

Virginia Western Community College

MDL 237

Clinical Bacteriology

Prerequisites

BIO 101 or equivalent

Course Description

This course will introduce the student to the basic concepts of clinical microbiology with an emphasis on bacterial identification of clinically significant pathogenic bacteria and fungi. Topics covered include biochemical identification and molecular biology identification techniques of pathogenic bacteria. Proper specimen collection and plating of bacteria from human body sites will be emphasized also. Susceptibility testing and antibiotic resistance will also be discussed.

Semester Credits: 4

Lecture Hours: 2

Lab/Clinical/Internship Hours: 0

Required Materials

Textbook:

Textbook of Diagnostic Microbiology. 5th Edition. C.R. Mahon, et al.
ISBN: 9780323089890

Other Required Materials:

Internet Access

Course Outcomes

At the completion of this course, the student should be able to:

- Perform a gram stain of samples containing bacteria to aid in a presumptive identification
- Plate biological samples containing bacteria onto the proper media and be able to identify the purpose of various selective media
- Identify bacteria by their colony characteristics and growth on selective media
- Identify bacteria by using biochemical testing methods and molecular testing methods such as PCR and DNA fingerprinting
- Understand the mechanism of action of common antibiotics and the basis of antibiotic resistance
- Describe and differentiate the characteristics of the various species of pathogenic bacteria including the staphylococci, streptococci, and enterococci, and be able to differentiate one species from another such as Staphylococcus Aureus and Epidermidis

- Learn proper isolation techniques for aerobic vs. anaerobic and facultative anaerobic bacteria
- Isolate and successfully identify pathogenic fungi and various non-bacterial pathogens such as *Mycoplasma* and *Ureaplasma*
- Understand the theory behind automated techniques of bacterial identification

Topical Description

I: Bacterial Cell Structure, Physiology, Metabolism and Genetics

- Significance
- Overview of the Microbial World
- Classification / Taxonomy
- Comparison of Prokaryotic and Eukaryotic Cell Structure
- Bacterial Morphology
- Microbial Growth and Nutrition
- Bacterial Genetics

II: The Laboratory Role in Infection Control

- General Concepts in Infection Prevention and Control Practice
- Emerging and Reemerging Pathogens

III: Performance Improvement in the Microbiology Laboratory

- General Guidelines for Establishing Quality Control
- Performance Improvement
- Analytic Analysis of Tests
- Clinical Analysis of Tests
- Operational Analysis of Tests
- Choosing a Laboratory Method
- Test Validation

IV: Specimen Collection and Processing

- Basic Principles of Specimen Collection
- Preservation, Storage and Transport of Specimens
- Specimen Receipt and Processing
- Culture Workup
- Communication of Laboratory Findings

V: Microscopic Examination of Materials from Infected Sites

- Preparation of Samples
- Stains
- Microscopes
- Examination of Prepared Material

- Grading or Classifying Materials
- Reports of Direct Examinations
- Examples of Sample Observations and Reports

VI: Use of Colony Morphology for the Presumptive Identification of Microorganisms

- Importance of Colonial Morphology as a Diagnostic Tool
- Initial Observation and Interpretation of Cultures
- Gross Colony Characteristics Used to Differentiate and Identify
- P Colonies with Multiple Characteristics
- Growth of Organisms in Liquid Media

VII: Biochemical Identification of Gram Negative Bacteria

- Carbohydrate Utilization
- Glucose Metabolism and Its Metabolic Products
- Amino Acid Utilization
- Manual Multitest Systems
- Rapid and Automated Identification Systems

VIII: Applications of Molecular Diagnostics

- Nucleic Acid Hybridization Techniques
- Nucleic Acid Amplification Procedures
- Strain Typing and Identification
- Future of Molecular Diagnostics Testing in the Clinical Microbiology Laboratory
- Nanomedicine

IX: Antimicrobial Agent Mechanisms of Action and Resistance

- Antibiotic Targets and Mechanisms of Action
- Dissemination
- Nanotechnology to Deliver Therapeutic Agents

