 2123; MICR 3033 or MICR 3223 or equivalents.**Description:** Basic approaches and strategies for microbial genome analysis, and hands-on training on the subject. Graduate students enrolled in the class are expected to give a comprehensive presentation on the genomic analysis done throughout the semester. The presentation should be a manuscript format with a brief Introduction, Materials and Methods, Results, and Discussion. A comprehensive use of all principals covered in class is expected and will be used for evaluation. Credit will also be given to handling questions and presentation skills. May not be used for degree credit with MICR 4543.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 5990 Special Problems****Prerequisites:** Permission of instructor.**Description:** Investigations in the field of Microbiology. Offered for variable credit, 1-4 credit hours, maximum of 10 credit hours.**Credit hours:** 1-4**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Microbiology & Mol Gen**MICR 6000 Dissertation****Prerequisites:** Consent of major adviser.**Description:** Research in microbiology for the PhD degree. Offered for variable credit, 1-15 credit hours, maximum of 45 credit hours.**Credit hours:** 1-15**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Microbiology & Mol Gen**MICR 6112 Molecular Biology of Bacterial Viruses****Prerequisites:** MICR 4123 and MICR 4133.**Description:** Advanced study of bacteriophages. Course previously offered as MICR 6113.**Credit hours:** 2**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 6120 Recent Advances in Microbiology****Prerequisites:** One graduate course in biochemistry.**Description:** Discussion and evaluation of recent scientific contributions in terms of the living organism. Offered for fixed credit, 1 credit hour, maximum of 6 credit hours.**Credit hours:** 1**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Microbiology & Mol Gen**MICR 6133 Cellular Microbiology****Prerequisites:** A strong undergraduate level background in microbiology, biochemistry or cell biology is expected.**Description:** The molecular interactions between intracellular parasites and their host cells will be explored, emphasizing the manipulation of normal cellular processes to the benefit of the parasite. The course will involve critical reading of the current literature and development of an understanding of molecular microbe and cell biology research techniques.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen**MICR 6143 Advanced Microbial Physiology****Prerequisites:** MICR 3223 or consent of instructor.**Description:** Discussion of selected topics in microbial physiology. Critical analysis of research papers.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Microbiology & Mol Gen



**MICR 6153 Molecular Microbial Genetics**

**Description:** Examine modern and classical genetic techniques to understand the underlying principles of molecular genetics using original literature.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 6163 Quantum Microbiology**

**Prerequisites:** OSU graduate student or permission of instructor.

**Description:** This class will provide an in-depth introduction into fundamental principles that apply to any microorganism and will provide an intellectual framework to understand all cells. The fundamentals discussed will be illustrated through a combination of classical and recent scientific breakthroughs. It will provide a solid, deep foundation for a successful academic career in microbiology.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 6223 Molecular Environmental Microbiology and Ecology**

**Prerequisites:** MICR 3223 or consent of instructor.

**Description:** This course focuses on fundamental and applied aspects of microbial ecology, physiology and genomics. The course aims to highlight the value of microbes in applied disciplines such as medicine, agriculture, and biotechnology. Recent advances in methodologies and approaches for examining the phylogenetic and metabolic diversity of microorganisms in various ecosystems, as well as tools for understanding microbial community composition and identification of rare members of microbial community will be highlighted.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 6253 Microbial Evolution**

**Prerequisites:** MICR 2123, MICR 2132, BIOC 3653, BIOL 3023.

**Description:** The mechanisms and results of microbial evolution in nature and in the laboratory, with emphasis on microbes as model evolutionary systems, molecular evolution, classification and phylogeny, and discussion of protobiology and the probable fate of engineered microbes.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

**MICR 6323 Cell Signaling**

**Prerequisites:** A strong undergraduate level background in microbiology, biochemistry, or cell biology is expected.

**Description:** Discussion of current literature on the mechanisms of prokaryotic and eukaryotic signal transduction and gene regulation.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Microbiology & Mol Gen

## Undergraduate Programs

- Microbiology/Cell & Molecular Biology, BS (<http://catalog.okstate.edu/arts-sciences/microbiology-molecular-genetics/microbiology-cell-molecular-biology-bs>)
- Microbiology/Cell & Molecular Biology: Medical Laboratory Science, BS (<http://catalog.okstate.edu/arts-sciences/microbiology-molecular-genetics/microbiology-cell-molecular-biology-medical-laboratory-science-bs>)
- Microbiology/Cell & Molecular Biology: Pre-Medical Professional, BS (<http://catalog.okstate.edu/arts-sciences/microbiology-molecular-genetics/microbiology-cell-molecular-biology-pre-medical-professional-bs>)
- Microbiology (MICR), Minor (<http://catalog.okstate.edu/arts-sciences/microbiology-molecular-genetics/microbiology-minor>)

## Graduate Programs

The department offers graduate studies leading to the MS and PhD degrees in various areas of concentration, including microbial physiology, microbial genetics, microbial ecology, microbial pathogenesis, immunology, cell biology and the human microbiome.

## Prerequisites

Applicants for admission must have received the baccalaureate degree from an accredited university or college and must have completed a minimum of 30 semester credit hours in the biological and physical sciences. The Aptitude Test portion of the Graduate Record Examination is required of all applicants. A majority of the departmental graduate faculty must approve applicants.

## The Master of Science Degree

In addition to the general requirements for the degree, the following departmental requirements must be met in attaining 30 credit hours with thesis. The plan of study must include six thesis hours and one credit hour microbiology seminar for the traditional degree. An accelerated MS degree is available that is largely coursework and literature based, which allows completion of the degree in as little as 12 months. Literature research includes at least six credit hours in independent study.

Candidates for the MS degree are expected to attend and participate in all departmental seminars. A final oral examination covering the thesis (or literature research for the accelerated program) is administered by the advisory committee following a public presentation of the candidate's research.

## The Doctor of Philosophy Degree

The study plan of a student entering the program with a bachelor's degree must include 30 credit hours in the biological and physical sciences. Those entering with a master's degree must include 15 hours in courses other than dissertation credits which were not included in the master's study plan. Three hours of microbiology seminar must be included.

Candidates for the PhD are expected to attend and participate in all departmental seminars. Candidates for the PhD degree must pass both a written and an oral qualifying examination. The final examination covering the dissertation research is given promptly after the candidate has given a public seminar on his/her research work.

## Faculty

Tyrrell Conway, PhD—Regents Professor and Department Head

**Professors:** Robert L. Burnap, PhD (Vennerberg Chair in Bioinformatics); Mostafa S. Elshahed, PhD; Jeffrey A. Hadwiger, PhD; Wouter D. Hoff, PhD; Rolf A. Prade, PhD

**Associate Professors:** Babu Z. Fathepure, PhD; Marianna A. Patrauchan, PhD; Edward I. Shaw, PhD; Noha Youssef, PhD

**Assistant Professors:** Matt Cabeen, PhD; Erika Lutter, PhD; Randy Morgenstein, PhD; Karen Wozniak, PhD