

# ID

## Infectious Disease

### Course Goals

#### Goals

1. Name common microbial pathogens.
2. Name the diseases caused by common microbial pathogens.
3. Describe presenting symptoms of specific infectious diseases.
4. Describe laboratory methods used to diagnose specific infectious diseases.
5. Explain therapeutic options for specific infectious diseases.
6. Describe vaccines to prevent specific infectious diseases.
7. Describe key virulence factors for specific infectious diseases and explain how these virulence factors are important in the pathogenesis and symptoms of specific infectious diseases.
8. Describe features of the innate and acquired host response associated with protection from disease (protective immune responses).
9. Describe features of the host immune response associated with immunopathogenesis.
10. Appreciate epidemiologic features of specific infectious diseases, including modes of transmission (aerosols, food-borne, parenteral, sexual, zoonotic, iatrogenic, etc...) and means of blocking transmission (handwashing, body fluid precautions, pasteurization, mosquito control, etc...).
11. Appreciate how the microbiome and dysbiosis contribute to health and disease.

# Spring 2019

## Infectious Disease

### Session Learning Objectives

#### **ID - Anaerobes**

1. Discuss the ramifications of oxygen toxicity for the ability of anaerobes to cause significant disease in humans.
2. Discuss the role of the anaerobic normal flora in the formation of soft tissue abscesses.
3. Identify and describe the pathogenesis of disease(s) caused by the major species of Clostridium (C. tetani, C. botulinum, C. perfringens, C. difficile), and discuss similarities and differences in terms of acquisition of the organism, virulence factors associated with disease, treatment, prevention, and public health implications.
4. Discuss the likely means by which botulinum toxin would be used as a "bioweapon."

#### **ID - Antifungals**

1. For the specific drug groups listed, describe the target(s) of the drug, mechanism of action and resistance.
2. For the specific drug groups listed, explain how the general spectrum of activity influences the drug's main uses.
3. Describe (know) how the different aspects of drug pharmacokinetics (absorption, distribution, and metabolism/excretion) impact dosing and usage.
4. Understand how the host defense system impacts the choice of antifungal agent.
5. Understand the different types of toxicities and adverse reactions.
6. Understand the differences between the types of antifungal therapy.
7. Understand how adverse reactions relate to the drug mechanism of action and drug-drug interactions.
8. Describe which drug combinations are given and why.
9. For the specific drug groups listed, understand the basis for their selective toxicity.
10. For the specific drug groups listed, describe (know) the pharmacokinetic factors in the selection of the antifungal.
11. For the specific drug groups listed, describe the major restricting toxicities important in the selection of antimicrobial therapy.

## **ID - Antimicrobials II**

1. Discuss why tuberculosis is ALWAYS treated with multiple drugs for a long time.
2. Understand that drug resistant TB treatment CAN REQUIRE MORE THAN 4 DRUGS.
3. Explain the use of 4 drug therapy: Isoniazid, rifampin, pyrazinamide, and ethambutol.
4. Understand the differences between the types of antimycobacterial therapy.
5. Discuss how adverse reactions relate to the drug mechanism of action and drug-drug interactions.
6. Understand how the host defense system impacts drug choice.
7. Understand that leprosy and MAC are also treated with drug combinations.
8. For the drug groups listed, discuss the target(s) of the drug, mechanism of action and resistance.
9. For the drug groups listed, understand the basis for their selective toxicity.
10. For the drug groups listed, describe (know) the pharmacokinetic factors in the selection of the antibiotic.
11. For the drug groups listed, understand the toxicities and metabolic traits.
12. For the drug groups listed, explain the important aspects of host factors that influence the selection of therapy.
13. For the drug groups listed, explain how the spectrum of activity of antimycobacterials influence their main uses.

## **ID - Antiparasitic Pharmacology**

1. Discuss the therapeutic uses of antiparasitics.
2. Describe the mechanism of action of antiparasitic agents (where known).
3. Discuss the important pharmacokinetics of antiparasitic agents that impact or limit use.
4. Discuss the antiparasitic agents' significant drug toxicity that prevents use or requires additional consideration during treatment.
5. Describe the drug resistance and alternative treatment strategies for antiparasitic agents.

## **ID - Antiretroviral Pharmacology**

1. Describe the six different mechanistic classes of agents currently available.
2. Describe the basic mechanisms of resistance for each of the six classes of anti-HIV agents and discuss the relevance of the high rate of mutation of HIV per replication cycle to the great potential for genotypic variation and the need for multi-drug treatment regimens that will reduce viral replication to the lowest possible level.
3. For the six classes of anti-HIV agents, list the primary route of administration and the primary elimination pathway and describe the potential drug-drug interactions that can occur at both the absorption and eliminations steps (detrimental and beneficial) - recognize that these factors influence the selection of agents for a given patient with regards to convenience and optimization of adherence.
4. List the most common use-limiting toxicities for each of the anti-HIV classes and recognize that drug tolerability is a major factor in drug selection for any given patient.
5. Recognize that the standard of care for HIV infections involves multi-drug regimens based on the results of resistance testing and the avoidance of virologic failure and drug-drug interactions.
6. Describe the sites of drug action in relation to the replicative life cycle of the HIV virus.
7. Describe the clinical relevance of NRTIs being prodrugs that require intracellular activation.

## **ID - Arboviral Diseases**

1. Define an arbovirus.
2. Name the major human disease outcomes associated with arboviral infection and describe how arboviral diseases are diagnosed.
3. Describe the transmission cycle of arboviruses, including: vectors, reservoir hosts, incidental hosts, and dead-end hosts; factors that determine reservoir hosts and vectors; whether humans can function as reservoir hosts for arboviruses; and reasons why other blood-borne viruses, like HIV, HBV, and HCV, are not arboviruses.
4. Describe other, non-vector mechanisms by which arboviruses can be transmitted and discuss why is this medically important.
5. Identify the number of Dengue virus serotypes and discuss why severe Dengue disease [Dengue Hemorrhagic Fever/Dengue Shock Syndrome (DHF/DSS)] occurs predominantly in regions of the world where multiple serotypes of Dengue virus co-circulate.
6. Describe the primary risk factor for acquiring severe Dengue disease [Dengue Hemorrhagic Fever/Dengue Shock Syndrome (DHF/DSS)] and discuss why some infants have in increased risk for acquiring DHF/DSS following a primary infection.
7. Describe multiple approaches to prevent arboviral diseases.

