UTTyler SCHOOL OF MEDICINE

BIOT 5221 **Proteins & Nucleic Acids** **Credit Hours: 2**

Semester: Spring **Year:** 2026
Class Day/Time: Mondays, 9am-11am **Class Location:** BMR Rm B12.1

Instructor of Record: Dr. Pierre Neuenschwander
Office: **BMR Lab B1**
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Office Hours: Thursdays, noon-1pm

Instructors: Dr. Pierre Neuenschwander (Instructor of Record)
Dr. Maolin Lu
Dr. Vijay Boggaram
Dr. Sreerama Shetty
Dr. Guohua Yi

Course Description: The goal of the course is to provide a critical understanding of the relationship between structure and function of biological macromolecules such as proteins and nucleic acids.

Prerequisite: BIOT 5312 **Co-requisite:** BIOT 5221L

Goals of Course & Course Objectives:

Course Objectives:

1. To be able to communicate and discuss fundamental molecular biochemical principles pertaining to protein structure & function.
2. To be able to discuss the background and theory behind various protein-based biotechnology techniques.
3. To be able to find and process scientific information.

Student Learning Outcomes (Course Competencies):

1. The student will be able to describe the general structural features of proteins.
2. The student will be able to describe characteristics and properties of the naturally occurring amino acids.
3. The student will be able to discuss various forms of molecular binding interactions, how to measure these binding interactions.
4. The student will be able to describe a binding isotherm and pitfalls of the various techniques used to generate binding isotherms.
5. The student will be able to discuss general kinetic properties and constants associated with binding interactions.
6. The student will be able to discuss and perform least-squares fitting of binding data using appropriate computer-based software, as well as interpret the results.

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, homework assignments, and class participation. Students who successfully complete the course will demonstrate a thorough understanding of fundamental molecular biochemical principles used in biotechnology, including basic background information, theory and applications.

- **Lecture Examinations:** There will be two non-comprehensive take home exams (a midterm and a final). These two exams will be of a subjective format based on preceding modules and are each worth 30% of the final grade**.**

- **Quizzes:** These will be short take home quizzes and will be worth 20% of the total lecture grade.
- **Class Participation:** This will be based on attendance and participation in class polls and discussions 20%
- **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 the points possible per additional week.**
- **Quizzes and exams should NOT be submitted in hand-written form.**

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

- PLO-2. The student will demonstrate mastery of basic and advanced biotechnology methods
- 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:
Biochemistry (4th Edition), by Donald Voet and Judith G. Voet, © John Wiley & Sons, Inc., 2011; ISBN 978-0-470-57095-1

Course Content:

Date	Module and Topic	Instructor
01/12	**INTRODUCTION & REVIEW (30 min)** **Module 1. PROTEINS I** A) Amino acids a. Nomenclature & General Structure b. Physical & Chemical Properties	Neuenschwander
	Take QUIZ 1 on Canvas before next class	
01/19	***MLK Day – no classes***	
01/26	B) Primary Structure a. Polypeptides b. Sequencing polypeptides c. Synthesizing polypeptides	Lu
02/02	C) The Peptide Bond a. Stereoisomers b. Peptide bond characteristics, Pro c. Angles, conformational space d. Ramachandran plots	Lu
	Take QUIZ 2 on Canvas before next class	
02/09	**Module 2. PROTEINS II** A) Secondary structures a. The Alpha Helix b. Beta Sheets, beta turns	Neuenschwander
02/16	B) Protein stability and Tertiary structures a. Triple helix (collagen) b. Fibrin	Neuenschwander

