

MERCER COUNTY COMMUNITY COLLEGE
COURSE OUTLINE

MLT 104 4
Course Number Credits

Immunology and Immunoematology 3
Course Title Class Hours

Science and Allied Health 3
Division Laboratory Hours

Texts: Title: Clinical Immunology and Serology
Author: Stevens, Christine
Publisher: F A Davis

Title: Basic and Applied Concepts of Immunoematology
Author: Blaney, Kathy and Howard, Paula
Publisher: Mosby, 2000

Optional Text: Title: Essentials of Immunology
Author: Flynn
Publisher: Saunders

Method of Instruction: Lecture, discussion, audio-visual media, and laboratory exercises

Method of Evaluation: Assignments, examinations, and laboratory performances

Revised 2004

7 1/2 Weeks
Length of Semester

Catalog Description
MLT 104 - Immunology and Immunoematology

Basic theory and concepts of antigen - antibody reactions. Relationships of infection and immunity. Study of specific serological methods for the diagnosis of disease. Theory of blood group antigens and the genetics of their inheritance. Methods of performing blood grouping, compatibility tests and component selection. The laboratory component of the course will be used to develop the skills required to perform blood bank procedures.

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MERCER COUNTY COMMUNITY COLLEGE
COURSE OUTLINE

Immunology and Immunoematology

Course Title

Lecture Schedule

Week 1	Serology Testing Techniques Syphilis Serology Lyme's Disease – Ehrlichiosis – Babesiosis Toxoplasmosis – Cytomegalovirus
Week 2	Infectious Mono – Viral Hepatitis Rubella – Rubeloa - Mumps HIV Serology Autoimmune Disorders
Week 3	TEST #1 ABO and H Blood Group System Rh Blood Group System
Week 4	Other Blood Group Systems Antibody Screen Antibody Identification
Week 5	TEST #2 Pre-Transfusion Testing Direct Antiglobulin Testing Elution and Absorption
Week 6	Hemolytic Disease of the Newborn Transfusion Reactions
Week 7	Blood Components Quality Control Quality Assurance Blood Donors
Week 8	TEST #3 (Tuesday) Thursday final exam & wet practical and dry practical

MERCER COUNTY COMMUNITY COLLEGE
COURSE OUTLINE

Immunology and Immunohematology

Course Title

Laboratory Schedule

Week 1	(T)	RPR
	(R)	Pregnancy testing, Latex Agg, Elisa testing
Week 2	(T)	ANA
	(R)	Agglutination testing
Week 3	(T)	ABO testing
	(R)	ABO and Rh testing
Week 4	(T)	Antibody screen
	(R)	Antibody screen and dry panel
Week 5	(T)	Mini Practical #1
	(R)	Antibody panel
Week 6	(T)	Antibody panel
	(R)	Mini Practical #2
Week 7	(T)	Compatibility testing
	(R)	HDN testing
Week 8	(T)	Quality control
	(W)	Comprehensive lab practical

Suggested Additional References

AABB:	<u>Technical Manual</u> (located in reference desk at MCCC library)
Barrett:	<u>Textbook of Immunology</u>
Bryant:	<u>An Introduction to Immunoematology</u>
Harmening:	<u>Modern Blood Banking and Transfusion Practices</u>
Ruddman:	<u>Immunoematology</u>
Turgeon, Mary	<u>Fundamentals of Immunoematology</u>
Turgeon, Mary	<u>Immunology and Serology</u>

Grading Policy

1. To receive a passing grade, the student must meet the following criteria.

a. Achieve the following minimum number of points in each section of the course:

Minimum lecture points	280
Minimum laboratory points	140

The final grade will not be computed unless the minimum points are achieved in each portion of the course that is, the lecture portion, and the laboratory portion.

b. Complete the open laboratory assignments as determined by the exit level skills component of the course outline.

