

## Clinical Microbiology (7 modules)

### Introduction to Medical Microbiology (4.5 CEU)

- Safety and quality control in microbiology
- Host-microorganism interactions, including pathogenic mechanisms of microorganisms
- Specimen collection, transport, receipt and processing
- Direct microscopic examination including Gram stain principle, procedure, interpretation/ reporting and troubleshooting, acid-fast stains, fluorochrome stains and wet preps
- Specimen preparation for culture set-ups and selection, inoculation and incubation of culture media
- Interpretation of cultures and overview of bacterial identification, including macroscopic and microscopic characteristics; environmental and nutritional requirements of bacteria
- Principles of identification schemes, including commercial systems

### Introduction to Antimicrobial Susceptibility Testing (2 CEU)

- Antimicrobial agents: definitions, mechanisms of action and mechanisms of resistance
- Antimicrobial susceptibility testing goals, standardization and quality control
- Testing methods that directly detect antimicrobial activity, including disk diffusion (Kirby-Bauer), E test, minimum inhibitory concentrations (MIC), agar dilution, and screening/supplemental test methods, e.g. MRSA and VRE screens, D-zone test, ESBL
- Testing methods that directly detect specific resistance mechanisms, e.g. beta-lactamase
- Review of cumulative antibiograms and predictable susceptibility patterns
- Review of common antimicrobial agents and their mode of action, family name, route of administration, common product name, spectrum of activity and indications for use

### Applications for Antimicrobial Susceptibility Testing (2.5 CEU)

- Comprehensive look at bacterial mechanisms of resistance, including enzymatic inactivation (beta-lactamases, ESBL, etc.), altered antimicrobial target or receptor, and altered permeability
- Laboratory strategies for antimicrobial susceptibility testing, including the correlation of susceptibility patterns to organism identification and selective reporting
- Detailed look at antimicrobial susceptibility test methods including the principle, method, interpretation, advantages, disadvantages and sources of error for both disk diffusion and dilution methods
- Discussion of anaerobic antimicrobial susceptibility testing
- Detailed look at the screening/supplemental methods for detection of antimicrobial resistance

### Aerobic Gram-Negative Cocci (1 CEU)

- Review of the *Neisseria* species, including *Neisseria gonorrhoeae*, *Neisseria meningitidis* and *Neisseria lactamica* and *Moraxella (Branhamella) catarrhalis*.
- Discussion of growth requirements, Gram stain reactions, colony morphology, identification, pathogenesis, treatment and antimicrobial susceptibility testing of these organisms.

### Staphylococcus (1.5 CEU)

- General information about gram-positive cocci
- Review of *Staphylococcus* and other related species, including genus and species differentiation and growth characteristics
- General discussion of appropriate test methods and media with corresponding interpretations for: slide and tube coagulase, latex agglutination, Novobiocin susceptibility, modified oxidase test, glucose utilization, Bacitracin susceptibility, mannitol salt agar and CHROMagar
- General information, identification tests and expected results, virulence factors, clinical significance, associated disease states and antimicrobial therapy and resistance provided for: *Staphylococcus aureus*, coagulase-negative staphylococci, *Staphylococcus epidermidis*, *Staphylococcus saprophyticus*, *Micrococcus* species, other *Staphylococcus* species, and *Stomatococcus (Rothia) mucilanginosus*

### Streptococcaceae (2 CEU)

- Overview of the general characteristics of *Streptococcaceae* and *Enterococcus*, including Lancefield's and Brown's classification systems and the following methods of identification: catalase, Bacitracin, SXT and optochin susceptibilities, bile solubility, bile esculin and sodium hippurate hydrolysis, 6.5% NaCl tolerance, PYR, CAMP and LAP
- Colonial and microscopic morphology, identification tests and expected results, virulence factors, clinical significance, associated disease states and antimicrobial therapy and resistance provided for the following organisms: *Streptococcus pyogenes* (Group A), *Streptococcus agalactiae* (Group B), Groups C, F, & G *Streptococcus*, Group D *Streptococcus*, *Enterococcus*, *Streptococcus pneumoniae*, *Streptococcus viridans* group, *Gamella* species, *Leuconostoc* species, and *Pediococcus* species

### Enterobacteriaceae (3 CEU)

- Overview of Enterobacteriaceae including discussion of primary vs. opportunistic pathogens and a review of appropriate isolation media with expected results including MacConkey, EMB, HE, XLD, SS, MacConkey Sorbitol and CIN agars and Gram-negative and phosphate buffered saline broths
- Overview of identification tests used to identify all Enterobacteriaceae (glucose, nitrate and oxidase) and those used to differentiate genera and species of Enterobacteriaceae (carbohydrate utilization, ONPG, indole, VP, citrate, urease, decarboxylation of arginine, lysine and ornithine, deaminase activity, H<sub>2</sub>S, gelatin, and motility)
- Discussion of 'O', 'K' and 'H' antigens

Characteristics, disease states and identification tests with key biochemical reactions for *Escherichia coli*, *Edwardsiella tarda*, *Shigella* species (Groups A, B, C, and D), *Citrobacter freundii*, *Citrobacter koseri*, *Salmonella typhi*, *Salmonella* species, *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Enterobacter cloacae*, *Enterobacter aerogenes*, *Serratia marcescens*, *Proteus mirabilis*, *Proteus vulgaris*, *Providencia rettgeri*, *Providencia* species, *Morganella morganii*, *Yersinia pestis* and *Yersinia enterocolitica*