MEDICAL LABORATORY TECHNIQUES

2022-2023
Grades: 11-12
Prerequisite(s): Introduction to Medical Laboratory & Health Sciences
Medical Health Science Systems & Structures

Course Description

Description: The third year course introduces the basic skills and knowledge necessary in the field of medical and research laboratory sciences. Emphasis is placed on safety, laboratory mathematics, medical terminology, basic laboratory skills, and equipment operation following standard operating procedures. Through hands-on learning experiences, scholars will become skillful at solution preparation, pipetting, microscopy, microbiology protocols using aseptic technique, and common testing procedures.

Course Units/Skills & Knowledge

This course is broken into 3 units:

UNIT 1: INTRODUCTION TO THE MEDICAL LABORATORY
UNIT 2: MICROBIOLOGY
UNIT 3: DIAGNOSTIC LABORATORY TESTING

SEP	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE

Unit 1 Introduction to the Medical Laboratory	Unit 2 Microbiology	Unit 3 Diagnostic Laboratory Testing

UNIT 1: INTRODUCTION TO THE LABORATORY

UNIT 1 UNDERSTANDINGS:

U1 The medical & research laboratories, regulated by governing agencies, are areas within the health science cluster in which a wide array of diagnostic testing and research takes place in support of diagnosing patients, developing and proposing treatments, and/or creating a better understanding of medical issues.

U2 Medical & research laboratories are staffed by many different levels of professionals who must be trained and/or licensed by regulating agencies and have the skills necessary to perform a variety of tasks.

U3 Every worker in medical & research laboratories must be thoroughly aware of legislation that significantly affects the laboratory as well as potential hazards in the workplace, and must perform tasks in a manner that keeps themselves and others safe.

Knowledge	Skills
What knowledge will students learn as part of this unit? ***Students will know…*** ● The value of the medical & research laboratories in healthcare ● Key information about the regulation, organization, and function of the laboratory ● Basic qualifications, job functions, and ethical responsibilities of medical & research laboratory personnel ● Potential safety hazards, standard precautions, and procedures to insure safety of self and others ● Common types of labware and equipment used in the medical laboratory ● The importance of proper use and maintenance protocols for laboratory equipment ● Professional behaviors or ethics characteristic of clinical laboratory technology professions ● How scientific theory and thinking is applied in the medical laboratory	*What skills will students learn as part of this unit?* ***Students will be skilled at…*** ● Describing the functions of the clinical laboratory and its role in patient care ● Diagram and describe the organizational structure of a healthcare organization ● Describe the roles of various clinical laboratory professionals ● Compare and contrast the educational and licensure/certification requirements for clinical laboratory professionals ● List and describe the roles of the agencies involved in clinical laboratory regulation ● Describe the major points of legislation that significantly affects the clinical laboratory, such as HIPAA, CLIA, or NYS public health laws ● Compare and contrast the laboratory testing performed in a clinical laboratory, a reference laboratory, a physician's office, and at point of care

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UNIT 1: PERFORMANCE TASK:

PERFORMANCE TASK: *How will students demonstrate their understanding (meaning-making and transfer) through a complex performance task?)*

Criteria to assess understanding: *(This is used to build the scoring tool.)* "Look Fors" Product: ● Thoroughly introduces the laboratory professional and the lab they work in, including their job description, degree/training/licensures required, and major agencies/points of healthcare legislation that impact their position ● Compares and contrasts at least 2 other positions in their lab with the position of the interviewee, including job description and degree/training/licensures required ● Insightful description of how the medical lab professional and/or their laboratory fits into the healthcare system and treatment of the patient ● Thoughtful impact statement to raise awareness of the profession as a future career option and/or their role in healthcare ● Creates a well-organized professional webpage utilizing relevant information and graphics to enhance understanding Self-Knowledge & Reflection: ● Fully articulates the thinking and learning processes and analyzes the value of the learning experience	**Performance Task focused on Transfer:** Goal: Your goal is to have a conversation with a clinical laboratory professional to deepen your understanding of the importance of clinical lab professionals and how they impact patient care. Role: You are an intern at URMC's Clinical Laboratory Services. Audience: Your audience will be your peers and other individuals who want to learn more about this "hidden profession". Situation: You have landed an internship with URMC's Clinical Laboratory Services. Your first task is to interview a laboratory professional and create an informational webpage that will raise awareness for the profession. **Product: A public Google webpage.**

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UNIT 2: MICROBIOLOGY

UNIT 2 UNDERSTANDINGS:
U1 The medical laboratory's microbiology department isolates and identifies medically important bacteria, viruses, fungi, and parasites.