2. If any part of the course, that is, the lecture part, or the laboratory part is failed, the student must repeat the entire course.
3. A final grade of “C” or better in each Medical Laboratory Technician course is necessary to progress to the next MLT course and to graduate.
4. If the student receives the minimum number of points in each section of the course as listed in “a” above (the lecture or the laboratory) then the final grade is computed as follows:

$$\begin{array}{l} \text{total lecture points} \\ \text{plus total laboratory points} = \text{Final Grade} \end{array}$$

5. Final grade points

A = 600-588	A- = 557-540
B+ = 539-522	B = 521-498
B- = 497-480	C+ = 479-462
C = 461-420	D = 419-360
F = below 360	

Total Lecture Points

Test #1	50 points	
Test #2	100 points	
Test #3	100 points	
Quizzes	50 points	
Final Exam	<u>100 points</u>	
	400 points	Lecture total points

Total Laboratory Points

Mini Lab Practical #1	50 points	
Mini Lab Practical #2	50 points	
Comp. “Wet” Practical	50 points	
Comp. “Dry” Practical	<u>50 points</u>	
	200 points	Lab total points

NOTE: All ABO and Rh must be performed to the 100% proficiency level (testing and interpretation of results must be correct to receive credit). These tests either performed incorrectly or interpreted incorrectly will receive a (0) grade.

There are no make-up labs. Absence from lab will deduct 5 points from the total lab score. Lateness to lab will deduct 2 points from the total lab score. Students must be in lab during the scheduled lab hours. Do not make any appointments during lecture or lab time. Incomplete laboratory work will result in a deduction of 5 points from the total laboratory grade.

COURSE OBJECTIVES
MLT 104

Students will be able to:

1. Discuss antigens, antibodies and serological test systems.
2. Perform ABO grouping and Rh typing of a blood sample.
3. Perform all tests necessary to obtain and prepare blood for transfusion to a patient including choosing a donor, ABO, Rh typing of patient and donor, Ab screen, Ab identification and compatibility testing.
4. Understand the criteria for transfusion of whole blood components.
5. Identify candidate for Rh immune globulin.
6. Perform blood bank reagent quality control procedures.

EXIT LEVEL SKILLS
Objectives

1. Demonstrate ability to understand and perform agglutination, Elisa, and immunofluorescent test procedures in serology.
2. Demonstrate proficiency and accuracy in the ABO grouping and Rh typing of random samples.

Given 5 patient blood specimens, the student will perform all procedures necessary for the determination of the correct ABO grouping and Rh typing at 100% accuracy.
3. Demonstrate skill and understanding of antibody screens, performance of antibody screening and antibody identification.
4. Demonstrate proficiency and accuracy in compatibility testing. Choosing the correct blood donor ABO and Rh type is at 100% accuracy.

Given a patient's sera and cells, the student will select 2 appropriate donors for the patient and perform the following procedures on the blood:

- * Patient - ABO grouping, Rh typing, antibody screening
- * Donor - ABO grouping, Rh typing
- * Compatibility test using appropriate crossmatch techniques
- * Accuracy level of all grouping and typing and choice of donor for compatibility testing is set at 100% accuracy in the comprehensive practical.

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WEEK 1

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. List the four types of attractive forces that bind Ag-Ab.	Ag-Ab interactions attractive forces affinity, avidity, elution	
2. Define elution, affinity, avidity.	Precipitation diffusion immunoelectrophoresis immunofixation	Perform RPR qualitative and quantitative.
3. Understand the principles of immunoassay testing using the following lab techniques: precipitation agglutination labeled immunoassays immunofluorescence nephelometry molecular biology blot technique nucleic acid probes	Agglutination latex RBC Labeled Immunoassays enzymes chemilluminiscent Immunofluorescence fluorochromes fluorescent microscopy Nephelometry principles of nephelometry Blot Technique southern, northern, western blot Nucleic Acid Proteins DNA, RNA	Interpret results of RPR testing. Discuss FTA-ABS testing.

ASSIGNMENTS: Blaney: pgs. 3-18
Stevens: Chapters 8-9-10-11-12

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WEEK 1

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Differentiate between treponemal and non-treponemal tests for syphilis.	A. Tests for syphilis	
2. Explain the terms specificity and sensitivity in relation to serological tests for syphilis.	1. Screening tests (non-treponemal antigen)	
3. Explain the term "prozone" reaction.	A. Rapid plasma regain (RPR) B. VDRL for spinal fluid	
4. Report RPR results properly.	2. Treponemal tests	
5. Discuss possible sources of error in each test outlined.	a. Specific tests	
6. Diagram and explain immunofluorescence tests - direct and indirect.	1. FTA 2. MHA-TP	
7. Diagram fluorescent microscope set-up.	B. Lymes Disease	
8. Explain method and principle of the tests mentioned in the outline.	1. Disease 2. Lab testing	
9. Give normal and abnormal values for each test.	C. Diagnostic tests	
	1. Cold agglutinins	Perform an ELISA test procedure.
	2. Antistreptolysin O (ASO test)	Perform serologic test procedures using latex agglutination.