## **ID - ARS: Viral Diagnostics**

1. Recognize diagnostic tests that are used in hospitals and central laboratories to identify pathogenic viruses.
2. Understand laboratory tests that are used to detect the presence of viruses or immune responses to viruses in clinical specimens.
  - a. Virus cultivation: growth in tissue culture cells and cytopathic effects (CPE)
  - b. Tests for virus antigen: immunofluorescence assay, rapid antigen detection assays
  - c. Tests for virus nucleic acid: PCR, RT-PCR, Multiplex PCR (qualitative vs. quantitative)
  - d. Tests for virus-specific antibody: ELISA, Neutralization assay
3. Explain how different tests and assays work and what some of the pitfalls in interpretation of lab data might be.
4. Describe the basic properties of RNA and DNA viruses and how these properties are useful in viral diagnostics.

## ID - Bacterial STDs I & II

1. List the major bacteriological features (i.e. Gram stain, morphology) of *Neisseria* and *Moraxella* species that are useful in laboratory diagnosis.
2. Discuss the standard procedures for diagnosis of gonorrhea, whether some are more effective for diagnosis in men than in women and why.
3. Discuss whether men or women more likely to have an asymptomatic infection with *N. gonorrhoeae*, the epidemiological significance of an asymptomatic carrier, and if an asymptomatic infection is of any concern if there are no symptoms.
4. Describe the clinical manifestations of gonorrhea and what organs (exclude the ones in the urogenital tract) that *N. gonorrhoeae* can infect.
5. Describe the importance of antigenic heterogeneity in the pathogenesis of gonorrhea, which bacterial surface structures undergo antigenic variation and/or phase variation, and how this antigenic heterogeneity relates to the ability of a single person to be infected multiple times with this organism.
6. Discuss the recommended guidelines for treatment of gonorrhea and how these relate to the treatment of other common STD's.
7. Define the major characteristics of spirochetes and discuss how they differ from other bacteria.
8. Discuss the various stages of syphilis and describe the major aspects of the pathogenesis and clinical manifestations of each stage.
9. Discuss how syphilis is diagnosed, the best tests for each stage of the disease, why serological tests are not very suitable for the diagnosis of the primary stage of syphilis, and how infectious each syphilis stage is.
10. Discuss the epidemiology of the various diseases caused by *Treponema* sp.
11. Discuss syphilis treatment, prevention, and the behavior that is most associated with small epidemics of syphilis.
12. Define the Herxheimer reaction.
13. Discuss the major characteristics that differentiate *Chlamydia* from other bacteria.
14. Describe the life cycle of *Chlamydia*, including how this unusual life cycle affects treatment of chlamydial infections.
15. Describe the major diseases caused by the different species of *Chlamydia*.
16. Identify the potential complications of sexually transmitted chlamydial infections for women.
17. Describe the epidemiological characteristics of the different chlamydial infections.
18. Name the diagnostic laboratory tests are used to identify *Chlamydia* infections.
19. Name the predominant chlamydial infection in developing countries and discuss the reason for its predominance, the consequences of the infection, and the preventive measures being taken to decrease either the incidence of disease or the complications arising from chronic infection.
20. Name the most significant emerging threat with regard to the treatment of gonococcal infections.
21. Describe the "Gold Standard" with regard to the laboratory diagnosis of gonorrhea.
22. Discuss antibiotic resistance developed in *Treponema pallidum* compared to other bacteria.

## **ID - Block Introduction (Infectious Disease)**

1. Discuss the importance of studying microbiology and infectious diseases.
2. Name three variables that affect the development of infection and disease.
3. Recognize the basic structures of bacteria that determine their Gram staining, innate immune stimulation and antimicrobial susceptibility and resistance.
4. Identify 4 bacterial groups based on stain and shape and two important bacteria in each group.
5. Identify common clinical syndromes that are associated with which common bacteria.
6. Name the four questions one can ask when evaluating a patient with presumed infectious disease and describe what factors affect the answers to each one.

## **ID - Block Introduction (Microbiology)**

1. Vaccines: Be aware of the vaccines used to prevent specific infectious diseases and the patient populations that should be vaccinated.
2. Vaccines: Be aware of the pediatric vaccination schedule, the adult vaccination schedule, and vaccines for special use
3. Vaccines: For common vaccines learn whether the vaccine is a killed vaccine, a live-attenuated vaccine, a subunit vaccine, or passive immunization (antibodies).
4. Vaccines: Should pregnant women be vaccinated? Why? Which vaccines?
5. Viruses: Name the major families of pathogenic viruses.
6. Viruses: Name common viral pathogens from each family and their respective disease(s).
7. Viruses: What are the distinguishing characteristics of the major families of pathogenic viruses?
8. Viruses: How do the distinguishing characteristics of virus families correlate with alternative strategies of viral gene expression and genome replication?
9. Viruses: Do viruses have pathogen-associated molecular patterns (PAMPs)? What are they? What do they do?

