Virginia Western Community College
MDL 215 Immunology

Prerequisites

Bio 101 and Bio 141 or equivalent

Course Description

Presents the physiological basis of humoral and cell mediated immunity, including the medical and clinical laboratory application of immunological principles.

Semester Credits: 2 **Lecture Hours: 2** **Lab/Clinical/ Internship Hours: 0**

Required Materials

Textbook:
Clinical Immunology & Serology A Laboratory Perspective, 6th Edition, by: Linda E Miller, Publisher: F. A. Davis, 2021, ISBN: 0803694407, ISBN13: 9780803694408
Note: Previous edition is acceptable

Course Outcomes

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

- Define, spell and pronounce key terminology used in Immunology and Serology, including concepts related to the lymphoid system, immunological reactions, autoimmunity, hypersensitivity, vaccination, transplantation, tolerance, and infectious disease.
- Apply fundamental immunological principles to analyze the methodologies of various assays commonly used in modern clinical immunology laboratories.
- Calculate and interpret results using mathematical formulas to solve problems related to testing procedures used in immunological assays.
- Evaluate the serological aspects of noninfectious clinical disorders, including allergy, hypersensitivity, autoimmunity, tumors, hematologic malignancies, transplantation immunology, and primary immunodeficiency disease.
- Describe and discuss the serological characteristics of infectious clinical disorders to include: acquired immunodeficiencies, viral diseases, bacterial diseases, and fungal and parasitic diseases.
- Differentiate between various immunological disorders based on their serological characteristics.
- Assess the role of the clinical immunology laboratory in disease diagnosis and explain its importance in clinical decision-making.

Topic Outline

	Topic	Objectives
PART 1.		
Week 1	**Chapter 8**. Safety and Quality Management	1. List the six components of the chain of infection and the safety precautions that break the chain. 2. Correctly perform hand hygiene procedures following CDC guidelines. 3. Describe the types of personal protective equipment used by laboratory personnel. 4. Differentiate between universal precautions, body substance isolation, and standard precautions. 5. State the acceptable methods for disposal of biological waste and sharp objects in the laboratory. 6. Discuss the federal regulations and guidelines for preparing and shipping patient samples from the laboratory. 7. Explain the components of the Occupational Exposure to Bloodborne Pathogens Compliance Directive. 8. Describe safety precautions utilized when handling chemicals. 9. Discuss the components of Chemical Hygiene Plans and Material Safety Data Sheets. 10. State and interpret the components of the National Fire Protection Association hazardous material labeling system. 11. Describe precautions that laboratory personnel should take with regard to radioactive, electrical, fire, and physical hazards. 12. Explain the RACE and PASS actions to be taken when a fire is discovered. 13. Recognize standard hazard warning symbols. 14. Define the preexamination (preanalytical), examination (analytical), and postexamination (postanalytical) components of quality management. 15. Distinguish between the components of internal quality control, external quality control, electronic quality control, and external quality assessment (proficiency testing). 16. Discuss the roles of the Clinical Laboratory Improvement Amendments (CLIA), Clinical and Laboratory Standards Institute (CLSI), The Joint Commission (JC), and the College of American Pathologists (CAP) in the regulation of health care. 17. State and describe the 12 quality essentials used in a quality management system. 18. Describe the purpose of quality indicators. 19. List the six areas of the Lean system and describe how it can benefit the laboratory. 20. State the purpose of the Six Sigma methodology in a management system.
	Quiz - Safety	
	Chapter 1. Introduction to Immunology and the Immune System	1. Define key terms for the chapter. 2. Describe what is meant by attenuated vaccine. 3. Distinguish innate from adaptive immunity 4. Describe the type of white blood cells capable of phagocytosis. 5. Explain the role of tissue cells in immunity.

6. Discuss how natural killer (NK) cells differ from T lymphocytes.
7. Identify the two primary lymphoid organs and discuss the main functions of each.
8. List four secondary lymphoid organs and discuss the overall importance to immunity.
9. Describe the function and architecture of a lymph node.
10. Compare a primary and a secondary follicle.
11. Explain the makeup of a cluster of differentiation.
12. Differentiate the roles of T cells and B cells in the immune response.