02/23	C) Protein Quaternary Structure and Complexes	Neuenschwander
	Take EXAM I on CANVAS (Modules 1 & 2) – *Due by 11:59 pm Sun 3/1*	**Neuenschwander**
03/02	**Module 3. LIGAND BINDING: Protein-protein** A) Binding kinetics a. On- and off-rates b. Ka, Kd	Neuenschwander
03/09	**SPRING BREAK – no class**	
03/16	B) Experimental Methods for Binding a. General binding methods based on protein character b. Binding methods using cells c. Enzymatic methods to measure binding**	Neuenschwander
03/23	C) Advanced Enzymes a. Enzymology b. Enzyme Kinetics c. Methodology i. Regular Enzyme methods ii. Enzymatic methods to measure binding**	Neuenschwander
03/30	D) Enzyme Inhibition a. Classical inhibition b. Methodology	Neuenschwander
04/06	E) Computer Analysis a. Curve fitting b. How to use a computer to interpret numbers	Neuenschwander
	Take QUIZ 3 on Canvas before next class	
04/13	**Module 4. Protein-nucleic acid interactions** A) Advanced Gene Regulation	Boggaram
04/20	B) Protein-RNA interactions	Shetty
04/27	C) RNA Viruses	Yi
	FINAL EXAM **TAKE HOME (Modules 3 & 4) - *Due by 11:59 pm Tues 5/05***	

Other Class Policies:

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 policy Sec. 8-802. Academic Dishonesty. 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.

AI (Artificial Intelligence) Policy:

UT Tyler is committed to exploring and using artificial intelligence (AI) tools as appropriate for the discipline and task undertaken. We encourage discussing AI tools' ethical, societal, philosophical, and disciplinary implications. All uses of AI should be acknowledged as this aligns with our commitment to honor and integrity, as noted in UT Tyler's Honor Code. Faculty and students must not use protected information, data, or copyrighted materials when using any AI tool. Additionally, users should be aware that AI tools rely on predictive models to generate content that may appear correct but is sometimes shown to be incomplete, inaccurate, taken without attribution from other sources, and/or biased. Consequently, an AI tool should not be considered a substitute for traditional approaches to research. You are ultimately responsible for the quality and content of the information you submit. Misusing AI tools that violate the guidelines specified for this course (see below) is considered a breach of academic integrity. The student will be subject to disciplinary actions as outlined in UT Tyler's Academic Integrity Policy.

Use of AI is not permitted in this course at all.

To best support your learning, you must complete all graded assignments by yourself to assist in your learning. Doing your own work, without human or artificial intelligence assistance, is best for your efforts in mastering course learning objectives. This exclusion of other resources to help complete assignments includes artificial intelligence (AI). Refrain from using AI tools to generate any course context (e.g., text, video, audio, images, code, etc.) for any assignment or classroom assignment.

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 the 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.

A listing and description of all student policies can be found here: Manual of Policies and Procedures for Student Affairs.

UTTyler SCHOOL OF MEDICINE

MARKETABLE SKILLS FOR YOUR CV/RESUME

Program:	Master of Science in Biotechnology
Degree:	MS
Department:	Cellular and Molecular Biology
School:	Medical Biological Sciences
Course:	**BIOT5211/5221L – Proteins and Nucleic Acids** (and associated lab)

Area	Marketable Skill*
TASKS	Maintain accurate laboratory records and data.
	Design molecular or cellular laboratory experiments, oversee their execution, and interpret results.
TECHNOLOGY SKILLS	Analytical or scientific software, Graphics and molecular imaging software – PyMOL, Autodock Vina, MGL Tools
	Object or component-oriented development software - Autodock Vina, MGLTools, Unix commands in supercomputer environment
SKILLS	**Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
ABILITIES	**Written Comprehension** — The ability to read and understand information and ideas presented in writing.
	Inductive Reasoning — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
	Written Expression — The ability to communicate information and ideas in writing so others will understand.
WORK ACTIVITIES	**Analyzing Data or Information** — Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.
	Updating and Using Relevant Knowledge — Keeping up-to-date technically and applying new knowledge to your job.
	Getting Information — Observing, receiving, and otherwise obtaining information from all relevant sources.
	Documenting/Recording Information — Entering, storing, or maintaining information in written or electronic/magnetic form.
	Processing Information — Compiling, coding, calculating, tabulating, or verifying information or data.

*All marketable skills listed for this course and program were drawn from the Knowledge, Skills, and Abilities identified by the US Department of Labor and Statistics for “Biological Technicians” and “Molecular and Cellular Biologists” as published on O*Net Online (www.onetonline.org)