## **ID - Cases: Cellulitis, Necrotizing Fasciitis, Bacteremia, Endocarditis**

1. Name three entities in the differential diagnosis of a tender red leg.
2. Name the four cardinal signs of soft tissue infection (the cardinal findings of inflammation).
3. Name the two most common pathogens that cause cellulitis.
4. Draw a simple diagram of a cross-section of skin, and label the level of involvement for erysipelas, cellulitis, abscess, and necrotizing fasciitis.
5. Describe the distinguishing clinical features of erysipelas, cellulitis, abscess, and necrotizing fasciitis.
6. Discuss the pathogenesis of necrotizing fasciitis with regard to the level of involvement of the skin and anatomic barriers.
7. Define clinical manifestations of necrotizing fasciitis and how they differ from other soft tissue infections.
8. Recognize the two different types of necrotizing fasciitis and the organisms involved.
9. Define the gold standard for diagnosis of necrotizing fasciitis.
10. Recognize the importance of a dual medical and surgical approach to this infectious disease emergency.
11. Recognize the common clinical symptoms and signs of infective endocarditis.
12. Describe the pathophysiology and clinical manifestations of the following features of IE: pre-existing cardiac lesions that predispose to IE, attachment of particular bacterial species to endocardial structures, local destruction of endocardial structures, embolization, systemic signs-fever, malaise, and immune complex mediated manifestations.
13. Discuss how the clinical manifestations of necrotizing fasciitis relate to the pathophysiology of a tender red leg.

## **ID - Cases: CNS Infections**

1. Recognize the common clinical manifestations of CNS infection in children.
2. Identify the most common bacterial etiologies, and the vaccine-preventable causes, of CNS infection in children.
3. Interpret the results of CSF cell count, glucose, and protein to help focus the etiologic differential diagnosis.
4. Identify the most common viral etiologies of acute meningoencephalitis in children.
5. Recognize the epidemiologic risk factors and clinical findings suggestive of enteroviral disease.
6. Discuss how enterovirus infections are transmitted and what infection control measures should be taken to prevent spread.
7. Identify one of the relatively common causes of viral encephalitis in normal hosts for which effective antiviral therapy is available.
8. Differentiate the typical CSF profiles seen in acute bacterial meningitis compared with those seen in cases of viral meningitis.
9. Describe the pathophysiology of acute bacterial meningitis.
10. Define meningitis, meningoencephalitis, cerebral edema, and intracranial pressure.
11. List the common etiologies of acute bacterial meningitis for various age groups, understanding the rationale for empiric treatment (see Harrison's Table 360-2 'indication and antibiotic' section for empiric treatment regimens).
12. Delineate a procedural algorithm for patients presenting with symptoms/signs of acute bacterial meningitis, understanding the necessity for rapid initiation of antimicrobials.
13. Generate a differential diagnosis of CNS mass lesion and highlight those diagnoses which would be expected in individuals with HIV-1.
14. Discuss the appropriate diagnostic studies (laboratory, pathology, serology) for evaluating a CNS mass lesion in HIV-infected individuals.
15. Name the most common protozoal disease to cause brain abscess and describe the life cycle and how humans become infected.

## **ID - Cases: Gastroenteritis & Diarrhea**

1. Identify three risks for enteric infection while traveling abroad.
2. Define "diarrhea."
3. Recognize the characteristics of inflammatory vs. non-inflammatory watery diarrhea.
4. Name three common organisms causing inflammatory and three for non-inflammatory diarrhea.
5. Name the single most important and effective intervention for controlling the morbidity and mortality of diarrheal illness in children and adults in the U.S. and worldwide.
6. Identify the common etiologies of viral gastroenteritis in childhood.
7. Describe the transmission, epidemiology, and pathophysiology of viral gastroenteritis.
8. Discuss the treatment of viral gastroenteritis.
9. Describe current strategies for the prevention of viral gastroenteritis.

## **ID - Cases: HIV and Immunocompromised Patients**

1. Recognize clinical scenarios that should lead you to consider an immunodeficiency in a child.
2. Describe the types of questions that should be asked when eliciting a family history when you suspect an immunodeficiency.
3. Discuss how immunodeficiencies are usually classified.
4. List the screening tests used to investigate immunodeficiency.
5. Explain the defect found in chronic granulomatous disease (CGD) and why this leads to susceptibility to certain types of microorganisms.
6. Identify the possible bacteria that might cause disease and be a gram positive rod on gram stain.
7. Outline the more common clinical manifestations of Nocardia infection in humans.
8. Identify the skin lesions associated with a herpes zoster outbreak.
9. Discuss the pathophysiology of herpes zoster infection and its relationship to chicken pox.
10. Describe the nature of immunodeficiencies associated with Varicella-Zoster virus (VZV reactivation).
11. Discuss the clinical presentation and treatment of patients with HIV-related Pneumocystis jirovecii pneumonia (PCP).
12. Discuss the diagnostic tests for persons with HIV infection.
13. Relate immunodeficiency to HIV and discuss the predisposition to opportunistic infections.
14. Discuss pulmonary complications of HIV infection.
15. Describe the natural history of HIV infection and discuss the benefit of antiretroviral therapy.

## **ID - Cases: Parasitic Diseases**

1. Describe the lifecycle of *Entamoeba histolytica*.
2. List the appropriate laboratory tests for the diagnosis of amebiasis.
3. Recognize the basic principles of treatment of amebiasis.
4. Outline public health measures to interrupt the transmission of *E. histolytica*.
5. Recognize that malaria must be considered in every febrile patient who lives in or has traveled to a malaria-endemic area in the past year.
6. Describe the important clinical differences between *Plasmodium falciparum* and other species that cause malaria.
7. Describe the three major clinical syndromes associated with severe malaria.
8. Identify the two most important drug treatment regimens for severe malaria.
9. Name three non-pharmaceutical life-saving interventions for severe malaria.
10. Describe the pathophysiologic process that leads to severe malaria.
11. Identify the human genetic variations associated with malaria.
12. Recognize the global importance of parasitic diseases.
13. Discuss childhood malnutrition.
14. Discuss public health interventions.
15. Discuss the clinical spectrum of helminthic infection.
16. Locate information regarding pre-travel immunizations for a traveler.
17. Given a travel destination, find information regarding infectious disease risk.
18. Describe the major epidemiologic features of human trypanosomiasis.
19. Discuss how trypanosomes evade the immune system during bloodstream infection.
20. List some public health interventions to prevent vector-borne diseases.

