**MLS 3312: Clinical Laboratory Immunology and Virology**

Department of Medical Laboratory Sciences

Dr. Ezekiel R. Dumke College of Health Professions, Weber State University

**COURSE SYLLABUS**

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| Instructor: | Matthew J. Nicholaou, Dr.P.H., MT(ASCP) | Term: | Spring 2014 |
| Office: | Marriott Health Bldg. – Rm. 214 | Lecture Days: | MWF |
| Phone: | 801-626-6101 | Lecture Hours:  Labs | 09:30-10:20 am  MW 12:30-13:50 or 14:00-15:20 or 15:30-16:50 |
| Cell: | 302-584-7230 | Location: | 117 |
| E-mail: | matthewnicholaou@weber.edu | Office Hours: | 2:30 – 3:30pm Mon. and Wed. |

**I. Course Description**

This is a discipline-specific course designed to prepare students for the clinical immunology portion of the American Society for Clinical Pathology Board Certification examination and to work in a clinical immunology laboratory. The course will be divided into three sections: basic concepts in immunology, clinical immunology & serology techniques, and immune related disease states. Students will learn to perform various clinical immunology laboratory techniques and be expected to pass a minimum competency for each assay. This course will focus heavily on correlating immune diseases with diagnostic testing and results.

**II. Course Information**

Course Credit Hours: 4

Required Texts: Rittenhouse-Olson, K. (2013) *Contemporary Clinical Immunology and Serology*. Upper Saddle River, NJ: Pearson Education Inc.

Parham, P. (2009). *The Immune System* (3rd ed.). New York, NY: Garland Science

Rosen, F. (2009). *Case Studies in Immunology: A Clinical Companion*. New York, NY: Garland Science

**III. Course Learning Objectives**

Lecture Objectives

After completion of this course the student will be able to meet the following theory based course objectives:

* Define and compare innate (natural) and adaptive (acquired) immunities.
* Define the major immune cell types and their rolls in protection and disease.
* Describe in detail, cell-mediated and antibody-mediated immunity.
* Describe the basic principles behind various clinically important immunoassay techniques: precipitation, agglutination, flocculation, competitive binding, and noncompetitive binding.
* Discuss the basic concepts, the operation, and the clinical applications of flow cell cytometry.
* Define the concepts of tolerance and autoimmunity.
* Discuss various disease states associated with the immune system, while describing general mechanisms and defining clinical laboratory findings of these immune disease states; autoimmune, tumor-associated antigens, immunodeficiency disorders, complement deficiencies, phagocyte deficiencies, acquired immunodeficiencies, viral infections, hypersensitivity, and bacterial diseases.
* Correlate clinical laboratory results, focusing on immunologic results, with various immune related disease states.

Laboratory Objectives

After completion of this course students will be able to meet the following practical course objectives:

* Collect, process and analyze immunology specimens.
* Perform quality control and preventative maintenance of equipment and instrumentation.
* Adhere to the safe handling of bio-hazardous human samples, i.e. Universal Precautions.
* Demonstrate professional conduct and customer service skills.
* Perform and interpret with adequate competency the following precipitation assays:
  + Ouchterlony double diffusion gel precipitation
  + Radial immunodiffusion
  + Optical analysis methods using Nephelometry and Turbidometry
* Preform and interpret with adequate competency the following agglutination assays:
  + Direct agglutination
  + Passive agglutination
  + Reverse passive agglutination
  + Agglutination inhibition
* Perform and interpret with adequate competency the following labeled immunoassays:
  + Direct immunoassay
  + Indirect immunoassay
  + Capture immunoassay
  + Western blot
  + Flow cytometry
* Perform and interpret with adequate competency the following molecular biology techniques:
  + Polymerase Chain Reaction (PCR)
  + Reverse transcriptase PCR
  + Real-time PCR
  + *In situ* hybridization

**IV. Basis for Final Grade (***MLS Specific Grading Scale***)**

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| **Grading Scale** | **Grade Points** | **(%)** |
| A | 4.0 | 100.0 – 93.0 |
| A- | 3.7 | 92.9 – 90.0 |
| B+ | 3.3 | 89.9 – 86.0 |
| B | 3.0 | 85.9 – 83.0 |
| B- | 2.7 | 82.9 – 80.0 |
| C+ | 2.3 | 79.9 – 76.0 |
| C | 2.0 | 75.9 – 73.0 |
| C- | 1.7 | 72.9 – 70.0 |
| D+ | 1.3 | 69.9 – 66.0 |
| D | 1.0 | 65.9 – 63.0 |
| D- | 0.7 | 62.9 – 60.0 |
| E | 0.0 | < 60.0 |

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| **Assessment** |  | **Percent of Grade** |
| Exam 1 |  | 20 % |
| Exam 2 |  | 20 % |
| Exam 3 |  | 20 % |
| Quizzes (6) |  | 15 % |
| Laboratory Practical Exams |  | 25 % |
| Final Grade |  | 100% |
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**V. Course Policies – Testing**

All examinations (tests and quizzes) will be given in the Dumke College of Health Professions (DCHP) Testing and Learning Center. Each exam will be a hard copy and open for two days. Failure to complete an exam during the designated time will result in a grade of zero for that exam. Quizzes will be given online through the Canvas course page and will be timed open book examinations. Competencies will be given for each laboratory unit and must be passed as per the Medical Laboratory Sciences policy outlined below.

