

BI 320, MOLECULAR GENETICS Summer 2023

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Office hour: MW 11am-noon*

*Office hours will be held via Zoom on the Canvas course website. *or by appointment*

BI 320 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 mastery of the material presented in BI 282H/BI 214 and with a basic 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 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 genetic studies. We will discuss how studies with these model organisms established fundamental principles, and how these principles and approaches apply to more complex creatures.

Major Learning Objectives:

In this class you will:

- Become familiar with prokaryotic and eukaryotic gene architecture and how it relates to regulation of gene expression. Understand the similarities and differences between the gene architecture of prokaryotes and eukaryotes along with the consequences on expression regulation.
- Understand the differences between coordinate regulation of gene expression in prokaryotes and eukaryotes.
- Understand the applications and limitations of common genetic techniques and be able to interpret data from these techniques.
- Be able to: 1) use your understanding of genetics to propose hypotheses for the mechanisms for gene regulation and maintenance of genome integrity, and 2) use your understanding of common genetic techniques to propose a means of testing these hypotheses.
- Understand how chromatin organization and modification in eukaryotes influences gene expression.
- Become familiar with basic RNA processing in eukaryotes and how this processing can be differentially regulated.

Course Format:

Important notice:

Posting course material including videos, lecture notes, problems, and solutions, on any platform that is not officially affiliated with the course is prohibited and will be treated as academic misconduct, reported to the Dean of Students Office, and result in an F grade in the course. This applies during the course and retroactively. If you have questions about what is appropriate and what is not, please ask. Ignorance will not be an acceptable defense. Cheating of any kind is strictly prohibited (see "Academic Honesty" section below). If found responsible for a violation of the Student Conduct Code related to the misconduct described above and below, you can expect to be subject to disciplinary action which will be reportable on your student record and include a failing grade in the course.

Videos:

Content - Mandatory

The main content lectures will be presented in pre-recorded videos that will be posted to Canvas as assignments. The videos are courtesy of another University of Oregon instructor, Diana Libuda, PhD. You will be responsible for all the content presented in the videos. Videos will be posted at the beginning of each week. Please immediately notify the instructor of any technological issues. Do not wait until just before assessment deadlines to watch these videos; you will not be given a last-minute extension on due dates because of technical problems with the videos.

Zoom lectures:

Optional Live Class Sessions
MWF 10:00-10:50am (PAC) via Zoom
Content – Mandatory
Attendance – Optional

The live class sessions on Mondays, Wednesdays, and Fridays will provide live engagement and application of the content presented in these pre-recorded lecture videos. These classes will either be: 1) review key concepts from the course material covered in the videos prior to the zoom lecture, 2) cover standard techniques used in Molecular Genetics, or 3) provide a review of the material covered for an upcoming exam. You will be responsible for all the content presented in the lectures. Lectures will be recorded and posted to the Canvas website after the designated class time.

Course Communication:

Announcements will be made via the Canvas website. Office hours will be held via Zoom on the Canvas website. For questions regarding the course and lecture material (outside of office hours), please email your instructor. I will be intermittently available by email weekdays 9:00am-5:00pm (PAC), and I will do my best to respond to your email within 24 hours. This does not apply to evenings, nights or weekends.

Canvas Site:

The UO Canvas Site will be used to distribute all information for the class, including exams and lectures. Please familiarize yourself with the site, print the lecture notes and readings, and consult it frequently for announcements and updates. Please make sure that your Canvas settings allow Canvas to email you when new announcements are posted.

Assigned Reading:

Everyone approaches reading assignments differently; if you are comfortable with the material presented in lecture, then you might want to do the reading after lecture to deepen your understanding; however, if you struggle to keep up in lecture, then you might find it more useful to do the reading before lecture.

Textbook. *Molecular Biology: Principles and Practices*, 2nd edition (Cox, Doudna, and O'Donnell) readings are listed at the end of this syllabus.

Excerpts from other texts. Since the text does not cover some topics in depth, assigned readings from other sources are available as PDF files on Canvas. These are listed in the course outline in *italic* text.

****The MIDTERM EXAM is scheduled to be taken at your leisure over the following period of time: Thursday 8-3-23 (exam opens at 9:00am PAC) to Friday 8-4-23 (exam closes promptly at noon)****

****The FINAL EXAM is scheduled to be taken at your leisure over the following period of time: Thursday 8-17-23 (exam opens at 9:00am PAC) to Friday 8-18-23 (exam closes promptly at noon)****

Grading Policy:

The final course grade will be calculated by the distributions below.

