UTTyler
MEDICAL BIOLOGICAL SCIENCES

BIOT 6312 Biotechnology II Credit Hours: 3

Semester:	Spring	**Year:**	2022
Class Day/Time:	Mondays, 9am-5pm	**Class Location:**	Room 116 & Lab B4

Instructor of Record: Dr. Mitsuo Ikebe
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Office Hours: Anytime arranged by email.

Course Description: This course covers isolation and purification of recombinant proteins, physical and chemical characterization of proteins (structure and function), transient enzyme kinetics, cell biology and cell imaging, immunochemistry, array technology, protein-protein/protein ligand interaction analysis and proteomics.

Prerequisite: BIOT 5222/5222L & BIOT 6336 **Co-requisite:** None

Goals of Course:

Course Objectives:

1. To demonstrate proficiency in advanced protein chemistry techniques.
3. To understand and comply with standards of professional ethics.
4. To fully understand lab safety issues associated with toxic and hazardous chemicals, infectious agents, and manipulation of recombinant and natural protein products.
5. To be able to correctly, completely and accurately maintain a laboratory notebook suitable for lab use and legal records.

Student Learning Outcomes (SLO or "course objectives"):

1. The student will be able to correctly maintain an accurate record of laboratory procedures, techniques and exercises.
2. The student will be able to perform experiments and evaluate data collected from advanced protein processing and analytical techniques including purification, physical biochemistry, advanced enzyme kinetics, confocal microscopy and cell imaging, immunochemistry, proteomics and fluorescent activated cell sorting.
3. The student will be able to produce professional industrial and research laboratory quality scientific write-ups.
4. The student will demonstrate an advanced understanding of protein chemistry experimental design and data analysis.
5. the student will demonstrate an understanding of advanced protein chemistry techniques, including advance background information and theory, applications, limitations, advantages and disadvantages, common problems and troubleshooting.

Course Assessment/Methods of Evaluation:

Student understanding will be evaluated with comprehensive examinations of a purely subjective nature covering each topic in detail, evaluations of quizzes, written reports and class participation. Student skills will be evaluated with lab quizzes and laboratory reports.

- **Lecture Examinations:** There will be **Four Exams** each covering lecture and lab materials.
- **Quizzes:** Required covering weekly work and will be scheduled as needed.

- **Written Reports:** There will be **Two full lab reports** written in correct scientific technical format will be scored based on content, clarity, and quality of writing. These reports must include the following sections: Title, Summary (including purpose), Introduction (including Background), Materials and Methods, Results (including figures and figure legends), Discussion, and References.
  There are **Five short lab reports**, which include Title, Materials and Methods, Results (including figures and figure legends) and Discussion (short discussion).

- **All the reports and EXAM answer have to be type written. Hand written documents are not accepted.**
- **Due Date is one week after the lab at 5:00pm**
- **Class Participation and Attendance. Punctual attendance is critical, and active participation in lab experiment is very important. It is critical to sign (legibly) the sign-up sheet for each class to record your attendance. Students are expected to be in attendance for the majority of the class time. If not, students will not get full-credit for attendance.**

Grading:
Two Full Lab Reports 200 pts each..... 400 pts
Class/lab participation and attendance 30 pts each
(missing class/lab loses 30pts/each) ..... 420 pts
Five Short Lab Reports (100 pts/each)..... 500 pts
Four Exams 100 pts/each ..... 400 pts

Max total: 1720 pts

A = 90% to 100%
B = 80% to 90%
C = 70% to 80%
D = 60% to 70%
F = <60%

- A grade of less than a B may result in loss of Graduate Assistantships.
- No grades will be withheld for completion of work except in extreme circumstances.
- Every attempt will be made to hand out reading assignments and descriptions of lab procedures one week prior to their performance. Therefore, students will be expected to be prepared at the beginning of each lab.
- Lab reports will be expected to be formal write-ups with an emphasis on computer manipulation and presentation of data as is expected in industry and research laboratories. Most of these reports should have a Title, Purpose, Summary, Background, Materials, Methods, Results, Discussion, References and Answers to and questions posed.

Work turned in late will lose 5% (1 day late), 10% (2-3 day late), 20% (4-7) and 30%(7-14) of the points possible. More than 14 days late loses additional 5% off of the points possible per additional week. Reports turned in more than four weeks late will not be accepted (0 point).

Linked Program Learning Outcomes:
The student learning outcomes listed above address the following Biotechnology Program PLOs:

- PLO1 - The student will demonstrate English communication skills in both oral and written forms.

