BI 320, MOLECULAR GENETICS
Fall 2013

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BI320 is an advanced undergraduate course covering gene expression and gene regulation in both prokaryotic and eukaryotic organisms. The course has been designed with the assumption that students enter with a solid grasp of the material presented in BI 252/BI 214 and with a rudimentary understanding of protein biochemistry. We will explore how genetic analysis can be used to understand cellular processes, how different sets of genes are selectively activated in different cell types within multicellular organisms, and the nature of the genetic mechanisms that enable organisms to respond to changes in their environment. The course will focus on the experimental approaches that have been used with several model organisms whose properties make them especially well suited for genetically-based studies. We will discuss how fundamental principles were established with these model organisms, and how these principles and approaches apply to more complex creatures.

Course Blackboard Site

The UO Blackboard Site will be used to distribute reading material, lecture overheads, lecture notes, problem sets, answer keys, and other information for the class. Please familiarize yourself with the site, download and print the lecture figures and readings, and consult it frequently for announcements and updates. ***You should bring printouts of the lecture figures to class for note-taking, these will be posted the evening before each class.***

Format

Lectures are scheduled for Tuesdays and Thursdays, from 12-1:20 in 229 MCK. Marked up lecture slides will be posted on Blackboard **after** each lecture. You are *required* to attend lectures and discussion section each week (5 KLA, Tuesdays at 2:00, 3:00, 4:00, and 5:00). Discussion sessions will be used to introduce new material like common techniques in molecular genetics, and to clarify and expand upon material presented in lecture. *Material presented in Discussions will be represented on exams.*

PLEASE BRING PRINTOUTS OF THE DISCUSSION OUTLINES AND ASSOCIATED FIGURES TO DISCUSSION SECTIONS WHEN THEY ARE AVALIABLE.

I-Clickers

I-clickers will be used in this class to review lecture topics and to encourage participation. Please bring your i-clicker to each lecture and have it ready for use. I-clickers are available for purchase at the UO Bookstore and should be registered to your Blackboard account as soon as possible. I-clicker registration can be done in the "Course Information" section of the BI 320 Blackboard account.

Assigned Reading
Assigned readings will come from three sources.
(1) Textbook. *Molecular Biology of the Gene,* 6th edition (Watson et al.) is the text for the course. It is available for purchase at the UO Bookstore, and two copies have been placed on reserve in the Science Library.

(2) Excerpts from other texts. Because the text covers several topics rather superficially, assigned readings from a variety of sources are available as PDF files on Blackboard. These are listed in the course outline in italic text and are REQUIRED reading.

(3) Research articles. We will discuss several original research articles, which can be downloaded from the course Blackboard site. An important goal of this course is to help you appreciate the process and excitement of genetic research rather than simply memorizing the current state of knowledge. These papers offer you the opportunity to become acquainted with experimental design and methods used in molecular genetics research. On exams and problem sets you will sometimes be asked to use what you have learned to develop your own hypotheses and experimental strategies for testing them.

Problem Sets

Five problem sets will be assigned during the term; these can be accessed on Blackboard. The problem sets serve to reinforce the material covered in the lectures and reading, and will help you explore its ramifications and applications. Each set will have approximately six problems; **you will only need to turn in the first three problems and *only one of these will be graded***. You are encouraged to discuss the problems with your classmates and instructors. *However, you are expected to write up the answers for the problems (to be turned in) on your own.* ***Working through ALL of the problems as independently as possible will provide the best preparation for the exams and quizzes.***

Problem set due dates are indicated on the Syllabus. **Answers must be typed (with the exception of illustration, which can be hand drawn), and should be concise.** They should be turned in to the slot box labeled "BI320" next to Rm 13 Klamath. **Late problem sets will not be accepted** because the answer keys will be posted on Blackboard immediately after they are due. The Problem Sets will be graded by the GTF; however, *due to the large size of the class, the GTF will not be able to provide detailed written feedback so please check the answer key for details about the answers.*

Exams

There will be two midterm exams, a final exam, and three to five quizzes. All exams will be closed book. **However, you may bring one page of notes (hand written on both sides) to the midterm exams and two such pages to the final exam.** You will not be allowed notes during the quizzes, unless otherwise instructed. You will do two capstone projects in this class, an operon model project, and a paper project; each of these will count as a quiz grade.

