Home page:

## BI 282H (Winter 2022; 21727) Honors Biology II

## Syllabus including Learning Objectives, Optional Readings, and Grading Rubric here.

Staff contact and Office hours here.

### The following table contains links to all assignments for this course:

*To do BEFORE each lecture: V* (links to videos), *pre-Q* (pre-class quiz based on the videos, to be completed by 9:30am the day of lecture); lecture slides will be posted in this table before each class

*To do DURING each lecture:* answer clicker questions - you will get credit whether your answers are correct or not; answers will be posted in this table after each class

*To do AFTER each lecture: post-Q* (post-class quiz to be completed by 9:30am the day of the next lecture)

To do EACH WEEK: HW (lecture-based homework on the week's subject, due the following Thursday by midnight); and LAB work

**Z** = this is the link to the LIVE zoom session. Recordings of all lecture sessions can be found by clicking on the "Zoom Meetings" course tab on the left; then click on the "Cloud recordings" tab that will appear in a menu along the top to get to the list of links for the recordings.

Date	Lecture topic	BEFORE lecture	Lecture	AFTER lecture	WEEKLY lecture- based homework	Lab ( <u>details</u> )
week 1	DNA is the hereditary material	watch videos & take quiz	attend	take quiz (due before the beginning of the next class session)	(due the following Thursday before midnight)	
1/3	<ol> <li>DNA is necessary</li> <li>&amp; sufficient to confer heritable traits</li> </ol>	V1A (Links to an external site.), V1B (Links to an external site.), pre-Q1	Z (Links to an external <u>site.)</u> , lecture 1	post-Q1, <u>lecture</u> <u>1 clicker</u> <u>answers</u> Download	HW1: due by Thurs 1/13 midnight	No Pre-Lab Chemical Nature of Genetic

			slides	lecture 1 clicker answers		<u>Material</u> (1/11 or 1/12)
1/5	2. DNA has a structure remarkably suited to making copies of itself	V2A (Links to an external site.), V2B (Links to an external site.), pre-Q2	to an external site.), lecture 2 slides	<u>post-Q2, lecture</u> <u>2 clicker</u> <u>answers</u> Download lecture 2 clicker answers		<u>Slides</u> Download Slides <u>Lab Puzzle</u> (1/10)
			Download lecture 2 slides			
1/7	3. Replicating a molecule of DNA requires a set of ordered operations	<u>V3A (Links to an</u> <u>external site.),</u> <u>V3B (Links to an</u> <u>external site.),</u> <u>pre-Q3</u>	Z (Links to an external	post-Q3, lecture <u>3 clicker</u> <u>answers</u> Download lecture 3 clicker answers		
week 2	DNA has separable units (genes) that can encode amino acid sequences	watch video & take quiz	attend	take quiz		
1/10	4. DNA sequences can change - mutants and mutations	<u>V4A (Links to an</u> <u>external site.),</u> <u>V4B (Links to an</u> <u>external site.),</u> <u>pre-Q4</u>	<u>to an</u> external	post-Q4, <u>lecture</u> <u>4 clicker</u> <u>answers</u> Download lecture 4 clicker answers	<u>HW2</u> : due by Thurs 1/20 midnight	Pre-Lab (1/11 9am) DNA Structure Download DNA Structure (1/19-20) Slides
1/12	5. DNA has separable	V5A (Links to an	Z (Links	post-Q5,		Download Slides

