CASPER COLLEGE COURSE SYLLABUS
MLTK 2700 Immunology

Semester/Year: Fall 2006

Lecture Hours: 3       Lab Hours: 3       Credit Hours: 4

Class Time: Days: Room:
Lecture 1:00 – 1:50 pm MWF LS 109
Lab 2:00-4:50 pm F LS 202

Instructor’s Name: Dr. John Chase and Dr. Audrey E. Hentzen

Instructor's Contact Information:
Office Phone: Email:
Chase: 262-2898 jchase@caspercollege.edu
Hentzen: 268-2632 ahentzen@caspercollege.edu

Office Hours: By appointment 10:00-2:00 M, W and 4-5:30 pm T, TH.

Course Description:
Advanced biology course of immune systems: cellular and molecular mechanisms; host resistance to infectious agents; as well, as hypersensitivities, autoimmunity, tumor and tissue rejection. Includes laboratory for molecular and immunological techniques.

Statement of Prerequisites:
MOLB 2220 or consent of instructor

Health Requirements You will need to obtain proof of the following health requirements to be in student laboratory.
• Health Insurance (Private or available through Casper College)
• Hepatitis B vaccination (at least the first in the series of three)

Goal:
Students will gain experience and proficiency in advanced principles of immunology, serology, molecular, and cellular culture techniques used in immunological procedures.

Outcomes:
1. Describe components of the immune system, their functional interactions and physiology as it relates to immunity, disease states and disorders.
2. Perform immunology, serology and molecular assays using a variety of techniques, evaluate clinical data, interpret results, and correlate abnormal results with disease states.
3. Monitor and evaluate quality assurance data, identify errors and formulate plan for corrective action.
5. Operate clinical instruments, evaluate results, identify errors and resolve malfunctions.
6. Critique patient results and select appropriate follow-up tests.
7. Compare and contrast clinical laboratory procedures, interpret data and predict diagnosis.
8. Compare and contrast immunoassays, including dual-platform instrumentation for chemical and immuno-based assays.
9. Explain the use of the Southern transfer and hybridization techniques in the application of DNA fingerprinting and human genomic identity testing.
10. Analyze and interpret restriction fragment polymorphism patterns and relate these to paternity and crime scene investigations.
11. Describe and evaluate types of target sequences (DNA, mRNA, tRNA, rRNA).
12. Describe the amplification process of PCR including:
    a. Basic steps of an amplification process
    b. Principles of the methodology
    c. List and describe the function PCR components in the reaction mix
13. Explain the application of PCR to STR testing.

Methodology:
Short lectures and student discussion will be incorporated into a mostly laboratory setting for student instruction. Laboratory activities will be independent and will be assisted by one-on-one instruction.

Evaluation Criteria:

REQUIRED STUDENT TASK/ASSIGMENTS
The required tasks and assignments are used to evaluate the student’s acquisition and comprehension of the learning objectives. Assignments are designed to allow students to put the information learned in class and in readings into practice making judgments based on the data presented.

Lecture Exams/Final (50%)
Midterm exams will cover materials listed in the learning objectives for defined segments or units outlined on the lecture schedule. Most material will be covered specifically in class but exam questions may cover materials presented in the assigned reading. There will be three lecture exams and a comprehensive final. Exams can only be made up if the student provides prior notification of absence.

Laboratory reports (30%)
Each student will complete specified laboratory exercises. In each lab, the students will use the basic immuno-techniques found in clinical laboratories to detect disease states, infectious organisms or patient immune status. The student will write a 1-2 page lab report describing the tests used and strategy for differential diagnosis and prognosis.

Advanced Laboratory Experience (10%)
Based upon class discussions, lessons and laboratory experiences in this class, design a assay system to detect target molecules found in an infectious or disease state. Describe sample choice, collection processing and the overall procedure for the detection of the target molecule in a complex mixture such as a human sample (vaginal, throat, sputum swabs). Be sure to describe the target molecule, assay methodology, procedure, detection system, quality control, interpretation of results and correlation to disease state.
Molecular Testing (10%)  
Using molecular manipulatives and genetic databases, the student will explore the practices of clinical molecular based testing.  

1. RFLP MAPPING:  
In this lab, each student will evaluate a set of genomic DNA ladders and standard obtained from suspects or crime scene in the case histories you are provided. Students generate restriction fragment length polymorphism (RFLP) patterns for each individual in the case, analyze and interpret the RFLP patterns to answer case history questions.  

2. PCR:  
Using the manipulatives provided, students will characterize the PCR amplification process, determine the mathematical expression for the PCR amplification. Given DNA sequences, identify a target sequence, design a forward and reverse primer that bind specifically to amplify a portion of the target DNA sequence. Students are expected to calculate the primer annealing temperature based upon the melting requirements. Additionally, the reaction conditions for the hybridization reaction must be specified. Students must design and explain how the amplicons will be detected and concentration determined.  

