I. INTRODUCTION

A. An introduction to the theory and laboratory techniques in Immunology/Serology with an emphasis on basic immunologic mechanisms, theory of immunologic and serological procedures, immunologic manifestations in infectious disease, and immune disorders.

B. The courses are designed to meet basic curriculum requirements for the Central Texas College Medical Laboratory Technician Program.

C. This course is occupationally related and provided didactic and practical knowledge required for entrance into the clinical portions of the Medical Laboratory Technology Program.

D. Prerequisite(s): None

II. LEARNING OUTCOMES

Upon successful completion of the courses, Immunology/Serology, the student will be able to:

A. Describe collection, handling, storage and preparation of immunology specimens.
B. Examine immunologic and physiologic theory of various immunology tests.
C. Compare principles of methods in immunology relate manifestation and clinical correlation in immunology.
D. Relate disease manifestation and correlation in immunology.
E. Describe the following immunology tests: RPR, VDRL, FTA-Abs, Mono test, Heterophile antibody, ASO, ANA, Hepatitis, Rubella, HIV, cold agglutinin, and CRP.
F. Use critical thinking skills to trouble shoot problems as they occur and determine possible causes.
G. Utilize appropriate safety equipment and procedures according to established laboratory protocol and regulatory compliance.
H. Exhibit the professional and ethical attributes required by the medical laboratory technician.
I. Perform quality control (QC) procedures according to established protocol and evaluate the results.

J. Relate the clinical significance of laboratory procedures to the appropriate disease process. Correlate values with given diseases states, diagnosis, and treatment.

K. At the conclusion of this lecture series, the student will have achieved the following: Achievement will be met when a minimum score of 75 percent is earned on the written examination covering the material.

III. INSTRUCTIONAL MATERIALS

A. Text: The instructional materials identified for this course are viewable through www.ctcd.edu/books

IV. COURSE REQUIREMENTS

A. To receive transferable credits for this course, you must earn a grade of 2.5 or better.

B. Class attendance is mandatory. A student who is late for 15 minutes or more will be marked absent. A student who is late for less than 15 minutes late will be marked tardy. 2 tardy will count as an absence. 3 absences result in loss of a letter grade for the course, 4 absences will disqualify a student from the MLT program and the student will be required to meet with the program director for readmission.

C. Students with a grade of 2.4 or less should make an appointment with the instructor to discuss the reason for low performance. Any material not understood by the student can be discussed with the instructor privately during office hours. Office hours are posted; please try to schedule an appointment at your convenience.

D. Lecture examinations will be taken from class notes, assigned pages in your text, and any additional information such as computer assignments or videos.

E. Laboratory examinations will be taken from a combination of lecture and any laboratory information covered in any format. Often theory of procedures is required to perform the procedure and evaluate your results.

V. EXAMINATIONS

A. Six lecture, three laboratory examinations, and laboratory assessment will be given. A comprehensive final examination will be given.
B. Makeup examinations will not be given. If you must miss an exam, you can use your final exam grade to replace your missed exam grade. Any additional missed exams would result in a “0” and cannot be made up.

VI. SEMESTER GRADE COMPUTATION

<table>
<thead>
<tr>
<th>*Lecture Examinations</th>
<th>Point Value</th>
<th>*Laboratory Examinations</th>
<th>Point Value</th>
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<tbody>
<tr>
<td>Lecture 1</td>
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<td>Laboratory Assessment</td>
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<tr>
<td>Lecture 5</td>
<td>100</td>
<td>Total Lab Points Possible</td>
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<tr>
<td>Lecture 6</td>
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Quiz, CS 40
Final Examination 200

Total Lecture/Lab/Final Points Possible 1240

<table>
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<tr>
<td>992-1115</td>
<td>B</td>
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<tr>
<td>930-991</td>
<td>C</td>
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<tr>
<td>744-929</td>
<td>D</td>
</tr>
<tr>
<td>743 – Below</td>
<td>F</td>
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</tbody>
</table>

Professionalism Grade: 50 Points (This grade cannot be replaced by final)
Grading for Professionalism Grade: Subtract 2 pts per tardy or absence, 1 pt for other infractions
Includes:
- Preparation for Class
- Completion of assignments (Homework assignments: Full credit at start of class, half points at end of day, 0 points after 1st day. See attendance below.)
- Attendance (Must bring a doctor’s note for each absence due to illness to accept assignments the following day)
- Tardies
- Unlawful Use of electronics (cell phones, etc)
- Observation (Team player, Participation, Stay on Task – minimal Distractions, cheating, plagiarism, talking)

Extra credit: Maximum of 3% of total grade. Extra credit for lecture portion only. Lab has lab participation points. No extra assignments without approval of professor for lecture. Again, must fit within 3% of total extra points.