can encode proteins       VSB (Links to an external site.), pre-Q5       external site.), external site.), pre-Q5       answers       answers         lecture 5       Jownload lecture 5       sides       answers       answers         1/14       6. The genetic code is separated by commas, and triplet       V6A (Links to an external site.), pre-Q5       Download lecture 6       6. Clicker         1/14       6. The genetic code is separated by commas, and triplet       V6A (Links to an external site.), pre-Q5       Download lecture 6       6. Clicker         week 3       DNA sequences changes can affect protein function in different ways       watch video & slides       attend       take quiz       attend       take quiz       Pre-Lab (1/18 gam)         1/17       MLK Jr Day; No School       2.1.Links to an external site.), pre-Q5       post-Q7. lecture 6 lecture 7 lecture 1 lecture 6 lecture 7 lecture 7 lecture 1 lecture 6 lecture 7 lecture 1 lecture		units of function that	external site.),	to an	lecture 5 clicker		Lab Puzzle (1/18)
pre-Q5lecture 5Download lecture 51/146. The genetic code is non-overlapping, not separated by commas, and tripletV6A (Links to an external site.) pre-Q6Z (Links to an external site.) pre-Q6Download lecture 6 slidesanswers Download lecture 6 lecture 6 external separated by commas, and tripletV6A (Links to an external site.) pre-Q6Z (Links to an external site.) pre-Q6Download lecture 6 lecture 6 slidesSidesSidesWeek 3DNA sequences changes can affect protein function in different wayswatch video & take quizattendtake quizPre-Lab (I/18 9am)1/17MLK Jr Day; No SchoolZZpre-Q7post-Q7, lecture to an external site.)Mutation Rate site.) pre-Q71/197. The genetic code is degenerate, unambiguous, and uiversal; mutations within a proteinV7 (Links to an pre-Q7Zpost-Q7, lecture to an external site.) pre-Q7Mutation Rate external site.) pre-Q71/198. Changes to a protein's anino acid within a proteinV8A (Links to an pre-Q7Zpost-Q7, lecture to an external site.) pre-Q7Mutation Rate (1/25-26) answers1/128. Changes to a protein's anino acidV8A (Links to an external site.) pre-Q7post-Q8, lecture to an external site.) pre-Q7post-Q6, lecture to an external site.) pre-Q7J1/218. Changes to a protein's anino acidV8A (Links to an external site.) pre-Q7Sot-Q8, lecture to an ext							<u></u> (1/10)
Internal siteSideslecture 5 clicker answers1/146. The genetic code is non-overlapping, not separated by commas, and tripletV6A (Links to an external site.), pre-Q6Z.(Links post-Q6, lecture betwere 6post-Q6, lecture clicker answers1/146. The genetic code is non-overlapping, not separated by commas, and tripletV6A (Links to an external site.), pre-Q6Z.(Links post-Q6, lecture 6answers Download lecture 60DNA sequences changes can affect protein function in different wayswatch video & take quizattendtake quizanswers post-Q7, lecture to an external site.)pre-Lab (1/18 9am)1/17MLK Jr Day; No SchoolZ.(Links to an external site.), pre-Q7Z.(Links post-Q7, lecture to an external site.)Mutation Rate by Thurs answers1/197. The genetic code is degenerate, unambiguous, and universal; mutations within a proteinV7 (Links to an pre-Q7SchoolMutation Rate external site.)1/198. Changes to a protein's amino acid within a proteinV8A (Links to an pre-Q7School, pre-Q7Mutation Rate site.)1/218. Changes to a protein's amino acidV8A (Links to an external site.), pre-Q7Z.(Links post-Q7, lecture to an external site.)Mutation Rate (1/25-26) answers1/218. Changes to a protein's amino acidV8A (Links to an external site.)SchoolLub Puzzle (1/24)		-	external site.),	<u>site.)</u> ,			
1/14     6. The genetic code is non-overlapping, not separated by commas, and triplet     V6A (Links to an external site.), pre-Q6     Z. (Links post-Q6, lecture to an external site.), per-Q6     answers       1/14     6. The genetic code is non-overlapping, not separated by commas, and triplet     V6A (Links to an external site.), pre-Q6     Z. (Links post-Q6, lecture to an external site.), per-Q6     answers       Download lecture 6     Download electure 6     Sides     Download lecture 6     Sides       Week 3     DNA sequences changes can affect protein function in different ways     watch video & take quiz     attend     take quiz       1/17     MLK Jr Day; No School     Z. (Links post-Q7, lecture degenerate, unambiguous, and universal; mutations external site.), pre-Q7     Z. (Links post-Q7, lecture to an external site.), pre-Q7     post-Q7, lecture site.)     HW3; due by Thurs I27 midnight     Mutation Rate (1/25-26)       1/19     R. Changes to a protein's amino acid within a protein     V8A (Links to an pre-Q7     post-Q8, lecture sides     HW3; due by Thurs I27 midnight     Mutation Rate (1/25-26)       1/21     8. Changes to a protein's amino acid     V8A (Links to an external site.), pre-Q7     post-Q8, lecture sides     Lab Puzzle (1/24)			pre-Q5				
Image: here is the second of				<u>slides</u>			
IndextIndex					answers		
IndextIndex				Download			
1/146. The genetic code is non-overlapping, not separated by commas, and tripletV6A (Links to an external site.), pre-Q6Z.(Links to an external site.), lecture 6post-Q6, lecture 6 clicker answers Download lecture 6 clicker answersweek 3DNA sequences changes can affect protein function in different wayswatch video & take quizattendtake quizper-Lab (1/18 90st-Q7, lecture to an external site.), pre-Q71/17MLK Jr Day; No SchoolZ.(Links post-Q7, lecture to an external site.), pre-Q7post-Q7, lecture to an external site.), pre-Q7Mutation Rate (1/25-26)1/19MLK Jr Day; No schoolZ.(Links post-Q7, lecture to an external site.), pre-Q7Mutation Rate (1/25-26)1/19MLK Jr Day; No schoolY7 (Links to an external site.), pre-Q7Z.(Links post-Q7, lecture to an external site.), slidesMutation Rate (1/25-26)1/19SchoolY7 (Links to an external site.), pre-Q7Sides slidesMutation Rate (1/25-26)1/198. Changes to a protein's amino acidV8A (Links to an external site.), pre-Q7Z.(Links post-Q8, lecture slidesHW3: due by Thurs answers1/218. Changes to a protein's amino acidV8A (Links to an external site.), pre-Q7Z.(Links post-Q8, lecture bidesLab Puzzle (1/24)							
1/146. The genetic code is non-overlapping, noi separated by commas, and tripletV6A (Links to an external site), pre-O66 clicker answers Download lecture 6 clicker answers6 clicker answers Download lecture 6 clicker answers6 clicker answers1 clicker answers				slides			
1/146. The genetic code is non-overlapping, not separated by commas, and tripletV6A (Links to an external site.), pre-Q6external site.), pre-Q6answers answersans				Z (Links			
1/146. The genetic code is non-overlapping, not separated by commas, and tripletV6A (Links to an external site.), DGB (Links to an external site.), pre-Q6site.) lecture 6answers Download lecture 6 clicker answersInswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Download lecture 7Inswers Pre-Lab (1/18 9am)Inswers Pre-Lab (1/18 9am)1/17MLK Jr Day; No SchoolV7 (Links to an external site.), pre-Q7Z (Links to an external site.), Pre-Q7Inswers Download lecture 7Inswers Pre-Q8Inswers Pre-Lab (1/18 Pre-Lab (1/18 <b< th=""><th></th><th></th><th></th><th></th><th><u>6 clicker</u></th><th></th><th></th></b<>					<u>6 clicker</u>		
1/14       6. The genetic code is separated by commos, and triplet       external site.), pre-Q6       Download lecture 6 clicker answers         1/14       separated by commas, and triplet       external site.), pre-Q6       Download lecture 6 clicker answers         1/14       DNA sequences changes can affect protein function in different ways       watch video & take quiz       Download lecture 6 clicker answers         1/17       MLK Jr Day; No School       sattend       take quiz       post-Q7. lecture 7 clicker answers         1/17       MLK Jr Day; No School       v7. (Links to an external site.), pre-Q7       post-Q7. lecture 7 clicker answers       post-Q7. lecture 7 clicker answers       Mutation Rate (1/25-26) answers         1/19       7. The genetic code is degenerate, unambiguous, and universal; mutations can alter zero, one, or multiple amino acids within a protein       V7. (Links to an external site.), pre-Q7       pre-Q7       slides       Download lecture 7 clicker answers       HW3: due by Thurs 1/27 midnight         1/121       8. Changes to a protein's amino acid       V8A (Links to an external site.), to an       Z (Links post-Q8, lecture 7 to an sticker       Slides       Download lecture 7 clicker         1/21       8. Changes to a       V8A (Links to an external site.), to an       Z (Links post-Q8, lecture 7 to an external site.), to an       8 clicker       Lab Puzzle (1/24)			$V6\Lambda$ (Links to an				
1/14non-overlapping, non-overlapping, non-overlap		6. The genetic code is		<u>bree.</u> ,			
separated by commas, and tripletexternal site.), pre-Q6 answersanswersmeek 3DNA sequences changes can affect protein function in different wayswatch video & take quizattendtake quiztake quiz1/17MLK Jr Day; No School	1/14						
commas, and tripletpre-Q6Download lecture 6week 3DNA sequences changes can affect protein function in different wayswatch video & take quizattendtake quiztake quiz1/17MLK Jr Day; No Schoolzzjj1/17MLK Jr Day; No Schoolzzj1/17MLK Jr Day; No Schoolzzj1/19N. K. Jr Day; No Schoolzzj1/19N. K. Jr Day; No Schoolzzj7. The genetic code is degenerate, unambiguous, and universal; mutations can alter zero, one, or multiple amino acids within a proteinV7 (Links to an external site.), pre-Q7jjj1/218. Changes to a protein's amino acidV8A (Links to an external site.), medationZ (Links post-Q7, lecture slidesjjj1/218. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links post-Q8, lecture to an external site.),jjj1/21S. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links post-Q8, lecture to an external site.),jjj1/21S. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links to an external site.),jjj1/21Notacin S and second protein's amino acidjjjjj1/21Notacin S and second protein's amino acidjj </th <th>_,</th> <th></th> <th></th> <th><u>snacs</u></th> <th></th> <th></th> <th></th>	_,			<u>snacs</u>			
Image: heat set of the state set of the s		commas, and triplet					
indexindexindexindexindexindexweek 3DNA sequences changes can affect protein function in different wayswatch video & take quizindexindexindexindexindex1/17MLK Jr Day; No School1/17MLK Jr Day; No School1/17MLK Jr Day; No School							
week 3DNA sequences changes can affect protein function in different wayswatch video & take quizattendtake quiztake quiz1/17MLK Jr Day; No School							
week 3 protein function in different wayswatch video & take quizattendtake quiztake quiz1/17MLK Jr Day; No School				slides			
week 3 protein function in different wayswatch video & take quizattendtake quiztake quiz1/17MLK Jr Day; No School							
1/17SchoolImage: SchoolSchoolImage: SchoolImage:	week 3	changes can affect protein function in		attend	take quiz		
7. The genetic code is degenerate, unambiguous, and universal; mutations 	1/17						
1/19The genetic code is degenerate, unambiguous, and universal; mutations can alter zero, one, or multiple amino acids within a proteinV7 (Links to an external site.), pre-Q7to an external site.), slides7 clicker external answers lecture 7HW3: due by Thurs 1/27 midnightMutation Rate Download Mutation Rate (1/25-26)1/191/19V7 (Links to an external site.), pre-Q71/201/27 midnightHW3: due by Thurs 1/27 midnightMutation Rate (1/25-26)1/218. Changes to a protein's amino acidV8A (Links to an external site.), to anZ (Links to anpost-Q8, lecture 8 clickerLab Puzzle (1/24)				Z (Links	post-Q7, lecture		,
1/19degenerate, unambiguous, and universal; mutations can alter zero, one, or multiple amino acids within a proteinV7 (Links to an external site.), pre-Q7isite.), lecture 7 slidesanswers Download lecture 7 clicker answersHW3: due by Thurs 1/27 midnightDownload Mutation Rate (1/25-26)1/19Mutations external site.), pre-Q7Download external site.), pre-Q7HW3: due by Thurs 1/27 midnightDownload Mutation Rate (1/25-26)1/20Download external site.), For this amino acid protein's amino acidV8A (Links to an external site.),Z (Links to anPost-Q8, lecture 8 clickerLab Puzzle (1/24)					7 clicker		Mutation Rate
1/19unambiguous, and universal; mutations can alter zero, one, or multiple amino acids within a proteinV7 (Links to an external site.), pre-Q7lecture 7 slidesDownload lecture 7 clicker answersHW3: due by Thurs 1/27 midnightMutation Rate (1/25-26)1/210.00000000000000000000000000000000000		e					Derruhand
1/19universal; mutations can alter zero, one, or multiple amino acids within a proteinexternal site.), pre-Q7slideslecture 7 clicker answersby Thurs 1/27 midnight(1/25-26)Download lecture 7Download lecture 7SlidesSlidesSlidesSlides1/218. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links to anpost-Q8, lecture 8 clickerLab Puzzle (1/24)		U ,	V7 (Links to an			HW3. due	
can alter zero, one, or multiple amino acids within a proteinpre-Q7answers1/27 midnightDownload lecture 7 slidesDownload lecture 7 slidesDownload lecture 7 slidesSlides1/218. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links to anpost-Q8, lecture 8 clickerLab Puzzle (1/24)	1/19	-					
multiple amino acids within a proteinDownload lecture 7midnight1/218. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links to anpost-Q8, lecture 8 clickerLab Puzzle (1/24)		,		011000			( - ···/
1/21     8. Changes to a protein's amino acid     V8A (Links to an external site.),     Z (Links to an     post-Q8, lecture 8 clicker     Lab Puzzle (1/24)		1				midnight	
slides1/211/218. Changes to a protein's amino acid1/21 <th></th> <th>within a protein</th> <th></th> <th></th> <th></th> <th></th> <th></th>		within a protein					
8. Changes to a protein's amino acidV8A (Links to an external site.),Z (Links to anpost-Q8, lecture 8 clickerLab Puzzle (1/24)							Download Slides
1/21   protein's amino acid   external site.),   to an   8 clicker		8 Changes to a	V84 (Links to an		nost_08 lactura		$\mathbf{I}$ ab <b>D</b> uzzla $(1/24)$
	1/21	e					$\frac{1}{2} \frac{1}{2} \frac{1}$
		r					

