Biology 482 - Molecular Biology - Spring 2006

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Lecture: Mon/Wed/Fri, 11:15 - 12:10, ST129
Lab: Tues or Wed 2:30-6:30, ST429

Office Hours: Mon 1:30 - 3:30 PM, Tues 8:30 - 10:00 AM, Thurs 8:00 - 9:30 AM or by appointment. Email is typically an excellent way to get a quick response to a question.

Course Home Page: home.sandiego.edu/~cloer/bio482.html

Main text for lecture (required) - *Molecular Biology*, 3rd Edition, by Robert Weaver. ©2005 WCB/McGraw-Hill. (Your Genetics text may be useful for review: *Principles of Genetics* by Snustead, Simmons & Jenkins.)

Items on reserve -
Genes VI by Benjamin Lewin. ©1997 Oxford University Press.
Discovering Molecular Genetics by Jeffrey Miller. ©1996 Cold Spring Harbor Laboratory Press.
Molecular Biology of the Cell by Alberts *et al*. 3rd edition, ©1994 Garland Publishing Inc.
The Eighth Day of Creation: Makers of the Revolution in Biology by Horace Judson. Expanded edition, ©1996 Cold Spring Harbor Laboratory Press.

Books required for laboratory -
Laboratory DNA Science by Bloom, Freyer, and Micklos, ©1996 Benjamin-Cummings Publishing Co., Inc. - This is the main text for the lab.
Cold Spring Harbor Laboratory Research notebook, ©1999 Jones & Bartlett Publishers
Biology 482 Lab Manual (Supplements & Modifications), ©2006 C. Loer
Other lab requirements -
Semi-log graph paper, Sharpie extra-fine or ultrafine permanent markers, watch with second hand or timer, scientific calculator, lab coat

<u>Goals of the Course</u>

This course is about genes - their structure and function - therefore, students will study nucleic acid structure and the mechanics of replication, repair, transcription, and translation in prokaryotes and eukaryotes. A central goal is understanding gene regulation at all levels. Critical experiments will be examined to learn how our current understandings have come about. Techniques in molecular biology will be examined in lecture as necessary to understand experiments and concepts. We will also study protein structure and function (especially their interactions with nucleic acids), and post-translational events since, with a few important exceptions, proteins constitute the functional output of genes. We will also pursue a selection of special topics which varies from year to year such as the molecular biology of HIV and other retroviruses, whole genome sequencing, comparative and functional genomics, etc.

In the laboratory, students will learn basic bacterial culture techniques, transformation, agarose gel electrophoresis, plasmid DNA purification, DNA restriction digestion and analysis, Southern hybridization, library construction, polymerase chain reaction (PCR), and basics of computer-based DNA sequence analysis and data acquisition over the internet.

Course Mechanics

Attendance at all lectures is **strongly recommended**, but not required. Students who miss more than a few lectures often do poorly in class; such students will find little sympathy for their plight. For any missed lecture, a student should consult a fellow student for notes. The instructor will gladly provide any printed material handed out (also typically available on the class home page), but not a repeat of material presented in lecture. Note that attendance at any class presentations/discussions or guest lectures is **required**.

Missed quizzes or tests may be made up only for excused absences (e.g., sickness). Students should inform the instructor of the reason for their absence as soon as possible. Grades on problem sets, papers, lab reports or other assignments turned in late will be severely reduced except for excused absences.

Attendance at all laboratory sessions is **required**. If you miss a lab for a legitimate reason (e.g., sickness) you may have an opportunity to make it up later. In some cases, however, this is impossible; some other form of makeup may be arranged.

The text of all lab reports and papers must also be submitted electronically to Turnitin.com (a link may be found on the class home page), unless students choose to opt out. Further instructions and information about this will be provided in the lab syllabus. Submission should be completed by 5 PM of the day following the assignment due date. (Submit a regular paper copy to the instructor for grading.)

Tests and Grading

There will be three hourly tests during the semester covering the material in lectures preceding them. Each will count for 17% of your grade. A cumulative final exam covering previously untested material and major concepts from the entire course also counts for 22% of your grade. The lab portion of the class will be 27% of your final grade (for a breakdown on lab grade, see the lab syllabus). Note that adjustments to grading percentages may be required if assignments are altered.

Assigned readings contain more material than will be covered in lecture. Tests will tend to emphasize lecture material. The quality of your writing is on exams important. Your answer to a question must be clear (and legible) to be correct. Spelling of new words you are adding to your biological vocabulary must also be correct.

Grading Summary:

Hourly tests (3, ea. 17%)	51%
Final	22%
Lab	27%

Provisional Lecture Schedule

	Topics	Reading
Jan. 27	Introduction, review of class syllabus and mechanics. History of molecular biology of the 20th & 21st centuries, Genomics and the "Post-Genomic" Age.	Chapter 1
Jan. 30, Feb. 1	DNA as the genetic material, nucleotides, nucleic acid structure, supercoiling, hybridization	Chapters 2, 3
	Molecular methods will not be covered as a unit in lecture; rather, they will be reviewed and discussed as necessary during the semester. These chapters of the text should be read now, and reviewed by the student as needed. Much of this should be review from Genetics (Bio 300).	Chapters 4, 5
Feb. 3, 6, 8 **Note: Feb. 3 class meets 10:20-11:00**	DNA Replication: Basic mechanism & enzymology. Semi-discontinuous replication, replication strategies, prokaryotic and eukaryotic DNA polymerases, priming.	Chapter 20
Feb. 10, 13	DNA Replication (cont.): elongation, DNA Pol III subunit functions, termination. DNA repair mechanisms	Chapter 21
Feb. 15, 17	Recombination and Transposition. Homologous recombination, Holliday junction, RecBCD, RuvA, B, Site-specific recombination, transposons.	Chapters 22, 23
Mon., Feb. 20	**FIRST EXAM**	
Feb. 22, 24, 27	Gene structure and transcription in prokaryotes, *E. coli* RNA polymerase, Initiation, functions of σ, elongation, termination	Chapter 6
March 1, 3, 6	Operons, Major shifts in prokaryotic transcription, *E. coli* σ subunits, *B. subtilis* sporulation	Chapters 7, 8
March 8, 10	λ phage life cycle in *E. coli*: lysis vs. lysogeny. DNA-protein interactions in prokaryotes.	Chapters 8, 9
March 13 - 17	**SPRING BREAK**	
March 20, 22, 24	Eukaryotic transcription: RNA polymerases, promoters & enhancers. Eukaryotic transcription factors - general & specific.	Chapters 10, 11, 12
Mon., March 27	**SECOND EXAM**	
Mar 29, 31, April 3	Origins of life in the 'RNA world.' RNA Processing: exons & introns, splicing, spliceosomes, SNRPs.	Chapter 14, supplements
April 5, 7	RNA Processing: self-splicing introns, capping, polyadenylation. [Withdrawal deadline is April 5]	Chapters 14, 15
April 10, 12	RNA editing, trans-splicing, recently discovered small RNAs	Chapter 16
April 13 - 17	**EASTER HOLIDAYS**	
April 19, 21	Translation: translation initiation, the genetic code	Chapter 17
Mon., April 24	**THIRD EXAM**	
Apr. 26, 28, May 1	Translation elongation and termination, ribosome & tRNA structure and function.	Chapters 18, 19
May 3, 5, 8	Molecular Biology of HIV and other retroviruses	Reserve reading
May 10, 12, 15	Genomics, Proteomics and other topics (as time allows)	Chapter 24
May 16	**STUDY DAY**	
May 17 - 23	**FINALS**	

Final Exam: Friday, May 19, 11:00 AM - 1:00 PM