Assignment	Total points	% Total grade
Importance of Diversity in Sci. (short paper)	25	5%
Problem Sets (4)	100 (25 pts ea.)	20%
Quizzes (6, lowest grade will be dropped)	125 (25 pts ea.)	25%
Midterm Exam	100	20%
Final Exam	125 (graded out of 100 pts)	25%
Exam notes (2)	25 (up to 10 pts and 15 pts, respectively)	5%
TOTAL	500	100%
Extra credit opportunity (2)	10 (up to 5 pts ea.)	2%

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

Importance of Diversity in Science (short paper, 250-500 words, typed; 5% of course grade): A self-reflection on how your background influences your scientific interests.

Problem Sets (20%): 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. Problem sets must be turned in via the Canvas website by 5pm on the indicated due date. *The grader will not provide detailed written feedback on grades, so please check the answer key for details about the answers.*

Quizzes (25%): Quizzes will be taken on the Canvas website and will be multiple choice. They will cover lecture material presented since the previous quiz. There will be 6 quizzes in total and the lowest quiz score will be dropped. You will have 60 minutes to complete the quizzes on Canvas before 11:59pm on the indicated day. You may use your notes and textbook to answer the questions.

Midterm and Final (45%): Exams will be administered on the Canvas website and will be open book and open notes. You may not consult with anyone while taking the exam, nor may you utilize any resources (including internet resources). The emphasis will be on testing your understanding of the concepts, not your ability to memorize facts. You will have a **27 hour window** in which to take your exam; both exams will open at 9:00am (PAC) on a Thursday and close promptly at noon (PAC) on Friday. Once the exam is started, you will only have 90 minutes to complete the midterm and 120 minutes to complete the final. Thus, it would be unwise to start your exam at 11:00am on Friday as you will be kicked out of the exam right at noon, giving yourself only 60 minutes for your exam. Because of the flexibility afforded you to take your exam within a broad window of time, **NEITHER EARLY EXAMS NOR MAKE-UP EXAMS WILL BE GIVEN UNDER ANY CIRCUMSTANCES!** If you have accommodations through the accessible education center (AEC), then you must make sure the AEC has emailed your instructor at least 3 days before the exams to have your accommodations applied.

Midterm (20%): On Canvas, Thursday 8-3-23 (opens at 9:00am [PAC]) to Friday 8-4-23 (closes promptly at noon [PAC]). This exam will cover material from Videos 1-6, including techniques described in zoom lectures. You will have 90 minutes (1.5 hours) to complete the exam on Canvas once started. You are not allowed to consult with anyone else while taking this exam.

Final Exam (25%): On Canvas, Thursday 8-17-23 (opens at 9:00am [PAC]) to Friday 8-18-23 (closes promptly at noon [PAC]). This exam will cover material from the entire course. You will have 120 minutes (2 hours) to take your exam on Canvas once started. You are not allowed to consult with anyone else while taking this exam.

Exam Notes (5%): A copy of your handwritten notes must be turned in immediately following your exam (within 15 minutes) via the Canvas website. They must be handwritten **ONLY**, including drawing images! Preparation of notes on a computer or tablet will not be accepted. A picture or scan of your notes will suffice; make sure the image is high resolution.

For the Midterm Exam, please prepare:

- One page of notes, handwritten on both sides.
- Can earn up to 10 points.

For the Final Exam, please prepare:

- Two pages of handwritten notes, handwritten on both sides.
- Can earn up to 15 points.

Extra Credit Assignments (extra credit on midterms): Create a meme based on the course material covered in the exam. Please see the assignment description on the Canvas website. For examples of science memes:

<https://www.buzzfeednews.com/article/alexkasprak/best-science-memes>

Submit your Memes via the Canvas website by 5pm on the Friday following the exam. Only a single meme per exam may be submitted. For each meme, extra credit will be given up to 5 pts per exam.

Tentative Course Outline: BI 320 Winter 2021

Text: Molecular Biology: Principles and practices, 2nd ed, Cox, Doudna, and O'Donnell. Abbreviated as "Cox" below.

Other readings are *italicized* below and can be downloaded from Canvas.