**VI. Course Policies – Competency**

The Department of Medical Laboratory Sciences requires AAS and BS students to fulfill the following competency requirements

* A minimum competency level of 80% must be obtained on all course exams.
* If a score of 80% is not achieved on an exam, you will be required to take a parallel retake exam and you must achieve at least an 80%. The first exam score will be used for grading purposes.
* Failure to achieve an 80% on a retake exam will result in a final letter grade for the course being no greater than a “C”.
* If during the semester, it is necessary for you to take more than two retake examinations, the final letter grade for the course will be no greater than a “C”. A letter grade of “C” will require you to retake the course in order to receive an AAS or BS degree in MLS.

Further information on MLS departmental competencies can be found at:

(<http://www.weber.edu/mls/degrees/campus/Student_handbook_campus.html>)

**VII. Course Policies – Laboratory**

The laboratory section of this course will cover routine diagnostic testing performed in the clinical immunology laboratory. Students we be expected to keep a laboratory notebook containing record of all assays performed and results obtained for each lab session. Students will use biological human samples and thus must adhere to Universal Precautions. The use of personal protective equipment is required.

**IIX. Course Policies – Homework**

Homework will be generally NOT be assigned in this class, but if a student is assigned homework they are expected to follow the below format:

* Homework must be completed on ruled notebook paper or graph paper and in pencil. If you have more than one page, please staple them together.
* Place a header at the top left of each page stating name, date and the assignment name.
* Show all your work. Partial credit will be given; it is in your advantage to show all the steps and calculations you used to complete the problem.
* If the homework question has multiple parts please head each section of your written homework appropriately… e.g. [sections a.), b.), c.), etc.]
* Final answers should be written on your homework with an underline or box around the answer.
* Answers should be reported to the appropriate significant figures and always use units if applicable.

**IX. Course Policies – Attendance & Participation**

Attendance is required for all lecture classes in this course. Students will be present with homework assignments turned in by the start of each lecture. Failure to arrive on time consistently will not be tolerated. If a student is consistently late to lecture points will be deducted from their final grade. Being late to class or missing class will only hurt you and your ability to learn in this class. If a student accrues more than six unexcused absences, they will lose half of a letter from their final grade.

Class participation is expected and encouraged from every student. In-class participation does not count directly towards your final grade.

**X. Course Policies – Academic Conduct Policy**

Weber State University Policies and Procedures Manual (PPM) specifically outline acceptable student behavior in the clinical laboratory and in the academic setting (PPM 6-22 Student Code).

Maintain academic ethics and honesty, to this end, the following activities are specifically prohibited:

1. Cheating, which includes but is not limited to:
2. Copying from another student’s test paper
3. Using materials during a test not authorized by the person giving the test (as an example – cell phones)
4. Collaborating with any other person during a test without authority
5. Knowingly obtained, using, buying, selling, transporting, or soliciting in whole or in part, the contents on a any test, without authorization of the appropriate official
6. Bribing any other person to obtain any test or test content
7. Soliciting or receiving unauthorized information about any test
8. Substituting for another student or permitting any other person to substitute for oneself to take an exam
9. Plagiarism, which is the unacknowledged (un-cited) use of any other person or group’s ideas or work. This includes purchased or borrowed papers.
10. Collusion, which is the unauthorized collaboration with another person in preparing work offered for credit.
11. Falsification, which is the intentional and unauthorized altering or inventing of any information or citation in an academic exercise, activity, or record-keeping process.
12. Giving, selling, or receiving unauthorized course, lab results, or test information.
13. Using any unauthorized resource or aid in the preparation or completion of any course work, exercise or activity.
14. Infringing on the copyright of the United States which prohibits the making of reproductions of copyrighted material except under certain specified conditions.

Further information can be found at:

[ <http://www.weber.edu/ppm/Policies/6-22_StudentCode.html> ]

**XI. Course Policies – Professionalism**

Per Weber State University policy and classroom etiquette, mobile devices must be silenced during all classroom lectures. Those who do not follow this rule and disturb class will be asked to leave the classroom.

**XII. Disability Access**

Weber State University is committed to providing accommodations for all persons with disabilities. This syllabus is available in alternate formats upon request. Any student requiring accommodations or services due to a disability must contact Student Services with Disabilities (SSD) in room 181 of the Student Services Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary.