NOTE: Plagiarism in any form will not be tolerated. A student who chooses to plagiarize will be given a zero on the assignment. A formal charge may be made to the College Disciplinary Board.
**Testing:** If professor elects to use testing center, tests will only be available on Tues-Thursday only. No exceptions. Tests will only be for same time period as the class. Class must meet during original scheduled class time for extra lectures and/or labs. Professor will take test on Monday, pick up tests on Friday to be able to grade by next class period.

**NOTE:** Cheating in any form will not be tolerated. A student observed cheating will be given a zero on the test. A formal charge may be made to the College Disciplinary Board.

**VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR**

A. **Course Withdrawal:** It is the student’s responsibility to officially withdraw from a class if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The withdrawal form must be signed by the student.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is as follows:

<table>
<thead>
<tr>
<th>Session Length</th>
<th>Deadline</th>
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<tbody>
<tr>
<td>10-week session</td>
<td>Friday of the 7th week</td>
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<tr>
<td>8-week session</td>
<td>Friday of the 6th week</td>
</tr>
<tr>
<td>5-week session</td>
<td>Friday of the 3rd week</td>
</tr>
</tbody>
</table>

The equivalent date (75% of the semester) will be used for other sessions of other lengths. The specific last day to withdrawal is published each semester in the Schedule Bulletin.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the college before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued the student a grade of “F” or “FN” for nonattendance.

B. **Administrative Withdrawal:** An administrative withdrawal may be initiated when the student fails to meet College attendance requirements. The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

C. **Incomplete Grade:** The College catalog states, “An incomplete grade may be given in those cases where the student has completed the majority of the course work but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course…” Prior approval from the instructor is required before the grade of “I” for Incomplete is recorded. A student who merely fails to show for the final examination will receive a zero for the final and an “F” for the course.
D. **Cellular Phones and Beepers**: Student cellular phones and beepers will be turned off while the student is in the classroom or laboratory. Students choosing to disregard this policy will be asked to leave and will be recorded as absent. If a cell phone rings or is used during testing, the test will be taken and a grade of zero will be given.

E. **American’s with Disabilities Act (ADA)**: Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

F. **Instructor Discretion**: The instructor reserves the right or final decision in course requirements.

G. **Civility**: The collegiate expectation is that students will conduct themselves with civility at all times in classrooms. Minimal civility includes:

a. Being in class on time
b. Staying in class for the entire class period
c. Leaving early occurs only after informing the teacher, prior to class, of an unavoidable conflict requiring your early departure (if possible, position yourself close to the door for a minimum disruption of the class)
d. Avoiding such uncivil conduct as talking, sleeping, reading papers/magazines, or working on some other class homework assignment
e. Using socially acceptable language in classroom discussions Failure to do so can result in disciplinary action up to and including expulsion.

VIII. COURSE OUTLINE

A. **Part I: Basic Immunologic Mechanisms, 1**

Chapter 1: An Overview of Immunology, 1

**Learning Outcomes**: Upon completion of this chapter, the student will be able to:

a. Compare an immunogen and an antigen
b. Define the term *immunology*
c. Explain the functions of the immune system
d. Describe the first, second, and third lines of body defense against microbial diseases
e. Compare innate and adaptive immunity
f. Analyze a case study related to immunity

g. Correctly answer case study related multiple choice questions

h. Be prepared to participate in a discussion of critical thinking questions

i. Describe the characteristics of five mature leukocytes and their immune function

j. Correctly answer end of chapter review questions

Chapter 2: Antigens and Antibodies, 10

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Define the terms antigen and antibody

b. Compare the characteristics of major histocompatibility complex (MHC) classes I and II

c. Name and compare the characteristics of each of the five immunoglobulin classes

d. Draw and describe a typical immunoglobulin G (IgG) molecular structure

f. Name the four phases of an antibody response

h. Describe the characteristics of a primary and secondary (anamnestic) response

g. Compare the terms antibody avidity and antibody affinity

i. Describe the method of production of a monoclonal antibody

j. Correctly answer case study related multiple choice questions

k. Be prepared to participate in a discussion of critical thinking questions

l. Describe the principle and agglutination reactions in ABO blood grouping

m. Describe the principle, expected results, reference values, and clinical interpretation of the serum protein electrophoresis procedure

n. Correctly answer end of chapter review questions

Chapter 3: Cells and Cellular Activities of the Immune System: Granulocytes and Mononuclear Cells, 30

