BI 320, MOLECULAR GENETICS
Winter 2021

Diana Libuda PhD, Instructor	E-mail:	dlibuda@uoregon.edu	Office hours: 9-10am Mon*
Lila Kaye, GE	E-mail:	lkaye@uoregon.edu	Office hours: 4-5pm Tues*
John O'Hara-Smith, GE	E-mail:	joharasm@uoregon.edu	Office hours: 9-10am Thurs*
Shannon Snyder, GE	E-mail:	ssnyder3@uoregon.edu	Office hours: 10-11am Fri*

*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.

Lectures and Discussion Sections:

Pre-Recorded Lectures

Content - Mandatory

The main content lectures will be presented in pre-recorded videos that will be posted to the "Panopto Recordings" section of the Canvas website. You will be responsible for all the content presented in the videos. Videos will be posted at the beginning of the 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. The live class sessions on Thursdays (of the same week) and Tuesdays (of the next week) will provide live engagement and application of the content presented in these pre-recorded lectures.

Tuesdays

Optional Live Class Session

10:15-11:45am via Zoom

Content – Not mandatory

Attendance – Optional

Tuesday class sessions will be live and will either: 1) relate the material covered in the previous week to ongoing COVID-19 research, treatments, vaccines, and testing; or, 2) review key concepts from the course material covered the previous week. These class sessions are for your interest only and you are NOT responsible for the content covered in these sessions. These classes will be recorded and posted to the Canvas website after the designated class time.

****MIDTERMS will be scheduled during class time on Tuesday 1/26 and 2/23.****

Thursdays

Live Lecture on Molecular Genetics Techniques ("Techniques Lecture")

10:15 – 11:45am via Zoom

Content – Mandatory

Attendance – Recommended but Optional

Thursday class sessions will be live and will either cover standard techniques used in Molecular Genetics or provide a review of the material covered on an upcoming exam. You will be responsible for all the content presented in the live Thursday lecture. Lectures will be recorded and posted to the Canvas website after the designated class time.

Live Discussion Sections

12:30-1:30pm; 2-3pm; 3:30-4:30pm; 5-6pm via Zoom

Attendance – Mandatory

The discussion sections will be live and will utilize active learning to answer one of the questions on the problem sets, or provide a review of the material covered on an upcoming exam. Attendance at discussion sections is mandatory and will constitute 2% of your grade. If you have to miss a discussion section, then please inform the instructor immediately so that we can assign a make-up assignment.

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. Copies of the textbook will be available in the science library.

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

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)	10%	see schedule
Importance of Diversity in Science (short paper)	2%	1/11
Quizzes (5, lowest grade will be dropped)	20%	see schedule
Midterm 1	20%	**1/26**
Midterm 2	20%	**2/23**
Final Exam	25%	**3/16**
Exam notes	1%	after midterms and final
Participation	2%	
Extra Credit Assignments		
Meme on Midterm 1 Material	up to 5 pts on Midterm 1	
Meme 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 (10%): 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. *GE 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, 250-500 words, typed; 2% of course grade): A self-reflection on how your background influences your scientific interests. Due on 1/11.

Quizzes (20%): 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 5 quizzes in total and the lowest quiz score will be dropped. You will have 60 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 (65%): 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. I will grade the exams with the GEs. 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. **EARLY EXAMS WILL NOT BE GIVEN UNDER ANY CIRCUMSTANCES!**

Midterm 1 (20%): Tuesday, January 26th at 10:15am on Canvas. This exam will cover material from the beginning of the course through Lecture 6, including Techniques Lectures 1-2. 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.

Midterm 2 (20%): Tuesday, February 23rd at 10:15am on Canvas. This exam will cover material from Lecture 7 through Lecture 10 and Techniques Lectures 3-4. 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 (25%): 8:00am on Tuesday, March 16th on Canvas. This exam will cover material from the entire course. You will have 2 hours 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.

Exam Notes (1%): 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.

Participation (2%): This component of the grade will take into account participation and attendance in discussion sections. If you have to miss a discussion section, then please inform the instructor immediately so that we can assign a make-up assignment.

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 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 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.

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.

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.

