COURSE DESCRIPTION

Lecture and laboratory studies of the newest developments in laboratory diagnostic medicine. Includes advanced clinical chemistry, microbiology, immunology, and molecular diagnostic procedures. This course emphasizes the theory and practice of the developing tests in the clinical laboratory.

LEARNING OBJECTIVES

The student will be able to:

1. Develop an understanding of the general principles of advanced medical laboratory procedures.
2. Discuss the basic concepts of nucleic acid biochemistry and genetics relative to the application of molecular diagnostic procedures in the clinical laboratory.
3. Develop an understanding of the use of laboratory tests in diagnosis, prognosis, and treatment.
4. Acquire skill in the use of molecular diagnostic methods.

Specific course objectives are attached. All examination questions are keyed to the objectives.

TEXT and MATERIALS


You will be provided with lecture notes, handouts, and articles. You will also need a scientific calculator.
DROPPING A CLASS

I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. April 01, 2011 is the last day to drop a class with an automatic grade of “W” this term.

CLASSROOM/PROFESSIONAL BEHAVIOR

Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom.

GRADES

Course grades will be determined based on three exams, attendance, problem portfolios, lab average, and a final exam according to the following percentages:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>PERCENT OF GRADE</th>
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<tbody>
<tr>
<td>Exam I</td>
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<td>Exam 2</td>
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<td>Exam 3</td>
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<td>Final</td>
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<td>Problem Portfolio</td>
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<tr>
<td>Journal Presentation</td>
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<tr>
<td>Lab Average</td>
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The following scale will be used to report grades:
- A 90 - 100
- B 80 - 89
- C 70 - 79
- D 60 - 69
- F below 60

You will be required to research, write, and present an article review of molecular interest. Written report must be a minimum of three pages to be turned in at time of oral presentation. Specific requirements will be given in class.
GRADE APPEALS

As stated in the Texas A&M University-Corpus Christi University Rules and Procedures (Section B [Academic Program], Pat 13 [Students]: 13.02.99.C2 [Student Grade Appeals] and 13.02.99C2.01 [Student Grade Appeal Procedures]), a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is on the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, consult the University Rules and Procedures specified above (accessible through the University Rules and Procedures website at http://www.tamucc.edu/provost/university_rules/index.html). For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

ACADEMIC HONESTY

The University catalog contains the university statement on academic integrity. It is essential that anyone considering a health career demonstrate honesty and integrity in their academic and professional life. Therefore, cheating will not be tolerated and will result in a failing grade in the course and possible further disciplinary action by the university.

ATTENDANCE

Attendance is required, and if you miss a class, you are expected to know the material covered in class. There is no provision for making up late work and missed exams. There are no provisions for making up wet labs. If absent from lab due to illness, you may turn in the lab questions for 50% credit only. Unexcused absence during major exams will also result in a zero for that exam. It is the student’s responsibility to contact me in cases of extreme emergency. The only excused absences are personal illness, immediate family medical emergency, or attending funeral of immediate family. Lab worksheets are to be turned in the week following the assignment. They must be turned in at the beginning of the lab period. Late labs will not be accepted and a grade of zero will be entered for that lab.

AMERICANS WITH DISABILITIES ACT (ADA)

Texas A&M University-Corpus Christi is committed to providing persons with disabilities an equal opportunity to access campus facilities, resources and programs. The ADA is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation for their disabilities. Support and accommodations are also available for returning veterans who experience cognitive and/or physical access issues in the classroom or on campus. Our Office of Disability Services arranges such support and academic accommodations. To make a request, or for more information, call (361) 825-5816 or visit the office in Driftwood 101. It is important to contact the Office of Disability Services in a timely fashion as it will take time for them to review requests and prepare accommodations and accommodation letters.
The following class schedule is subject to change. It is the student’s responsibility to stay abreast of any changes announced in class.

