



Scope and Sequence

Cluster:	Health Science		
Course Name:	Medical Microbiology (One-Half to One Science Credit)		
Course Description:	<p>(1) Medical Microbiology. Students in Medical Microbiology explore the microbial world, studying topics such as pathogenic and non-pathogenic microorganisms, laboratory procedures, identifying microorganisms, drug resistant organisms, and emerging diseases.</p> <p>(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.</p> <p>(3) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.</p> <p>(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).</p> <p>(5) Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.</p>		
Course Requirements:	This course is recommended for students in Grades 10-12. Recommended prerequisites: three credits of science. To receive credit in science, students must meet the 40% laboratory and fieldwork requirement identified in §74.3(b)(2)(C) of this title (relating to Description of a Required Secondary Curriculum).		
Equipment & Supplies	<p>Required: Clock (with second hand), meter sticks or metric rulers, anatomical charts, isolation kit (mask, glove & gown), gloves, masks, hand scrub/germicidal soap, microscopes, culture media - plates, culture media - broth, water bath 37 degrees centigrade, incubator 37 degrees centigrade, loops, Bunsen burner, sterile cotton swabs, coagulase/oxidase reagents, toothpicks, bacterial (non-pathogenic) cultures, reagent strips, slides, cover strips, test tubes, stains for blood and bacteria, distilled water, autoclave, autoclave tape, assorted instruments, computers, monitors, tv/dvdplayer</p> <p>Recommended: Centrifuge, wraps (paper-sterile, cloth-nylon), multimedia projector</p>		
Units of Study	Knowledge and Skills	Student Expectations	Resources
I. INTRODUCTION TO MICROBIOLOGY			
<p>A. Define Microbiology</p> <p>B. Microorganisms affecting Health & Wellness</p> <ol style="list-style-type: none"> 1. Bacteria 2. Fungi 3. Parasites 4. Viruses 	<p>(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:</p>	<p>(A) demonstrate safe practices during laboratory and field investigations; and</p> <p>(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.</p>	<p>Microbiology for Health Careers, 5E</p> <p>Medical Microbiology, 4E</p> <p>Microbiology An Introduction, 7E</p> <p>www.texashte.com</p>

Units of Study	Knowledge and Skills	Student Expectations	Resources
	(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section.	
	(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student; and	
		(E) evaluate models according to their limitations in representing biological objects or events.	
II. LABORATORY SAFETY AND INFECTION CONTROL			
<p>A. Laboratory Safety Agreement B. Standard Precautions C. The Microscope D. Quality Control E. Analysis of Current Infection Control Measures F. Scientific Method</p>	(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations; and (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.	<p>Microbiology for Health Careers, 5E Medical Microbiology, 4E Microbiology An Introduction, 7E www.texasstate.com</p>
	(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	<p>(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;</p> <p>(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;</p> <p>(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;</p> <p>(D) distinguish between scientific hypotheses and scientific theories;</p> <p>(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;</p>	

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		<p>(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;</p> <p>(G) analyze, evaluate, make inferences, and predict trends from data; and</p> <p>(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.</p> <p>(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:</p>	
III. HISTORY OF MEDICAL MICROBIOLOGY			
<p>A. Medical Microbiology</p> <ol style="list-style-type: none"> 1. Past Triumphs 2. Present 3. Future Challenges <p>B. Biotechnology – New Applications</p> <ol style="list-style-type: none"> 1. Gene Identification 2. Gene Therapy 3. Stem Cell Research 4. Pharmaceutical Products 	<p>(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:</p> <p>(4) The student describes the relationships between microorganisms and health and wellness in the human body. The student is expected to:</p>	<p>(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;</p> <p>(D) evaluate the impact of scientific research on society and the environment; and</p> <p>(E) evaluate models according to their limitations in representing biological objects or events.</p> <p>(A) research and describe the historical development of microbiology as it relates to health care of an individual; and</p> <p>(H) research roles, functions, and responsibilities of agencies governing infectious disease control.</p>	<p>Microbiology for Health Careers, 5E Medical Microbiology, 4E Microbiology An Introduction, 7E www.texasstate.com</p>

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	(5) The student examines the role of pathogens in infectious diseases. The student is expected to:	(H) outline the role of the governing agencies in monitoring and establishing guidelines based on the spread of infectious diseases.		
IV. The Immune Response				
<p>A. Infectious Process</p> <ol style="list-style-type: none"> 1. Mode of Transmission 2. Portal of Entry 3. Virulence 4. Signs & Symptoms 5. Pathogenesis 6. Treatments <p>B. Factors Determining the occurrence of Infection</p> <ol style="list-style-type: none"> 1. Type of Microorganism 2. Virulence 3. Susceptibility 4. Route of Transmission <p>C. Basic Concepts</p> <ol style="list-style-type: none"> 1. Natural Immunity 2. Acquired Immunity 3. Artificial Immunity 4. Passive Immunity 5. Active Immunity 6. Immunization 	(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services.	<p>Microbiology for Health Careers, 5E Medical Microbiology, 4E Microbiology An Introduction, 7E www.texashste.com</p>	
	(5) The student examines the role of pathogens in infectious diseases. The student is expected to:	(A) outline the infectious process;		
		(D) explain the body's immune response and defenses against infection; and		
		(E) evaluate the effects of anti-microbial agents.		
V. Microorganisms				
<p>A. Beneficial</p> <ol style="list-style-type: none"> 1. Normal Flora 2. Probiotics <p>B. Pathogenic</p> <ol style="list-style-type: none"> 1. Bacteria 2. Fungi 3. Viruses 4. Protozoa 5. Helminthes <p>C. Drug-resistant Organisms</p> <ol style="list-style-type: none"> 1. MRSA 2. VRSA 3. VRE 4. TB 	(4) The student describes the relationships between microorganisms and health and wellness in the human body. The student is expected to:	(D) explain pathogenic and non-pathogenic microbes in the human body; and	<p>Microbiology for Health Careers, 5E Medical Microbiology, 4E Microbiology An Introduction, 7E www.texashste.com</p>	
		(G) explain how pathogens affect the human body systems.		
	(5) The student examines the role of pathogens in infectious diseases. The student is expected to:	(C) categorize diseases caused by bacteria, fungi, viruses, protozoa, rickettsias, arthropods, and helminths;		
		(F) examine reemergence of diseases such as malaria, tuberculosis, and polio; and		
		(G) investigate drug-resistant microorganisms, including methicillin-resistant Staphylococcus aureus , vancomycin-resistant enterococci, and superbugs.		