Week 2

Chapter 2.

Nature of Antigens and the Major Histocompatibility Complex

1. Define and characterize the nature of immunogens.
2. Differentiate an immunogen from an antigen.
3. Discuss several biological properties of individuals that influence the nature of the immune response.
4. Describe four important characteristics of immunogens that affect the ability to stimulate a host response.
5. Identify the characteristics of a hapten.
6. Describe how an epitope relates to an immunogen.
7. Discuss the role of adjuvants.
8. Differentiate heterophile antigens from alloantigens and autoantigens.
9. Explain what a haplotype is in regard to inheritance of major histocompatibility complex (MHC) antigens.
10. Describe the differences in the structure of class I and class II proteins.
11. Compare the transport of antigen to cellular surfaces by class I and class II proteins.
12. Describe the role of transporters associated with antigen processing (TAP) in selecting peptides for binding to class I molecules.
13. Discuss the differences in the source and types of antigen processed by class I and class II molecules.
14. Explain the clinical significance of the class I and class II molecules.

Chapter 3.

Innate Immunity

1. Differentiate between the external and internal defense systems.
2. Give examples of several external defense mechanisms.
3. Describe how normal flora act as a defense against pathogens.
4. Explain what a pathogen-associated molecular pattern (PAMP) is and give some examples.
5. Discuss the role of pathogen recognition receptors (PRRs) in both the innate and adaptive immune responses.
6. Describe the function of Toll-like receptors (TLRs).
7. Discuss the role of acute-phase reactants in the innate immune response.
8. Explain how each of the following acute-phase reactants contributes to innate immunity: C-reactive protein (CRP), serum amyloid A, complement, alpha1-antitrypsin, haptoglobin, fibrinogen, and ceruloplasmin.
9. Determine the significance of abnormal levels of acute-phase reactants.
10. Describe the process of inflammation.
11. List the steps in the process of phagocytosis.
12. Discuss the intracellular mechanism for destruction of foreign particles during the process of phagocytosis.
13. Explain the importance of phagocytosis in both innate and adaptive immunity.

14. Explain how natural killer (NK) cells recognize target cells.
15. Describe two methods that NK cells use to kill target cells.

Week 3 **Chapter 4.** Adaptive Immunity

1. Compare and contrast adaptive immunity and innate immunity.
2. Discuss the role of the thymus in T-cell maturation.
3. Describe the CD3 receptor for antigen on a T cell.
4. Explain how positive and negative selection contribute to the development of immunocompetent T cells.
5. List and describe five different subsets of T cells that bear the CD4 marker.
6. Describe maturation of a B cell from the pro-B cell to a plasma cell.
7. Contrast the antigen-independent and antigen-dependent phases of B-cell development.
8. Explain how cytotoxic T cells recognize and kill target cells.
9. Discuss the role of class I MHC and class II MHC molecules in the presentation of antigens to T cells.
10. Differentiate T-dependent antigens from T-independent antigens on the basis of how each activates B cells.
11. Discuss how T helper (Th) cells stimulate B cells to transform into plasma cells.
12. Explain the importance of both T and B memory cells to the adaptive immune response.
13. Apply knowledge of T- and B-cell function to immunologically based disease states.
14. Describe current testing used to identify T and B cells.

Test Part 1

PART 2.

Weeks 4 -6 **Chapter 5.** Antibody Structure and Function

1. Describe the structure of a typical immunoglobulin.
2. Identify the electrophoretic fraction of serum that contains the majority of immunoglobulins.
3. Differentiate between isotypes, allotypes, and idiotypes.
4. Characterize the five immunoglobulin types found in humans.
5. Differentiate between light and heavy chains of immunoglobulins.
6. Describe experimental evidence for the structure of IgG.
7. Discuss how the IgG subclasses differ in functional capability.
8. Explain how the structure of IgM differs from that of IgG.
9. Relate differences in structure of the five immunoglobulin classes to their function.
10. Describe the secretory component of IgA.
11. Discuss how IgD differs from other immunoglobulin types.
12. Identify the types of cells that IgE binds to in allergic reactions.
13. Compare the primary and secondary responses to antigen.
14. Describe how recent knowledge about immunoglobulin genes supports the clonal selection hypothesis.
15. Discuss the process of monoclonal antibody production.
16. Relate the influence of monoclonal antibodies to current laboratory testing practices.