ASSIGNMENTS: Stevens: Chapters 19-20

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WEEK 2

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Name the three types of heterophile antibodies and explain how to differentiate between them.	Diagnostic tests (continued) A. Heterophile 1. Types a. Forssman b. Serum sickness c. Infectious mono-nucleosis	Perform ANA testing using immunofluorescent techniques.
2. Explain what is meant by heterophile antibodies and specific Epstein-Barr antibodies.		Observe ANA patterns.
3. Interpret mono test results.	2. Davidsohn differential test a. Method b. Interpretation	
4. Explain the antigen-antibody principles in hemagglutination.	3. Epstein-Barr antibodies	
	B. Rubella 1. IgG and IgM levels 2. Methods of testing	
	C. Rubeola	
	D. Mumps	

ASSIGNMENTS: Stevens: Chapter 21

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WEEK 2 (continued)

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
5. Define HIV.		
6. Understand the laboratory findings of HIV antibody.		
7. Explain EIA and Western Blot procedures for HIV antibody.	E. HIV	
8. Explain the term autoimmunity.	1. Disease	
9. Understand the principles of lab testing for Lupus, RA.	2. Lab testing	
10. List 5 autoimmune disorders.	a. Elisa	
11. Analyze and interpret ANA patterns.	b. Western blot	
12. Understand the purpose for HLA testing.	1) gag antigens	
	2) pol antigens	
	3) envelope antigens	
	3. Suds testing - HIV	
	F. Autoimmune disorders	
	1. Lupus	
	2. RA	
	G. Organ transplants	
	1. HLA testing	

ASSIGNMENTS: Stevens: Chapters 14-17-22

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WEEK 3

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Define genetic terms: <ul style="list-style-type: none"> a. gene/allele b. genotype c. phenotype d. dominance e. recessiveness f. homozygous/heterozygous g. autosomal h. sex-linked 	A. Genetics <ul style="list-style-type: none"> 1. Definition of terms 	Perform RBC grading agglutination exercises.
2. Review the concepts of Mendelian genetics.	B. Mendelian genetics <ul style="list-style-type: none"> 1. Review of concept of inheritance 2. Diploid genotype 3. Haploid genotype 4. Dominance 5. Recessiveness 6. Co-dominance 	Interpret RBC agglutination using AABB standards.
3. Explain the concept of genotype and phenotype patterns.		Observe hemolysis of RBC.
4. Diagram a punnett square.	C. Punnett square	
5. Relate the concept of population genetics as it applies to the ABO blood group antigens.	D. Genotype E. Phenotype F. Inheritance patterns <ul style="list-style-type: none"> 1. Pedigree chart <ul style="list-style-type: none"> a. autosomal b. sex-linked 	
	G. Population genetics <ul style="list-style-type: none"> 1. Introduction to blood group genetics. 	

ASSIGNMENTS: Blaney, pg. 56-73

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WEEK 3

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
	III. BLOOD BANKING	
1. Explain the basic functions of a blood bank.	A. Introduction to blood banking	1. Accurately perform ABO cell grouping-demonstrating knowledge of proper procedure and technique including:
2. Describe the effects of antigen-antibody interaction in vivo and in vitro.	1. Functions of the blood bank	a) Amount of reagents
3. Describe the ABO and H blood group system: Antigens and Antibodies.		b) Equipment
4. Using a Punnett Square, interpret probable genetic inheritance of ABO groups.	B. Effects of antigen-antibody interaction	c) Procedure
5. Discuss forward and reverse blood typing.	1. In vivo	d) Centrifugation
6. Discuss ABO typing discrepancies.	2. In vitro	e) Reading and recording agglutination and hemolysis
	C. The nature of blood groups	f) Interpretation of proper blood group
	1. Genetic principles	2. Record and interpret forward and reverse typings.
	2. Antigen, antibodies	3. Recognize discrepancies between forward and reverse typing.
	D. ABO systems	
	1. ABO red cell antigens	
	2. ABO blood group antibodies	
	E. Lectins	