Date	Topic (Concepts)	Reading Cox 2nd ed.	Due dates
Week 1	**Pre-recorded Lectures** (Diana Libuda) **Lecture 1** -Types of mutations **Lecture 2** -Prokaryotic genome organization -Transcription initiation (cis elements and trans factors).	• *Hartwell 221-224* • Cox 31-43 • *Hartwell 487-493* • Cox 520-536	
1/5	**Course Logistics Meeting** (Diana Libuda) -Overview of Course Themes and Organization		
1/7	**Techniques Lecture 1** (GE: John O'Hara-Smith) -Techniques: PCR, gel mobility shift assays, blue/white screening	• Cox 199, 221-226, 136-142, 700-701	
1/7	**Discussion, week 1** (GEs: Lila Kaye and Shannon Snyder) Problem Set 1 Question		
1/8			• **Quiz 1 due @ 5pm**
Week 2	**Pre-recorded Lectures** (Diana Libuda) **Lecture 3** -A closer look at the promoter and how mutational analysis can be used to identify it -Prokaryotic Termination and palindromic sequences **Lecture 4** -Positive and negative control of transcription initiation in prokaryotes: *lac* operon. (Dyad symmetry, allostery, cis/trans test)	• Cox 526-536 • Cox 694-702	
1/11			**Diversity in STEM paper due @ 5pm (2%)**
1/12	**Optional Class Session** (Diana Libuda) -PCR test for COVID-19		
1/14	**Techniques Lecture 2** (GE: John O'Hara-Smith) -Techniques: Restriction enzymes, Southern blots, northern blots, western blots	• Cox 199, 212-216, 241-242	
1/14	**Discussion, week 2** (GEs: Lila Kaye and Shannon Snyder) Problem Set 1 Question		
1/15			• **Quiz 2 due @ 5pm**
Week 3	**Pre-recorded Lectures** (Diana Libuda) **Lecture 5** -Positive and negative control of transcription initiation in prokaryotes: *lac* operon cont'd (Combinatorial control, dominant negative alleles, redundancy, DNA "looping") **Lecture 6** -Transcriptional attenuation: Interplay of translation and transcription in the *trp* operon (feedback inhibition of gene expression, RNA structure/function)	• Cox 667-680 • Cox 618-622; 704-705	
1/19	**Optional Class Session** (Diana Libuda) -Antigen test for COVID-19		

1/21			**• Problem Set 1 due @ 5pm**
1/21	**Midterm Review** (GE: John O'Hara-Smith)		
1/21	**Discussion, week 3** (GEs: Lila Kaye and Shannon Snyder) - Midterm review		
1/22			**• Quiz 3 due @ 5pm**
Week 4	*No pre-recorded lectures*		
1/26	**MIDTERM 1**		
1/28	*No Lecture*		
1/28	*No Discussion Section*		
1/29			**Extra Credit 1 due @ 5pm**
Week 5	**Pre-recorded Lectures** (Diana Libuda) **Lecture 7** -Eukaryotic genome architecture -Transcription in eukaryotes: general transcription factors, RNA polymerase recruitment	• Cox 260-275, 537-547	
2/2	**Optional Class Session** (Diana Libuda)		
2/4	**Technique Lecture 3** (GE: John O'Hara-Smith) -Techniques: DNA sequencing, High throughput sequencing	• Cox 226-232	
2/4	**Discussion, week 5** (GEs: Lila Kaye and Shannon Snyder) -Problem Set 2 Question		
2/5			**Problem Set 2 due @ 5pm**
Week 6	**Pre-recorded Lectures** (Diana Libuda) **Lecture 8** -Transcription in eukaryotes: Gal regulon in yeast; steroid hormone response in animals (Specific transcription factors, Promoter proximal elements, enhancers, insulators)	• Cox 682-686, 736-752	
2/9	**Optional Class Session** (Diana Libuda) -Evolution and Mutation of COVID-19		
2/11	**Technique Lecture 4** (GE: John O'Hara-Smith) -Techniques: ChIP, ChIP-sequencing, HiC	• Cox 345, 347, 732-733	
2/11	**Discussion, week 6** (GEs: Lila Kaye and Shannon Snyder) -Problem Set 3 Question		
2/12			**• Quiz 4 due @ 5pm**
Week 7	**Pre-recorded Lectures** (Diana Libuda) **Lecture 9** -Genome packaging and Influence of chromatin structure on transcription (chromatin organization and modification) **Lecture 10** -Genome packaging and Influence of chromatin structure on transcription (X-chromosome inactivation, DNA and histone modifications, Genomic imprinting)	• Cox 728-730, 332-360 • Cox 332-360	
2/16	**Optional Class Session** (Diana Libuda) -Infection by COVID-19		
2/18	**Midterm Review** (GE: John O'Hara-Smith)		
2/18	**Discussion, week 7** (GEs: Lila Kaye and Shannon Snyder) -Midterm Review		
2/19			**Problem Set 3 due @ 5pm**