Units of Study	Knowledge and Skills	Student Expectations	Resources
VI. Concepts of Medical Microbiology			
<p>A. Bacterial Growth</p> <ol style="list-style-type: none"> 1. Lag Phase 2. Logarithmic / Exponential Phase 3. Stationary Phase 4. Death Phase <p>B. Factors Influencing Bacterial Growth</p> <ol style="list-style-type: none"> 1. Temperature 2. Moisture 3. Salt Requirements 4. Oxygen Requirements 5. pH 6. Nutritional Requirements 	<p>(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:</p> <p>(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:</p> <p>(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:</p>	<p>(A) demonstrate safe practices during laboratory and field investigations; and</p> <p>(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.</p> <p>(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;</p> <p>(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;</p> <p>(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;</p> <p>(D) distinguish between scientific hypotheses and scientific theories;</p> <p>(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;</p> <p>(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;</p> <p>(G) analyze, evaluate, make inferences, and predict trends from data; and</p> <p>(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.</p> <p>(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;</p>	<p>Microbiology for Health Careers, 5E Medical Microbiology, 4E Microbiology An Introduction, 7E www.texashte.com</p>

Units of Study	Knowledge and Skills	Student Expectations	Resources
		<p>(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;</p> <p>(C) draw inferences based on data related to promotional materials for products and services;</p> <p>(D) evaluate the impact of scientific research on society and the environment;</p> <p>(E) evaluate models according to their limitations in representing biological objects or events; and</p> <p>(F) research and describe the history of science and contributions of scientists.</p> <p>(4) The student describes the relationships between microorganisms and health and wellness in the human body. The student is expected to:</p> <p>(B) identify chemical processes of microorganisms;</p> <p>(C) recognize the factors required for microbial reproduction and growth; and</p> <p>(E) describe the morphology and characteristics of microorganisms using a variety of microbiological techniques.</p> <p>(5) The student examines the role of pathogens in infectious diseases. The student is expected to:</p> <p>(B) classify microorganisms using a dichotomous key.</p>	
VII. Laboratory Investigations and Identification of Causative Agents			
<p>A. Biosafety Level Labs</p> <ol style="list-style-type: none"> 1. Level 1 2. Level 2 3. Level 3 4. Level 4 <p>B. Gram Staining for Identification</p> <ol style="list-style-type: none"> 1. Gram-Positive 2. Gram-Negative <p>C. Shapes</p> <ol style="list-style-type: none"> 1. Cocci 2. Bacilli 3. Spirochettes 	<p>(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:</p> <p>(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:</p>	<p>(A) demonstrate safe practices during laboratory and field investigations; and</p> <p>(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.</p> <p>(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;</p> <p>(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;</p> <p>(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;</p> <p>(D) distinguish between scientific hypotheses and scientific theories;</p>	<p>Microbiology for Health Careers, 5E Medical Microbiology, 4E Microbiology An Introduction, 7E www.texashste.com www.cdc.gov/OD/ohs/symp5/jyrtext.htm</p>

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		(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;	
		(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;	
		(G) analyze, evaluate, make inferences, and predict trends from data; and	
		(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.	
	(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of scientific research on society and the environment.	
(4) The student describes the relationships between microorganisms and health and wellness in the human body. The student is expected to:	(F) discuss the results of laboratory procedures that are used to identify microorganisms.		

Resources: Books

Microbiology for Health Careers. 5th ed. Delmar.	9780766809178
Medical Microbiology, Elsevier Health Sciences. Diversified Health Occupations, 6E, 2004 Delmar Learning.	9780323054706 1401814565
Microbiology An Introduction, Benjamin Cummings.	9780805347906
Case Studies for Understanding the Human Body, Jones & Bartlett Publishers, Inc.	9780763742003
Blueprints Medicine, Third edition, Lippincott Williams & Wilkins.	9780781788700
In a Page Medicine, Lippincott Williams & Wilkins.	9780781770354

Resources: Web Sites

Texas Health Science Curriculum Resources	www.texashte.com
Morbidity and Mortality Weekly Report	www.cdc.gov/mmwr
Microbiology Place	www.microbiologyplace.com
University of South Carolina School of Medicine	http://pathmicro.med.sc.edu/book/welcome.html
Society for General Microbiology Online	http://www.sgmjournals.org/
Occupational Safety and Health Administration	www.osha.gov