	Materials for the week	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1: Prokaryotic transcription, gene expression, and gene regulation	<p>Videos</p> <p>-V1: Prokaryotic genome and mutations</p> <p>-V2: Transcription initiation</p> <p>-V3: Promoter and transcription termination</p> <p>-V4: lac operon</p> <p>Files</p> <p>-V1: Slides ↓, Notes</p> <p>-V2: Slides ↓, Notes</p> <p>-V3: Slides ↓, Notes</p> <p>-V4: Slides ↓, Notes</p> <p>Readings</p> <p>-V1: Hartwell 221-224 ↓</p> <p>-V2: Cox 31-43, 520-536; Hartwell 487-493 ↓</p> <p>-V3: Cox 526-536</p> <p>-V4: Cox 694-702</p> <p>-Techniques: Cox 136-142, 199, 212-216, 221-226, 241-242, 700-701</p>	<p>24</p> <p>Optional Zoom Lecture, 10-11am: course logistics</p> <p>Molly zoom office hour, 11-12pm</p>	<p>25</p> <p>Quiz 1 (V1 and V2): due by 11:59pm</p>	<p>26</p> <p>Optional Zoom Lecture, 10-11am</p> <p>Molly zoom office hour, 11-12pm</p>	<p>27</p> <p>Diversity in stem paper: due by 11:59pm</p>	<p>28</p> <p>Optional Zoom Lecture, 10-11am: techniques</p> <p>Quiz 2 (V3 and V4): due by 11:59pm</p>
Week 2: Prokaryotes continued	<p>Videos</p> <p>-V5: lac operon continued</p> <p>-V6: trp operon and transcriptional attenuation</p> <p>Files</p> <p>-Problem Set 1 (word ↓) (pdf ↓)</p> <p>-Problem Set 1 Key</p> <p>-V5: Handout ↓</p> <p>-V5: Slides ↓, Notes</p> <p>-V6: Slides ↓, Notes</p> <p>Readings</p> <p>-V5: Cox 667-680</p> <p>-V6: Cox 618-622, 704-705</p>	<p>31</p> <p>Optional Zoom Lecture, 10-11am</p> <p>Molly zoom office hour, 11-12pm</p> <p>Problem Set 1 (V1-6): due by 5pm</p>	<p>1</p> <p>Quiz 3 (V5 and V6): due by 11:59pm</p>	<p>2</p> <p>Optional Zoom Lecture, 10-11am: REVIEW</p> <p>Molly zoom office hour 11-12pm</p>	<p>3</p> <p>Midterm Exam (V1-6), opens at 9am, limit=90 mins</p> <p>Notes submission: due within 15 minutes of your exam submission</p>	<p>4</p> <p>No Zoom Lecture</p> <p>Midterm Exam closes at noon (12pm)</p> <p>Extra credit (meme on V1-6 material): due at 5pm</p>