January
24  Method Evaluation
28  LAB: Introduction
29  Statistics for Method Evaluation
31  Electrophoretic Techniques

February
04  LAB: Evaluation of New Method in Clinical Laboratory
05  Electrophoretic Techniques
07  Chromatographic Techniques
11  LAB: Evaluation of New Method in Clinical Laboratory
12  Chromatographic Techniques
14  Gammopathies
18  LAB: Serum Protein Electrophoresis
19  Hemoglobin Electrophoresis
21  EXAM 1
25  LAB: Journal Presentations
26  Nucleic Acid Chemistry, Structure, and Function
28  General Principles of Molecular Pathology

March
04  LAB: Nucleic Acid Isolation
05  Nucleic Acid Enzymes, Hybridization, Stringency and Probes
07  Polymerase Chain Reaction
11-15  Spring Break
18  LAB: Journal Presentations
19  Optimization and Troubleshooting of PCR Reactions

March
21  Ligase Chain Reaction, FISH & Restriction Fragment Length Polymorphisms (RFLP)
25  LAB: Quantitation of DNA
26  EXAM 2
28  RNA Diseases and Viruses

April
01  LAB: Restriction Digestion and Electrophoresis
02  Infectious Diseases
04  Pharmacogenetics and Pharmacogenomics
08  LAB: Journal Presentations
09  Genetic Diseases
11  Molecular Analysis of Hematologic Diseases

April
15  LAB: DNA Fingerprinting
16  Flow Cytometry
18  EXAM 3
22  LAB: Journal Presentations
23  Mass Spectrometry
25  Cancer diagnosis
29  LAB: ELISA Testing
30  Cancer diagnosis
May 02  ELISA and Luminex technology
06  LAB: Journal Presentations
07  ELISA and Luminex technology
14  FINAL 1:45-4:15 p.m.

General Disclaimer:
The instructor reserves the right to modify the schedule when necessary. These changes will be announced in class. It is the responsibility of the student to obtain the information as no effort will be made to contact the students who were absent when the announcement was made.
LEARNING OUTCOMES FOR BIMS 438: ADVANCED MEDICAL LABORATORY PROCEDURES

Method Evaluation and Statistics for Method Evaluation
At the completion of the lecture and laboratory, the student should be able to:
1. List aspects to be considered when selecting a method for use in a clinical laboratory
2. Define: random error, constant error, systematic error, total error, delta check
3. Describe experimental methods of evaluating each type of error including design of the experiment, type of specimens, and materials required.
4. Describe statistical evaluation and interpretation of the data obtained.

Electrophoretic Techniques
At the completion of the lecture and laboratory, the student should be able to:
1. Explain the principles of electrophoresis.
2. Discuss the different types of electrophoresis.
3. Describe the charge properties of proteins at acidic, isoelectric, and basic pH.
4. Discuss factors influencing an electrophoretic separation.
5. List the most common support materials and give relevant characteristics of each.
6. Define immunofixation electrophoresis (IFE) and immunoelectrophoresis (IEP) and their role in diagnosis
7. Discuss SDS polyacrylamide gel electrophoresis
8. Discuss Isoelectric Focussing
9. Discuss and define capillary zone electrophoresis (CZE)

Chromatographic Techniques
At the completion of the lecture and laboratory, the student should be able to:
1. State the general principles of chromatography.
2. Describe the different separation processes involved with the following types of chromatography and list the class of molecules that can be separated by each type.
   a. adsorption
   b. partition
   c. ion exchange
   d. gel permeation
3. Explain the principles of gas chromatography, high-performance liquid chromatography, and mass spectrometry.
4. Discuss the clinical applications of GC, GC-MS, and HPLC.

Gammopathies
At the completion of the lecture and laboratory, the student should be able to:
1. Describe the structure of each class of immunoglobulin and list the classes of immunoglobulins in order of relative concentration in plasma.
2. Explain polyclonal and monoclonal gammopathies and para-protein Bence-Jones proteins.
3. Describe diseases associated with abnormalities of the gamma proteins and detection by SPE
4. Describe the criteria for monoclonal gammopathy on SPE and criteria for benign vs pathological monoclonal gammopathy.
Hemoglobin Electrophoresis
At the completion of the lecture and laboratory, the student should be able to:
1. Describe the basic differences between acid and alkaline electrophoresis for hemoglobin.
2. Discuss the different electrophoretic patterns for pathologic hemoglobin conditions.
3. Explain differentiation of hemoglobins that migrate in similar positions on alkaline electrophoresis.

Nucleic Acid Chemistry, Structure, and Function
At the completion of the lecture and laboratory, the student should be able to:
1. Describe the basic structure of RNA/DNA.
2. Discuss the function of RNA/DNA.
3. Define and describe the basic types of mutations and briefly explain how they can cause cell dysfunction.