	the protein to lose or gain function - or may have no effect	<u>external site.),</u> <u>pre-Q8</u>	<u>site.),</u> <u>lecture 8</u> <u>slides</u> Download lecture 8 slides			
week 4	DNA for each gene is transcribed into RNA; mRNA is translated into protein (example: <i>E.</i> <i>coli</i> )	watch video & take quiz	attend	take quiz		
1/24	9. DNA for each gene is transcribed into RNA by RNA polymerase	<u>V9A (Links to an</u> <u>external site.),</u> <u>V9B (Links to an</u> <u>external site.),</u> <u>pre-Q9</u>	lecture 9	<u>post-Q9</u> , lecture 9 clicker answers		Pre-Lab (1/25 9am) Complementation Download Complementation (2/1-2) Lab Puzzle (1/31)
1/26	10. Non-amino-acid- coding DNA sequences denote the start and stop sites for transcription and translation	<u>V10A (Links to</u> <u>an external site.),</u> <u>V10B (Links to</u> <u>an external site.),</u> <u>pre-Q10</u>	Z (Links to an external site.), lecture 10 slides Download lecture 10 slides	lecture 10 clicker answers	HW4: due by Thurs 2/3 midnight	
1/28	<ol> <li>Aminoacyl-tRNA synthetases and the ribosome allow mRNAs to be translated into protein</li> </ol>	<u>V11 (Links to an</u> <u>external site.)</u> (only one), <u>pre-</u> <u>Q11</u>	Z (Links	post-Q11, lecture 11 clicker answers		

