

BI 320, MOLECULAR GENETICS
Fall 2021

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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.

Lectures: The main content lectures will be presented on Tuesdays and Thursdays in-person.

Discussions: Friday class sessions will either: cover standard techniques used in Molecular Genetics or provide a review of the material covered on an upcoming exam. Discussion attendance and participation is required.

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 utilize the "Discussion" part of Canvas to post questions. We will try to answer your questions as soon as possible.

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, download and 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. library.

Excerpts from other texts. Since the text does not cover some topics in depth, assigned readings.

Grading Policy:

The final course grade will be calculated by the distributions below. Please make note of the due dates.

Assignment	% of final grade	Due date
Problem Sets (4)	20% (200)	see schedule
Importance of Diversity in Science (short paper)	2% (20)	10/29
Quizzes (7, but drop lowest score)	28% (280)	see schedule
Midterm 1	10% (100)	10/19
Midterm 2	10% (100)	11/11
Final Exam	20% (200)	12/8
Exam notes	2% (20)	after midterms and final
Participation (Weekly reflections (5) and Discussions (5) and 9 of each, but drop lowest score in each)	8% (80)	see schedule
Extra Credit Assignments		
Meme/Tik Tok on Midterm 1 Material	up to 5 pts on Midterm 1	
Meme/Tik Tok on Midterm 2 Material	up to 5 pts on Midterm 2	

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

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 on the indicated due date. *I will not provide detailed written feedback on grades so please check the answer key for details about the answers.*

Importance of Diversity in Science (short paper, ~500 words, typed; 2% of course grade): A self-reflection on diversity in science. See Canvas assignment for details. Due on 10/29.

Quizzes (28%): Quizzes will be taken on the Canvas website and will be multiple choice or short answer. They will cover lecture material presented since the previous quiz. There will be 7 quizzes in total, but your lowest quiz score will be dropped. You will have 45 minutes to complete the quizzes on Canvas before 5pm on the indicated day. You may use your notes and textbook to answer the questions.

Midterms and Final (50%): Exams will be administered on the Canvas website. 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. I will grade the exams. If you feel that you have been graded unfairly, you must submit your reasoning to the instructor in writing, within one week of the day the exam is returned to you. Attach the original exam to your request.

Midterm 1 (10%): 10/19. Posted to Canvas. Have 8 hours to complete, once you start, you have a 80 minute window. This exam will cover material from the beginning of the course through Lecture 6, including Discussion material. You will have the entire 1.5 hour scheduled class time to take your exam on Canvas. You are not allowed to consult with anyone else while taking this exam.

Midterm 2 (10%): 11/15. Posted to Canvas. Have 8 hours to complete, once you start, you have a 80 minute window. This exam will cover material from Lecture 7 through Lecture 12 and Discussion material. You will have the entire 1.5 hour scheduled class time to take your exam on Canvas. You are not allowed to consult with anyone else while taking this exam. If you take your exams through the accessible education center (AEC), then you must sign up with the AEC at least a week in advance.

Final Exam (20%): 12/8. Posted to Canvas. Have 8 hours to complete, once you start, you have a 120 minute window. This exam will cover material from the entire course. You will have 2 hours to take your exam on Canvas. Exam is comprehensive. You are not allowed to consult with anyone else while taking this exam. If you take your exams through the accessible education center (AEC), then you must sign up with the AEC at least a week in advance.

Exam Notes (2%): A copy of your notes must be turned in immediately following your exam via the Canvas website. A picture or scan of your notes will suffice. If the resolution of the image of the notes is not sufficient, then we will contact you.

For each Midterm, please prepare:

- One page of notes, handwritten on both sides.

For the Final Exam, please prepare:

- Two pages of handwritten notes, handwritten on both sides.

Weekly Reflection and Discussion Participation (8%): This component of the grade will take into account your reflections based on the given prompts, each week, as well as your attendance in Discussion sections. Each reflection is 5 points, and each Discussion is 5 points. Lowest Reflection and Discussion scores are dropped

Extra Credit Assignments (extra credit on midterms): Create a meme or Tik Tok 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 or Tiki Tok 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 midterm.

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 uoac@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.

COVID Containment Plan for Classes

As the University of Oregon returns to in-person instruction, the key to keeping our community healthy and safe involves **prevention, containment, and support**. Here is information critical to how the UO is responding to COVID-19.

