BI 320 MOLECULAR GENETICS
Fall 2010

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Office Hours
Jana: Klamath 15D, 4-5 on Tuesday and 3-4 on Thursdays
Claire: Onyx Bridge 360, 1-2 on Wednesdays and 2-3 on Thursdays

BI320 is an advanced undergraduate course covering gene expression and gene regulation in both procaryotic and eucaryotic 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 128 Chiles. To encourage active and effective listening in class, lecture notes will be posted on Blackboard **after** each lecture. You are *required* to attend one discussion section each week (33 Klamath, Fridays at 10:00, 11:00, and 1:00); however, you do NOT need to attend the section for which you are registered, and you may choose any section each week. These sessions will be used to clarify and expand upon material presented in lecture. Discussion Outlines will be posted on Blackboard to summarize much of the content planned for each Discussion, though changes/additions may be made. *Material presented in Discussions will be represented on exams.*

PLEASE BRING PRINTOUTS OF THE DISCUSSION OUTLINES AND ASSOCIATED FIGURES TO DISCUSSION SECTIONS.

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.

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, ***only three of which 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 graded problems on your own.* ***Working through ALL of the problems as independently as possible will provide the best preparation for the exams.***

Problem set due dates are indicated on the Syllabus. **Answers must be typed, and should be concise.** They should be turned in to the slot box labeled "BI320" next to Rm 13 Klamath. **Late problem sets cannot 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.* If, after reading the posted answer keys carefully, you feel that you have been graded unfairly, you can contact me. This should be done within one week of the date that the graded problem set is returned to you.

Exams

There will be two midterm exams and a final exam. All exams will be closed book. **However, you may bring one page of notes (written on both sides) to the midterm exams and two such pages to the final exam.** Your name must be written in ink on each page of the exam, but you may use either pen or pencil for your answers.

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 time by Tuesday October 5th (second week of class). Make up exams will not be scheduled after the fact.

YOU ARE EXPECTED TO KEEP ALL OF YOUR GRADED EXAMS AND PROBLEM SETS 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 three distributions:

Method A:

Discussion*	5%
Problem Sets	10%
Midterm I	22.5%
Midterm II	22.5%
Final Exam	40%

Method B:

Discussion*	5%
Problem Sets	10%
Midterm I	15%
Midterm II	30%
Final Exam	40%

Method C:

Discussion*	5%
Problem Sets	10%
Midterm I	30%
Midterm II	15%
Final Exam	40%

* 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 attempt at least 70% of the clicker questions. You **do not** need to answer the clicker questions correctly to get full credit.

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, 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 Disability Services in 164 Oregon Hall at 346-1155 or disabsrv@uoregon.edu

Course Outline: BI320 Spring 2010

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 *Italicized readings can be downloaded from Blackboard*	Problem Sets
9/28	Overview of Course Themes Procaryotic genome organization and transcription. (Second-site suppressors, protein structure/function)	• *Hartwell, 487-493* • Watson 136-140 • Watson 377-383 • Watson 794	
9/30	Positive and negative control of transcription initiation in prokaryotes: *lac* operon. (Dyad symmetry, allostery, cis/trans test)	• Watson 383-396; 563 • Watson 547-556	
10/1	Discussion, week 1 - principals of genetic analysis - techniques: PCR, DNA sequencing, DNA footprinting, gel mobility shift assays	• *Hartwell, pp 221-224* • Watson 739-747; 751-756; 776-778	
10/5	*lac* operon cont'd (Combinatorial control, dominant negative alleles, redundancy)	Watson 554-562	
10/7	Positive and negative control of transcription initiation in procaryotes: Arabinose operon (Negative autoregulation, DNA "looping")	Watson 567-568 • *Weaver 193-197*	
10/8	Discussion, week 2 - Dunn et al article: evidence for DNA looping in ara operon regulation; applying DNA footprinting	*Dunn et al, PNAS*	**Problem Set 1 due @ 4pm**
10/12	Phage Lambda: paradigm for a genetic switch (Regulatory cascade, antitermination)	• Watson 568-582	
10/14	Phage Lambda continued. (Stochasticism, positive autoregulation, cooperativity)	• Watson 582-584	
10/15	Discussion, week 3 - further exploration of lambda regulatory circuits - More tools: Northern blots, Western blots	•*Williams, Science* • Watson 744-745; 768-769	
10/19	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	
10/21	Translational control in prokaryotes Riboswitches (translational control, more RNA-mediated feedback regulation)	• Watson 479-480; 503-508 • Watson 633-637	
10/22	Discussion, week 4 - translational control in procaryotes: - review for midterm		**Problem Set 2 due @ 4pm**

10/26	**MIDTERM I**		
10/28	Eucaryotic genome organization and packaging (genome complexity, chromatin organization)	• Watson 140-144; 156-165; 169-173	
10/29	Discussion, week 5 -Southern blots, restriction enzymes, DNA fingerprinting	• Watson 742-745	
11/2	Transcription in eucaryotes (general vs specific transcription factors, RNA polymerase recruitment, enhancers)	• Watson 396-406	
11/4	Control of transcription in eucaryotes: Gal regulon in yeast; steroid hormone response in animals	• Watson 589-598; 605-610; 618-620. • *Lodish 392-396*	
11/5	Discussion, week 6 -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	**Prob Set 3 due @ 4pm**
11/9	Influence of chromatin structure on transcription (X-chromosome inactivation, DNA and histone modifications)	• Watson 174-187; 657; 624-626	
11/11	mRNA processing in eucaryotes (5' cap, splicing, polyadenylation)	• Watson 406-410; 415-425	
11/12	Discussion, week 7 Epigenetic silencing of tumor suppressor genes in cancer	• *Lodish 1063-1069* • *Merlo et al, Nat. Medicine*	
11/16	Regulation of mRNA processing in eucaryotes (alternative splicing, Drosophila sex determination)	• Watson 430-435; 439-445	
11/18	Translation and its control in eucaryotes	• Watson 482-487; 508-512	
11/19	Discussion, week 8 - review for midterm	• *Beaumont, Nature Genetics*	**Prob Set 4 Due @ 4pm**
11/23	**MIDTERM II**- material through mRNA processing (translational control to be covered on Final Exam)		
11/25 & 11/26	Thanksgiving holiday, have fun and safe travels		
11/30	Transposable Elements	• Watson 334-342; 347-351; 354-357	
12/2	Control of gene expression by small RNAs: RNAi and microRNAs	• Watson 641-655	
12/3	Discussion, week 10- Review for final		**Prob Set 5 Due @ 4pm**
12/9	**THURSDAY 8:00 am FINAL EXAM (cumulative)**		