

# Immunology / Serology - MLAB 1235

## Course Syllabus: Spring 2017



"Northeast Texas Community College exists to provide responsible, exemplary learning opportunities."

**Gaylon Barrett BS MT, MBA-HCM**

**Office:** UHS 209

**Phone:** 903-434- 8250

**Email:** gbarrett@ntcc.edu

**Laboratory** meets in room UHS226 on Thursdays from 1pm – 4:50pm

Office Hours	Monday	Tuesday	Wednesday	Thursday	Friday
	9a-4p	9a-11a	9a-4p	By appt.	by appt.

*The information contained in this syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.*

**Catalog Course Description (include prerequisites):** Immunology is the study of the immune system. This course is designed to provide an understanding of the basic principles of immunity and the human immune system. Clinical applications will be emphasized, including antigen-antibody reactions, principles of serologic procedures, and identification of infectious diseases, autoimmune disorders, genetic disorders and organ transplantation.

### **Required Textbook(s):**

Turgeon, Mary Louise. *Immunology and Serology in Laboratory Medicine*, 5<sup>th</sup> Edition., 2014.

**Publisher:** Mosby Publishers

**ISBN Number:** 978-0-323-08518-2

### **Recommended Reading(s):**

Textbook companion website: <https://evolve.elsevier.com/Courses/99382>

Additional readings provided by instructor

### **Student Learning Outcomes:**

1. Apply principles of safety, quality assurance and quality control in Immunology / Serology.
2. Evaluate specimen acceptability.
3. Describe the principles involved in the immune response.
4. Explain the principles and perform serological tests.
5. Identify the structure, function, and characteristics of immunoglobulins
6. Evaluate and correlate test results with associated diseases or conditions.
7. Demonstrate improvement in affective traits, including organizational skills, work habits, attitude, interpersonal skills and problem-solving abilities.

**SCANS Skills:**

Resources - Identify reagents, supplies and equipment needed for each lab and organize laboratory procedure and organize laboratory procedures so that all reagents, supplies and equipment are used correctly.

Interpersonal - Recognize limitations of expertise and communicate with instructor when questions arise. Show respect for instructor and peers during class time.

Information - Apply information gained from lecture, laboratory and independent study to problem-solve results provided as case studies or unknowns during laboratory.

Systems - Apply critical thinking skills to problems encountered in the laboratory and theoretical case studies.

Technology - Achieve competency in routine serology procedures.

**Lectures & Discussions:**

Introduction to Immunology

Antigens and Antibodies

Cells and Tissues of the Immune system

Soluble mediators / Complement system

Immunochemical techniques

Immunologic Detection of infectious diseases

Autoimmunity and immunodeficiency

**Evaluation/Grading Policy:**

**Exams** 65%

Quizzes / Homework / Case studies

Laboratory 35%

Written lab assignments

Procedures

A = 90% or above

B = 80 - 89%

C = 79 - 79%

D = 60 - 69%

F = less than 60%

A minimum grade of "C" is required for **BOTH** the lecture and laboratory components of all Medical Laboratory Technology courses. This means a 70 or above is required for both lecture exams and lab assignments. Failure to meet the minimum passing score in each area will result in a "D" for the course and possible dismissal from the program.

**Tests/Exams:**

Four scheduled exams will be given over lecture and laboratory material

**Assignments:**

All assignments are due on the specified due date. Assignments will not be accepted late unless there is a legitimate reason. Failure to come to class a day is not acceptable as assignments can be turned in electronically. No assignment will be accepted after graded assignments are returned.

Homework and case studies will be assigned periodically which will have due dates.

**Other Course Requirements:**

Students are required to wear specified scrubs every day of class and laboratory. Appropriate laboratory attire is required - close-toed shoes, lab coat, and other supplied personal protective equipment if necessary. Without close-toed shoes or lab coat, no lab procedures may be performed and the grade will reflect a missed lab period.