Quiz – Antibody Structure and Function

Chapter 6. Cytokines

1. Define cytokine.
2. Define and describe the term cytokine storm and relate its medical importance.

3. Distinguish between autocrine, paracrine, and endocrine effects of cytokines.
4. Define pleiotropy as it relates to cytokine activities.
5. Explain the functions of interleukin-1 (IL-1) in mediating the immune response.
6. Explain the effects of tumor necrosis factor (TNF).
7. Discuss how interleukin-6 (IL-6) affects inflammation and other activities of the immune system.
8. Determine the role of chemokines in chemotaxis of white blood cells (WBCs).
9. Compare the functions of type 1 and type 2 interferons (IFN).
10. Describe the actions of interleukin-2 (IL-2) on target cells.
11. Discuss the biological roles of the hematopoietic growth factors.
12. Discuss cytokines involved in differentiation of T helper (Th) cell subpopulations: Th1, Th2, Th17, and T regulatory.
13. Describe the biological role of colony stimulating factors.
14. Describe the current types of anticytokine therapies.
15. Describe clinical assays for cytokines.

Chapter 7. Complement System

1. Describe the roles of the complement system.
2. Differentiate between the classical, alternative, and lectin pathways and indicate proteins and activators involved in each.
3. Discuss the formation of the three principal units of the classical pathway: recognition, activation, and membrane attack units.
4. Describe how initiation of the lectin pathway occurs.
5. Explain how C3 plays a key role in all pathways.
6. Describe regulators of the complement system and their role in the complement system.
7. Discuss the complement-related kidney disorders and applicable complement testing.
8. Relate biological manifestations of complement activation to generation of specific complement products.
9. Describe the deficiencies of complement components and the diseases they cause.
10. Differentiate tests for functional activity of complement from measurement of individual complement components.
11. Analyze laboratory findings and indicate disease implications in relation to complement abnormalities.

Test Part 2

PART 3.

Week 7 **Chapter 9.** Principles of Serologic Testing

1. Describe how whole blood is processed in order to obtain serum for serological testing.
2. Explain the difference between a volumetric and a graduated pipette.
3. Define the following: serial dilution, solute, diluent, compound dilution.
4. Describe how an accurate measurement is made using a serological pipette that is marked TD.
5. Calculate the final dilution of a sample, given the initial dilution and all subsequent dilutions.
6. Explain how an antibody titer is determined.

7. Calculate the amount of diluent needed to prepare a specific dilution of a serum specimen.
8. Determine how to make a specific percent solution from a concentrate.
9. Differentiate sensitivity and specificity as it relates to serological testing.
10. Discuss how positive and negative predictive values determine the chance that an individual has a truly positive or truly negative test result.

Quiz – Serology Math

Chapter 10. Precipitation and Agglutination Reactions

1. Discuss affinity and avidity and their influence on antigen–antibody reactions.
2. Describe how the law of mass action relates to antigen–antibody binding.
3. Distinguish between precipitation and agglutination.
4. Explain how the zone of equivalence is related to the lattice hypothesis.
5. Differentiate between turbidimetry and nephelometry and discuss the role of each in measurement of precipitation reactions.
6. Compare single diffusion to double diffusion.
7. Summarize the principle of the end-point method of radial immunodiffusion.
8. Determine the relationship between two antigens by looking at the pattern of precipitation resulting from Ouchterlony immunodiffusion.
9. Describe immunofixation electrophoresis and explain how it differs from passive diffusion.
10. Recognize how immunoglobulin M (IgM) and immunoglobulin G (IgG) differ in their ability to participate in agglutination reactions.
11. Describe physiological conditions that can be altered to enhance agglutination.
12. Define and give an example of each of the following:
    a. Direct agglutination
    b. Passive agglutination
    c. Reverse passive agglutination
    d. Agglutination inhibition
    e. Hemagglutination inhibition
13. Describe the principle of measurement used in particle-counting immunoassay (PACIA).
14. Identify conditions that must be met for optimal results in agglutination testing.