Week 8	*No Pre-recorded Lectures*		
2/23	**MIDTERM 2**		
2/25	*No Lecture*		
2/25	*No Discussion Section*		
2/26			**Extra Credit 2 due @ 5pm**
Week 9	**Pre-recorded Lectures** **Lecture 11** -CRISPR-Cas9 Gene Editing **Lecture 12** -Transposable Elements	• Cox 246-248 • Cox 496-507	
3/2	**Optional Class Session** (Diana Libuda) -COVID-19 treatments		
3/4	**Technique Lecture 5** (GE: John O'Hara-Smith) -Two-hybrid analysis	• Cox 243-244	
3/4	**Discussion, week 9** (GEs: Lila Kaye and Shannon Snyder) -Problem Set 4 Question		
3/5			**Quiz 5 due @ 5pm**
Week 10	**Pre-recorded Lectures** (Diana Libuda) **Lecture 13** -Control of gene expression by small RNAs: RNAi and microRNAs	• Cox 774-780	
3/9	**Optional Class Session** (Diana Libuda) -COVID-19 and BI320		
3/11	**Final Review** (GE: John O'Hara-Smith)		
3/11	**Discussion, week 10** (GEs: Lila Kaye and Shannon Snyder) - Final exam review		
3/12			**Problem Set 4 due @ 5pm**
3/16	**8:00am TUESDAY, FINAL EXAM (cumulative)**		

***Early exams will not be given under any circumstances**.

January

Monday	Tuesday	Wednesday	Thursday	Friday
4 Pre-recorded Lectures 1 & 2	5 Course Logistics Meeting	6	7 Techniques Lecture 1	8 **Quiz 1 (5%)**
11 Pre-recorded Lectures 3 & 4 **Diversity in STEM paper (2%) due at 5pm**	12 Live Class Session (optional)	13	14 Techniques Lecture 2	15 **Quiz 2 (5%)**
18 Pre-recorded Lectures 5 & 6	19 Live Class Session (optional)	20	21 Midterm Review **Problem Set 1 (2.5%) due at 5pm**	22 **Quiz 3 (5%)**
25	26 **Midterm 1 (20%)**	27	28 *No Lecture and No Discussion*	29 **Extra Credit 1 due at 5pm**

February

Monday	Tuesday	Wednesday	Thursday	Friday
1 Pre-recorded Lecture 7	2 Live Class Session (optional)	**3**	4 Techniques Lecture 3	5 **Problem Set 2 (2.5%) due at 5pm**
8 Pre-recorded Lecture 8	9 Live Class Session (optional)	10	11 Techniques Lecture 4	12 **Quiz 4 (5%)**
15 Pre-recorded Lectures 9 & 10	16 Live Class Session (optional)	17	18 Midterm Review	19 **Problem Set 3 (2.5%) due at 5pm**
22	23 **Midterm 2 (20%)**	24	25 *No Lecture and No Discussion*	26 **Extra Credit 2 due at 5pm**

March

Monday	Tuesday	Wednesday	Thursday	Friday
1 Pre-recorded Lectures 11 & 12	2 Live Class Session (optional)	3	4 Techniques Lecture 5	5 **Quiz 5 (5%)**
8 Pre-recorded Lecture 13	9 Live Class Session (optional)	10	11 Final Review	12 **Problem Set 4 due at 5pm (2.5%)**
15	16 **Final at 8:00am (25%)**	17	18	19