**Student Responsibilities/Expectations:**

1. Attend all classes and labs, be on time and remain in class for the entire period. For every three days missed, one letter grade may be deducted from the final grade. Three episodes of tardiness or early departure will be equated with one class absence. Exams are to be taken on the scheduled date and time. Prior approval of the instructor is required for anyone missing an exam date. Makeup exams must be taken within 2 days of returning to campus. Every day after that will have 10 points deducted from the exam grade. Missing an exam without notifying the instructor will result in a grade of "0" for the exam. Anyone more than 15 minutes late for an exam without prior approval will take the exam in the testing center after the class period and have 10 points deducted from the exam grade.
2. Complete assigned readings before the lecture over each topic.
3. Be prepared to take notes and participate in class.
4. Be respectful of instructors and classmates.
5. All cell phones will be turned off or to silent during class time.
6. Laptops/tablets may be used for note-taking but do not abuse this privilege. They are not for personal use during class time.
7. Any missed laboratory session for any reason will require an essay of no less than 250 words (2 hand-written pages) covering the topic or activity performed during that session. This essay will be submitted before the next scheduled class period. The activity or procedure must also be made up, if possible, and any assignments as part of the missed lab session will also be turned in as soon as the lab activity has been completed. It is the student's responsibility to contact the instructor for such assignments.
8. When illness or emergencies arise which necessitate a student's absence from any scheduled class or other scheduled activity, the instructor should be notified as soon as possible.
9. There will be no makeup for unannounced quizzes.

**NTCC Academic Honesty Statement:**

"Students are expected to complete course work in an honest manner, using their intellects and resources designated as allowable by the course instructor. Students are responsible for addressing questions about allowable resources with the course instructor. NTCC upholds the highest standards of academic integrity. This course will follow the NTCC Academic Honesty policy stated in the Student Handbook."

**Academic Ethics**

The college expects all students to engage in academic pursuits in a manner that is beyond reproach. Students are expected to maintain complete honesty and integrity in their academic pursuit. Academic dishonesty such as cheating, plagiarism, and collusion is unacceptable and may result in disciplinary action. Refer to the student handbook for more information on this subject.

**ADA Statement:**

It is the policy of NTCC to provide reasonable accommodations for qualified individuals who are students with disabilities. This College will adhere to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations as required to afford equal educational opportunity. It is the student's responsibility to arrange an appointment with a

College counselor to obtain a Request for Accommodations form. For more information, please refer to the NTCC Catalog or Student Handbook.

### **Family Educational Rights And Privacy Act (FERPA):**

The Family Educational Rights and Privacy Act (FERPA) is a federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. FERPA gives parents certain rights with respect to their children's educational records. These rights transfer to the student when he or she attends a school beyond the high school level. Students to whom the rights have transferred are considered "eligible students." In essence, a parent has no legal right to obtain information concerning the child's college records without the written consent of the student. In compliance with FERPA, information classified as "directory information" may be released to the general public without the written consent of the student unless the student makes a request in writing. Directory information is defined as: the student's name, permanent address and/or local address, telephone listing, dates of attendance, most recent previous education institution attended, other information including major, field of study, degrees, awards received, and participation in officially recognized activities/sports.

## **COURSE LECTURE OBJECTIVES**

### **Unit 1: Chapters 1, 2, 7 and 8**

- Define the term *immunology*.
- Explain the functions of the immune system.
- Describe the first line of defense, natural immunity and adaptive immunity as body defense systems against microbial diseases
- Compare innate and adaptive immunity.
- Describe the characteristics of five mature leukocytes and their immune function.
- Define the terms *antigen* and *antibody*.
- Compare the characteristics of major histocompatibility complex (MHC) classes I and II
- Name and describe the characteristics of each of the five immunoglobulin classes.
- Draw and describe a typical immunoglobulin G (IgG) molecular structure.
- Name the four phases of an antibody response.
- Describe the characteristics of a primary and secondary (anamnestic) response.
- Compare the terms antibody *avidity* and *affinity*.
- Describe the method of production of a monoclonal antibody.
- Describe the principle and agglutination reactions in ABO blood grouping.
- Describe the eight nonanalytical factors related to testing accuracy.
- Define the terms *accuracy*, *precision*, *reproducibility*, and *reliability*.
- Define true positive, true negative, false positive, and false negative.
- Define positive predictive value and negative predictive value.
- Describe the process of proficiency testing
- Explain the use of control specimens
- Cite seven causes for a control value being out of the acceptable range or out of control
- Define the terms *mean*, *median*, *mode*, *standard deviation*, and *reference range*.
- Describe parallel testing of test kits.
- Describe how a new procedure is validated.
- Evaluate a procedural write-up using CLSI requirements.
- Describe the preparation of blood specimens for testing.