- **Prevention:** To prevent or reduce the spread of COVID-19 in classrooms and on campus, all students and employees:
 1. Must to be comply with [vaccination policy](#)
 2. Must [wear face coverings](#) in all indoor spaces on UO campus
 3. Complete weekly [testing](#) if not fully vaccinated or exempted
 4. [Wash hands](#) frequently and practice social distancing when possible
 5. Complete daily [self-checks](#)
 6. Stay home/do not come to campus if feeling [symptomatic](#)
 7. Complete the UO [COVID-19 case and contact reporting form](#) if you test positive or have been in close contact with a confirmed or presumptive case.
- **Containment:** If a student in class tests positive for COVID-19, all relevant classes will be notified via an email by the Corona Corps Care Team with instructions for students and staff based on their vaccination status. Specifically:
 1. **Vaccinated and Asymptomatic students:** Quarantine not required, but daily self-monitoring before coming on campus is advised; sign up for testing through MAP 3-5 days after exposure if advised you are a contact.”
 2. **Unvaccinated or partially vaccinated students:** 14-day quarantine advised – do not come to class – and sign up for testing 3-5 days after notification through [MAP](#), if asymptomatic, or through University Health Services (541-346-2770) or your primary care provider, if symptomatic.
 3. **Symptomatic students:** stay home (do not come to class/campus), complete the online [case and contact form](#), and contact University Health Services (541-346-2770) or your primary care provide to arrange for immediate COVID-19 testing.

Students identified as a **close contacts** of a positive case will be contacted by the Corona Corps Care Team (541-346-2292).

- **Support:** The following resources are available to you as a student.
 - [University Health Services](#) or call (541) 346-2770
 - [University Counseling Center](#) or call (541) 346-3277 or (541) 346-3227 (after hrs.)
 - [MAP Covid-19 Testing](#)
 - [Corona Corps](#) or call (541) 346-2292
 - [Academic Advising](#) or call (541) 346-3211
 - [Dean of Students](#) or call (541)-346-3216

Good Classroom Citizenship

- Wear your **mask** and make sure it fits you well

- **Stay home** if you're sick
- **Get to know your neighbors** in class, and let them know if you test positive
- **Get tested** regularly
- Watch for **signs and symptoms** with the daily symptom self-check
- **Wash your hands** frequently or use hand sanitizer

Complete the UO COVID-19 [case and contact reporting form](#) if you test positive or are a close contact of someone who tests positive.

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 Outline: BI 320 Fall 2021

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

Date	Topic (Concepts)	Reading Cox 2nded.	Notes:
Week 1	Lecture 1 Foundations of molecular genetics, studying genes Lecture 2 Studying genes Diversity in Science Prompt posted	• 43-54, 212-217, 220-223, 226-232, 239-244, 246-248 (CRISPR)	
9/29	Week 1 Reflection posted		
10/1	Discussion 1 -Techniques: PCR, gel mobility shift assays, Restriction enzymes	• 136-142, 199, 212-216, 221-226, 241-242, 700-701	
Week 2	Lecture 3 Genome organization in eukaryotes vs. prokaryotes, DNA mutations Lecture 4 Modifications to the genome: transpositions, hybrid recombination	• 260-269, 414-423, 486-487, 496-500, 502-507, 510-511	
10/3	Week 1 Reflection due		Midnight
10/4	Quiz 1 due @ 5pm (Via Canvas)		5pm
10/6	Week 2 Reflection posted		
10/8	Discussion 2 -Techniques: Northern, Southern and Western blots	• 136-142, 199, 212-216, 221-226, 241-242, 700-701	
10/9	Problem Set 1 Posted		
Week 3	Lecture 5 Chromosomes, nucleosomes, chromatin Lecture 6 Nucleosomes, chromatin	• 298-304, 332-353	
10/10	Week 2 Reflection due		Midnight
10/11	Quiz 2 due @ 5pm (Via Canvas)		5pm
10/13	Week 3 Reflection posted		
10/15	Discussion 3 Exam Review		
10/16	Problem Set 1 Due		Midnight
Week 4	Lecture 7 Transcription basics and in bacteria	• 520-536	
10/19	MIDTERM 1 (COVERS LECTURES 1-6 and Discussions)		Opens at 8am, Due no later than 5pm.
10/17	Week 3 Reflection due		Midnight
10/20	Week 4 Reflection posted		
10/22	Discussion 4 -Techniques: DNA sequencing, High throughput sequencing	226-232	
10/23	Problem Set 2 Posted		