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Describe the general functions of granulocytes, monocytes-macrophages, and lymphocytes and plasma cells as components of the immune system.

b. Explain the process of phagocytosis
c. Describe the composition and function of neutrophil extracellular traps (NETs)
d. Discuss the role of monocytes and macrophages in cellular immunity
e. Define and compare acute inflammation and sepsis
f. Briefly describe cell surface receptors
g. Name and compare the signs and symptoms of disorders of neutrophil function
h. Compare the signs and symptoms of two monocyte or macrophage disorders
i. Describe states involving the leukocyte integrins
j. Analyze case studies related to defects of neutrophils
k. Correctly answer case study related multiple choice questions
l. Be prepared to participate in a discussion of critical thinking questions
m. Describe the principal reporting of results, sources of error, clinical applications, and limitations of phagocytic engulfment test
n. Correctly answer end of chapter review questions

Chapter 4: Cells and Cellular Activities of the Immune System: Lymphocytes and Plasma Cells, 48

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Differentiate and compare the function of primary and secondary lymphoid tissues.
b. Describe the structure and function of a lymph node.
c. Explain the role of the thymus in T lymphocyte maturation.
d. Describe the maturation of a B lymphocyte from origination to plasma cell development.
e. Compare the function of T lymphocytes and B lymphocytes in immunity.
f. Explain the function of natural killer (NK) cells.
g. Define the term cluster of differentiation (CD) and explain the purpose of detecting this marker.
h. Differentiate the characteristics of T lymphocyte subsets on the basis of antigen structures and function.
i. Describe the evaluation of suspected lymphocytic or plasma cell defects.
j. Name and compare disorders of immunologic (lymphocytic or plasma cell) origin.
k. Compare various categories of immunodeficiency disorders.
l. Analyze and apply knowledge from this chapter to a representative case study.
m. Correctly answer case study-related multiple choice questions.

n. Be prepared to participate in a discussion of critical thinking questions.

o. Describe the assessment of the cellular immune status.

p. Correctly answer end of chapter review questions.

Chapter 5: Soluble Mediators of the Immune System, 78

**Learning Outcomes:** Upon completion of this chapter, the student will be able to:

a. Name and compare the three complement activation pathways.

b. Describe the mechanisms and consequences of complement activation.

c. Explain the biological functions of the complement system.

d. Name and describe alterations in complement levels.

e. Briefly describe the assessment of complement levels.

f. Compare other types of nonspecific mediators of the immune system, including cytokines, interleukins, tumor necrosis factor, hematopoietic growth factors, and chemokines.

g. Discuss the clinical applications of C-reactive protein.

h. Compare acute-phase reactant methods.

i. Analyze and acute-phase protein case study.

j. Correctly answer case study related multiple choice questions.

k. Be prepared to participate in a discussion of critical thinking questions.

l. Describe the principle, reporting results, sources of error, limitations, and clinical applications of the C-reactive protein procedure.

m. Correctly answer end of chapter review questions.

B. Part II: The Theory of Immunologic and Serologic Procedures, 103

Chapter 6: Safety in the Immunology-Serology Laboratory, 103

**Learning Outcomes:** Upon completion of this chapter, the student will be able to:

a. Name the federal or national agencies responsible for safety issues.

b. Discuss the occupational transmission of hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

c. Describe the practice of Standard Blood and Body Fluid Precautions.

d. Explain the proper handling of hazardous material and waste management, including infectious waste, chemicals, and radioactive waste.

e. Describe the basic aspects of infection control policies, including the use of personal protective equipment or devices (gowns, gloves, goggles) and the purpose of Standard Precautions.
f. Compare pre-exposure and post-exposure prophylactic measures for handling potential occupational transmission of certain pathogens (HBV, HCV, and HIV).
g. Demonstrate the proper decontamination of a work area at the start and completion of work and after a hazardous spill.
h. Explain the process of properly segregating and disposing of various types of waste products generated in the clinical laboratory.
i. Analyze a safety case study to identify violations and remediation for the violations.
j. Correctly answer case study-related multiple choice questions.
k. Be prepared to participate in a discussion of critical thinking questions.
l. Identify items essential to safety in the clinical laboratory.
m. Correctly answer end of chapter review questions.