## **ID - Cases: Respiratory Infections I**

1. Describe the clinical syndrome of community-acquired pneumonia and the role of clinical examination and radiography in diagnosis.
2. List the three most important “typical” and “atypical” pathogens causing CAP in the United States.
3. Define the terms “definitive” and “presumptive” in describing etiological diagnoses of pneumonia.
4. Given a sputum gram stain, describe the criteria for an acceptable specimen and identify the characteristics of *S. pneumoniae*, *H. influenzae*, *S. aureus*, and mixed normal flora.
5. Describe the steps in the pathogenesis of pneumococcal pneumonia - from colonization to pneumonia, including the pathologic changes that are expected.
6. Compare and contrast aspiration pneumonitis and aspiration pneumonia.
7. Outline the guidelines for managing a patient with new pneumonia, including consideration of risk factors for antibiotic resistant bacteria.
8. Describe the role of antibiotic prophylaxis, vaccination and other measures in prevention of pneumonia.

## **ID - Cases: Respiratory Infections II**

1. Describe the PPD test and given a host category interpret the test results.
2. Outline the pathologic steps which occur with tuberculosis from initial exposure through latent disease and reactivation.
3. Describe appropriate laboratory tests in the evaluation of suspected TB.
4. Explain the rationale for multidrug therapy, prolonged treatment, and directly observed therapy.
5. Contrast the clinical findings in latent TB, inactive TB, and active pulmonary TB.
6. Given a patient description, assess the patient's risk of tuberculosis.
7. Locate the most recent CDC guidelines for identifying patients at risk for TB in the United States.
8. Recognize the epidemiology of animal bites in the United States.
9. Identify risk factors for bacterial infection after bites (human and animal).
10. Discuss indications for prophylactic antibiotics after a bite and management of the patient with a clinically infected bite.
11. Identify the major microorganisms associated with cat, dog, rat, and reptile exposure.
12. Discuss indications for tetanus prophylaxis after animal exposure.
13. Identify risks that predispose patients to septic joint.
14. Define clinical and laboratory criteria for diagnosing septic joint.
15. Recognize the differential diagnosis of septic joint.
16. Name the most common organisms causing septic joint.
17. Describe the important clinical interventions in the treatment of septic joint.

## **ID - Cases: STDs, UTIs, and PID**

1. Identify important conditions in the differential diagnosis of UTI symptoms in women.
2. Recognize the clinical characteristics of upper versus lower urinary tract infection.
3. Identify microscopic characteristics of UTI.
4. Name four common organisms causing community-acquired urinary tract infections.
5. List four defense mechanisms against UTI.
6. Identify four factors/conditions that increase the risk for UTI.
7. Recognize key differences between community-acquired and catheter-associated UTI's.
8. Define pelvic inflammatory disease.
9. Name four common organisms causing pelvic inflammatory disease.
10. Identify important considerations in treatment of pelvic inflammatory disease.
11. Name two long-term sequelae of PID.
12. Name three common causes of genital ulcer disease.
13. Recognize the clinical characteristics of the common causes of genital ulcer disease in the United States.
14. Identify diagnostic tests for common genital ulcer diseases.
15. Identify appropriate antimicrobial therapy for common causes of genital ulcer disease.

### **ID - Clinical Vignette: Protozoa and Worms**

1. List the names of a group of important human parasites.
2. Associate clinical symptoms and histories with important human parasites.
3. Recognize important human parasites in clinical specimens.
4. Recognize infective forms of important human parasites.
5. Identify the morphologies of the parasites that are critical for the diagnosis.

### **ID - Encapsulated Pathogens**

1. Describe 3 mechanisms by which polysaccharide capsules allow bacteria to evade host defenses.
2. Identify 3 Gram-positive and 3 Gram-negative encapsulated pathogens.
3. Recognize the common syndromes caused by common encapsulated bacteria.
4. Outline the mechanisms of protection against encapsulated bacteria and the different mechanisms of immune response to pure polysaccharide and protein-polysaccharide conjugate vaccines.
5. List the indications for immunization with vaccines against each common encapsulated pathogen.

### **ID - Enteric Bacteria I & II**

1. Relate morphology, metabolism and genetics of enteric bacteria to pathogenesis.
2. Discuss the diagnostic value of major antigenic structures of enteric bacteria.
3. Compare and contrast mechanisms of pathogenicity of invasive and non-invasive enteropathogenic bacteria.
4. Explain how acidity of the stomach and bacterial virulence factors contribute to the pathogenicity of gastrointestinal pathogens.
5. Identify virulence factors and host cell targets of enterotoxigenic bacteria.
6. Identify mechanisms by which type III secretion systems contribute to pathogenesis.
7. Classify enteric bacteria according to environmental and host range distribution.

## **ID - Helminths**

1. Identify distinctive properties of helminths especially in comparison to other types of infectious agents (e.g. bacteria, viruses, fungi).
2. Discuss the major epidemiological factors associated the following intestinal helminths: Tapeworms, Hookworms, Ascaris, Pinworms, Whipworms, and Strongyloides. A, including how the disease can be prevented or controlled, where the organism is acquired (i.e. its reservoir in nature); the mode of transmission; whether it is only transmitted human to human or is it acquired by contact with animals; where the worm can be located in the human body; and whether it invades beyond the intestine.
3. Recognize the major symptoms associated with human disease and describe how a laboratory or clinical diagnosis is made.
4. Discuss the major factors associated with the following blood and deep tissue helminths: Cysticercus & Echinococcus, Trichinella, Schistosoma, and Filaria, including where the organism is acquired (i.e. its reservoir in nature); the mode of transmission; whether it is only transmitted human to human or is it acquired by contact with animals; and whether there is an insect or animal vector that is required for its transmission.
5. Describe where the worm or other form of the organism (e.g. cyst) can be located in the human body; whether it invades beyond the intestine; how bacteria are associated with the symptoms associated with certain filarial diseases (e.g Wuchereria bancrofti, Elephantiasis); the major symptoms associated with human disease; how a laboratory or clinical diagnosis is made; and when eosinophilia is present and diagnostic for helminth infections.