**XIV. Course Content**

**XIV-a. Lecture Outline**

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| **Unit 1: Basic Concepts in Immunology** | | | |
| **Unit** | **Topic** | **Reading** | **Case Study Reading** (Rosen) |
| 1.1 | Introduction to Immunology | Chapter 1 (Parham) | - |
| 1.2 | Innate & Adaptive Immunity | Chapters 2, 3 & 10 (Parham) | - |
| 1.3 | T &B Cell Development | Chapters 6 & 7 (Parham) | - |
| 1.4 | Antibody-Mediated Immunity | Chapters 4 & 9 (Parham) | - |
| 1.5 | Cell-Mediated Immunity | Chapters 5 & 8 (Parham) | - |
| 1.6 | Immune Defense, Evasion & Vaccination | Chapters 10, 11 & 15 (Parham) | - |
| **Unit 1 Examination** | | | |
| **Unit 2: Clinical Immunology Techniques** | | | |
| 2.1 | Precipitation & Agglutination | Chapter 6 (Rittenhouse-Olson) | - |
| 2.2 | Direct & Indirect Immunoassays | Chapter 7 (Rittenhouse-Olson) | - |
| 2.3 | Competitive Binding & Western Blot | Chapter 7 (Rittenhouse-Olson) | - |
| 2.4 | Flow Cytometry | Chapters 1, 7 & 13 (Rittenhouse-Olson) | - |
| 2.5 | Serology Laboratory Math | Chapter 8 (Rittenhouse-Olson) | - |
| 2.6 | Molecular Biology Techniques | Chapter 23 (Rittenhouse-Olson) | - |
| **Unit 2 Examination** | | | |
| **Unit 3: Immune Related Diseases** | | | |
| 3.1 | Primary Immunodeficiency Diseases | Chapter 15 (Rittenhouse-Olson) | 1. X-linked Agammaglobulinemia  5. X-linked SCID  7. Omenn Syndrome  9. DiGeorge Syndrome  16. Wiskott-Aldrich Syndrome  26. Chronic Granulomatous Disease  27. Leukocyte Adhesion Deficiency  31. Hereditary Angioedema |
| 3.2 | Autoimmune Diseases | Chapters 10 & 11 (Rittenhouse-Olson) | 17. APECED  36. Rheumatoid Arthritis  37. Systemic Lupus Erythematosus  40. Multiple Sclerosis  42. Myasthenia Gravis |
| 3.3 | Hypersensitivity | Chapter 9 (Rittenhouse-Olson) | 44. Celiac Disease  49. Acute Systemic Anaphylaxis  50. Allergic Asthma  51. Atopic Dermatitis  53. Contact Sensitivity to Poison Ivy |
| 3.4 | Transplantation & Tumor Immunology | Chapters 12 & 14 (Rittenhouse-Olson) | 11. Graft-Versus-Host Disease |
| 3.5 | Immunoproliferative Diseases | Chapter 13 (Rittenhouse-Olson) | 13. X-linked Immunoproliferative Syndrome  19. Autoimmune Lymphoproliferative Syndrome (ALPS) |
| 3.6 | HIV, Hepatitis & Herpesviridae | Chapters 16, 17 & 18 (Rittenhouse-Olson) | 10. Acquired Immune Deficiency Syndrome (AIDS)  45. Acute Infectious Mononucleosis |
| 3.7 | Bacterial Serology, Fungi & Parasitic Infections | Chapters 19 & 20 (Rittenhouse-Olson) |  |
| **Unit 3 Examination** | | | |

**XIV-b.** **Laboratory Outline**

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| **Week** | **Laboratory Assay** | **Competency Level**  1 = Discussed  2 = Demonstrated  3 = Practiced  4 = Performed (maximum supervision)  5 = Performed (minimum supervision) |
| Week 2 | Ouchterlony double diffusion gel precipitation assay | 1 – 5 |
| Week 3 | Radial immunodiffusion (IgA quantification) | 1 – 5 |
| Week 4 | Nephalometry & Turbidometry (quantitative C-Reactive Protein assay) | 1 – 5 |
| **Laboratory Practical 1** | | |
| Week 5 | Rapid Plasma Reagin (RPR)  Antistreptolysin O (ASO) | 1 – 5 |
| Week 6 | Mononucleosis Antibody Spot (MONOSPOT) | 1 – 5 |
| Week 7 | Human Chorionic Gonadotropin (hCG)  Influenza A + B | 1 – 5 |
| Week 8 | Respiratory Syncytial Virus (RSV)  Human Immunodeficiency Virus (HIV) – screen | 1 – 5 |
| Week 9 | HIV Western Blot – confirmation | 1 – 5 |
| Week 10 | Anti-Nuclear Antibodies (ANA) | 1 – 5 |
| **Laboratory Practical 2** | | |
| Week 11 | Methicillin Resistant Staphylococcus aureus (MRSA) Screen – PCR | 1 – 5 |
| Week 12 | HIV RNA detection – Reverse Transcriptase PCR | 1 – 5 |
| Week 13 | *in situ* Hybridization | 1 |
| Week 14 | Cell Phenotyping – Flow Cytometry | 1 |
| **Laboratory Practical 3** | | |

Note: Semester schedule is subject to revision.