Chapter 7: Quality Assurance and Quality Control, 115

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Identify the regulatory and accrediting organizations that influence quality assessment in clinical laboratories.
b. Describe the eight non-analytical factors related to testing accuracy.
c. Identify and give examples of the three categories of errors related to the phase of testing.
d. Define the terms accuracy, precision, reproducibility, and reliability.
e. Describe the use of the coefficient of variation and give the formula.
f. Define true positive, true negative, false positive, and false negative.
g. Provide the equations for calculating percentage sensitivity and percentage specificity.
h. Define positive predictive value and negative predictive value.
i. Describe the process of proficiency testing.
j. Explain the use of control specimens.
k. Cite seven causes for a control value being out of the acceptable range or out of control.
l. Define the terms mean, median, mode, standard deviation, and reference range.
m. Discuss issues related to testing outcomes.
n. Describe parallel testing of test kits.
o. Describe how a new procedure is validated.
p. Write and evaluate a procedural write-up using CLSI requirements.
q. Correctly answer case study-related multiple choice questions.
r. Be prepared to participate in a discussion of critical thinking questions.
s. Correctly answer end of chapter review questions.

Chapter 8: Basic Serologic Laboratory Techniques, 125
Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Identify and explain the parts of a procedure.
b. Describe the preparation of blood specimens for testing.
c. Provide examples of the types of specimens that can be tested using immunologic procedures.
d. Explain how complement is inactivated in a serum sample.
e. Compare the differences between the two types of pipettes typically used in the immunology-serology laboratory.
f. Describe and demonstrate pipetting techniques using manual and automatic pipettes.
g. Define the term dilution.
h. Calculate the concentration of a substance using the dilution factor.
i. Calculate the concentration of a single dilution.
j. Compare the characteristics of the acute and chronic phases of illness.
k. Define the term antibody titer.
l. Analyze a case study with the interpretation of the assay results.
m. Correctly answer case study related multiple choice questions.
n. Be prepared to participate in a discussion of critical thinking questions.
o. Correctly answer end of chapter review questions.
p. Explain and prepare serial dilution.

Chapter 9: Point-of-Care Testing, 135

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Define point-of-care testing (POCT).
b. Cite some advantages and disadvantages of POCT.
c. Differentiate among the four different types of testing categories.
d. Analyze a POCT case study.
e. Correctly answer case study related multiple choice questions.
f. Be prepared to participate in a discussion of critical thinking questions.
g. Describe the principle and clinical application of one POCT assay.
h. Correctly answer end of chapter review questions.

Chapter 10: Agglutination Methods, 139

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Describe the principles of agglutination.
b. Identify and compare the characteristics of agglutination methods.
c. Explain methods for enhancing agglutination.
d. Describe the characteristics of graded agglutination reactions.
e. Discuss the principles of pregnancy testing, including sources of error.
f. Analyze a case study.
g. Correctly answer case study related multiple choice questions.
h. Be prepared to participate in a discussion of critical thinking questions.
i. Explain agglutination reactions of the ABO blood group procedure.
j. Describe the principle and sources of error of the ABO blood group procedure.
k. Correctly answer end of chapter review questions.

Chapter 11: Electrophoresis Techniques, 151

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Define the term electrophoresis.
b. Describe the electrophoresis technique.
c. Identify the fractions into which serum proteins can be divided by electrophoresis.
d. Describe the characteristics of immunoelectrophoresis.
e. Compare immunoelectrophoresis and immunofixation electrophoresis.
f. Compare capillary electrophoresis and microchip capillary electrophoresis.
g. Describe two electrophoresis separation methods.
h. Analyze a case study related to the results of serum protein electrophoresis.
i. Correctly answer case study related multiple choice questions.
j. Be prepared to participate in a discussion of critical thinking questions.
k. Describe the principle of the immunofixation electrophoresis procedure.
l. Correctly answer end of chapter review questions.