## **ID - Herpesvirus Infections I & II**

1. Define the shared properties of all herpesviruses and understand the implications of shared features in pathogenesis of infection.
2. Describe the major gammaherpesvirus-associated malignancies and distinguishing hallmarks.
3. Explain the basis for division of herpesviruses into three subfamilies.
4. Define the molecular targets of antiviral therapy for herpesviruses during lytic replication.
5. Describe the general lytic replication cycle of herpesviruses.
6. Describe methods of transmission for the major herpesviruses.
7. Explain the pathogenesis and natural history of disease associated with major herpesviruses during acute primary infection and during reactivation.
8. Describe the latent reservoir for major herpesviruses from each subfamily.

## **ID - HIV**

1. Discuss the origins of the AIDS epidemic.
2. Describe how HIV infection leads to AIDS.
3. Recognize the common clinical manifestations of acute and chronic HIV infection.
4. Describe how antiretroviral drugs prevent or reverse the clinical manifestations of HIV.
5. Describe the role of antiretroviral therapy in HIV prevention.

## **ID - HIV Cases**

1. Discuss the laboratory tests necessary for HIV diagnosis and management: rapid antibody test, enzyme immunoassay (EIA), NAAT (DNA PCR and RNA PCR), HIV genotyping, CD4 count/percentage.
2. Apply testing strategies to real-life clinical scenarios.
3. Discuss concepts related to antiretroviral drug choices.
4. Describe opportunistic infections associated with AIDS.

## **ID - Hospital Infection Control**

1. Recognize the proper indications and use of hand hygiene, define hand hygiene, describe the different methods of hand hygiene and when each method should be employed, and explain why health care workers with patient contact are not allowed to have artificial nails.
2. Recognize the various types of barrier precautions and why they are utilized, and explain the rationale for standard precautions and what it entails, what transmission based precautions are, what airborne precautions entail, what contact precautions entail, and what droplet precautions entail.
3. List three organisms that can be transmitted via needle sticks and explain the proper procedure that should occur after exposure to a bodily fluid.
4. Recognize the utility of and methods used in infection control surveillance.
5. Recognize the role of infection control in emerging infections and bioterrorism, identify bacteria or viruses that are considered potential bioterrorism threats, and define the role of infection control in emerging infections and bioterrorism.
6. Give an example of an organism(s) that would require standard precautions versus airborne precautions versus contact precautions versus droplet precautions.
7. Describe three methods used to prevent exposures to blood borne pathogens or body fluids and list three circumstances in which a health care worker should avoid contact with patients infected with particular organisms.
8. Describe why surveillance is important and list three methods used for surveillance.
9. Describe the process of an outbreak investigation and the methods used to prevent common nosocomial infections.

## **ID - ID Block Introduction (Pharmacology) and Antimicrobials I**

1. Discuss the differences between the types of antimicrobial therapy.
2. Distinguish the different types of toxicities and adverse reactions.
3. Discuss how adverse reactions relate to the drug mechanism of action and drug-drug interactions.
4. Describe (know) how the different aspects of drug pharmacokinetics (absorption, distribution, and metabolism/excretion) impact dosing and usage.
5. Explain how the host defense system impacts the choice of antibacterial agent.
6. Describe which drug combinations are given and why.
7. For each drug group listed, discuss the target(s) of the drug, mechanism of action and resistance.
8. For each drug group listed, discuss which drugs are broad-spectrum, bactericidal and or bacteriostatic.
9. For each drug group listed, discuss the basis for their selective toxicity.
10. For each drug group listed, describe (know) the pharmacokinetic factors in the selection of the antibiotic.
11. For each drug group listed, discuss the major restricting toxicities important in the selection of antimicrobial therapy.
12. For each drug group listed, explain how the general spectrum of activity influences the drug's main uses.

## **ID - Immune Defense and Deficiency**

1. Define Immunity and how immunity relates to immunology.
2. Name four components of immune function.
3. Recognize immunodeficiency clinically and with basic lab tests.
4. Recognize the most common causes of immunodeficiency, especially secondary immuno-deficiency.
5. Identify the consequences of immunodeficiency, especially which bugs with which deficiency

## **ID - Immunodeficiency Cases**

1. Recall warning signs of primary immunodeficiency diseases in children and adults.
2. Compare infection susceptibility patterns in differing primary immunodeficiency diseases.
3. Predict underlying primary immunodeficiency disease by presenting symptoms/history.
4. Devise diagnostic algorithm to diagnosis underlying primary immunodeficiency disease.

## **ID - Integrated Review Cases**

1. Recognize common clinical syndromes (duration, symptoms, CXR patterns, risks) for common causes of Community-acquired pneumonia (CAP).
2. Know common causes of typical and atypical CAP.
3. Interpret Gram stain, culture other diagnostic results for common causes of CAP.
4. Know appropriate treatment for CAP by syndrome and organism.

## **ID - Intracellular Bacteria**

1. Explain the advantages and disadvantages of an intracellular lifestyle inside phagocytic and non-phagocytic host cells.
2. Describe the strategies used by different intracellular pathogens to avoid the antimicrobial defenses encountered during the maturation of phagosomes into phagolysosomes.
3. Describe how different intracellular lifestyles may impact on antibiotic usage and susceptibility.
4. List intracellular pathogens that escape into the cytosol, or remain in vacuoles that are fusogenic or non-fusogenic.
5. Define the genetic basis for the classification of obligate or facultative intracellular pathogens.
6. Compare and contrast the means by which zipper and trigger mechanisms contribute to invasion and dissemination of intracellular pathogens.
7. Explain how the trigger mechanism adds to Listeria clinical syndromes.