Week 8 **Chapter 11.** Labeled Immunoassays

1. Describe the difference between competitive and noncompetitive immunoassays.
2. Distinguish between heterogeneous and homogeneous immunoassays.
3. Explain how the principle of competitive binding is used in radioimmunoassays.
4. Discuss criteria for selection of an enzyme for enzyme immunoassay.
5. Explain the principle of sandwich or capture immunoassays.
6. Describe applications for homogeneous enzyme immunoassay.
7. Describe uses for rapid immunoassays.

8. Compare and contrast enzyme immunoassay and radioimmunoassay regarding ease of performance, sensitivity, and clinical application.
9. Describe the difference between direct and indirect immunofluorescence techniques.
10. Relate the principle of fluorescence polarization immunoassay.
11. Explain how chemiluminescent assays are used to identify analytes.
12. Discuss advantages and disadvantages of each type of immunoassay.

Quiz – Immunoassays

Chapter 12. Molecular Diagnostic Techniques

1. Describe the structure of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
2. Identify complementary sequences.
3. Define hybridization.
4. Describe restriction enzyme mapping of DNA.
5. Discuss the principles of the polymerase chain reaction (PCR).
6. Apply dye and probe signal detection to PCR.
7. Assess template quantity by qPCR.
8. Discuss DNA and RNA amplification methods.
9. Differentiate target amplification from probe amplification and give examples of each.
10. Explain the basis of DNA chain termination sequencing.
11. List technologies for next generation sequencing (NGS).

Week 9 **Chapter 13.** Flow Cytometry and Laboratory Automation

1. List and describe the function of each of the major components of a flow cytometer.
2. Compare intrinsic and extrinsic parameters in flow cytometry.
3. List the advantages and disadvantages of automated testing in a clinical immunology laboratory.
4. Summarize the principle of hydrodynamic focusing within the flow cytometer.
5. Define the concept of fluorescence in flow cytometry.
6. Explain the difference between forward-angle light scatter (FSC) and side scatter (SSC).
7. Describe the difference between analyzing flow cytometry data using single-parameter histograms and dual-parameter dot plots.
8. List several clinical applications for flow cytometry.
9. Apply knowledge of various T- and B-cell surface antigens to identify various cell populations.
10. Compare advantages and disadvantages of automated immunoassay analyzers.
11. Describe the difference between a random access and a batch analyzer.
12. Define accuracy, precision, reportable range, analytic sensitivity, analytic specificity, and reference interval.

Test Part 3

PART 4.

Week 10 **Chapter 14.** Hypersensitivity

1. Explain the concept of hypersensitivity.
2. Differentiate between the four types of hypersensitivity reactions in terms of antibody involvement, complement involvement, antigen triggers, and timing of the response.

3. Associate specific examples of clinical manifestations with each type of hypersensitivity.
4. Discuss the immunologic mechanisms involved in each of the four types of hypersensitivity reactions.
5. Provide examples of preformed and newly synthesized mediators released from IgE sensitized mast cells and basophils and discuss their effects.
6. Discuss the influence of genetic and environmental factors on susceptibility to type I hypersensitivity responses.
7. Discuss the types of reactions that can result from latex sensitivity and their clinical manifestations.
8. Explain the underlying mechanisms of pharmacological therapy, monoclonal anti-IgE therapy, and allergy immunotherapy in the treatment of allergies.
9. Discuss the procedure, clinical applications, advantages, and limitations of skin testing for type I hypersensitivity.
10. Discuss the principles and clinical applications of allergen-specific and total-IgE testing.
11. Explain how hemolytic disease of the newborn (HDN) arises.
12. Explain the significance of a positive direct antiglobulin test.
13. Discuss the principle of cold agglutinins testing, and associate the presence of a positive result with specific disorders.
14. Discuss how skin testing for delayed hypersensitivity is performed, its clinical applications, and how to interpret the results.