Chapter 12: Labeling Techniques in Immunoassay, 160

Learning Outcomes: Upon completion of this chapter, the student will be able to:

a. Compare heterogeneous and homogeneous immunoassays.
b. Name and cite applications of at least three types of labels that can be used in an immunoassay.
c. Describe chemiluminescence.
d. Describe and compare chemiluminescence, enzyme immunoassay (EIA), and immunofluorescence techniques.
e. Briefly compare direct immunofluorescent, inhibition immunofluorescent, and indirect immunofluorescent assays.
f. Describe the advantages, disadvantages, and application of Q dots, SQUID technology, luminescent oxygen-channeling immunoassay,
fluorescent in situ hybridization, signal amplification technology, and magnetic labeling technology.

g. Analyze a case study related to immunoassay.

h. Correctly answer case study related multiple choice questions.
i. Be prepared to participate in a discussion of critical thinking questions.
j. Describe the principle of the solid-phase immunosorbent assay for pregnancy testing.
k. Describe the direct fluorescent antibody test for *N. gonorrhea*.
l. Correctly answer end of chapter review questions.

**Chapter 13: Automated Procedures, 170**

**Learning Outcomes:** Upon completion of this chapter, the student will be able to:

a. Identify and give examples of the three phases in automated testing.
b. Describe the principle, advantages, and disadvantages of nephelometry.
c. Discuss the analysis and clinical implications of cryoglobulins.
d. Explain the principle of flow cell cytometry and cite clinical applications.
e. Discuss current trends in immunoassay.
f. List at least three potential benefits of automated immunoassay.
g. Analyze a case study related to immunoassay.
h. Correctly answer case study related multiple choice questions.
i. View and discuss questions related to videos about flow cytometry.
j. Correctly answer end of chapter review questions.

**Chapter 14: Molecular Techniques, 183**

**Learning Outcomes:** Upon completion of this chapter, the student will be able to:

a. Describe the composition of DNA and RNA.
b. Describe the polymerase chain reaction (PCR) amplification technique.
c. Compare functions of DNA and various forms of RNA.
d. Compare various PCR modifications.
e. Identify and briefly describe other amplification techniques.
f. Describe the gold standard of genetic analysis.
g. Compare DNA sequencing and branched DNA protocols.
h. Identify and compare three hybridization techniques.
i. Explain how microarrays are applied to immunologic testing.
j. Discuss the general concept of nucleic acid blotting.
k. Compare the characteristics and clinical applications of Southern, Northern, and Western blotting techniques.
C. **Part III: Immunologic Manifestations of Infectious Diseases, 197**

**Chapter 15: The Immune Response in Infectious Diseases, 197**

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Describe important characteristics in the acquisition and development of infectious diseases.
b. Compare how the body develops immunity to bacterial; parasitic; fungal; and viral, rickettsial, and mycoplasmal diseases.
c. Briefly describe the laboratory detection of immunologic responses.
d. Analyze a case study related to the immune response in infectious diseases.
e. Correctly answer case study related multiple choice questions.
f. Be prepared to participate in a discussion of critical thinking questions.
g. Describe the principle and results of the latex Cryptococcus antigen detection system.
h. Correctly answer end of chapter review questions.

**Chapter 16: A Primer on Vaccines, 208**

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Identify the federal agency that regulates vaccine products.
b. Describe vaccine policy and the role of vaccines in public safety.
c. Briefly describe the history and use of several specific vaccines.
d. Explain some new targets and technologies for vaccines.
e. Identify at least three essential characteristics of a vaccine.
f. Based on immunologic principles, describe the host response to vaccination.
g. Analyze the problems associated with AIDS vaccine development and use.
h. Describe the development and application of human papillomavirus vaccine.
i. Compare and contrast the applications of at least four vaccines.
j. Analyze a case study.
k. Correctly answer case study related multiple choice questions.
l. Be prepared to participate in a discussion of critical thinking questions.
m. Describe the principle and clinical application of the tetanus antibodies assay.
Chapter 17: Streptococcal Infections, 223

Learning Outcomes: Upon completion of this lesson, the student will be able to:

- Describe the etiology, epidemiology, signs and symptoms, and complications of streptococcal infection.
- Discuss the immunologic manifestations and diagnostic evaluation of streptococcal infection.
- Analyze and apply laboratory data to a case study.
- Correctly answer case study related multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions.
- Explain the principle and applications of the classic anti-streptolysin O (ASO) procedure.
- Briefly explain other methods of detection of group A streptococcus.
- Correctly answer end of chapter review questions.

Chapter 18: Syphilis, 232

Learning Outcomes: Upon completion of this lesson, the student will be able to:

- Describe the etiology; epidemiology; and signs and symptoms of primary, secondary, latent, and late (tertiary) syphilis.
- Describe the origin and manifestations of congenital syphilis.
- Explain the immunologic manifestations and diagnostic evaluation of syphilis.
- Analyze a case study related to syphilis testing.
- Correctly answer case study related multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions.
- Discuss the principles and clinical applications of the rapid plasma regain (RPR) card test and VDRL procedure.
- Discuss the principles and clinical applications of confirmatory syphilis testing, such as the fluorescent treponemal antibody absorption (FTA) test.
- Correctly answer end of chapter review questions.