General Principles of Molecular Pathology
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the structure of DNA and describe how its properties of complementary base pairing and digestion by specific nucleases can be used to identify specific sequences of DNA.
2. Discuss the applications of molecular pathology.
3. Discuss denaturation, reannealing, digestion, synthesis, and ligation of nucleic acid.
4. Discuss the importance of Human Genome Project.

Nucleic Acid Enzymes, Hybridization, Stringency and Probes
At the completion of the lecture and laboratory, the student should be able to:
1. Explain the separation and combination of DNA strands.
2. Discuss nucleic acid modifying enzymes.
3. Describe the methods used in nucleic acid separation.
4. Explain the terms: hybridize, amplify, primer, probe, clone.
5. Briefly describe the principles and different formats of hybridization assays.

Polymerase Chain Reaction
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the principle of PCR.
2. List the components of PCR.
3. Discuss the cycling parameters.
4. Explain the quality control

Optimization and Troubleshooting of PCR Reactions
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the factors that significantly impact PCR sensitivity and specificity, including: oligonucleotide primer design, PCR cycling parameters, the composition of the PCR mixture.
2. Discuss PCR contaminants.
3. Discuss PCR troubleshooting.
Ligase Chain Reaction, Fluorescent In Situ Hybridization (FISH), Restriction Fragment Length Polymorphisms (RFLP)
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss ligase chain reaction.
2. Describe restriction fragment length polymorphisms.
3. Discuss the following: the use of RFLP, Problem associated with RFLP, RFLP & DNA typing.
4. Discuss the applications of FISH.
5. Briefly describe nucleic acid extraction.

RNA Diseases and Viruses
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the structure of RNA.
2. Discuss the following: RNA viruses, characteristics of retrovirus, HIV testing.
3. Discuss hepatitis C virus and the laboratory testing.

Infectious Diseases
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss HIV and the associated clinical laboratory testing.
2. Describe the differences between genotyping and phenotyping for HIV.
3. Describe the different hepatitis viruses and the associated clinical laboratory testing.
4. Discuss H.pylori infections and the associated clinical laboratory testing.

Pharmacogenetics and Pharmacogenomics
At the completion of the lecture and laboratory, the student should be able to:
1. Define pharmacogenetics and pharmacogenomics.
2. Discuss pharmacogenomics classification.
3. Discuss the applications of pharmacogenomics.
4. Explain the barriers to progress associated with the application of pharmacogenomics.
5. Explain the future of pharmacogenomics.

Genetic Diseases
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the molecular structure of DNA.
2. Explain modes of inheritance.
3. Discuss the clinical applications of molecular genetic testing.
4. Discuss polygenic disorders.

Molecular Analysis of Hematologic Diseases
At the completion of the lecture and laboratory, the student should be able to:
1. Describe the principles and summarize the procedures for common laboratory tests used in molecular diagnostics.
2. Recall the clotting factors that contribute to the intrinsic, extrinsic and common pathways.
3. Describe and explain the applications of molecular tests in the diagnosis of hematologic disorders.
4. Discuss molecular analysis of hematologic malignancies: CML, APL.

Flow Cytometry
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the general principles of flow cytometry.
2. Explain the clinical applications of flow cytometry.
3. Discuss immunophenotyping and applications of immunophenotyping.
4. Discuss flow cytometry specimen requirement and preparation.

**Mass Spectrometry**
At the completion of the lecture and laboratory, the student should be able to:
1. Define mass spectrometry
2. Describe methods for ionization of molecules and mass analyses
3. Discuss approaches to tandem mass spectrometry
4. Discuss clinical applications of mass spectrometry

**Cancer Diagnosis**
At the completion of the lecture and laboratory, the student should be able to:
1. List common types of cancer.
2. Define oncogenes and tumor suppressor genes, and describe how they can cause cancers.
3. Differentiate between familial and sporadic cancers.
4. Discuss the roles of tumor markers in the assessment of cancers.
5. List commonly used tumor markers and state their clinical significant in relation to cancer.
6. Describe the laboratory tests used in cancer diagnosis.
7. Discuss the approaches to cancer treatments.

**ELISA and Luminex Technology**
At the completion of the lecture and laboratory, the student should be able to:
1. Discuss the principles of immunossays.
2. List the components of ELISA.
3. Discuss the principles ELISA.
4. Discuss the types of ELISA and the advantages and disadvantages of each.
5. Describe luminex technology.