Chapter 15. Autoimmune

1. Explain the mechanisms of central and peripheral tolerance that are essential in preventing the development of autoimmunity.
2. Discuss genetic and environmental factors that are thought to contribute to the development of autoimmunity.
3. Explain the relationship between microbial infections and the development of autoimmune disease.
4. Distinguish between organ-specific and systemic autoimmune diseases and give examples of each and their associated target tissues.
5. Discuss the immunopathology and clinical manifestations of each of the following diseases: systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), granulomatosis with polyangiitis (Wegener's granulomatosis), Graves disease, Hashimoto's thyroiditis, type 1 diabetes mellitus, celiac disease, autoimmune hepatitis, primary biliary cirrhosis, multiple sclerosis (MS), myasthenia gravis (MG), and Goodpasture's syndrome.
6. Associate each of the diseases listed in Learning Outcome 5 with its corresponding autoantibodies and laboratory findings.
7. Explain the principles of laboratory methods used to screen for and confirm the presence of antinuclear antibodies (ANA).
8. Describe common immunofluorescence patterns seen in the indirect immunofluorescence (IIF) test for ANAs and their clinical significance.
9. Describe the c-ANCA and p-ANCA patterns seen in the IIF test for ANCAs and their clinical significance.
10. Discuss the clinical significance of rheumatoid factor (RF) and anti-CCP.

Week 11 **Chapter 16.** Transplantation Immunity

1. List the histocompatibility systems relevant to clinical transplantation.
2. Compare the mechanisms of direct and indirect alloantigen recognition.
3. Distinguish between an allograft, autograft, xenograft, and syngeneic graft (isograft).
4. Compare the immunologic mechanisms involved in hyperacute, acute, and chronic graft rejection.
5. Identify risk factors for graft-versus-host disease (GVHD) and the types of grafts in which this mechanism of rejection could occur.
6. List the major classes of immunosuppressive agents and their effects on the immune system.
7. Explain the principles of laboratory methods for human leukocyte antigen (HLA) typing.
8. Describe laboratory methods for detecting and identifying HLA antibodies (i.e., antibody screening, identification, and crossmatching).
9. Deduce the suitability of a possible donor for a transplant recipient, based on results of HLA typing and antibody identification.
10. Describe the nomenclature used for HLA antigens and alleles.

Chapter 17. Tumor Immunology

1. Describe the characteristics that differentiate cancer cells from normal cells and the process by which malignant cells are thought to develop.
2. Differentiate between tumor-specific antigens and different categories of tumor associated antigens and recognize examples of each.
3. Summarize the uses of tumor markers in screening for cancer, diagnosing malignancy, detecting prognosis, and monitoring patient responses to treatment.
4. Identify the characteristics that should be possessed by an ideal tumor marker and explain how nonideal features can affect the clinical utility of a marker.
5. Explain the principles of immunohistochemistry as they apply to tumor marker detection.
6. Distinguish the clinical applications of each of the following tumor markers: alphafetoprotein (AFP), cancer antigen 125 (CA 125), carcinoembryonic antigen (CEA), human chorionic gonadotropin (hCG), and prostate-specific antigen (PSA).
7. Contrast the advantages and limitations of immunoassays for tumor markers.
8. Summarize key principles of molecular and proteomic testing for tumor markers.
9. Describe the innate and adaptive immune responses that play a role in defense against tumors and how they contribute to immunosurveillance.
10. Discuss the process of immunoediting and how this relates to mechanisms of tumor escape from the immune system.
11. Recognize the overall goal of immunotherapy and specific examples of active, passive, and adoptive immunotherapy for cancer.
12. Discuss principles and applications of molecular tests to cancer diagnosis.