The emphasis will be on testing your understanding of the concepts, not your ability to memorize facts. I will grade the exams. If you feel that you have been graded unfairly, you should submit your reasoning to me in writing, within one week of the day the exam is returned to you. Attach the original exam to your request. If you know ahead of time that you must miss a scheduled exam, see me to arrange an alternative, later, time by Tuesday 10/2 (second week of class). Make up exams will not be scheduled after the fact, and early exams will not be given.

YOU ARE EXPECTED TO KEEP ALL OF YOUR GRADED WORK UNTIL FINAL GRADES ARE POSTED, TO USE AS DOCUMENTATION SHOULD DISAGREEMENTS ARISE.

Grading Policy
The final course grade will be calculated by choosing the highest score from among the following distributions:

Method A:

Clickers / attendance	5%
Problem Sets	5%
Quizzes	15%
Midterm I	20%
Midterm II	25%
Final Exam	30%

Method B:

Clickers / attendance	5%
Problem Sets	5%
Quizzes	15%
Midterm I	25%
Midterm II	20%
Final Exam	30%

Final: The Final for this class is scheduled for Tuesday, 12/10 at 8:00am. Schedule travel plans accordingly. **EARLY EXAMS WILL NOT BE GIVEN UNDER ANY CIRCUMSTANCES!**

Midterms: Midterm I will be on Tuesday 10/29 and Midterm II will be on Tuesday 11/26. If you have conflicts with the scheduled midterms, you must let me know by the second week of class. Last minute accommodations will not be made (except under extreme, unforeseeable, circumstances).

Quizzes: Quizzes will be announced at least one class period prior to the quiz day. There will be a minimum of 4 and a maximum of 5 quizzes. Two of these quiz grades will be used for longer duration discussion projects: an operon modeling project during the first half of class, and a paper assignment during the second half of class.

Clickers / attendance: This component of the grade will take into account contributions to discussions in lecture and discussion sections as well as participation in clicker questions. To get full credit for this 5% you need to arrive to class ON TIME and attempt at least 80% of the clicker questions. Most clicker questions will be graded on participation, not accuracy, but there may be some exceptions, you will be told which questions need to be answered correctly before you attempt them. In addition there may be short discussion assignments you will need to complete, these will be graded based on effort not accuracy.

Academic Honesty

Academic dishonesty includes various forms of "cheating" (e.g. copying another person's answers to exam questions, altering your exam for a regrade, copying problem set answers from other students etc.) and will not be tolerated. For the definition of cheating and its penalties, consult the University of Oregon Student Conduct Code.

Learning Environment

The University of Oregon and myself are working to create inclusive learning environments. Please notify me if there are aspects of the instruction, or design of this course that result in barriers to your participation. You may also wish to contact the UO Accessible Education Center in 164 Oregon Hall at 346-1155 or uoaec@uoregon.edu

Tentative Course Outline: BI 320 Fall 2012
Text: Molecular Biology of the Gene, 6th ed, Watson et al. Abbreviated as "Watson" below.
Other readings are *italicized* below and can be downloaded from Blackboard.