Week 5	Lecture 8: Transcription in eukaryotes Lecture 9: RNA processing I	•537-545 •554-564	
10/24	Week 4 Reflection due		Midnight
10/25	Quiz 3 due @ 5pm (Via Canvas)		5pm
10/27	Week 5 Reflection posted		
10/29	Discussion 5 Covid testing: PCR and antigen tests mRNA vaccines Diversity in Science Short Paper Due		
10/30	Problem Set 2 Due		Midnight
Week 6	Lecture 10 : RNA processing II Lecture 11: The genetic code	• 564-579 • 590-604	
10/31	Week 5 reflection due		Midnight
11/1	Quiz 4 due @ 5pm (Via Canvas)		5pm
11/3	Week 6 reflection posted		
11/5	Discussion 6 ChIP, ChIP-sequencing, HiC		
11/6	Problem Set 3 Posted		
Week 7	Lecture 12: Protein Synthesis I	• 618-630	
11/7	Week 6 reflection due		Midnight
11/8	Quiz 5 due @ 5pm (Via Canvas)		5pm
11/10	Week 7 reflection posted		
11/12	Discussion 7 Exam Review		
11/13	Problem Set 3 Due		Midnight
Week 8	Lecture 13 Protein Synthesis II Lecture 14 Transcriptional regulation in eukaryotes I	• 639-647 • 727-750 • 759-793, 650-652	
11/14	Week 7 reflection due		
11/15	MIDTERM 2 (COVERS LECTURES 7-11 and Discussions)		Opens at 8am, Due no later than 5pm.
11/17	Week 8 reflection posted		
11/19	Discussion 8 TBA		
11/20	Problem Set 4 Posted		
Week 9	Lecture 15 Transcriptional regulation in eukaryotes II	• 639-647 • 727-750	
11/21	Week 8 reflection due		
11/22	Quiz 6 due @ 5pm (Via Canvas)		
11/24	Week 9 reflection posted		
11/27	Problem Set 4 Due		
Week 10	Lecture 17 Post-transcriptional regulation in eukaryotes I Lecture 18 Post-transcriptional regulation in eukaryotes II		
11/28	Week 9 reflection due		
12/3	Discussion 9 Exam Review		
12/3	Quiz 7 due @ 5pm (Via Canvas)		
12/8	FINAL EXAM (comprehensive)	•	Opens at 8am, Due no later than 5pm.

*Early exams will not be given under any circumstances.

Sept to Dec Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27	28 Lecture 1 <i>Diversity in Science Paper Posted</i>	29 WEEKLY REFLECTION POSTED	30 Lecture 2	1 (OCTOBER!) Discussion 1	2
3 WEEKLY REFLECTION DUE	4 Quiz 1	5 Lecture 3	6 WEEKLY REFLECTION POSTED	7 Lecture 4	8 Discussion 2	9 Problem Set 1 posted
10 WEEKLY REFLECTION DUE	11 Quiz 2	12 Lecture 5	13 WEEKLY REFLECTION POSTED	14 Lecture 6	15 Discussion 3 (exam review)	16 Problem Set 1 Due
17 WEEKLY REFLECTION DUE	18	19 MidTerm 1	20 WEEKLY REFLECTION POSTED	21 Lecture 7	22 Discussion 4	23 Problem Set 2 posted
24 WEEKLY REFLECTION DUE	25 Quiz 3	26 Lecture 8	27 WEEKLY REFLECTION POSTED	28 Lecture 9	29 Discussion 5 <i>Diversity in Science Paper Due</i>	30 Problem Set 2 due
31 WEEKLY REFLECTION DUE	1 (NOVEMBER!) Quiz 4	2 Lecture 10	3 WEEKLY REFLECTION POSTED	4 Lecture 11	5 Discussion 6	6 Problem Set 3 posted
7 WEEKLY REFLECTION DUE	8 Quiz 5	9 Lecture 12	10 WEEKLY REFLECTION POSTED	11 NO CLASS	12 Discussion 7 (exam review)	13 Problem Set 3 due
14 WEEKLY REFLECTION DUE	15 MidTerm 2	16 Lecture 13	17 WEEKLY REFLECTION POSTED	18 Lecture 14	19 Discussion 8	20 Problem Set 4 posted
21 WEEKLY REFLECTION DUE	22 Quiz 6	23 Lecture 15	24 WEEKLY REFLECTION POSTED	25 NO CLASS	26 NO CLASS	27 Problem Set 4 due
28 WEEKLY REFLECTION DUE	29	30 Lecture 16	1 (DECEMBER!)	2 Lecture 17	3 Discussion 9 (exam review) Quiz 7	4
5	6	7	8 FINAL	9	10	11