Quiz – Tumor markers

Week 12 **Chapter 18.** Immunoproliferative Diseases -Overview of Laboratory Testing

1. Compare and contrast leukemias and lymphomas.
2. Differentiate between acute leukemias and chronic leukemias and discuss an example of each type.
3. Associate specific CD markers with selected hematologic malignancies.
4. Correlate specified clinical manifestations and laboratory results with multiple myeloma or Waldenström macroglobulinemia.
5. Indicate the ways in which laboratory tests can be used to diagnose and follow the progression of immunoproliferative disorders.
6. Explain the underlying principles of serum and urine protein electrophoresis (UPE), immunofixation electrophoresis (IFE), immune-subtraction, and serum free light chain (sFLC) analysis.
7. Contrast serum protein electrophoresis (SPE) and IFE results seen in monoclonal gammopathies with those observed in a polyclonal increase in immunoglobulins.
8. Discuss the types of genetic abnormalities that are frequently seen in hematologic malignancies and the laboratory methods used to detect them.

Chapter 19. Immunodeficiency Diseases

1. Differentiate between primary immunodeficiency diseases and secondary immunodeficiency diseases.
2. Indicate the general immunologic defects associated with each of the nine categories of primary immunodeficiency diseases.
3. Associate examples of specific immunodeficiencies with each category.
4. Describe the types of infections typically associated with defects in the B-cell, T-cell, myeloid, or complement systems.
5. Recognize the association between immunodeficiency states and the risk of developing malignancy.
6. Explain the immunologic defects and clinical manifestations associated with selected primary immunodeficiency diseases.
7. Select appropriate laboratory tests to screen for and confirm the presence of specific congenital immunodeficiencies.
8. Correlate laboratory results with the presence of different types of primary immunodeficiencies.

Quiz – Diseases Involving the Immune System

PART 5. Overview of the following chapters:

Weeks 13-16 **Chapter 25.** Immunization and Vaccines

1. Differentiate between active immunity, passive immunity, and adoptive immunity.
2. Recognize examples of active immunity, passive immunity, and adoptive immunity.
3. Discuss the historical evolution of vaccines from the early contributions of Edward Jenner through modern approaches to producing next generation vaccines.
4. Define vaccine, toxoid, attenuation, adjuvant, and recombinant protein vaccine.
5. Describe the composition of live attenuated vaccines, inactivated vaccines, and subunit vaccines, and contrast their advantages and limitations. Provide examples of each type of vaccine.
6. Explain how factors that influence the immune response to vaccines determine the ways in which vaccines are administered.

7. Recognize examples of adjuvants and explain the mechanisms by which they enhance the immune response to vaccines.
8. Contrast the benefits and adverse effects associated with vaccines.
9. Differentiate between standard human immune serum globulin and specific human immune serum globulin and their clinical applications.
10. Differentiate between monoclonal antibodies, chimeric antibodies, humanized antibodies, and fully human antibodies in terms of their structure and nomenclature.
11. Discuss some of the clinical applications of monoclonal antibody therapy and immunosuppressive therapy with gamma globulins.
12. Provide examples of clinical applications of adoptive immunotherapy in the areas of cancer treatment and transplantation.

Chapter 20. Serology and Molecular Detection of Bacterial Infections

1. Cite the five general laboratory means of detecting the causative agent of a bacterial infection.
2. Explain the principle of lateral flow immunochromatographic assays.
3. List the exotoxins produced by Group A streptococci and the roles they play in contributing to the virulence of Streptococcus pyogenes.
4. Describe the symptoms and pathogenesis of acute rheumatic fever and poststreptococcal glomerulonephritis.
5. Explain the principle, interpretation, and clinical significance of the antistreptolysin O (ASO), antideoxyribonuclease B (anti-DNase B), and streptozyme tests.
6. Recognize the role Helicobacter pylori plays in gastrointestinal ulcers and the virulence factors that contribute to infection by this organism.
7. Discuss the various types of tests that may be performed to detect H pylori infection.
8. Discuss the use of serology for the diagnosis of M pneumonia infections, including the clinical value of detecting cold agglutinins.
9. Describe the epidemiology of Rocky Mountain spotted fever with respect to etiologic agent, transmission, and pathogenesis.
10. Select the appropriate serological and molecular techniques to diagnose Rocky Mountain spotted fever.