- PLO2 - The student will demonstrate mastery of basic and advanced biotechnology methods.
- PLO3 - The student will demonstrate the ability to safely operate basic and advanced laboratory equipment, analytic devices, and computers.
- PLO4 - The student will demonstrate independent and critical thinking skills integrated with the ability to utilize multiple informational resources.
- PLO5 - The student will explain the principles, mechanisms, and interrelatedness of both in vivo and in vitro biochemical, molecular biological, and genetic processes.

Textbook:
Protein Purification: Principles and Practice, 3rd Edition by Robert K. Scopes.

Course Content:
Topical Outline (based on eight-hour combined lecture/lab days):

Module 1. PROTEIN (ENZYME) PURIFICATION & ASSAY
1. Overview of assays, sources of proteins, methods of purification
2. Affinity chromatography for isolation of recombinant proteins expressed in Baculovirus expression system
3. SDS PAGE analysis
4. Enzyme assays
5. Protein determination during purifications
6. Regulation of enzyme function: Effects of an activator and enzyme phosphorylation
7. Transient enzyme kinetic assays using Stopped Flow Apparatus
8. Data analysis of transient enzyme kinetics

Module 2. CELL-BIOLOGY
1. Cell migration
2. Cytoskeletal Structural Analysis and Cell Staining
3. Inverted Fluorescence Microscopy

Module 3. IMMUNOCHEMISTRY
1. Practical Immunology
2. Antibody generation and antibody-antigen reactions
3. Ouchterlony analysis
4. SAS precipitation – SDS gel analysis
5. Antibodies in chromatography/Protein A/G
6. ELISAs/RIAs
7. LCM

Module 4. PROTEIN-PROTEIN (ligand) INTERACTIONS
1. Review of binding theory
2. Calorimetry
3. Yeast 2-hybrid technique

Module 5. PROTEOMICS
1. What is Proteomics?
2. Techniques and instrumentation used in proteomics
3. MS/MS
4. Analysis of complex MS data sets

Module 6. MICROARRAYS

1. Nature of microarrays and principles
2. Construction of DNA microarrays
3. Analysis and interpretation of microarray data
4. High-throughput uses of microarrays
5. Protein microarrays and next generation microarrays.

Other Class Policies

Attendance:

Regular or punctual attendance is **mandatory**. Tardiness of more than 30 min will lose a half of the point. If a student misses a class or lab, the student is responsible for obtaining any information distributed during those times. Make-ups are possible only under certain instances (labs cannot be made up). Arrangements for any make-ups and/or missed labs should be discussed directly with the instructor for that day's class.

Participation:

Regular or punctual attendance is **mandatory.**

Academic Honesty:

Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

Cheating

Dishonesty of any kind involving examinations, assignments, alteration of records, wrongful possession of examinations, and unpermitted submission of duplicate papers for multiple classes or unauthorized use of keys to examinations is considered cheating. Cheating includes but is not limited to:

- Using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class.
- Falsifying or inventing any information, including citations, on an assigned exercise.
- Helping or attempting to help another in an act of cheating or plagiarism.

Plagiarism

Plagiarism is presenting the words or ideas of another person as if they were your own. Materials, even ideas, borrowed from others necessitate full and complete acknowledgment of the original authors. Offering the work of another as one's own is plagiarism and is unacceptable in the academic community. A lack of adequate recognition constitutes plagiarism, whether it utilizes a few sentences, whole paragraphs, articles, books, audio-visual materials, or even the writing of a fellow student. In addition, the presentation of material gathered, assembled or formatted by others as one's own is also plagiarism. Because the university takes such misconduct very seriously, the student is urged to carefully read university policies on Misconduct in Research and Other Scholarly Activity 05.00. Examples of plagiarism are:

- Submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another.
- Submitting a work that has been purchased or otherwise obtained from an Internet source or another source.
- Incorporating the words or ideas of an author into one's paper without giving the author due credit.

Adding/Dropping:

The official deadline for adding and dropping courses is as published in the academic calendar (Registrar Withdrawal webpage). However, students are strongly encouraged to meet with their graduate advisor or the Program Coordinator prior to adding/dropping courses. Movement into and out of classes after the 4th class day requires approval of the Program Director. Each student is responsible for their own enrollment status with the university.

Disability Accommodations:
UT Tyler HSC abides by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act, which mandate reasonable accommodations be provided for students with documented disabilities. If you have a disability and may require some type of instructional and/or examination accommodations, please contact me early in the semester so that I can provide or facilitate provision of accommodations you may need. If you have not already done so, you will need to register with the Student Services Office (located on the main campus). You may call 903-566-7079 for more information.