U2 It is necessary to safely and aseptically collect and handle specimens to identify the offending organism, establish a diagnosis of infection, and to determine the proper course for treatment.

U3 Medical laboratories and their personnel must communicate with health agencies from around the world and continue to advance so they have the ability to quickly respond to emerging infectious diseases, a global pandemic, and potential bioterrorism agents.

Knowledge	Skills
What knowledge will students learn as part of this unit? ***Students will know…***	*What skills will students learn as part of this unit?* ***Students will be skilled at…***
• The fields of study included in microbiology • Key facts about each group of microorganisms • Similarities and differences of normal flora, pathogens, and opportunistic pathogens • Types of diseases caused by different groups of microorganisms • The chain of infection and ways to control infection, especially in healthcare settings • General microscopy terms and care • Fundamentals of growth media and selective and indicator media • Quality assurance procedures used in microbiology and cell culture • Key structures and functions of both prokaryotic and eukaryotic cells • Basic types of bacterial morphology • How bacterial morphology relates to staining results • Culture techniques and media used in bacteriology • The relationship between the zone of inhibition and the effectiveness of an antibiotic on a bacterial specimen • How bacteria can develop resistance to drugs • Process for throat culture and rapid test for group A Streptococcus • How emerging infectious diseases are a threat to the public health	• Maintaining accurate records and documentation • Adhering to safe work practices and following healthy and safety procedures, specifically when working with microorganisms • Using standard precautions and aseptic technique in accordance with OSHA standards • Demonstrating proper use of labware and equipment in the microbiology laboratory • Using laboratory math to perform measurements, calculations, and to prepare simple reagents related to the microbiology laboratory • Proper procedures to prepare, store, dispose of, and transport specimens for microbiological testing according to standard operating procedure • Preparing liquid and agar growth media and pouring culture plates • Inoculating liquid, slant, and plate media with bacteria specimens • Streaking bacterial samples to obtain single colonies • Preparing wet-mount slides, using appropriate staining techniques, and interpreting the results • Using a compound microscope to effectively see or determine bacteria specimens • Identifying and comparing bacteria specimens • Quantifying bacteria using plate counts and spectrophotometer

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• Potential agents of bioterrorism, the diseases they cause, and the role of the medical laboratory in surveillance and detection	• Performing antibiotic susceptibility testing • Making observations, formulating questions, collecting and analyzing data, and establishing valid conclusions

UNIT 2: PERFORMANCE TASK:

PERFORMANCE TASK: *How will students demonstrate their understanding (meaning-making and transfer) through a complex performance task?)*

Criteria to assess understanding: *(This is used to build the scoring tool.)* "Look Fors" Product: • Articulates basic information about the bacterial sample and laboratory protocols used to identify the specimen • Insightful analysis of the patient's symptoms and laboratory results to defend specimen identification and treatment plan • Clearly connects the diagnosis with the community of Rochester and thoughtfully provides a means of prevention and/or reduction of risk factors and answers the EQ: How do microorganisms impact humans? • Creates a well-organized professional presentation utilizing relevant information and graphics to enhance understanding Self-Knowledge & Reflection: • Fully articulates the thinking and learning processes and analyzes the value of the learning experience	**Performance Task focused on Transfer:** Goal: Your goal is to identify an unknown bacterial sample from a patient and provide a treatment plan based on basic bacteriology lab techniques. Role: You are the newest microbiologist for a medical lab at URMC. Audience: Your audience will be medical laboratory and health science professionals. Situation: Your lab has just been sent several patient bacterial specimens. Since they are understaffed and behind, they are hoping that you can help by using basic bacteriology techniques to identify one specimen and determine susceptibility to suggest a treatment plan. **Product: A professional poster that includes identification of the specimen, treatment plan, and techniques used.**

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UNIT 3: DIAGNOSTIC LABORATORY TESTING

UNIT 3 UNDERSTANDINGS:

U1 Running medical laboratory tests on body fluids, especially blood and urine, are an integral part of clinical medicine, and are used to screen, diagnose, and monitor patients, as well as to research and understand the pathophysiology of a particular disease process.