Chapter 22. Serology and Molecular Diagnosis of Parasitic and Fungal Infections

1. Explain why a host has more difficulty overcoming parasitic diseases than those caused by bacteria or viruses.
2. Discuss potential outcomes of host and parasite interactions.
3. Discuss the role of immunoglobulin E (IgE) antibody and eosinophils in parasitic infections.
4. Discuss the roles of serological and molecular assays in the diagnosis of parasitic infections.
5. Discuss the role serology plays in the diagnosis of Toxoplasma gondii and cite the limitations of serological testing for toxoplasmosis in the newborn.
6. List possible limitations associated with parasitic serology.
7. Cite the role that rapid antigen detection systems (RDTS) play in the detection of parasitic diseases.
8. Briefly describe the principle of lateral flow assays.
9. List factors that have led to a notable increase in fungal infections in the past 25 years.

10. Describe the etiological and physiological factors to be examined when a mycosis is suspected.
11. Cite the four types of clinical manifestations that fungi can produce.
12. Describe the types of immune defenses mounted by the host in response to fungal infections and identify the immune response that plays the most important role in responding to a fungal infection.
13. Discuss the role of serological and molecular testing in the diagnosis of fungal infections.
14. Recognize the clinical diseases and epidemiology of aspergillosis, candidiasis, cryptococcosis, histoplasmosis, and coccidioidomycosis.

Chapter 23. Serology and Molecular Diagnosis of Viral Infections

1. Correlate the presence of viral IgM and IgG antibodies with their clinical significance in detecting current infections, congenital infections, or immunity to infections.
2. Discuss the role of molecular tests in diagnosing and monitoring patients with viral infections.
3. Differentiate between the different hepatitis viruses and their modes of transmission.
4. Correlate the various serological markers of hepatitis with their diagnostic significance.
5. Explain the laboratory methods that are most commonly used to screen for, confirm, or monitor hepatitis virus infections.
6. Associate the following viruses with the specific diseases they cause: Epstein-Barr virus (EBV), cytomegalovirus (CMV), varicella-zoster virus (VZV), rubella virus, rubeola virus, mumps virus, and the human T-cell lymphotropic virus type I.
7. Discuss the laboratory methods used to diagnose and monitor infections with the preceding viruses.
8. 10. Correlate the heterophile antibody and EBV-specific antibodies with their clinical significance and describe the laboratory methods used to test for these antibodies.

Chapter 24. Laboratory Diagnosis of HIV Infection

1. Explain the conditions under which transmission of human immunodeficiency virus (HIV) can occur.
2. Describe the host's immune responses to HIV and the effects of HIV on the immune system.
3. Describe the clinical manifestations of HIV infection. Discuss antiretroviral treatments and the impact they have had on HIV infection.
4. Discuss the 2014 CDC-recommended algorithm for screening for HIV infection, as well as its advantages compared with previous algorithms and its limitations.
5. Discuss the principle of enzyme-linked immunosorbent assay (ELISA) testing for HIV infection and contrast first-generation, second-generation, third-generation, and fourth generation ELISA tests for HIV.
6. Discuss the underlying principle and clinical uses of rapid tests for HIV.
7. Describe the principle of the Western blot test, interpretation of the results, and limitations of the test.
8. Give reasons for false positives and false negatives in HIV antibody testing.
9. Discuss the principle and clinical utility of flow cytometric methods for CD4 T-cell enumeration.

10. Differentiate between reverse-transcriptase polymerase chain reaction (RT-PCR), quantitative (real-time) RT-PCR, and branched DNA (bDNA) testing for HIV nucleic acid.
11. Discuss the clinical utility of HIV viral load testing and drug-resistance testing.
12. Discuss the protocol for HIV testing of infants and children younger than 18 months of age.

Final Exam

Additional Comments:

- **There may be announced and unannounced quizzes**
- **The outline and time frames are tentative and subject to change**
- **Study Guides for test are provided at the discretion of the instructor**
- **Comprehensive questions on the final exam may come, in part, from past quizzes and exams and will also include questions on any new material**