			Download lecture 11 slides			
week 5	Cells can turn expression of some genes ON and OFF (example: <i>E. coli</i> )	watch video & take quiz	attend	take quiz		
1/31	12. Regulatory pathways, AND gates, OR gates, activators, repressors, cis, trans	V12A, V12B, pre-Q12	Z (Links to an external site.), lecture 12 slides	post-Q12, lecture 12 clicker answers		
2/2	<ul><li>13. How prokaryotic repressors work</li><li>(example: response of the <i>lac</i> operon to lactose)</li></ul>	V13, <u>pre-Q13</u>	Z (Links to an external site.), lecture 13 slides	post-Q13, lecture 13 clicker answers	HW5: due by Thurs 2/10 midnight	Pre-Lab (2/1 9am) Transcription and Translation (2/8- 9)
2/4	<ul> <li>14. How prokaryotic activators work</li> <li>(example: response of the <i>lac</i> operon to glucose). AND gates and OR gates revisited.</li> </ul>	V14, <u>pre-Q14</u>	Z (Links to an external site.), lecture 14 slides	post-Q14, lecture 14 clicker answers		Lab Puzzle (2/7)
week 6	Gene expression in eukaryotic cells is similar to <i>E. coli</i> but more complicated	watch video & take quiz	attend	take quiz		
2/7	15. Eukaryotic DNA is organized into chromatin within a special compartment (nucleus)	V15, <u>pre-Q15</u>	Z (Links to an external site.), lecture 15 slides	post-Q15, lecture 15 clicker answers	HW6: due by Thurs 2/17 midnight	Pre-Lab (2/8 9 am) Gene Regulation: Lac Operon

