Biology 482 - Molecular Biology - Spring 2009

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Lecture: Mon/Wed/Fri, 11:15 - 12:10, Camino Hall 112

Office Hours: Mon 1:30 - 3:30 PM, Tues 8:00 - 9:00 AM, Wed 1:30 - 2:30 PM, Thurs 9:00 - 10:00 AM, or by appointment. Email is typically an excellent way to get a quick response to a question – although is no substitute for one-on-one help and discussion in my office.

Course Home Page: home.sandiego.edu/~cloer/bio482.html; CE6 (WebCT) also used.

Main text for lecture (required) - *Molecular Biology*, 4th Edition, by Robert Weaver. ©2008 WCB/McGraw-Hill. (Your old Genetics text may be useful for review.)

Biology 482 Lecture outlines and *Biology 482 Lecture Powerpoint* files (in PDF note-taking format) - both available online at WebCT site.

Items on reserve -
Genes VI by Benjamin Lewin. ©1997 Oxford University Press.
The Eighth Day of Creation: Makers of the Revolution in Biology by Horace Judson. Expanded edition, ©1996 Cold Spring Harbor Laboratory Press.
The Double Helix : a personal account of the discovery of the structure of DNA by James Watson. Norton Critical Editions ©1980 New York: Norton
Gene cloning & DNA analysis : an introduction by T.A. Brown, 5th Ed., ©2006 Malden, MA : Blackwell Publishing.

Goals of the Course

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 bacteria, archaea 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 (and 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.

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 or WebCT), but not a repeat of material presented in lecture. Note that attendance at any class presentations/discussions or guest lectures will be **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 papers or other assignments turned in late will be severely reduced except for excused absences.

The text of papers may also be required to 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 later. In general, 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.)

Problem Sets

Throughout the course, a page of problems and questions similar to those that may be found on exams (or harder) will be handed out. Answers will be posted about a week later. Students are encouraged to treat these as practice exams. Many of these will be problems involving molecular data to be analyzed and explained.

Tests and Grading

There will be three hourly tests during the semester covering the material in lectures preceding them. A cumulative final exam covering previously untested material and major concepts from the entire course. [The final is like a 4th hourly test (21%) plus 11% covering cumulative concepts addressed throughout the course.] Other graded items may include CE6 (WebCT)-based quizzes, in-class quizzes, short papers, participation, etc.

Note that occasionally modifications to grading percentages may be necessary, depending on alterations in assignments, or unforeseen changes in the class schedule. As much as possible, grading will follow the outlines indicated.

Grading Summary:

Hourly tests (3, ea. 21%)	63%
Final	32%
Other	5%

Assigned readings contain more material than will be covered in lecture. Tests will tend to emphasize lecture material. The quality of your writing on exams is 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.

No electronic devices of any kind (cell phones, MP3 players, calculators, PDAs, etc.) are permitted during exams or quizzes. If you need a calculator for a test, one will be provided.

Provisional Lecture Schedule

	Topics	Reading
Jan. 26, 28, 30	Introduction, review of class syllabus and mechanics. History of molecular biology of the 20th & 21st centuries, Genomics and the "Post-Genomic" Age. DNA as the genetic material, nucleotides, nucleic acid structure, supercoiling, hybridization.	Chapter 1 - 3
	Molecular methods will not be covered as a unit in lecture, but will be reviewed and discussed as necessary during the semester. This material should be read now, and reviewed by the student as needed. Much should be review from Cell Processes (Bio 225) and Genetics (Bio 300).	Chapters 4, 5
Feb. 2, 4, 6	DNA Replication: Basic mechanism & enzymology. Semi-discontinuous replication, replication strategies, prokaryotic and eukaryotic DNA polymerases, priming.	Chapter 20
Feb. 9, 11	DNA Replication (cont.): elongation, DNA Pol III subunit functions, termination. DNA damage and repair.	Chapter 21
Feb. 13, 16, 18	Recombination: Homologous recombination, Holliday junctions, RecBCD, RuvAB functions. Site-specific recombination. Illegitmate recombination: DNA transposons, retrotransposons.	Chapters 22, 23
Fri., Feb. 20	**FIRST EXAM**	
Feb. 23, 25, 27	Gene structure and transcription in bacteria, *E. coli* RNA polymerase, Initiation, functions of σ, elongation, termination.	Chapter 6
March 2, 4, 6	Operons, Major shifts in bacterial transcription, *E. coli* σ subunits.	Chapters 7, 8
March 9-13	**SPRING BREAK**	
March 16, 18	λ phage life cycle in *E. coli*: lysis vs. lysogeny. DNA-protein interactions in bacteria, helix-turn-helix DNA binding motif.	Chapters 8, 9
Fri., Mar 20	**SECOND EXAM**	
March 23, 25, 27	Eukaryotic transcription: RNA polymerases, promoters & enhancers. RNA Pol II structure and subunit functions. General transcription factors, basal transcription complex formation.	Chapters 10, 11
March 30, April 1	Eukaryotic transcriptional activators: specific TF structural classes. Chromatin structure & regulation, histone modifiers, coactivators & corepressors.	Chapters 12, 13
April 3, 6	RNA Processing: exons & introns, splicing, spliceosomes, snRNPs. Origins of life in the 'RNA world.'	Chapter 14, supplements
April 8, 15	RNA Processing: self-splicing introns, capping, polyadenylation.	Chapters 14, 15
April 9-13	**EASTER HOLIDAYS**	
April 17	RNA editing, trans-splicing, siRNAs, miRNAs, other ncRNAs.	Chapter 16
Mon., April 20	**THIRD EXAM**	
April 22, 24, 27	Translation: translation initiation, genetic code	Chapter 17
Sat., April 25	**DNA DAY** [Class party Apr 24?]	
Apr. 27, 29, May 1	Translation elongation and termination, ribosome & tRNA structure and function.	Chapters 18, 19
May 4, 6, 8, 11	Retroviral (esp. HIV) and Influenza virus Molecular Biology	Supplements
May 13, 14	**STUDY DAYS**	
May 15 - 21	**FINALS**	

Final Exam: Friday, May 15, 11:00 AM - 1:00 PM