X: Antimicrobial Susceptibility Testing

- Reasons and Indications for Performing Antimicrobial Susceptibility Tests
- Selecting Antimicrobial Agents for Testing and Reporting
- Traditional Antimicrobial Susceptibility Testing
- Automated Antimicrobial Susceptibility Test Methods
- Interpretation of In Vitro Antimicrobial Susceptibility Test Results
- Methods of Detecting Antimicrobial-Inactivating Enzymes
- Quality Control of Antimicrobial Susceptibility Tests
- Selecting an Antimicrobial Susceptibility Test Method
- Susceptibility Testing Challenges
- Special Antimicrobial Susceptibility Tests

XI: The Staphylococci

- General Characteristics
- Clinically Significant Species
- Laboratory Diagnosis
- Antimicrobial Susceptibility

XII: *Streptococcus*, *Enterococcus* and Other Catalase-negative Gram-Positive Cocci

- General Characteristics
- Clinically Significant Streptococci and Streptococcus-like Organisms
- Laboratory Diagnosis
- Noncultural Identification
- Susceptibility Testing

XIII: Aerobic Gram-Positive Bacilli

- Non-Spore-Forming, Non-branching Catalase Positive Bacilli
- Non-Spore-Forming, Non-branching Catalase Negative Bacilli
- Non-Spore-Forming, Branching Aerobic Actinomycetes
- Spore-Forming, Non-branching Catalase-Positive Bacilli

XIV: *Neisseria* Species and *Moraxella Catarrhalis*

- Pathogenic *Neisseria* Species
- Commensal *Neisseria* Species

XV: *Haemophilus* and Other Fastidious Gram-Negative Bacilli

- *Haemophilus*
- HACEK Group
- *Capnocytophaga*
- *Pasteurella*
- *Brucella*
- *Franciella*
- *Legionella*
- *Bordetella*

XVI: *Enterobacteriaceae*

- General Characteristics
- Opportunistic Members of the Family Enterobacteriaceae and Associated Infections
- Primary Intestinal Pathogens of the Family Enterobacteriaceae
- Other Genera of the Family Enterobacteriaceae
- Laboratory Diagnosis of Enterobacteriaceae

XVII: *Vibrio*, *Aeromonas*, *Plesiomonas* and *Campylobacter* Species

- *Vibrio*
- *Aeromonas*
- *Plesiomonas*
- *Campylobacter* and *Campylobacter*-Like Species

XVIII: Nonfermenting and Miscellaneous Gram-Negative Bacilli

- General Characteristics of Nonfermenters
- Less Commonly Encountered Nonfermentative, Gram-Negative Bacilli

XIX: Anaerobes of Clinical Importance

- Important Concepts in Anaerobic Bacteriology
- Frequently Encountered Anaerobes and Their Associated Diseases
- Specimen Selection, Collection, Transport, and Processing
- Procedures for Identifying Anaerobic Isolates
- Antimicrobial Susceptibility Testing
- Treatment of Anaerobe-Associated Diseases

XX: The Spirochetes

- Leptospire
- Treponemes

XXI: *Mycoplasma* and *Ureaplasma*

- General Characteristics
- Clinical Infections
- Laboratory Diagnosis
- Antimicrobial Susceptibility
- Interpretation of Laboratory Results

XXII: *Mycobacterium Tuberculosis* and Nontuberculous Mycobacteria

- Clinical Significance of the *Mycobacterium Tuberculosis* Complex
- *Mycobacterium Leprae*
- Isolation and Identification of the Mycobacteria
- Susceptibility Testing of *Mycobacterium Tuberculosis*
- Immunodiagnosis of *Mycobacterium Tuberculosis* Infection

XXIII: Medically Significant Fungi

- General Characteristics
- Taxonomy
- Mycoses
- Clinically Significant Species
- Laboratory Diagnosis of Fungi
- Immunodiagnosis of Fungal Infections
- Antifungal Susceptibility

Laboratory Topics

- Laboratory Safety, Equipment, and Materials; Basic Techniques
- Survey of the Microbial World
- Staining Techniques
- Media: Enriched, Differential and Selective
- Growth
- Control of Microbial Growth
- DNA Fingerprinting
- Microbes and Disease
- Diagnostic Immunology
- Identifying Microbes
- Hydrolytic Enzymes
- Biochemical Testing
- Identification of Unknown Bacteria by Biochemical and Molecular Methods

Note to Instructors