SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: MLT-124 Department: Clinical Lab Science

Course Title: Medical Microbiology I Semester: Spring Year: 2021

COURSE OBJECTIVES: At the end of this course, students will to be able to:

a) demonstrate knowledge of basic facts and concepts regarding the etiology and pathogenesis of infectious diseases;

b) identify - i.e., properly name and accurately describe properties of, the most important infectious agents that cause disease in humans as well as normal flora for each part of the human body;

c) demonstrate understanding of basic principles of action and particular applications of antimicrobial therapeutic agents;

d) clearly communicate about the applications of microbiology in medicine and pathology.

. Prerequisite MLT-110 & 112 Co-Requisite MLT-124L

Student Learning Outcomes

Topic	Learning Outcome
Upon the completion of each lecture section, the student will be able to fulfill the section objectives as outlined in the assigned text and materials and/or defined by verbal instruction to the level identified in the MLT Program Matriculation Policy.	
Microbiology Introduction, Safety, and Quality	• Define the role of the microbiologist • Identify the contributions made by Leeuwenhoek, Pasteur, Koch, Lister, Ehrlich, Jenner, and Fleming, to modern diagnostic microbiology. • Summarize Koch's postulates. • Describe the role of the microbiologist both to the patient and to the healthcare system • Explain the difference between disinfection and sterilization • List methods of disinfection and sterilization • Discuss the levels of biosafety in relation to types of organisms and safety cabinets

Microbiological Taxonomy	• Discuss and define taxonomy, speciation, and nomenclature • Demonstrate the ability to write the name of an organism • Determine the level of taxonomy used daily in the microbiology lab • Describe Bergey's manual and what information it gives • Describe bacterial cell structures and discuss the difference in structure between gram positive and gram negative bacteria • Describe bacterial cell replication • Define bacterial growth phases; lag, log, stationary, decline • Describe shape and arrangement of bacterial cells
Structure and Reproductive Process of the Bacterial Cell.	• Differentiate prokaryotic and eukaryotic cells • Describe bacterial cell structures and discuss the difference in structure between gram positive and gram negative bacteria • Describe bacterial cell replication including the following: • Binary fission, plasmids, transformation, transduction, and conjugation • Describe shape and arrangement of bacterial cells. • Describe what happens in terms of bacterial growth during the lag, log, stationary, and decline phases of growth
Host-Microorganism Interaction and Infection Control	• Define: vector, vehicle, reservoir, pathogen, disease, infection, virulence, opportunistic pathogen, normal flora, colonization, antibiotics, and zoonoses • List methods of transmission of infection • Define the term "nosocomial" and describe some common infections • Give examples of sterile vs. non-sterile sites of the body • List the functions of an infection control committee/plan
Specimen Collection, Handling, Processing, and Inoculation of Media	• Discuss the most common types of specimens evaluated and how they are collected • Discuss transport time and how it relates to specimen acceptability • Discuss the importance of proper specimen collection • Define obligate aerobe, obligate anaerobe, facultative anaerobe • List the steps involved in a routine workup of a microbiological culture
Cultivation and Isolation of Bacteria	• Identify various types of media selection – Ex. MAC and describe their use– selective and differential, BAP – supportive and differential

	• List inhibiting agents, dyes, and other additives that make media selective or differential • Be able to select proper type of media for specific bacterial growth. • Identify the correct atmosphere in which to incubate specimens • Discuss the appearance of the growth of certain organisms in broth media (Ex. Differentiate Staph. Streaks vs. puff balls-Strep) • List common broth media and what they are used for • Be able to determine oxygen needs of organism based on where it grows in broth tube
The Role of Microscopy	• Name 4 steps/reagents in the Gram stain and the purpose of each • Define methods of media inoculation. • Define streak for isolation • Define: resolution, contrast, magnification
Identification of Bacteria – Gram positive Cocci	• Identify the microscopic characteristics of the genera and related organisms. • Identify the pivotal test used to differentiate Staphylococci and Streptococci • Name the reagent(s) used in the biochemical tests; Catalase, Coagulase, Oxidase, PYR, Bile esculin, hippurate, CAMP, "A" and "P" discs • Determine which tests can differentiate significant organisms
Staphylococcus ,Micrococcus, Streptococcus, and Enterococcus	• List the major pathogens in this group • Describe the disease states that are caused by this group of organisms • Explain how these organisms cause disease. • Determine the body site affected by the disease states and the corresponding appropriate specimen to collect • Be able to synthesize all information (specimen, symptoms, Gram stain, biochemical testing) to diagnose patient in a case study
Enterobacteriaceae identification testing	• List the five (5) general Biochemical characteristics of all Enterobacteriaceae • State the principle of the following tests (what you are testing for) Oxidase, indole, urease, PYR, MRVP, citrate, nitrate, TSI, lysine, ornithine, arginine, ONPG, and motility • List the reagents used in all testing • Describe the appearance of a positive and negative result for all tests • List the ingredients in the TSI slants and interpret the results in terms of K/A, A/A, K/K, H2S and gas