## **ID - Microbiome in Health and Disease**

1. Define microbiome, gnotobiotic, commensal, mutualist, parasite, and immune homeostasis.
2. Outline the large-scale organization of cellular life and name the primary Domains.
3. List two common pathogens belonging to each of these common bacterial phyla: Actinobacteria, Firmicutes, and Proteobacteria
4. Describe the concept of pathogen exclusion and provide an example.
5. Describe the role of the gut microbiome in human nutrition.
6. Discuss the natural history of the infant microbiome.
7. Discuss some primary factors that influence early colonization of an infant.
8. Define “dysbiosis” and provide two examples.

## **ID - Mycobacteria I & II**

1. Describe the unique properties of mycobacteria and how they create special problems for the isolation and identification of these organisms.
2. Describe how *M. tuberculosis* is transmitted and the odds of developing disease.
3. Describe the development of immunity to *M. tuberculosis*.
4. List the immune factors known to control *M. tuberculosis*.
5. Differentiate between primary, latent, and reactivation tuberculosis.
6. Describe how *M. tuberculosis* survives within a phagosome.
7. Discuss the primary goal of tuberculosis control.
8. Describe the symptoms of active tuberculosis and two methods for detecting latent infection.
9. Describe a typical antimicrobial regimen for treatment of *M. tuberculosis* (drug sensitive) and typical non-tuberculosis mycobacteria.
10. Describe the pros and cons of BCG vaccination.
11. Compare and contrast *M. tuberculosis* and non-tuberculosis mycobacterial (NTM) infections.
12. Describe disease caused by MAC.
13. Describe the definitive treatment for Buruli ulcer in early disease.
14. Describe how *M. leprae* is transmitted.
15. Compare and contrast the two extreme forms of leprosy in terms of their bacteriological and immunological characteristics.

## **ID - Mycology I**

1. Name an important pathogen in each of the following categories: Yeast, Hyaline mould, Dematiaceous mould, Dimorphic fungus, order Mucorales.
2. Choose which histologic stains and microbiology stains are useful for identifying fungi.
3. Diagram the key features of a typical fungal cell wall and identify targets for antifungal drugs.
4. Describe the pathogenesis of invasive fungal infections and typical histopathology.
5. Compare and contrast the distinguishing features of plant, fungal and animal cells.

## **ID - Mycology II**

1. Contrast the morphologic appearance of *Cryptococcus* vs. *Candida*.
2. Discuss the ecology of *Cryptococcus*.
3. Choose an appropriate rapid diagnostic test for *Cryptococcal* meningitis
4. Explain 2 key virulence factors associated with *Cryptococcus*.
5. Identify the fungal organism most frequently associated with infection of indwelling intravenous catheters.
6. Explain the limitations of the (Beta) $\beta$ -D-glucan antigen test.
7. Identify key host risk factors associated with invasive aspergillosis.
8. Describe key pathologic features associated with invasive aspergillosis.
9. Compare host risk factors and clinical symptoms between chronic pulmonary aspergillosis and invasive pulmonary aspergillosis.
10. Distinguish between the appearance of *Aspergillus* and *Mucorales* hyphae
11. Explain 2 key virulence factors of *Rhizopus* and correlate to host risk factors.
12. Summarize the clinical presentation of rhinocerebral mucormycosis and key management decisions.
13. Choose a diagnostic test to detect PCP.
14. For each of the diseases discussed, identify which antifungal agents are useful in management of severe disease.

## **ID - Mycology III**

1. Name the 6 medically important dimorphic fungi.
2. Compare and contrast the key features of dimorphic fungi vs opportunistic fungi, with regard to culture and histopathology.
3. Identify the geographic distribution and ecological niche for each of the dimorphic fungi.
4. For each of the dimorphic fungi, identify the characteristic yeast form and the mould form.
5. Choose an appropriate specimen for culture if disseminated histoplasmosis is suspected.
6. Interpret a serologic test result for *Coccidioides* and correlate to further management.
7. Describe the clinical appearance of “sporotrichoid” spread and provide a differential diagnosis.

## **ID - Mycoplasma & Legionella**

1. Describe the clinical syndrome of atypical pneumonia.
2. Describe and compare biological characteristics of *Mycoplasma* and *Ureaplasma*.
3. Explain how diagnostic tests for infections caused by *Mycoplasma pneumoniae* and *Ureaplasma urealyticum* work, and how they are used in medical practice.
4. Describe and compare biological characteristics of *Legionella pneumophila* and related species.
5. Explain how diagnostic tests for infections caused by *Legionella* species work, and how they are used in medical practice.

## **ID - Papillomaviruses, Warts, and Cancer**

1. Define unique features of HPV structure and life cycle.
2. Identify high and low risk HPVs and their associated diseases.
3. Describe the HPV oncoproteins and their important cellular targets.
4. Explain how HPV-associated lesions could be diagnosed.
5. Explain how the current HPV vaccines are made and what their limitations are.

## **ID - Picornavirus Diseases**

1. Identify molecules of the virus and host that define picornavirus serotypes.
2. Name human enteroviruses and the diseases they cause.
3. Discuss enterovirus transmission and epidemiology and identify when seasonal epidemics of enterovirus disease occur in the US.
4. Describe picornavirus gene expression and RNA replication and discuss the timing and magnitude of virus replication in tissue culture cells (one-step growth in HeLa cells).
5. Describe the "protective" immune response to enterovirus infections and discuss how IgA & IgG & maternal antibodies impact virus transmission and disease.
6. Describe the basic aspects of enterovirus pathogenesis, virus spread from portal of entry to target organs, and timing of host acquired immune response (antibodies).
7. Describe the advantages and disadvantages of the IPV and OPV vaccines, who gets vaccine-associated paralytic poliomyelitis (VAPP), and how cVDPVs arise. Discuss whether vaccination prevents infection, or prevents disease, or both.
8. Explain "herd immunity."
9. Describe the factors that influence the ability to eradicate viruses from the world and discuss whether you think the poliovirus eradication campaign will be successful or fail and why.