3. PCR Application: VNTR and STR analysis  
PCR has been applied to DNA sequencing, detection of nucleic acids from pathogens, genetic disease, paternity testing and forensic investigations. One application is the use of PCR to characterize variable numbers of tandem repeats (VNTRs) and short tandem repeats (STRs). Compare VNTR and STR genotypes in forensic and paternity case histories. 

GRADING: 
<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
<th>Final grades:</th>
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<tbody>
<tr>
<td>A</td>
<td>92-100%</td>
<td>Lecture Exams/Final 50%</td>
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<tr>
<td>B</td>
<td>82-91%</td>
<td>Lab Reports 30%</td>
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<tr>
<td>C</td>
<td>70-81%</td>
<td>Adv. Lab Experience 10%</td>
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<tr>
<td>D</td>
<td>60-69%</td>
<td>Molecular Testing 10%</td>
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<tr>
<td>F</td>
<td>&lt;60%</td>
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Required Text  

Required Personal Protective Equipment (PPE)  
Gloves  
Scrubs (any color)  
Safety goggles  

Class Policies: Last Date to Change to Audit Status or to Withdraw with a W Grade is the Casper College deadlines.  
Exams must be completed without the use of textbooks, notes or assistance from classmates. Attendance is required for lecture and student labs. No make-up labs will be available.
Student Rights and Responsibilities: Please refer to the Casper College Student Conduct and Judicial Code for information concerning your rights and responsibilities as a Casper College Student.

Chain of Command: If you have any problems with this class, you should first contact the instructor in order to solve the problem. If you are not satisfied with the solution offered by the instructor, you should then take your problem through the appropriate chain of command starting with the department head, then the division chair, and lastly the vice president for academic affairs.

Student complaints should be addressed through the following chain of command:
1) The instructor of your course. (Dr. Hentzen)
2) Biology Department Chair (Ms. Brandy Atnip)
3) The Life Science Division Chair, (Dr. Clifford)
4) The Vice President for Academic Affairs (Dr. Carmen Simone)

Academic Dishonesty - Cheating & Plagiarism: Casper College demands intellectual honesty. Proven plagiarism or any form of dishonesty associated with the academic process can result in the offender failing the course in which the offense was committed or expulsion from school. See the Casper College Student Code of Conduct.

ADA Accommodations Policy: It is the policy of Casper College to provide appropriate accommodations to any student with a documented disability. If you have a need for accommodation in this course, please make an appointment to see me at your earliest convenience.

Course content:
I. Immunology
   a. Introduction to Immunology
   b. Cells/organs of the Immune System
   c. Cells/organs of the Immune System
   d. Antigens
   e. Immunoglobulins
   f. Immunoglobulin gene organization
   g. Major Histocompatibility Complex
   h. Antigen Processing and Presentation
   i. T-Cell Receptors
   j. T-Cell Maturation
   k. B-Cell Maturation
   l. Cytokines
   m. Complement
   n. Cell Mediated Immunity
   o. Leukocyte Migration and Inflammation
   p. Hypersensitivities
II. Immune Response to Infectious Diseases
   a. Vaccines
   b. AIDS
   c. Autoimmune Disease
   d. Transplantation
   e. Immunity and Cancer
   f. Tumor Markers

III. Sample Processing
   a. Evaluate samples
   b. Prepare for testing
   c. Storage conditions

IV. Agglutination Techniques
   a. MHA-TP
   b. RPR
   c. Monospot
   d. Rheumatoid Arthritis Latex test
   e. Anti-streptolysin titer
   f. CRP

V. Precipitation Techniques
   a. Latex
   b. Radial-immuno-diffusion
   c. Immunoelectrophoresis

VI. Instrument Techniques
   a. Principles
   b. RIA
   c. ELISA
   d. Enzyme inhibition
   e. Nephelometry
   f. Immunofluorescence
   g. Instrument maintenance

VII. Molecular Biology
   a. Target Molecules
   c. Types of Nucleic Acid
   d. Collection, handling and storage
   c. Nucleic Acid Synthesis
   d. Protein Synthesis

VIII. Immunoassays
   a. Monoclonal Antibodies
   b. Antigen-Antibody Reactions
   c. Competitive-Binding Reactions
   d. Radioactive Labels
      1. Radioimmunoassay
      2. Immunoradiometric Assay
   c. Enzyme Labels
   d. Enzyme-linked immunosorbent assay
   e. Immunoenzymetric
f. Enzyme-multiplied immunoassay technique

IX. Fluorescent Labels
   a. Substrate-labeled fluorescent immunoassay
   b. Fluorescence polarization immunoassay
   c. Microparticle enzyme immunoassay
   e. Radioactive energy attenuation

X. Nucleic Acid Hybridization Reactions
   a. Probe design and synthesis
   b. Nucleic Acid Detection
      1. Radioactive labels
      2. Enzyme or Fluorescent labels