U2 The diagnostic laboratory is divided into distinct sections that are separated by the types of tests performed based on the sample type and the intended result.

U3 Adequate patient preparation, specimen collection, and specimen handling are essential prerequisites for accurate test results.

Knowledge	Skills
What knowledge will students learn as part of this unit? ***Students will know…***	*What skills will students learn as part of this unit?* ***Students will be skilled at…***
• The functions and importance of each of the various laboratory departments • The importance of safety policies and quality assessment procedures in the various laboratory departments • Key facts about how blood is formed, composition of blood and the function of the blood components • The principles of hematology • Instrumentation used in coagulation testing and the purpose of each test used to detect coagulation disorders • How the principles of immunology are used in the medical laboratory • Guidelines for blood donation • Basic information about blood typing & matching • Key facts about the urinary system and urine formation • Diseases that affect kidney function • Urine collection and preservation methods • Reference values for the tests included in the routine urinalysis • Frequently performed clinical chemistry tests and the significance of each • Common point-of-care testing and their role in health care	• Maintaining accurate records and documentation • Adhering to safe work practices and following healthy and safety procedures, specifically when working with biological specimens • Proper procedures for collecting and processing specimens to maintain quality • Performing a hemoglobin determination and microhematocrit. • Use a hemocytometer to perform manual blood cell & platelet counts • Preparing and staining a peripheral blood smear • Identifying normal and abnormal blood cells from stained smears • Performing a white blood cell differential count • Interpreting the information available from automated differential counts • Performing an erythrocyte sedimentation rate test • Correlating common coagulation test results with hemostasis disorders • Performing immunological assays and agglutination assays • Performing ABO grouping and Rh typing • Performing a physical, chemical, and microscopic examination of urine and correlating the results with physiological and disease states • Performing a urine test for human chorionic gonadotropin (hCG) • Utilizing a POCT to determine blood glucose

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UNIT 3: PERFORMANCE TASK:

PERFORMANCE TASK: *How will students demonstrate their understanding (meaning-making and transfer) through a complex performance task?)*

Criteria to assess understanding: *(This is used to build the scoring tool.)* "Look Fors" Product: • Thoroughly articulates information about the patient, their specimens, and the tests that were performed • Insightful analysis of test results, clearly connecting the laboratory test results with medical conditions • Thoughtfully provides a plan to determine if the doctor's treatment is effective and the overall health of the patient, answering the EQ: What do patient specimens tell us about their health? • Creates a well-organized professional presentation utilizing relevant information and graphics to enhance understanding Self-Knowledge & Reflection: • Thoughtfully reflects on the professionalism and performance of the medical lab team • Fully articulates the thinking and learning processes and analyzes the value of the learning experience	**Performance Task focused on Transfer:** Goal: Your goal is to work as part of a team and provide the appropriate laboratory test results and expected outcome with a determined treatment plan for your patients. Role: You are a medical laboratory fellow at URMC learning about diagnostic laboratory testing and what patient specimens can reveal about their health. Audience: Your audience will be other clinical laboratory fellows (peers) and medical professionals. Situation: Medical laboratory tests can help detect a condition, determine a diagnosis, plan treatment, check to see if treatment is working, or monitor the condition over time. A physician may order these tests as part of a routine checkup, to check for certain diseases and disorders, or to monitor the patient's health. While medical laboratory scientists do not diagnose patients, it is important to know the ideal ranges and what conditions common medical lab tests can detect. **Product: Product: Professional presentation that could be, but is not limited to, PowerPoint, Prezi, or Poster.**

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