- Provide examples of the types of specimens that can be tested using immunologic procedures.
- Explain how complement is inactivated in a serum sample.
- Compare the differences between the two types of pipettes typically used in the immunology-serology laboratory.
- Describe and demonstrate pipetting techniques using manual and automatic pipettes.
- Define the term *dilution*.
- Calculate the concentration of a substance using the dilution factor.
- Calculate the concentration of a single dilution.
- Compare the characteristics of the acute and chronic phases of illness.
- Define the term *antibody titer*

## Unit 2: Chapters 3-5

- Describe the general functions of granulocytes, monocytes-macrophages, lymphocytes and plasma cells as components of the immune system.
- Explain the process of phagocytosis.
- Describe the composition and function of neutrophil extracellular traps (NETs)
- Discuss the role of monocytes/macrophages in cellular immunity.
- Define and compare acute inflammation and sepsis
- Briefly describe cell surface receptors.
- Name and compare the signs and symptoms of disorders of neutrophil function.
- Compare the signs and symptoms of two monocyte or macrophage disorders.
- Analyze case studies related to defects of neutrophils
- Correctly answer case study related multiple choice questions
- Be prepared to participate in a discussion of critical thinking questions.
- Describe the principal reporting of results, sources of error, clinical applications, and limitations of a phagocytic engulfment test.
- Differentiate and compare the functions of primary and secondary lymphoid tissue.
- Describe the structure and function of a lymph node.
- Explain the role of the thymus in T lymphocyte maturation.
- Describe the maturation of a B lymphocyte from origination to plasma cell development
- Compare the function of T lymphocytes and B lymphocytes in immunity.
- Explain the function of natural killer (NK) cells.
- Define the term *cluster of differentiation* (CD) and explain the purpose of detecting this marker.
- Describe the evaluation of suspected lymphocytic or plasma cell defects.
- Name and compare disorders of immunologic (lymphocytic or plasma cell) origin.
- Compare the categories of immunodeficiency disorders.
- Analyze and apply knowledge from this chapter to a representative case study.
- Correctly answer case study-related multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions.
- Describe the assessment of the cellular immune status.
- Name and compare the three complement activation pathways.
- Describe the mechanisms and consequences of complement activation.
- Explain the biologic functions of the complement system.
- Name and describe alterations in complement levels
- Briefly describe the assessment of complement levels.
- Discuss the clinical applications of C reactive protein.
- Compare acute phase reactant methods.

### Unit 3: Chapters 10,11,12,13 and 15

- Describe the principles of agglutination.
- Identify and compare the characteristics of agglutination methods.
- Explain methods for enhancing agglutination.
- Describe the characteristics of graded agglutination reactions.
- Discuss the principles of pregnancy testing, including sources of error.
- Analyze a case study
- Correctly answer case study related multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions
- Explain the agglutination reactions of the ABO blood group procedure.
- Describe the principle and sources of error of the ABO blood group procedure.
- Define *electrophoresis*.
- Describe the electrophoresis technique.
- Identify the fractions into which serum proteins can be divided by electrophoresis.
- Describe the characteristics of immunoelectrophoresis.
- Explain the features of immunofixation electrophoresis.
- Discuss the clinical applications of immunoelectrophoresis.
- Compare immunoelectrophoresis and immunofixation electrophoresis
- Analyze a case study related to the results of serum protein electrophoresis
- Correctly answer case study related multiple choice questions
- Be prepared to participate in a discussion of critical thinking questions
- Compare heterogenous and homogenous immunoassays
- Name and cite applications of at least three types of labels that can be used in an immunoassay.
- Describe chemiluminescence.
- Describe and compare chemiluminescence, enzyme immunoassay (EIA), and immunofluorescence techniques.
- Briefly compare direct immunofluorescent, inhibition immunofluorescent, and indirect immunofluorescent assays.
- Be prepared to participate in a discussion of critical thinking questions.
- Describe the direct fluorescent antibody test for *N. gonorrhoeae*
- Identify and give examples of the three phases in automated testing.
- Describe the principle, advantages and disadvantages of nephelometry.
- Discuss the analysis and clinical implications of cryoglobulins.
- Explain the principle of flow cell cytometry and cite clinical applications.
- Discuss current trends in immunoassay.
- List at least three potential benefits of automated immunoassay.
- Be prepared to participate in a discussion of critical thinking questions.
- Describe important characteristics in the acquisition and development of infectious diseases.
- Compare how the body develops immunity to bacterial, parasitic, fungal, viral, rickettsial and mycoplasmal diseases.
- Briefly describe the laboratory detection of immunologic responses.
- Analyze a case study related to the immune response in infectious diseases.
- Correctly answer case study related multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions.
- Describe the principle and results of the latex *Cryptococcus* antigen detection system.