			Z (Links			(2/15-16)
2/9	16. Eukaryotic RNAs undergo significant modification before being translated	V16, <u>pre-Q16</u>	<u>to an</u> <u>external</u> <u>site.)</u> , lecture 16 slides	post-Q16, lecture 16 clicker answers		<u>Lab Puzzle</u> (2/14)
2/11	17. An introduction to how eukaryotes turn gene expression ON and OFF	V17, links to optional videos of <u>C. elegans (Links</u> <u>to an external</u> <u>site.)</u> and <u>Drosophila (Links</u> <u>to an external</u> <u>site.)</u> embryos, pre- <u>Q17</u>	$\frac{\underline{Z} (\underline{LINKS})}{\underline{to an}}$	post-Q17, lecture 17 clicker answers		
week 7	Regulated gene expression allows cells within multicellular organisms to specialize	watch video & take quiz	attend	take quiz		
2/14	18. Mitosis (DNA replication followed by cell division) generates genetically identical cells	V18A, V18B, <u>pre-Q18</u>	Z (Links to an external site.), lecture 18 slides	post-Q18, lecture 18 clicker answers		Pre-Lab (2/15
2/16	19. Example of how cells become different during development: the early <i>C. elegans</i> embryo	V19, <u>pre-Q19</u>	Z (Links to an external site.), lecture 19 slides	post-Q19, lecture 19 clicker answers	HW7: due by Thurs 2/24 midnight	9am) <u>Mitosis and</u> <u>Meiosis</u> (2/22- 23)
2/18	20. Cells within multicellular organisms specialize by expressing different sets of genes	V20, <u>pre-Q20</u>	Z (Links to an external site.), lecture 20 slides	post-Q20, lecture 20 clicker answers		<u>Lab Puzzle</u> (2/21)