ASSIGNMENTS: Blaney, Ch. 4, pgs. 77-105
Blaney, Ch. 2, pgs. 37-45

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WEEK 3

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Explain the Rh antigen system including: <ul style="list-style-type: none"> a) Genetic Inheritance b) Nomenclature of Wiener, Race-Fisher Rosenfield. c) Translate Wiener to Fisher-Race. 	A. Rh system <ul style="list-style-type: none"> 1. Theories of inheritance 2. Rh antigens 3. Weiner system 4. Fisher-Race system 5. Rosenfield system. 6. CIS and Trans genes 	RH <ul style="list-style-type: none"> 1. Perform Rh cell grouping 2. Perform D^u (weak D) testing. 3. Record and interpret results of Rh typing. 4. Discuss Rh typing sera and controls.
2. Describe procedures for performing: <ul style="list-style-type: none"> a) Rh typing b) D^u (weak D) 	B. Rh testing <ul style="list-style-type: none"> 1. High protein 2. Low protein 3. Rh control reagent 	
3. Define D ^u (weak D) phenotype.		
4. Discuss CIS and trans inheritance patterns of the Rh antigens.		
4. Interpret ABO groups and Rh typing from lab results given on a written test.		

ASSIGNMENTS: Quinley, pg. 111-121
Blaney, Ch. 5, pgs. 107-123

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WEEK 4

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
<ol style="list-style-type: none"> 1. List other major blood group systems including their antigens and corresponding antibodies. 2. State the optimal temperature and media at which the antibodies react. 3. State whether these antibodies can cause hemolytic disease of the newborn or transfusion reactions. 4. List serologic characteristics of these antigen or antibodies including incidence in the population. 	<ol style="list-style-type: none"> A. Other blood group systems <ol style="list-style-type: none"> 1. Lewis 2. P 3. MNSS 4. Kell 5. Duffy 6. Kidd 7. Lutheran 8. Other 9. Incidence of each group 10. Serologic characteristics 11. Clinical significance of each group. 12. Laboratory procedures to detect other blood group system antibodies. 	<ol style="list-style-type: none"> 1. Perform antibody screen procedures. 2. Observe a dry antibody identification system.

ASSIGNMENTS: Blaney, Ch. 6, pgs. 124-153

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WEEK 4

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. State principles and uses of antibody screening.	1. Antibody identification	1. Given unknown samples, the student will be able to perform the screen I, screen II, screen III cells.
2. Explain how irregular antibodies are produced, clinical manifestations and serologic.	a. Panels	
	b. Rule out techniques	
	c. Autocontrol	
	d. Dosage	
	e. Mixture of antibodies	2. Discuss rule out technique.
3. Explain the use of a panel of known red cell antigens used in Ab identification.	2. Enhancement media	
	a. LISS	
	b. Enzyme	
	c. PEG	
	d. Albumin	
4. Evaluate a panel identifying an Ab using rule out technique.	3. Phases of testing RT 37° AHG	
5. Identify a single antibody.	4. Phenotyping the patient.	

ASSIGNMENTS: Blaney, Ch. 7, pgs. 157-183
Blaney, Ch. 2, pgs. 46-55

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WEEK 5

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
<ol style="list-style-type: none"> 1. Define compatibility testing. 2. Describe the specimen labeling required for crossmatch. 3. Describe a compatible and an incompatible crossmatch reaction in vitro. 4. Explain an IS crossmatch. 5. Explain an IgG crossmatch. 6. Explain an electronic crossmatch. 7. Explain alternate blood group choices and inventory control. 8. Describe the procedure for antigen typing a donor unit. 9. Discuss common reasons for an incompatible crossmatch. 	<p>Compatibility testing</p> <ol style="list-style-type: none"> 1. Purpose of crossmatch 2. Procedure for crossmatch 3. Alternate blood group selections 4. Types of crossmatch procedures IS crossmatch IgG (full AHG Crossmatch) Electronic crossmatch 5. Tagging the blood unit 6. Emergency release of blood 7. Release of blood for infants. 	<ol style="list-style-type: none"> 1. Given unknown samples perform mini practical #1 which includes ABO group, Rh type, and Ab screen. 2. Perform antibody identifications using a panel of reagent red blood cells.

