UTTyler SCHOOL OF MEDICINE

MS in Biotechnology Program

BIOT 5312 Molecular Biochemistry **Credit Hours: 3**

Semester: Fall **Year:** 2024
Class Day/Time: Mondays, 2pm-5pm **Class Location:** **BMR Auditorium**

Instructor of Record: Dr. Pierre Neuenschwander Professor
Office: CBMR 107.2
Office Phone: 903-877-7593
E-Mail: Pierre.Neuenschwander@uthct.edu
Office Hours: Anytime arranged by email.

Course Description: Graduate-level course of biotechnological aspects of gene expression, transcription control mechanisms; molecular cloning, and its applications to biotechnology at the molecular level. The student will gain a thorough understanding of fundamental molecular biochemical principles used in biotechnology, including basic background information, theory and applications.

Prerequisite: As per program admission. **Co-requisite:** None

Goals of Course & Course Objectives:

Course Objectives:

1. To be able to communicate and discuss fundamental molecular biochemical principles.
2. To be able to discuss the background and theory behind various nucleic-acid-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 explain the thermodynamic principles behind enzymatic catalysis.
2. The student will be able to describe the structural features of nucleic acid and compare and contrast its different forms and modifications.
3. The student will be able to discuss the mode of action of restriction enzymes and describe their uses in biotechnology.
4. The student will be able to explain the DNA replication process, discuss the various steps and place them in context to cellular function.
5. The student will be able to explain transcription, discuss the various steps and place them in context to cellular function.
6. The student will be able to explain translation, discuss the various steps and place them in context to cellular function.

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.

- **Examinations (50%):** There will be two comprehensive exams (a midterm and a final). These two exams will be of a subjective format based on preceding modules and are each worth 25% of the final grade. Both of these are take-home exams.
- **Quizzes/Assignments (25%):** There will be eight (8) short quizzes/assignments (in-class or online). The lowest score will be dropped, and the remaining will be combined and be worth 25% of the total grade.

- **Class Participation (25%):** This will be based on attendance, participation in class polls, discussions, and assignments.

Assignment/Exam/Quiz Submission Policy:
Students are expected to turn in all class assignments, exams and quizzes on time.

Late assignments will be handled as follows:

1 day late	5% deduction from the assignment grade
2 days late	10% deduction from the assignment grade
3 days late	20% deduction from the assignment grade
4+ days late	No credit will be given for the assignment.

Late Exams or Quizzes will be handled as follows:

1 day late	5% deduction from the exam/quiz grade
2-3 days late	10% deduction from the exam/quiz grade
4-7 days late	20% deduction from the exam/quiz grade
7+ days late	30% deduction from the exam/quiz grade

Attendance:
Students are expected to attend all classes. Students will be allowed to miss 1 class without penalty. Additional absences will be handled as follows:

2 absences	Lose 20% of class participation grade
3 absences	Lose 30% of class participation grade
4 absences	Lose 40% of class participation grade
5+ absences	Student will have to remediate in class participation

Students will be considered absent if they arrive more than 15 minutes after the start of class.

Emergencies
In the event of an emergency or sickness, the student **MUST** contact me and/or the Program Coordinator (Mr. Yonatan Moya) by email no later than the day of the expected absence. Failure to do so will result in the absence being counted as 2 absences, resulting in a 10% decrease in this category of the class grade.

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-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 & Schedule:

08/26 – *INTRODUCTION*

- Course description, format and grading policies.

***MODULE 1*:** Review and important thermodynamic concepts.

- Prokaryotes/Eukaryotes (Chapter 1; pp3-19, 26-28, 34-37)
- Aqueous solutions (Chapter 2; pp40-45)
- Thermodynamic Principles (Chapter 3; pp58-59)

Quiz 1 on Module 1 on CANVAS (due before next class)

09/02 – ***MODULE 2*:** Nucleic Acid Structure

- Theory and properties (Chapter 5)
- Applications
  - Nucleic acid purification (Chapter 6; pp156-159)
  - Nucleic acid sequencing (Chapter 7; pp176-185)
  - Nucleic acid synthesis (Chapter 7; pp209-214)

Quiz 2 on Module 2 available on CANVAS (due before next class)

09/09 – ***MODULE 3*:** Enzymes & Biotechnology

- Review of enzyme function and regulation (Chapter 13; pp469-480)
- Restriction enzymes
- Polymerases

09/16 – ***MODULE 4***: DNA Topology (part 1)

- Double helix (Chapter 29)
- Base pairing
- Methylation
- Circular/linear
- Supercoiling

Take Quiz 3 on Modules 3 & 4 before next class

09/23 – This week we will do some review and an in-class discussion problem based on MODULE 4 as practice for the mid-term.

Participation in discussion and assignment will count as Quiz 4.

09/30 – ***MODULE 5***: DNA Replication (part 1)

- Chapter 30

10/07 – DNA Replication (part 2)

- We will do another in-class exercise and discussion.

Participation in discussion and assignment will count as Quiz 5.

10/14 – Review of Modules 1-5.

Midterm exam will be available on CANVAS at end of class. It will be on Modules 1-5 and is a take-home, open-book exam).

10/21 – ***MODULE 6***: Reverse Transcriptase.

- Chapter 33 – Viruses (pages 40-52)

10/28 – ***MODULE 7***: Transcription.

- Prokaryotic Transcription - Chapter 31 (pages 1260-1283)
- Eukaryotic Transcription - Chapter 34 (pages W88-W121)

Take Quiz 6 on Modules 6 & 7 before next class

11/04 – ***MODULE 8***: Transcriptional Regulation (part 1)

- Prokaryotic control systems
  - Repressors *vs* Activators
  - *E. coli lac* operon
  - Other operons & applications in biotechnology

Take Quiz 7 on Module 8 (Prokaryotic transcriptional regulation) before next class

11/11 – ***MODULE 8***: Transcriptional Regulation (part 2)

- Eukaryotic control systems
- Enhancers and other elements
- Transcription assays

Participation in discussion and assignment will count as Quiz 8.

11/18 – ***MODULE 9***: Translation (part 1) – Chapter 32, pages 1338-1395

- How to read DNA
- tRNA and tRNA Synthetases

11/25 – **THANKSGIVING BREAK** – no class

12/02 – ***MODULE 9***: Translation (part 2)

- Ribosomes
- Toeprinting

Final exam will be available for download on CANVAS at end of this class.

- Covering MODULES 6-9; take-home, open book.
- **Due by 11:59 pm Wednesday 12/11**

12/09 – ***FINALS WEEK: Final exam due on CANVAS by 11:59 pm on Wednesday 12/11***

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 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

MS in Biotechnology Program

MARKETABLE SKILLS FOR YOUR RESUME/CV

Program:	Master of Science in Biotechnology
Degree:	MS
Department:	Cellular and Molecular Biology
School:	Medicine
Course:	**BIOT5312 – Molecular Biochemistry**

Area	Marketable Skill*
SKILLS	**Reading Comprehension** — Understanding written sentences and paragraphs in work-related documents.
	Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
	Active Listening — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
ABILITIES	**Written Comprehension** — The ability to read and understand information and ideas presented in writing.
	Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.
	Inductive Reasoning — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
WORK ACTIVITIES	**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.

*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)