Chapter 19: Vector-Borne Diseases, 246

Learning Outcomes: Upon completion of this lesson, the student will be able to:

- Describe the etiology, epidemiology, and signs and symptoms of Lyme disease.
- Analyze the immunologic manifestations and diagnostic evaluation of Lyme disease.
c. Explain the principle, interpretation, and limitations of an antibody detection assay.
d. Describe prevention strategies of Lyme disease.
e. Summarize the etiology, epidemiology, and signs and symptoms of ehrlichiosis.
f. Analyze the immunologic manifestations and diagnostic evaluation of ehrlichiosis.
g. Explain the prevention of ehrlichiosis.
h. Summarize the etiology, epidemiology, and signs and symptoms of Rocky Mountain spotted fever.
i. Analyze the immunologic manifestations and diagnostic evaluation of Rocky Mountain spotted fever.
j. Explain the prevention of Rocky Mountain spotted fever.
k. Summarize the etiology, epidemiology, and signs and symptoms of Babesiosis.
l. Analyze the immunologic manifestations and diagnostic evaluation of Babesiosis.
m. Explain the prevention of Babesiosis.
n. Briefly discuss the etiology and laboratory diagnosis of West Nile virus infection.
o. Analyze case studies related to the immune response in Lyme disease, Ehrlichiosis, and Babesiosis.
p. Correctly answer case study related multiple choice questions.
q. Be prepared to participate in a discussion of critical thinking questions.
r. Describe the principle, limitations, and clinical applications of the rapid *Borrelia burgdorferi* antibody detection assay.
s. Correctly answer end of chapter review questions.

**Chapter 20:** Toxoplasmosis, 264

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Describe the etiology and epidemiology of toxoplasmosis.
b. Explain the signs and symptoms of acquired and congenital toxoplasmosis infection.
c. Discuss the immunologic manifestations and diagnostic evaluation of toxoplasmosis, including the quantitative determination of IgM antibodies to *Toxoplasma gondii*.
d. Analyze a case study related to toxoplasmosis.
e. Correctly answer case study related multiple choice questions.
f. Be prepared to participate in a discussion of critical thinking questions.
g. Describe the principle, interpretation, and limitations of the TORCH procedure.
h. Correctly answer end of chapter review questions.

**Chapter 21:** Cytomegalovirus, 271
Learning Outcomes: Upon completion of this lesson, the student will be able to:

a. Discuss the etiology and epidemiology of acquired, latent, and congenital cytomegalovirus (CMV) infection.
b. Explain the signs and symptoms of acquired and congenital CMV infections.
c. Describe the immunologic manifestations of CMV.
d. Identify and explain the serologic markers and diagnostic evaluation of CMV.
e. Discuss the principles and applications of passive latex agglutination and other quantitative determinations of IgM and IgG antibodies.
f. Analyze a CMV case study.
g. Correctly answer case study related multiple choice questions.
h. Be prepared to participate in a discussion of critical thinking questions.
i. Describe the principle, reference range, sources of error, limitations, and clinical applications of Latex Agglutination for Antibodies to CMV.
j. Describe the principle and clinical applications of antibody detection to CMV.
k. Correctly answer end of chapter review questions.

Chapter 22: Infectious Mononucleosis, 279

Learning Outcomes: Upon completion of this lesson, the student will be able to:

a. Describe the etiology, epidemiology, and signs and symptoms of infectious mononucleosis.
b. Explain the immunologic manifestations of infectious mononucleosis, including heterophile antibodies.
c. Discuss the elements of Epstein-Barr virus (EBV) serology and the diagnostic clinical applications of the presence of each component.
d. Analyze and apply laboratory data to a case study.
e. Correctly answer case study related multiple choice questions.
f. Be prepared to participate in a discussion of critical thinking questions.
g. Compare the serologic procedures and clinical applications of the Paul-Bunnell, Davidsohn differential, and rapid agglutination techniques.
h. Correctly answer end of chapter review questions.

