

CHEM 4360: Molecular Biology
Fall 2017

Tuesday and Thursday 8:00 am – 9:20 am, UAC 308

Instructor:

Dr. Karen A. Lewis

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Office Hours: Monday & Wednesday 9 – 10 am; Tuesday & Thursday 2 – 3 pm

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Course Description: This course provides Biochemistry majors and minors with advanced knowledge of the field of molecular biochemistry. Topics include gene expression (transcription and translation of genes in bacteria and higher organisms), post-translational modification of proteins, chromosomal DNA replication, cell cycle checkpoint controls, DNA damage and repair, as well as theories of cancer and aging.

Prerequisites: CHEM 3375 or CHEM 4375 with a minimum grade of D. Advanced Biochemistry builds directly on the material covered in CHEM 3375/4375. If you have not mastered that material, you begin this course at a significant disadvantage.

Course Format: Multiple instructional formats will be used to accommodate different learning styles. Students are expected to be active participants in their learning by reading the assigned material, engaging in the material presented, and participating in classroom activities.

Assigned reading material: Students are expected to read the material assigned before class in preparation for a focused discussion of the more challenging aspects of the topic.

Problem sets and student presentations: Some material will be taught through problem sets and student presentations. This information is as important as other material presented in the text or in lecture, and will be included in assessments.

Course Objectives

After completion of this course, the student should be able to:

- Employ a working vocabulary of biochemical and molecular biology terms (*i.e.*, give a definition, use terms in context, and apply the term in a new context).
- Identify and explain the structure of nucleic acids.
- List and explain the cellular functions of nucleic acids.
- Predict and explain the behavior of biomolecules and biochemical systems by applying chemical principles to these systems.
- Describe the current understanding of the molecular biology processes of DNA replication, DNA repair, gene expression and regulation, and protein synthesis.
- Explain and interpret data produced from a variety of molecular biology techniques.
- Interpret experimental data and relate their interpretation to the current understanding of molecular biology processes.
- Solve problems involving nucleic acids by utilizing molecular biology techniques.
- Read and interpret a scientific research article and be able to articulate its contents in both written and oral formats.
- Work cooperatively in teams to identify a problem, create a plan, and complete a task.
- Assess the quality of presentations by others and oneself.

Course Grades and Assessment

The course will include problem sets, quizzes, and class participation via Clickers (50 possible points); a primary literature review assignment and poster presentation (100 possible points); three semester exams (300 possible points); and a comprehensive Final Exam (150 possible points). Letter grades are determined as follows:

A	$\geq 89.5\%$
B	79.5 – 89.49%
C	69.5 – 79.49%
D	59.5 – 69.49%
F	$\leq 59.49\%$

The instructor reserves the right to adjust grading depending on student performance. Any changes to the above policy will be announced in class and on TRACS.

Quizzes: In-class quizzes for points will be periodically used to assess student knowledge and progress. There are no make-up quizzes.

Assignments: In-class and take-home assignments related to current course topics will be given, including scientific reading and writing assignments as well as oral presentations. Details about these assignments will be provided at appropriate times during the semester.

Clickers: TurningPoint Technology Clickers will be used weekly. If you do not have a Clicker, you may purchase one from the University Bookstore. Clicker use requires (1) an active license, which can be purchased either as a one-term or one-year license for less than \$30, and (2) activation through the course TRACS website. Class participation via Clickers will comprise a maximum of 5% of the overall course grade.

Exams: The exams will contain a combination of multiple-choice and short answer. They will draw on material covered by lectures, textbook reading, suggested problems, problem sets, student presentations, and other assignments.

While all exams are effectively cumulative, the semester exams will emphasize topics covered since the previous exam. The final exam is cumulative.