Date	**Topic (Concepts)**	Reading	Problem Sets
10/1	Overview of Course Themes Types of mutations Prokaryotic genome organization and transcription. (Second-site suppressors, protein structure/function)	• *Hartwell 487-493* • *Hartwell 221-224* • Watson 136-140 • Watson 377-383 • Watson 794	
10/3	Positive and negative control of transcription initiation in prokaryotes: *lac* operon. (Dyad symmetry, allostery, cis/trans test)	• Watson 383-396; 563 • Watson 547-556	
10/4	Discussion, week 1 - techniques: PCR, restriction enzymes, gel mobility shift assays, DNA footprinting - Form groups of 4 for operon model projects, discuss operon project and paper project	• Watson 739-743; 751-752; 776-778	
10/8	*lac* operon cont'd (Combinatorial control, dominant negative alleles, redundancy)	• Watson 554-562	
10/10	Positive and negative control of transcription initiation in prokaryotes: Arabinose operon (Negative autoregulation, DNA "looping")	• Watson 567-568 • *Weaver 193-197*	
10/11	Discussion, week 2 - More tools: Southern blots (DNA fingerprinting), northern blots, western blots, cloning, blue white screening	• Watson 743-750; 768-769	**Problem Set 1 due Friday 10/11 @ 11:00am**
10/15	Transcriptional attenuation: Interplay of translation and transcription in the *trp* operon (feedback inhibition of gene expression, RNA structure/function)	• Watson 458-460; 464-466; 469-475 (optional review of translation) •Watson 638-640	
10/17	Phage Lambda: paradigm for a genetic switch (Regulatory cascade, antitermination)	• Watson 568-582	
10/18	Discussion, week 3 - Williams paper discussion - Work on operon models, bring lac and ara models	•*Williams, Science*	**Quiz Williams and Techniques**
10/22	Phage Lambda continued. (Stochasticism, positive autoregulation, cooperativity)	• Watson 582-584	
10/24	Translational control in prokaryotes Riboswitches (translational control, more RNA-mediated feedback regulation)	• Watson 479-481; 503-508 • Watson 633-637	
10/25	Discussion, week 4 - Operon Model show and tell - Review for midterm		**Problem Set 2 due Monday 10/28 @ 11:00**
10/29	**MIDTERM I**		

10/31	Eukaryotic genome organization and packaging (genome complexity, chromatin organization)	• Watson 140-144; 156-165; 169-173	
11/1	Discussion, week 5 -DNA sequencing, High throughput sequencing	• Watson 753-764	
11/5	Transcription in eukaryotes (general vs specific transcription factors, RNA polymerase recruitment, enhancers)	• Watson 396-406	
11/7	Control of transcription in eukaryotes: Gal regulon in yeast; steroid hormone response in animals	• Watson 589-598; 605-610; 618-620. • *Lodish 392-396*	
11/8	Discussion, week 6 -Midterm review OR paper search time		**Prob Set 3 due Friday 11/8 @ 11:00**
11/12	Influence of chromatin structure on transcription (X-chromosome inactivation, DNA and histone modifications)	• Watson 174-187; 657; 624-626	
11/14	mRNA processing in eukaryotes (5' cap, splicing, polyadenylation)	• Watson 406-410; 415-425	**Ben**
11/15	Discussion, week 7 -Modular organization of transcription factors: Yeast 2-hybrid assay - Establishment of distinct patterns of gene expression in different cells of multicellular organisms	• Watson p. 594; 661-664	
11/19	Regulation of mRNA processing in eukaryotes (alternative splicing, Drosophila sex determination)	• Watson 430-435; 439-445	
11/21	Translation and its control in eukaryotes	• Watson 482-487; 508-512	
11/22	Discussion, week 8 -Epigenetic silencing of tumor suppressor genes in cancer	• *Lodish 1063-1069* • *Merlo et al, Nat. Medicine*	**Quiz Lodish & Merlo** **Prob Set 4 due Monday 11/25 @ 11:00**
11/26	**MIDTERM II**		
11/28 **11/29**	Thanksgiving break		
12/3	Transposable Elements	• Watson 334-342; 347-351; 354-357	
12/5	Control of gene expression by small RNAs: RNAi and microRNAs	• Watson 641-655	
12/6	Discussion, week 10 - Paper project show and tell		**Prob Set 5 due Friday 12/8 @ 11:00**
12/10	**Tuesday 8:00 am FINAL EXAM (cumulative)**		