### Unit 4: Chapters 26-30

- Define the terms hypersensitivity, allergy and sensitization, and immunization.
  - Identify and explain the three categories of antigens.
  - Compare the basic differences among and give examples of types I, II, III and IV hypersensitivity reactions.
  - Describe the etiology, immunologic activity, signs and symptoms, laboratory evaluation, and treatment of type I hypersensitivity reactions.
  - Discuss examples of type II hypersensitivity reactions, including laboratory evaluation.
  - Describe the mechanism of tissue injury, clinical manifestations, and laboratory testing for type III hypersensitivity reactions.
  - Describe the characteristic and laboratory evaluation of type IV hypersensitivity reactions.
  - Discuss the acquisition and consequences of latex sensitivity.
  - Analyze case studies related to hypersensitivity reactions.
- 
- Correctly answer case study related multiple choice questions.
  - Be prepared to participate in a discussion of critical thinking questions.
  - Describe the principle, clinical applications, or sources of error of a food allergy test, and the direct antiglobulin test.
  - Compare the general characteristics of monoclonal and polyclonal gammopathies.
  - Describe and compare the etiology, epidemiology, signs and symptoms, immunologic manifestations, diagnostic evaluation and treatment of multiple myeloma and Waldenstrom's primary macroglobulinemia.
  - Compare and contrast the characteristics of other monoclonal disorders, such as monoclonal gammopathy of unknown significance.
  - Analyze a case study related to immunoproliferation and correctly answer multiple choice questions.
  - Be prepared to participate in a discussion of case study related critical thinking questions.
  - Describe the principle and application of the Bence Jones Protein Screening Procedure.
  - Describe the nature of autoimmune disorders.
  - Compare organ-specific and organ-nonspecific characteristics.
  - Describe the organ-specific and mid-spectrum disorders.
  - Analyze representative case studies and correctly answer multiple choice questions.
  - Be prepared to participate in a discussion of case study related critical thinking questions.
  - Compare the different forms of lupus, citing manifestations, incidence, and other features.
  - Name the two most common drugs that can cause drug-induced lupus.
  - Explain the epidemiology and signs and symptoms of SLE
  - Describe the immunologic manifestations of SLE, including diagnostic evaluation.
  - Discuss the laboratory evaluation of antinuclear antibodies.
  - Analyze selected SLE case studies and correctly answer multiple choice questions
  - Be prepared to participate in a discussion of critical thinking questions.
  - Describe the principle, sources of error, limitation, and clinical application of the antinuclear antibody visible method
  - Describe the principle and clinical applications of the rapid slide test for antinucleoprotein and autoimmune enzyme immunoassay ANA screening test
  - Name significant factors related to the development of arthritis
  - Describe the etiology, epidemiology, and signs and symptoms of rheumatoid arthritis
  - Discuss the immunologic manifestations and diagnostic evaluation of rheumatoid arthritis
  - Briefly describe juvenile rheumatoid arthritis

- Explain diagnostic procedures used in the identification and evaluation of rheumatoid arthritis.
- Analyze representative rheumatoid arthritis case studies and correctly answer multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions
- Describe the principle, sources of error, clinical applications, and limitations of a rapid rheumatoid factor procedure.

## **Unit 5: Chapters 31 - 33**

- Identify and describe the histocompatibility antigens.
- Explain the clinical applications of histocompatibility antigens and human leukocyte antigens.
- List frequently used terms in transplantation
- Identify various types of transplants
- Define graft-versus-host disease
- Explain the etiology, epidemiology, signs and symptoms, manifestations, diagnosis and prevention of graft-versus-host disease
- Describe the types of graft rejection
- Briefly explain the mechanism of organ or tissue rejection
- Identify and explain some methods of immunosuppression
- Analyze a representative transplantation case study and correctly answer multiple choice questions.
- Be prepared to participate in a discussion of critical thinking questions.
- Identify and discuss various types of cancer treated with progenitor cell transplants.
- Define the term *progenitor cell*
- Name three types of stem cell transplants
- Discuss the evaluation of candidates for transplantation
- Describe the process of obtaining blood stem cells
- Compare the characteristics of benign and malignant tumors.
- Describe the epidemiology of cancer in adults and children
- Explain the characteristics of the three major causative factors in human cancer
- Compare the stages of carcinogenesis
- Describe the aspects of cancer-related genes
- Describe the role of oncogenes
- Describe the characteristics of the major body defenses against cancer
- Identify and discuss the characteristics of tumor markers
  - Discuss what's new in cancer diagnostic testing.
- Be prepared to participate in a discussion of critical thinking questions
- Describe the principle and clinical applications of the prostate-specific antigen procedure