Exam	Possible Points	Dates
1	100	Tuesday, September 26 th
2	100	Tuesday, October 24 th
3	100	Tuesday, November 21 st
Final	150	Tuesday, December 12 th at 8 am

Exam Policies: Exams will begin 5 minutes after the scheduled class start time (*i.e.*, 8:05 am) and end at the scheduled class end time (*i.e.*, 9:20 am). No student will be allowed additional time without documented need by the Office of Disability Services.

All effort is made to grade exams carefully and consistently. You may petition for corrections to an exam grade. Any exam corrections must be petitioned for in writing **no sooner than 48 hours and no later than two weeks** after the graded exams have been returned. The petition must contain a clear, written explanation of why you should receive additional points as well as evidence for the correct answer. Dr. Lewis may choose to re-grade the answer in question or the entire exam, resulting in gain or loss of points on other questions not being contested. **Grade corrections outside the above window will not be considered.**

If you must leave the room during an exam, leave your exam with Dr. Lewis. In an emergency evacuation, remain in the vicinity of the classroom if safety permits and return when allowed. Dr. Lewis will determine whether there is sufficient time to complete the exam.

Extra Credit: Bonus points are built into each exam (e.g. 105 possible points/100 graded points). No individualized extra assignments will be given.

Exam Grade Replacement: At the end of the semester, students will be given the option to replace their lowest exam score with their final exam score (scaled to 100 points). This is a strictly opt-in policy; the lowest exam grade will not automatically be replaced.

Resources

Textbooks: The required textbook for the class is Molecular Biology: Principles and Practice, by Cox, Doudna, and O'Donnell (W.H. Freeman). Either the 1st edition (2012) or the 2nd edition (2015) is suitable; when there are critical differences, Dr. Lewis will note it in class. A copy of the 2nd edition is on reserve in Alkek Library.

Reading the same material in a couple of different ways can often help to solidify an understanding of the material. Additional biochemistry textbooks are available in the library; books that may be particularly helpful are Molecular Biology of the Gene, by Watson *et al.*, Biochemistry by Voet & Voet, and Fundamentals of Biochemistry by Voet, Voet, & Pratt.

Scientific Journals: Biochemistry and molecular biology are constantly growing fields that change rapidly. Therefore, textbooks may be out of date by the time they reach press. The best and most recent information is found in scientific journals. Review articles found in most journals are a great summary of the current understanding on a topic. Some relevant journals carried in our library are:

Biochemistry

Nature

Science

Cell

Molecular Cell

Nature Structural & Molecular Biology

Trends in Biochemical Sciences

Annual Reviews of Biochemistry

Journal of Biological Chemistry

Journal of Molecular Biology

Nucleic Acids Research

Attendance Policy: While attendance is not taken, ***you are expected to attend every class.*** Attendance is important to fully understand the material; merely reading the textbook is insufficient. There will be material covered in class that is not in the reading and which will be on quizzes and exams. Because attendance is not taken, there are no excused absences.

Exams: Exams must be taken on the scheduled day; make-up exams will not be given. If a student arrives late to class, they will have the remainder of the class period to complete the exam. If a student misses an exam, they may elect to replace that zero with the final exam grade as described above ("Exam Grade Replacement"). Any second missed exam will be given a zero.

Quizzes: Quizzes, including unannounced ones, will be given in class. Make-up quizzes will not be given. If a student misses a quiz (whether announced or unannounced), the grade for that quiz will be a zero.

TRACS: A TRACS site will be used extensively during this course for both resources and assignments. Please refer to it frequently. You must have a valid Texas State University username and password.

Email questions to instructor: You are welcome to email questions to the instructor. If the email is relevant to the entire class, the response will be posted on TRACS in the “Fall 2015 e-mail responses” folder in a manner that anonymizes the original query.

Professionalism and Respect: Both the University and Dr. Lewis are committed to an educational community in which each individual is respected, appreciated, and valued. Class rosters are provided with the student's legal name. All requests to address you by an alternate name, pronunciation, and/or gender pronoun will be honored. Please advise Dr. Lewis (either in person or by email) of this preference early in the semester.