## **ID - Pneumonia**

1. Describe why pneumonia is a "great neglected disease of mankind."
2. Distinguish pneumonia from other causes of cough and respiratory symptoms.
3. Identify the common risks and mechanisms of risk for pneumonia.
4. Name the common causes of community-acquired pneumonia (CAP) and their related risks, syndromes, and treatment. Discriminate between CAP, HCAP and HAP.
5. Describe the efficacy and related caveats associated with protection provided by pneumococcal and influenza vaccines.

## **ID - Protozoa I**

1. Define protozoa and explain why they are important for human health and medicine.
2. Describe the life cycles and diagnostic features of the major protozoa that grow in the intestinal tract and genitourinary tract.
3. Describe some pathogenic mechanisms of these protozoa.
4. Describe the major diseases caused by these protozoa and explain the principles for preventing them.
5. Identify which infections are endemic to the US, which infections are more likely to be observed in immigrants or travelers, and which infections you would most likely see.

## **ID - Protozoa II**

1. Describe the transmission, clinical presentation, and diagnostic features of the major protozoa that grow in the blood and tissues.
2. Describe the pathogenic mechanisms of these protozoa and compare them with those of other pathogenic microbes.
3. Describe the major diseases caused by these protozoa and explain the principles for preventing and treating them.
4. Identify which infections are endemic to the US, which infections are more likely to be observed in immigrants or travellers and which you would most likely see.

## **ID - Pseudomonas & Opportunistic Pathogens**

1. Define the terms Opportunistic, Nosocomial and Iatrogenic infections.
2. Describe a bacterial biofilm.
3. Describe clinical conditions where biofilms play a role in a specific disease.
4. Describe the affect biofilm formation has on antibiotic resistance.
5. Describe patient conditions that can contribute to opportunistic infections.
6. List predominant gram-negative organisms associated with opportunistic infections.
7. Summarize *P. aeruginosa* virulence factors that contribute to its pathogenesis in specific kinds of infections (e.g., acute pneumonia vs. chronic CF pneumonia).

## **ID - Respiratory Viruses I - III**

1. Name the different types of viruses that can replicate in respiratory tract and whether they can replicate in URT, LRT or both.
2. Identify which viruses have replication limited to the respiratory tract and which viruses become systemic.
3. Describe how the respiratory viruses are transmitted.
4. Describe in detail influenza virus (e.g. replication, prevention, pathogenesis, treatment).
5. Describe in detail measles, mumps, and RSV (e.g. replication, prevention, pathogenesis, treatment)
6. Differentiate between orthomyxoviruses and paramyxoviruses.
7. Describe the common presenting symptoms of respiratory viruses and how epidemiology plays a role in identifying causes of respiratory tract infections.
8. Describe how respiratory viral infections are diagnosed.

## **ID - Retroviruses and Cancer**

1. Define AIDS, its etiology, epidemiology and origin.
2. Identify which viral proteins are targeted by current ARVs.
3. Discuss developments in the two holy grails of HIV/AIDS research.

## **ID - Rickettsia**

1. Describe the major biological characteristics of Rickettsiae and related bacteria.
2. Describe the pathogenesis and clinical presentations of infections caused by Rickettsiae and related bacteria.
3. Identify and describe the etiologic agents, common reservoirs, and modes of transmission of epidemic typhus, endemic typhus, Brill's disease, scrub typhus and Rocky Mountain spotted fever.
4. Describe the characteristics of Ehrlichia sp. and the major features of infections that they cause.

## **ID - Rota, Calici, Viral Diarrhea**

1. List/Name viruses that can cause gastroenteritis.
2. Explain the hallmarks of viral gastroenteritis differentiating it from bacterial diarrhea. Interpret situations in which a viral diagnosis in gastroenteritis is useful/ not useful. Explain how diagnosis of gastroenteritis viruses can be made.
3. Describe the transmission routes of viruses causing gastroenteritis. Recognize the factors leading to high transmission rates in epidemics (low infectious dose, high viral load in stool, prolonged asymptomatic shedding, hardy on surfaces).
4. Describe the replication and pathogenesis of Rotaviruses and Noroviruses.
5. Explain reasons for the changing epidemiology of the different gastroenteritis viruses. Which is most common in the US? Which is most common in developing countries? Which is the biggest contributor to mortality? Which is most likely to cause epidemics in a cruise ship or in a US hospital setting? Which are associated with common-source food-borne or water-borne outbreaks?
6. Describe the problems in eliciting immunity to gastroenteritis viruses. Explain why one can get viral gastroenteritis multiple times each year.
7. Compare the types of vaccines currently licensed and in development for gastroenteritis viruses. Explain which vaccines will need to contain multiple serotypes of virus.

## **ID - Sepsis**

1. Describe the cardinal signs and symptoms of sepsis, severe sepsis septic shock and multiple organ dysfunction syndrome (MODS).
2. Discuss the epidemiology of sepsis and the clinical risk factors, including who gets sepsis, when, and why.
3. Describe the key microbial factors and host response molecules responsible for the systemic inflammatory response (SIRS) and the nature of the immune response in severe sepsis.
4. Catalog the early (3 hour bundle) treatment components and delayed (6 hour bundle components) for early recognition, diagnosis and treatment of sepsis based on the 2012 Surviving Sepsis Campaign guidelines.
5. Analyze the host and environment factors that challenge successful development of novel targeted therapies including new antibiotics and immune modulatory therapies for the treatment of sepsis.