ASSIGNMENTS: Blaney, Ch. 8, pgs. 184-201

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WEEK 5

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Describe the principle and procedure of the DAT.	A. DAT 1. Purpose	Continue performance of antibody identification using red blood cell panels.
2. Distinguish between polyspecific and monospecific antiglobulin sera.	B. DAT 1. Sample 2. Procedure	
3. Compare the direct antiglobulin test with the indirect antiglobulin test.	C. Antiglobulin reagents 1. Poly-specific 2. Mono-specific	
4. Discuss the principle and use of elution and adsorption procedures.	D. DAT 1. Interpretation of results E. Application of DAT 1. Autoimmune hemolytic anemia 2. Drug induced hemolytic anemia 3. Hemolytic disease of newborn 4. Hemolytic transfusion reactions F. Elution 1. Principle 2. Methods 3. Procedure 4. Controls G. Adsorption 1. Principle 2. Procedure	

ASSIGNMENTS: Blaney, pgs. 24-25; 27, 46, 158-159, 172, 193-194, 277
 definition DAT: 23, 46; association with HDN: 290-291
 Blaney (Elution) pg. 85, pgs. 175-176

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WEEK 6

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Define HDN in relation to blood incompatibilities between mother and fetus, including ABO and Rh frequency and severity and serological findings.	Hemolytic disease of the newborn 1. Disease description and etiology a. Genetic factors	1. Perform antibody identification using a red blood cell panel.
2. Define amniocentesis including its importance in predicting HDN.	2. Diagnosis: cord blood a. Direct anti-globulin test (DAT)	2. Perform mini-practical #2 - antibody identification.
3. Explain procedure, importance and purpose of prenatal testing.	b. Hemoglobin	
4. Define applications of direct and indirect Coomb's test.	3. Prevention a. Rh ^o immune globulin study	
5. Discuss factors affecting the direct anti-globulin test.	b. Possible administration of Rh ^o immune globulin	
6. Define RHIG, explain how it works, to whom it is given and the criteria used to determine eligibility.	c. Antenatal dose d. Postnatal dose	
7. Determine whether Rh ^o immune globulin should be given when presented with lab results on a written test.	e. Rosette test f. Kleihauer-Betke test	

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WEEK 6

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
<ol style="list-style-type: none"> 1. Define a transfusion reaction and list the types. 2. List the steps necessary for lab investigation of a transfusion reaction. 3. Explain necessity of each test as outlined in AABB procedural manual for transfusion reactions. 	<ol style="list-style-type: none"> I. Transfusion reaction <ol style="list-style-type: none"> 1. Immediate hemolytic reaction 2. Delayed hemolytic reaction 3. Allergic reactions 4. Febrile reactions 5. Transmission of disease 	

ASSIGNMENTS: Blaney, Ch. 12, pgs. 265-282

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WEEK 7

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. Define the term blood component.	Blood	1. Perform compatibility testing including antigen typing a segment of donor blood.
2. List factors that affect proper preparation of blood components.	Components 1. Whole blood 2. Packed red cells 3. White blood cells	2. Given unknown specimens, the student will perform procedures to work up an HDN study on mom and baby cord blood.
3. List blood components used at the present time.	4. Platelets 5. Fresh frozen plasma 6. Cryoprecipitates 7. Blood filters	3. The student will
4. Explain the importance of each component preparation in regard to therapeutic value to the patient. determine		the results of an HDN study and explain to the instructor the elution procedure to follow.
5. List all the steps in preparation of the above components using AABB recommended methods.		4. Determine the Rhogam status of the mother in their given HDN study.
6. List expiration date storage requirement and whether given as type specific for each component prepared.		5. Create a chart for blood components.
7. Discuss pretransfusion preparation and serological testing of each component being transfused.		

ASSIGNMENTS: Blaney, Ch. 11, pgs. 241-261
Ch. 14, pgs. 303-316

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WEEK 7

KNOWLEDGE OBJECTIVES	OUTLINE	PERFORMANCE OBJECTIVES
1. List the criteria for selection of a donor on the basis of medical history and physical characteristics.	K. Donors Blood donor 1. Medical history screening 2. Physical check-up 3. Storage and processing of blood 4. Recordkeeping 1. Homologous 2. Autologous 3. Directed donation	1. Perform quality control procedures for a blood bank laboratory.
2. Describe collection of blood from phlebotomy to refrigeration.		2. Perform comprehensive lab practicals.
3. Recognize donor reactions that are common and unexpected know what to do in each instance.		
4. Choose or reject a donor based on interview data.		
5. Define quality control.		L. Quality and Safety Issues
6. Explain the purpose for daily quality control procedures in a blood bank.		1. Quality control a. Technical factors b. Physical c. Reagents and solutions
7. Given quality control results explain the meaning of each and determine if acceptable.		2. Records 3. Labels 4. Blood bank

ASSIGNMENTS: Blaney, Ch. 9, pgs. 205-226
Ch. 10, pgs. 227-261
Ch. 15, pgs. 321-335
Ch. 16, pgs. 337-352