Chapter 23: Viral Hepatitis, 287

Learning Outcomes: Upon completion of this lesson, the student will be able to:
a. Identify and describe the characteristics of the various forms of primary infectious hepatitis, including laboratory assays.
b. Compare the etiology, epidemiology, signs and symptoms, laboratory evaluation, and prevention of the various types of hepatitis.
c. Analyze case studies related to the immune response various forms of hepatitis.
d. Correctly answer case study related multiple choice questions.
e. Be prepared to participate in a discussion of critical thinking questions.
f. Describe the principle, results, and limitations of the rapid HCV test.
g. Correctly answer end of chapter review questions.

Chapter 24: Rubella and Rubeola Infections, 315

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Describe the etiology and epidemiology of rubella (German measles) infection.
b. Explain the signs and symptoms of acquired and congenital rubella infection.
c. Compare the immunologic manifestations of acquired and congenital rubella infection.
d. Explain the laboratory diagnostic evaluation of rubella infection.
e. Summarize the epidemiology and laboratory diagnosis of Rubeola (measles).
f. Analyze a representative case study.
g. Correctly answer case study related multiple choice questions.
h. Be prepared to participate in a discussion of critical thinking questions.
i. Describe the principle, results, limitations and clinical applications of the passive latex agglutination test for Rubella.
j. Correctly answer end of chapter review questions.

Chapter 25: Acquired Immunodeficiency Syndrome, 322

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Describe the etiology and viral characteristics of human immunodeficiency virus (HIV-1).
b. Explain the epidemiology, including modes of transmission, and prevention of HIV-1.
c. Discuss the signs and symptoms of various stages and the classification of HIV infection.
d. Describe the immunologic manifestations and cellular abnormalities of HIV-1 infection.
e. Explain the serologic markers and diagnostic evaluation of HIV.
f. Compare the features of fourth generations HIV testing to other generations of testing.
g. Analyze a representative HIV-1 case study.

h. Correctly answer case study related multiple choice questions.

i. Be prepared to participate in a discussion of critical thinking questions.

j. Describe the principles of the Rapid HIV antibody test, GS HIV Combo Antigen/Antibody EIA, and simulation of HIV-1 Detection.

k. Correctly answer end of chapter review questions.

C. **Part IV: Immune Disorders, 347**

**Chapter 26: Hypersensitivity Reactions, 347**

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Define the terms *hypersensitivity, allergy, sensitization,* and *immunization*.

b. Identify and explain the three categories of antigens.

c. Compare the basic differences among and give examples of types I, II, III, and IV hypersensitivity reactions.

d. Describe the etiology, immunologic activity, signs and symptoms, laboratory evaluation, and treatment of type I hypersensitivity reactions.

e. Discuss examples of type II hypersensitivity reactions, including laboratory evaluation.

f. Describe the mechanism of tissue injury, clinical manifestations, and laboratory testing for type III hypersensitivity reactions.

g. Describe the characteristics and laboratory evaluation of type IV hypersensitivity reactions.

h. Discuss the acquisition and consequences of latex sensitivity.

i. Analyze case studies related to hypersensitivity reactions.

j. Correctly answer case study related multiple choice questions.

k. Be prepared to participate in a discussion of critical thinking questions.

l. Describe the principle, clinical applications, or sources of error of a food allergy test, and the direct antiglobulin test.

m. Correctly answer end of chapter review questions.

**Chapter 27: Immunoproliferative Disorders, 366**

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Compare the general characteristics of monoclonal and polyclonal gammopathies.

b. Describe and compare the etiology, epidemiology, signs and symptoms, immunologic manifestations, diagnostic evaluation, and treatment of multiple myeloma and Waldenström’s primary macroglobulinemia.
c. Explain and contrast the characteristics of other monoclonal disorders, such as monoclonal gammopathy of unknown significance.
d. Analyze a case study related to immunoproliferation.
e. Correctly answer case study related multiple choice questions.
f. Be prepared to participate in a discussion of case study related critical thinking questions.
g. Describe the principle and application of the Bence Jones Protein Screening Procedure.
h. Correctly answer end of chapter review questions.

Chapter 28: Autoimmune Disorders, 382

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Describe the nature of autoimmune disorders.
b. Compare organ-specific and organ-nonspecific characteristics.
c. Describe organ-specific and mid-spectrum disorders.
d. Analyze representative case studies.
e. Correctly answer case study related multiple choice questions.
f. Be prepared to participate in a discussion of case study related critical thinking questions.
g. Be prepared to participate in a discussion of case study related critical thinking questions.
h. Describe the principle, sources of error, limitations, and application of the antinucleoprotein slide test.
i. Correctly answer end of chapter review questions.