Academic Integrity: The University Honor Code “require[s] all members of this community to be conscientious, respectful, and honest”:

<http://www.txstate.edu/effective/upps/upps-07-10-01-att1.html>

More broadly, the practice of science is founded upon principles of honesty, trust, accountability, and respect. Without such a foundation, the entire enterprise would crumble. Therefore, the Honor Code is strictly enforced in this course and any violations will be pursued.

As a reminder of the critical role of academic integrity, you are expected to include the students’ pledge on all written assignments:

“I pledge to uphold the principles of honesty and responsibility at our university.”

All assignments are to be completed individually, unless you are explicitly instructed to work in groups. ***Violation of the honor code will result in academic penalties at the instructor’s discretion, up to and including failure in the course.***

Drop Policy: Students may drop this course and receive a "W" at anytime prior to the official university deadline on Monday, October 30th at 11:59 pm. Students may withdraw from the university (*i.e.*, drop all courses and go to zero hours enrolled) by Tuesday, November 28th at 11:59 pm.

Special Needs Information: Students with special needs as documented by the Office of Disability Services should identify themselves at the beginning of the semester in order for accommodation to be made. If accommodations are needed for in-class quizzes and/or exams, the quizzes and/or exams must be taken at the Testing, Research Services, and Evaluation Center (TREC) on the date and time the assessment is administered in class. Students are strongly advised to schedule TREC exam times as early as possible in the semester. Exceptions to this policy will only be made under extraordinary circumstances, as determined by the instructor.

COURSE OUTLINE:

Class #	Date	Topic	Corresponding Chapter* Assignment Due Dates
1	29-Aug	Introduction, Assessment	Chapter 1
2	31-Aug	Genes to Proteomes	Chapter 6, 7, 8 <i>In-class problem set</i>
3	5-Sep	Genes to Proteomes	<i>In-class problem set</i>
4	7-Sep	Chromatin & Genome Structure	Chapter 9, 10
5	12-Sep	Chromatin & Genome Structure	
6	14-Sep	DNA Replication <i>Lasker Award</i>	Chapter 11 <i>Article selections due</i>
7	19-Sep	DNA Replication	
8	21-Sep	DNA Replication	<i>In-class problem set</i>
9	26-Sep	EXAM I	
10	28-Sep	DNA Mutation and Repair	Chapter 12
11	3-Oct	DNA Recombination <i>Nobel Prize in Physiology or Medicine</i>	Chapter 13
12	5-Oct	DNA Recombination <i>Nobel Prize in Chemistry</i>	Chapter 14
13	10-Oct	Transcription	Chapter 15
14	12-Oct	Transcription	
15	17-Oct	Transcription	<i>Outline due</i>
16	19-Oct	mRNA Processing	Chapter 16
17	24-Oct	EXAM II	
18	26-Oct	ncRNA Processing	Chapter 16
19	31-Oct	Translation	Chapter 17, 18
20	2-Nov	Translation	
21	7-Nov	Translation <i>Breakthrough Prize</i>	<i>In-class problem set</i>
22	9-Nov	Translation	<i>Quiz</i>
23	14-Nov	Poster Presentations	<i>Posters due</i>
24	16-Nov	Poster Presentations	
25	21-Nov	EXAM III	
	23-Nov	<i>no class - Thanksgiving Break</i>	
26	28-Nov	Regulation of Gene Expression	Chapter 19, 20
27	30-Nov	Regulation of Gene Expression	Chapter 21, 22 <i>Review paper due</i>
28	5-Dec	Regulation of Gene Expression	<i>In-class problem set</i>
29	7-Dec	Broader Impacts	
12-Dec	8 am	COMPREHENSIVE FINAL EXAM	

* Additional reading may be assigned during the semester as appropriate for the topic being discussed. Listed are the corresponding chapters in the textbook. Note that the above topics, schedule, and exam content are subject to change as needed. Students will be notified *in class* of any changes.