Enterobacteriaceae organisms	• List the major pathogens in this group • Describe the disease states that are caused by this group of organisms • Explain how these organisms cause disease. • Determine the body site affected by the disease states and the corresponding appropriate specimen to collect • Be able to synthesize all information (specimen, symptoms, Gram stain, biochemical testing) to diagnose patient in a case study
Other Gram Negative Bacilli	• List the biochemical characteristics of Stenotrophomonas, Acinetobacter, Pseudomonas, Burkholderia, Vibrio, and Aeromonas species in regards to oxidase, glucose, and growth on MAC: • Compare this group of gram negative bacilli with previously studied gram negative rods • Describe any biochemical testing and/or colonial morphology to speciate • Describe the pathogenicity of each organism including disease states and virulence factors present • Describe the Gram morphology of Campylobacter and Helicobacter species. • List special media and environmental conditions to cultivate these organisms • Describe common disease states associated with Campylobacter and Helicobacter species and the appropriate specimens to diagnose • Describe any biochemical testing and/or colonial morphology to speciate • Describe the Brucella species in relation to animal hosts. • List special media and environmental conditions to cultivate these Organisms • Describe the disease states and biological safety classification of the Brucella genus
Antimicrobial Susceptibility Testing	• Define antibiotic, antimicrobial, bacteriocidal, bacteriostatic. • Define Intrinsic resistance, acquired resistance, MIC, MacFarland standard, and therapeutic index • Describe modes of action of the antibiotic groups • Name one example of an antibiodtic for each mode of action • Name the four classes of antibiotics • Describe the Kirby Bauer susceptibility test. • List methodologies used to perform testing such as Agar dilution, broth dilution, etc. • Define peak and trough and drug assay terms.

Gram Negative Coccobacilli	• Describe the Gram stain appearance of these organisms including any characteristic appearances by species • List the organisms that make up the HACEK group • Describe the disease states caused by haemophilus influenzae • List laboratory testing used to identify Haemophilus influenzae • Describe the X and V factors and how they relate to Haemophilus identification • Describe the disease state caused by Haemophilus ducreyi • Describe the transmission process of Pasturella • List diagnostic appearance, odor, and testing of Pasturella
Gram Negative Cocci	• Name the primary pathogens and list diseases caused by Neisseria • Describe the Gram stain morphology of the Neisseria and Moraxella genera • Identify positive and negative test to diagnose this genus. Name any selective and/or differential media that supports the growth of and helps to diagnose this group of organisms
Gram Positive Bacilli	• Student will possess knowledge of clinically significant Gram Positive Bacillus and proper techniques for identification. • Bacillus, Listeria, Corynebacterium, Erysipelothrix, Lactobacillus, Gardnerella • Nocardia, Streptomyces, Rhodococcus • List the organisms within this group that are clinically significant and identify the diseases caused by them. • Describe the unique characteristics of each genus in relation to spore formation, branching, and Catalase reaction • Identify how to culture the different genera in this group for identification. • Demonstrate how to microscopically identify these organisms. • Compare these gram positive organisms with previously studied gram positive organisms. • List the biochemical and morphological testing used for each group of organisms including; CAMP, H2S,Clue cells, acid fast stain, casein, xanthine, tyrosine, motility, and hemolysis

Anaerobic Bacteria	• Describe growing environment needed for anaerobes and how it is created in the lab • List the organisms within this group that are clinically significant and identify the diseases caused by them. • Describe the aerotolerance test and interpret results • List the primary media for anaerobes and describe the function of each plate and broth • Describe the Gram morphology of the common pathogenic anaerobes. • Describe any unique colonial morphology of anaerobes. • List the three antibiotics that are used to classify anaerobic non-spore-forming Gram negative rods • List the pathogenic species of Clostridium, the disease states they cause, toxins formed, and the placement of the spores within the rod. • Describe biochemical testing used to differentiate the anaerobic species
Acid Fast Bacilli	• List the five general characteristics of the Mycobacterium genus • Be able to list media needed for growth (ex. L J –Lowenstein Jensen or Middlebrook 7 H • List the criteria by which Runyon Classifications are made • Define: Photochromogen , Scotochromogen • List the staining methods used, the stains involved, and determine whether they are cold or heated procedures. • Interpret the Kinyoun stain as positive or negative • Describe the disease states caused by the Mycobacterium species and determine how the disease is transmitted. • Describe the common biochemical testing used to identify Mycobacteria in the lab. • Describe the PPD skin test and its interpretation and follow-up indications
Rare organisms and those Requiring Special Media	• Describe the disease states caused by this group of organisms • Describe the special media that is used for this group. • Discuss the present day implications of Tularemia in regards to biosafety level and laboratory personnel • Describe unique Gram stain morphology • When biochemical testing fails to identify an organism, the student will consider the presence of a rare organism as the causative agent including: • Achromobacter, Chryseobacterium, Alcaligenes, Bordetella non-pertussis

	• Describe the rare bacteria in terms of its oxidase and glucose use, its growth on MacConkey media, and its number of flagella and placement • Describe the type of patients in which we find these organisms as infectious agents
Instrumentation in the Microbiology laboratory	• Discuss the application of photometry principles in the microbiology laboratories • Describe the newest techniques in the microbiology lab to include molecular and MALDI-TOF techniques • List and describe the basic features of the Microscan and Vitek systems • Compare and contrast Blood culture instruments commonly used in the clinical laboratory including BacT-alert, Bactec, and VersaTec systems
Identifying organism by body site	• Discuss the types of samples commonly collected to determine if an infection is present in the : ○ Urine, upper respiratory tract, lower respiratory tract, vaginal/genital tract, stool, wound, blood culture, or other body fluid • List at least three (3) normal flora organisms present for the body site sampled. (if present) • List at least three (3) pathogens that can cause an infection in the body site sampled • Review all organisms studied, biochemical and cultural characteristics used for identification. • Follow flow charts in a linear fashion for identification of organisms. • Read and analyze case studies related to microbiology. • Uncover answers to case study questions. • In group format, discuss the case study topic and the impact on laboratory testing and/or interpretation