XI. Chemiluminescent labels
   a. Direct nucleic acid testing
      1. Southern and northern hybridization
      2. DNA fingerprinting
      3. Fluorescent in situ hybridization
      4. Semi-automated testing
      5. Hybridization protection assay
      6. Amplified detection system
   b. Amplified nucleic acid testing
      1. Polymerase chain reaction
      2. Ligase chain reaction
      3. Nucleic acid based amplification
      4. Transcription mediated amplification
      5. Strand displacement amplification
      6. Emerging technologies
## Tentative Time Schedule

<table>
<thead>
<tr>
<th>Month</th>
<th>Day</th>
<th>Topic</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>Aug</td>
<td>28</td>
<td>Lecture Syllabus, Overview of the immune system</td>
<td>Chpt 1 John</td>
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<td>30</td>
<td>Lecture Cells/organs of the immune system</td>
<td>Chpt 2 John</td>
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<tr>
<td>Sept</td>
<td>1</td>
<td>Lecture Target Molecules</td>
<td>Audrey</td>
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<td>Lab Agglutination reactions</td>
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<td>Lecture Labor Day</td>
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<td>Lecture Innate Immunity</td>
<td>Chpt 3 Audrey</td>
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<td>Lab</td>
<td>Heterophile antibodies/Monospot</td>
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<td>Lab</td>
<td>HCG or C. diff ELISA</td>
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<td>22</td>
<td>Lecture RFLP Mapping, VNTRS, STRS</td>
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<td>Lecture Complement</td>
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<td><strong>Lab practical</strong></td>
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<td>Oct</td>
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<td>Lecture M H C and Antigen Presentation</td>
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<td>Lecture T-cell receptors</td>
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<td>Rapid Strep EIA / ASO</td>
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<td>Lecture Direct Nucleic Acid Testing/Probe Syn/Hybridization</td>
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<td>Probe hybridization lab</td>
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<td>Lecture Leukocyte activation and migration</td>
<td>Chpt 13 Audrey</td>
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<td>Lecture DAT and Amplified Nucleic Acid Techniques</td>
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<td>Lab</td>
<td>PCR and STRS lab</td>
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<td>Lecture</td>
<td>Cell mediated cytotoxic responses</td>
<td>Chpt 14 John</td>
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<tr>
<td>Nov 3</td>
<td>Lecture</td>
<td>Review target molecules and assay techniques</td>
<td>John</td>
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<tr>
<td>Nov 6</td>
<td>Lecture</td>
<td>Hypersensitivities</td>
<td>Chpt 15 John</td>
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<td>Nov 8</td>
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<td>Hypersensitivities</td>
<td>Chpt 15 John</td>
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<td>Nov 10</td>
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<td>Nov 13</td>
<td>Lecture</td>
<td>Ouchterlony antibody identification</td>
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<td>Tolerance and Autoimmunity</td>
<td>Chpt 16 Audrey</td>
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<td>CRP</td>
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<td>Nov 22</td>
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<td>Immune response to infectious disease</td>
<td>Chpt 18 John</td>
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<td>Dec 29</td>
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<td>Arthritis</td>
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<td>Vaccines</td>
<td>Chpt 19 Audrey</td>
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<td>AIDS and Immunodeficiencies</td>
<td>Chpt 20 John</td>
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<td>SLE</td>
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<td>Dec 11</td>
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<td>Cancer and the immune system</td>
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<td>Dec 13</td>
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<td>Cancer markers</td>
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<td>Exam</td>
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<td>Dec 15</td>
<td>Lab</td>
<td>Immuno- techniques written exam (chpt 6 &amp; 22)</td>
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<td>Dec 15</td>
<td>Finals</td>
<td>Comprehensive Final</td>
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**Course Schedule**

- **Nov 1**: Lecture on Cell mediated cytotoxic responses, Chpt 14, John
- **Nov 3**: Lecture on Review target molecules and assay techniques, John
- **Nov 6**: Lecture on Hypersensitivities, Chpt 15, John
- **Nov 8**: Lecture on Hypersensitivities, Chpt 15, John
- **Nov 10**: Lecture on Lab Exam, John
- **Nov 13**: Lecture on Ouchterlony antibody identification, John
- **Nov 15**: Lecture on Tolerance and Autoimmunity, Chpt 16, Audrey
- **Nov 17**: Lecture on Inflammation, Audrey
- **Nov 20**: Lecture on CRP, Audrey
- **Nov 22**: Lecture on Thanksgiving break
- **Nov 24**: Lecture on Thanksgiving break
- **Nov 27**: Lecture on Immune response to infectious disease, Chpt 18, John
- **Dec 1**: Lecture on Arthritis, John
- **Dec 4**: Lecture on Vaccines, Chpt 19, Audrey
- **Dec 6**: Lecture on AIDS and Immunodeficiencies, Chpt 20, John
- **Dec 8**: Lecture on SLE, Audrey
- **Dec 11**: Lecture on Cancer and the immune system, Chpt 21, John
- **Dec 13**: Lecture on Cancer markers, Audrey
- **Dec 15**: Lecture on Exam, John
- **Dec 15**: Lab on Immuno- techniques written exam (chpt 6 & 22), John
- **Dec 15**: Finals on Comprehensive Final