Chapter 29: Systemic Lupus Erythematosus, 407

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Compare the different forms of lupus, citing manifestations, incidence, and other features.
b. Name the two most common drugs that can cause drug-induced lupus.
c. Explain the epidemiology and signs and symptoms of SLE.
d. Describe the immunologic manifestations of SLE, including diagnostic evaluation.
e. Discuss the laboratory evaluation of antinuclear antibodies.
f. Analyze selected SLE case studies. Correctly answer case study related multiple choice questions.
g. Be prepared to participate in a discussion of critical thinking questions.
h. Describe the principle, sources of error, limitation, and clinical application of the antinuclear antibody visible method.
i. Describe the principle and clinical applications of the rapid slide test for antinucleoprotein and autoimmune enzyme immunoassay ANA screening test.
Chapter 30: Rheumatoid Arthritis, 424

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Name significant factors related to the development of arthritis.
b. Describe the etiology, epidemiology, and signs and symptoms of rheumatoid arthritis.
c. Discuss the immunologic manifestations and diagnostic evaluation of rheumatoid arthritis.
d. Briefly describe juvenile rheumatoid arthritis.
e. Explain diagnostic procedures used in the identification and evaluation of rheumatoid arthritis.
f. Analyze representative rheumatoid arthritis case studies.
g. Correctly answer case study related multiple choice questions.
h. Be prepared to participate in a discussion of critical thinking questions.
i. Describe the principle, sources of error, clinical applications, and limitations of a rapid rheumatoid factor procedure.
j. Correctly answer end of chapter review questions.

Chapter 31: Solid Organ Transplantation, 436

**Learning Outcomes:** Upon completion of this lesson, the student will be able to:

a. Identify and describe the histocompatibility antigens.
b. Explain the clinical applications of histocompatibility antigens and human leukocyte antigens.
c. Identify and describe several laboratory methods for evaluating potential transplant recipients and donors.
d. List frequently used terms in transplantation.
e. Identify various types of transplants.
f. Define graft-versus-host disease.
g. Explain the etiology, epidemiology, signs and symptoms, manifestations, diagnosis, and prevention of graft-versus-host disease.
h. Describe the types of graft rejection.
i. Briefly explain the mechanism of organ or tissue rejection.
j. Identify and explain some methods of immunosuppression.
k. Analyze a representative transplantation case study.
l. Correctly answer case study related multiple choice questions.
m. Be prepared to participate in a discussion of critical thinking questions.
o. Correctly answer end of chapter review questions.

Chapter 32: Bone Marrow Transplantation, 461
Learning Outcomes: Upon completion of this lesson, the student will be able to:

a. Identify and discuss various types of cancer treated with progenitor cell transplants.
b. Define the term *progenitor cell*.
c. Name three types of stem cell transplants.
d. Discuss available treatment options for cancer.
e. Discuss the evaluation of candidates for transplantation.
f. Describe the process of obtaining blood stem cells.
g. Discuss the transplantation protocol, related complications, graft manipulation and storage, and cell infusion.
h. Compare at least three current directions in bone marrow transplantation.
i. Identify and discuss directions in bone marrow transplantation.
j. Analyze laboratory and clinical data of the cited case study and apply these concepts to the field of bone marrow transplantation.
k. Correctly answer case study related multiple choice questions.
l. Be prepared to participate in a discussion of critical thinking questions.
m. Correctly answer end of chapter review questions.

Chapter 33: Tumor Immunology, 474

Learning Outcomes: Upon completion of this lesson, the student will be able to:

a. Compare the characteristics of benign and malignant tumors.
b. Describe the epidemiology of cancer in adults and children.
c. Explain the characteristics of the three major causative factors in human cancer.
d. Compare the stages of carcinogenesis.
e. Describe the aspects of cancer-related genes.
f. Define and give examples of proto-oncogenes.
g. Describe the role of oncogenes.
h. Describe the characteristics of the major body defenses against cancer.
i. Identify and discuss the characteristics of tumor markers.
j. Discuss what’s new in cancer diagnostic testing.
k. Compare various modalities for treating cancer.
l. Analyze representative case studies.
m. Correctly answer case study related multiple choice questions.
n. Be prepared to participate in a discussion of critical thinking questions.
o. Describe the principle and clinical applications of the prostate-specific antigen procedure.
p. Correctly answer end of chapter review questions.