## ID - Staphylococci and Streptococci

1. Identify the major species of Staph and Strep, their sites of colonization, and their principal diseases.
2. Describe the hemolytic behavior of Staphylococci and Streptococci on sheep red blood cell agar. Identify the Lancefield classification of streptococci.
3. Identify the gram stain, morphology, laboratory growth media, and typical identification tests (catalase, coagulase) of the major gram positive cocci.
4. List and describe the importance of major staphylococcal toxins (including enterotoxin, toxic shock toxin, exfoliatin) .
5. Describe streptococcal enzymes and toxins and their importance in pathogenesis.
6. Describe M protein of group A strep and its role in disease.
7. Describe the importance of group B Streptococcus , Enterococci and Strep anginosus.
8. Name the major diseases caused by Staph and Strep. Identify the organism(s) responsible for each of the following: Pharyngitis, Neonatal sepsis, Impetigo, Scarlet Fever, Cellulitis, Erysipelas, Rheumatic Fever, Glomerulonephritis, Osteomyelitis/septic arthritis, cellulitis, Toxic shock syndrome, endocarditis, food poisoning, foreign body infections.

## ID - Toxigenic Bacteria

1. Discuss why diphtheria toxin is the most important virulence determinant of C. diphtheria.
2. Discuss how the diphtheria toxin is used in the prevention of diphtheria and explain why antibiotics should not be used as the only therapeutic agent for diphtheria.
3. Discuss the safety and efficacy of the respective current vaccines against Diphtheria and Whooping Cough.
4. Discuss how known vaccines protect against Diphtheria and Whooping Cough.
5. Describe other known virulence factors of C. diphtheriae and B. pertussis besides Diphtheria toxin and Pertussis Toxin and their possible role in disease, if they are known.
6. Discuss specific problems associated with making a laboratory and clinical diagnosis of Diphtheria and Whooping Cough and how they influence initiation of treatments for these diseases.
7. Discuss whether or not a physician should always wait for a laboratory diagnosis before treating these diseases and why.
8. Explain why some strains of C. diphtheria carry the toxin gene and others do not.
9. Identify the shared enzymatic activity of the Diphtheria and Pertussis Toxin.
10. Discuss the value of antibiotic usage in Diphtheria and Whooping Cough when the major manifestations of these diseases are due to toxins, against which antibiotics have no effect.
11. Describe the difference between the current pertussis vaccines (i.e. acellular vaccines) and the whole cell pertussis vaccine, and explain the purpose of vaccinating pregnant women with the Tdap vaccine during their 3rd trimester.
12. Discuss why the incidence of Whooping Cough in the United States has increased more than 10-fold in the past 10 years. Distinguish whether it is due to: problems with the vaccine currently in use compared to the original whole cell vaccine; the emergence of more virulent strains; fewer people being vaccinated. These issues will be discussed in class.

## ID - Viral Hepatitis I & II

1. Describe the presenting symptoms of patients with acute viral hepatitis. Why is the patient jaundiced?
2. Name the viruses that cause hepatitis, describe their molecular features, and describe their modes of transmission.
3. Name the hepatitis viruses for which there are vaccines, describe the antigens used in the vaccines, and explain which populations should be vaccinated.
4. Explain how active and passive immunization for HAV can be used under different circumstances.
5. Recognize the molecular basis of laboratory tests used to diagnose specific hepatitis viruses.
6. Describe circumstances when HBV can cause chronic infection (especially in neonates), the pathologic consequences of chronic infection, and how HBV vaccine and HBIG can prevent infection (especially in neonates).
7. Describe HCV infections in patients, the spectrum of disease associated with HCV infections.
8. Identify the treatments available for patients with chronic HBV infections. For 10. For chronic HBV & HCV, discuss what patient specific factors (age, weight, viral load, degree of cirrhosis, etc..) affect whether to treat or to monitor the patient without antiviral therapy.
9. Know FDA-approved treatment regimens for chronic HCV infections: regimens common before 2015 (interferon-ribavirin - HCV protease inhibitors); regimens common after 2015 (IFN-free, all oral approaches with DAAs).
10. Know mechanism of action of direct-acting antiviral (DAAs): HCV protease inhibitors (telaprevir & boceprevir & paritaprevir); RDRP inhibitors (sofosbuvir and dasabuvir); and NS5A inhibitors (ledipasvir and ombitasvir). New drugs in 2016 and thereafter (see lecture notes & PPT slides for up-to-date info).

## ID - Zoonotic Bacterial Diseases

1. Recognize societal factors leading to the emergence of zoonotic infections.
2. Identify major pathways of transmission of zoonotic infections (e.g. direct contact or vector borne).
3. Recognize the individuals who are at greatest risk for zoonotic infections.
4. Describe major aspects of the microbiology, epidemiology, clinical features, diagnosis, treatment, and prevention of three important zoonotic infections: plague, tularemia and Lyme disease.

## ID - Zoonotic Viral Diseases

1. Describe zoonotic viruses, emerging infections, and re-emerging infections.
2. Describe factors that contribute to the emergence or re-emergence of zoonotic viruses.
3. Be familiar with the types of zoonotic viruses and examples of each type.
4. Be aware of the epidemiology, prevention, diagnosis, treatment and outcomes of zoonotic viral diseases present in Colorado (Rabies virus, Sin Nombre virus, West Nile virus). Note: some of these are covered in the Arboviruses lecture.
5. Discuss who should receive the rabies vaccine and rabies post-exposure prophylaxis. Explain how they should be administered and why.
6. Be familiar with other notable zoonotic viral diseases (Ebola, Lassa, Influenza, HIV, arboviruses).
7. Explain how physicians, global surveillance, and public health interventions can be used to recognize emerging or re-emerging infections and to protect people in the U.S.A. and throughout the world (e.g. Ebola, Hantavirus Pulmonary Syndrome, reemergence of WNV in the U.S.A., SARS-CoV, MERS-CoV, chikungunya virus).