## **COURSE LABORATORY OBJECTIVES**

*This list of lab activities is tentative and not all-inclusive. We will not perform all of these activities and we will probably participate in some additional activities. Instructor will provide addition information during the semester.*

### **Laboratory activity #1 – Serial dilutions**

After completion of this laboratory activity, the student will be able to:



- Discuss the relationship between serial dilutions, titer, and activity or concentrations of antigens and antibodies in human body fluid
- Correctly use serological pipettes and micropipettors
- *Accurately perform a serial dilution using methylene blue dye and be able to calculate the final volume, working dilution, final dilution, and titer of each tube in the series using a spectrophotometer and a graph of results.*

#### **Laboratory activity #2 – Serial dilutions using RBCs as indicator cells**

After completion of this laboratory activity, the student will be able to:

- *Accurately perform a serial dilution using Type A RBCs and determine the antibody titer*
  - *Must agree within  $\pm 1$  dilution with instructor results*

#### **Laboratory activity #3 – “Kit” tests (Strep A, Influenza, Infectious Mononucleosis, etc.)**

After completion of this laboratory activity, the student will be able to:

- Read the procedure of a “kit” test and discuss the
  - Appropriate specimen to be used
  - Principle of the procedure
  - Expected values
  - Significance of abnormal results
  - Limitations of the procedure
  - Troubleshooting procedures to follow if or when control results are unacceptable
- *Accurately perform the test and obtain acceptable results of controls and patient samples*
- *Appropriately record and report results as instructed*
- Use textbook, laboratory information and product insert to answer study questions assigned

#### **Laboratory activity #4 – Ouchterlony procedure (Ag-Ab reactions from Edvotek)**

After completion of this laboratory activity, the student will be able to:

- Discuss the principles of the Ouchterlony procedure
- Discuss the following as pertains to antigen-antibody interactions
  - Antibody-excess zone
  - Equivalence zone
  - Antigen-excess zone
- *Accurately perform, interpret and report results for the Ouchterlony procedure*

#### **Laboratory activity #5 – RPR testing**

After completion of this laboratory activity, the student will be able to:

- Discuss the different stages of syphilis
- Discuss the different methods of syphilis testing
  - Darkfield microscopy
  - Non-treponemal tests for syphilis
  - Treponemal tests for syphilis
- Discuss the principle of the RPR test
- Discuss possible false positives in non-treponemal tests
- Discuss the interpretation of results of the various types of syphilis testing
- *Accurately perform and report results of RPR testing on 3 given specimens*
- *Accurately perform, interpret and report results of 1 RPR titer*
  - *Results must agree within  $\pm 1$  dilution with instructor results*

### **Laboratory activity #6 – EBV or HIV Testing (ELISA method from Edvotek)**

After completion of this laboratory activity, the student will be able to:

- Discuss the principle of the ELISA method of testing for antibody or antigen
- *Accurately perform, interpret and report results for the ELISA test for EBV or HIV*
  - *Control solutions (positive and negative)*
  - *4 simulated patient serum samples*

### **Laboratory activity #7 – hCG testing (ELISA method from Edvotek)**

After completion of this laboratory activity, the student will be able to:

- Discuss the principle of the ELISA method of testing for antibody or antigen
- *Accurately perform, interpret and report results for the ELISA test for hCG*
  - *Control solutions (positive and negative)*
  - *2 simulated patient urine samples*

### **Laboratory activity #8 – Blood-based Cancer detection (HPV and PSA precipitation agglutination method from Edvotek)**

After completion of this laboratory activity, the student will be able to:

- Discuss the principle of the precipitation agglutination method of antibody testing
- Discuss the use of cancer biomarker testing (those listed below) as screening tests, monitoring of therapy, and/or detection of recurrence.
  - Carcinoembryonic antigen (CEA)
  - Prostate specific antigen (PSA)
  - CA 125
  - Human papilloma virus (HPV)
- *Accurately perform, interpret and report results for the HPV and PSA testing*
  - *Control solutions (positive and negative)*
  - *6 simulated male serum specimens for PSA*
  - *6 simulated female serum specimens for HPV*