<p>Week 3: Eukaryotic transcription, gene expression, and gene regulation</p>	<p>Videos</p> <p>-V7: Eukaryotic genome, GTFs, and RNA polymerase</p> <p>-V8: Gal regulon, steroid hormone response, STF, PPEs, enhancers, and insulators</p> <p>-V9: Chromatin organization and modifications</p> <p>-V10: Examples of histone regulation of transcription</p> <p>Files</p> <p>-Problem Set 2 (word ↓) (pdf ↓)</p> <p>-Problem Set 3 (word ↓) (pdf ↓)</p> <p>-Problem Set 2 Key</p> <p>-Problem Set 3 Key</p> <p>-V7: Slides ↓ Notes</p> <p>-V8: Slides ↓ Notes</p> <p>-V9: Slides ↓ Notes</p> <p>-V10: Slides ↓ Notes</p> <p>Readings</p> <p>-V7: Cox 260-275, 537-547</p> <p>-V8: Cox 682-686, 736-752</p> <p>-V9: Cox 332-360, 728-730</p> <p>-V10: 332-360</p> <p>Techniques: Cox 226-232, 345, 347, 732-733</p>	<p>7</p> <p>Optional Zoom Lecture, 10-11am: technique</p> <p>Molly zoom office hour 11-12pm</p> <p>Quiz 4 (V7 and V8): due by 11:59pm</p>	<p>8</p> <p>Problem Set 2 (V7 and V8): due by 5pm</p>	<p>9</p> <p>Optional Zoom Lecture, 10-11am: techniques</p> <p>Molly zoom office hour 11-12pm</p>	<p>10</p> <p>Quiz 5 (V9-10): due by 11:59pm</p>	<p>11</p> <p>Optional Zoom Lecture, 10-11am</p> <p>Problem Set 3 (V8-10): due by 5pm</p>
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<p>Week 4: Other types of gene regulation</p>	<p>Videos</p> <p>-V11: CRISPR-Cas9 gene editing</p> <p>-V12: Transposable elements</p> <p>-V13: microRNA and RNAi</p> <p>Files</p> <p>-Problem Set 4 (word ↓) (pdf ↓)</p> <p>-Problem Set 4 Key</p> <p>-V11: Slides ↓ Notes</p> <p>-V12: Slides ↓ Notes</p> <p>-V13: Slides ↓ Notes</p> <p>Readings</p> <p>-V11: Cox 246-248</p> <p>-V12: Cox 496-507</p> <p>-V13: Cox 774-780</p> <p>Techniques: Cox 243-244</p>	<p>14</p> <p>Optional Zoom Lecture, 3-4pm (NOTE DIFFERENT TIME!): techniques</p> <p>Molly zoom office hour 4-5pm (NOTE DIFFERENT TIME!)</p> <p>Quiz 6 (V11 and V12): due by 11:59pm</p>	<p>15</p> <p>Problem Set 4 (V11-13): due by 5pm</p>	<p>16</p> <p>Optional Zoom Lecture, 10-11am: REVIEW</p> <p>Molly zoom office hour 11-12pm</p>	<p>17</p> <p>Final Exam (V1-6 and V8-13), opens at 9am, limit=120 mins</p> <p>Notes submission: due within 15 minutes of your exam submission</p>	<p>18</p> <p>No Zoom Lecture</p> <p>Final Exam closes at noon (12pm)</p> <p>Extra credit (meme on V8-13 material): due at 5pm</p>
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EXTRA INFORMATION

Academic Honesty:

Academic dishonesty includes various forms of "cheating" and will not be tolerated. Academic dishonesty includes but is not limited to:

1. Copying another person's answers to exam and quiz questions.
2. Utilizing materials otherwise not allowed on exam (e.g. textbooks, more than the allocated pages of notes, internet access, etc.).
3. Having someone else take your exams.
4. Altering an exam for a regrade.
5. Copying problem set answers from others.
6. Obtaining/distributing previous exams if those exams are not made available by the instructor to everyone in the class.
7. Submitting clicker questions for other students.
8. Misrepresenting circumstances leading to missed classes, exams, or quizzes.

All such activities will be reported to the Dean of Students office and will result in a failing grade in the class if academic dishonesty is confirmed. For further definitions of cheating and its penalties, consult the University of Oregon Student Conduct Code <https://policies.uoregon.edu/vol-3-administration-student-affairs/ch-1-conduct/student-conduct-code>.

Learning Environment:

The University of Oregon and I 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

Reporting:

The instructor of this class is a Student-Directed Employee. As such, if you disclose to me, I will respond to you with respect and kindness. I will listen to you, and will be sensitive to your needs and desires. I will not judge you. I will support you. As part of that support, I will direct students who disclose sexual harassment or sexual violence to resources that can help. I will only report the information shared to the university administration when you as the student requests that the information be reported (unless someone is in imminent risk of serious harm or is a minor). Please note the difference between 'privacy' and 'confidentiality.' As a Student-Directed Employee I can offer privacy because I am not required to report certain information to the university. However, I cannot be bound by confidentiality in the same way that a counselor or attorney is. Confidential resources such as these means that information shared is protected by federal and state laws. Any information that I as a student-directed employee receive may still be accessed by university or court proceedings. This means, for example, that I could still be called as a witness or required to turn over any related documents or notes I keep.

Please note also that I am required to report all other forms of prohibited discrimination or harassment to the university administration. Specific details about confidentiality of information and reporting obligations of employees can be found at titleix.uoregon.edu.

Class Courtesy

Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the quarter (or before) so that I may address you properly.

Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities. Classroom courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Our classroom is a learning environment, and as such should be a safe, inclusive and respectful place. Being respectful also includes using preferred pronouns for your classmates. Disrespecting fellow students as well as combative approaches, tones and/or actions are not acceptable. Please make me aware if there are classroom dynamics that impede your (or someone else's) full engagement.