BIOT 6312 Advanced Techniques in Protein Chemistry Credit Hours: 3

Semester: Spring **Year:** 2013
Class Day/Time: Fridays, 9am-5pm **Class Location:** Room 116 & Lab B4

Instructor of Record: Dr. Pierre Neuenschwander Lead Professor
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Office Hours: Mondays 12pm-1pm, and anytime arranged by email.

Course Description: This course covers isolation and purification of proteins, physical and chemical characterization of proteins (structure and function), antibody production and applications, confocal microscopy, fluorescence-activated cell sorting (FACS), array technology, protein-protein interaction analysis and proteomics.

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

Goals of Course & Course Objectives:

Objectives (Learning Outcomes):

1. To demonstrate proficiency in advanced molecular techniques.
2. To become certified to correctly handle radioisotopes.
3. To understand and comply with standards of professional ethics.
4. To fully understand lab safety issues associated with toxic chemicals, radioisotopes, infectious agents, and manipulation of DNA.
5. To be able to correctly, completely and accurately maintain a laboratory notebook suitable for lab use and legal records.

Student Learning Outcomes (Course Competencies):

Knowledge & Understanding:

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. Students who successfully complete Advanced Techniques in Protein Chemistry will demonstrate:

- An understanding of advanced protein chemistry, including advanced background information and theory, applications, limitations, advantages and disadvantages, common problems and troubleshooting.
- An advanced understanding of experimental design and data analysis.
- An understanding of the role of computerized operations involved in molecular modeling, control of advanced laboratory equipment, and data analysis.

Subject-specific Skills:

Student skills will be evaluated with lab quizzes and laboratory reports. Students who successfully complete Advanced Techniques in Molecular Biology will have the following skills:

- The ability to correctly maintain an accurate record of laboratory procedures, techniques and exercises.
- The ability to perform and evaluate data collected from advanced protein processing and analytical techniques including purification, physical biochemistry, immunochemistry, proteomics and fluorescent activated cell sorting.
- The ability to produce professional industrial and research laboratory quality scientific write-ups

Course Assessment/Methods of Evaluation:

- **Lecture Examinations:** There will be two lecture exams each covering approximately six weeks of lecture materials.
- **Final Examination.**
- **Quizzes:** Required covering weekly work and will be scheduled as needed.
- **Written Reports:** There will be four 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, Purpose, Summary, Background, Materials, Methods, Results, Discussion, References and Answers (to questions posed by the instructor).
- **Class Participation and Attendance.**

Grading:

Four Lab Reports 100 pts each.....400 pts
One exam 100 pts.....100 pts
Three Quizzes (25 pts each, drop the lowest score).....50 pts
Class participation and attendance 100 pts.....100 pts
Final Exam (optional) up to 100 pts added.

Max total: 650 pts

A = 90% to 100% (585-650) D = 60% to 70% (390 – 454)
B = 80% to 90% (520-584) F = <60% (<390)
C = 70% to 80% (455-519)

- 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% to 10% of the points possible

Linked Program Learning Outcomes:

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

- PLO-1. The student will demonstrate English communication skills in both oral and written forms.
- PLO-2. The student will demonstrate mastery of basic and advanced biotechnology methods
- PLO-3. The student will demonstrate the ability to safely operate basic and advanced laboratory equipment, analytic devices and computers.
- PLO-4. The student will demonstrate independent and critical thinking skills integrated with the ability to utilize multiple informational resources.
- PLO-5. 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. Enzyme assays
3. Ion exchange resins: selection process, adsorption tests
4. Protein determination during purifications
5. Column packing
6. Loading, washing, eluting protein
7. Analysis of fractions, activity etc., deciding how to pool
8. Gel Filtration – packing column
9. Determination of protein yields
10. Practical enzyme kinetics. Designing kinetic assays.
11. SDS gels of fractions from gel filtration
12. Determination of protein yield
13. Characterizing your enzyme preparation
14. Determination of kinetic parameters
15. Use of computers for curve-fitting

Module 2. CELL-BASED TECHNIQUES

1. Patch-Clamp
2. LCM

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. Forensics applications

Module 4. PROTEIN-PROTEIN INTERACTIONS

1. Review of binding theory
2. Surface-plasmon resonance & BIACORE technology
3. Other methods of measuring biomolecular interactions

Module 5. FACS

1. Principles and operation of a FACS instrument
2. Identification of cell surface markers/receptors

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.

Module 7. PROTEOMICS

1. What is Proteomics?
2. Techniques and instrumentation used in proteomics
3. MALDI-TOF/Mass Spec
4. Analysis of complex MS data sets

Other Class Policies:

Attendance:
Regular or punctual attendance is expected. 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.

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 and Graduate Bulletin (typically the day before Census Day). 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. Students can drop until mid-semester without a WP or WF. Drops after mid-semester require approval of the Dean. Each student is responsible for their own enrollment status with the university.

Disability Accommodations:
UTHSCT 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 UT Tyler Campus). You may call 903-566-7079 for more information.