week 8	Sexual reproduction	watch video & take quiz	attend	take quiz		
2/21	21. Meiosis and single Mendelian traits	V21, <u>pre-Q21</u>	Z (Links to an external site.), lecture 21 slides	post-Q21, lecture 21 clicker answers		<u>Pre-lab</u> (2/22 9am)
2/23	22. Sex-linked traits and independent assortment	V22, <u>pre-Q22</u>	Z (Links to an external site.), lecture 22 slides	post-Q22, lecture 22 clicker answers	HW8: due by Thurs 3/3 midnight	,
2/24	23. Linkage analysis (and the chi square test)	V23, <u>pre-Q23</u>	Z (Links to an external site.), lecture 23 slides	post-Q23, lecture 23 clicker answers		<u>Lab Puzzle</u> (2/28)
week 9	Special cases of inheritance	watch video & take quiz	attend	take quiz		
2/28	24. Maternal-effect genes	V24, <u>pre-Q24</u>	Z (Links to an external site.), lecture 24 slides	post-Q24, lecture 24 clicker answers	HW9: due	<u>Pre-Lab</u> (3/1 9 am)
3/2	25. An introduction to epigenetic effects	V25, <u>pre-Q25</u>	Z (Links to an external site.), lecture 25 slides	post-Q25, lecture 25 clicker answers	by Thurs 3/10 midnight	<u>Mendelian</u> <u>Genetics</u> (3/8-9) <u>Lab Puzzle</u> (3/7)
3/4	26. Cytoplasmic inheritance and other	V26, <u>pre-Q26</u>	Z (Links to an	post-Q26, lecture 26		

	sources of mosaicism		external site.), lecture 26	clicker answers	
			slides		
week 10	Human genetics: unlike lab strains, wild populations consist of individuals with unique DNA sequences	watch video & take quiz	attend	take quiz	
3/7	27. Pedigree analysis and genome sequencing	V27, <u>pre-Q27</u>	Z (Links to an external site.), lecture 27 slides	post-Q27, <u>1</u> Download l ecture 27 clicker answers	
3/8	28. Establishing causation can be complicated	V28, <u>pre-Q28</u>	Z (Links to an external site.), lecture 28 slides	post-Q28	
3/10	29. Optional review	optional survey due Thurs 6pm	Z (Links to an external site.), lecture 29 review slides	2019 midterm 1 Download 2019 midterm 1 , 2019 midterm 1 , 2019 midterm 1 answers Download 2019 midterm 1 answers , 2019 <u>midterm 2</u> Download 2019 midterm 2 answers Download 2019 midterm 2 answers , 2019	Final Review

Final			<u>final</u> Download 2019 final <u>, 2019</u> <u>final answers</u> Download 2019 final answers	
exam week				
3/17	Final exam 10:15AM			

Syllabus page:

# **Course Syllabus**

#### Jump to Today

In this course we will examine the genetic and molecular mechanisms responsible for the inheritance of physical characteristics. We will begin with the key role of DNA as the hereditary material in cells. We will then learn how DNA directs the synthesis of proteins, including how that synthesis is regulated. Finally, we will explore the ways in which DNA is inherited and thereby passes molecular information to subsequent generations.

## **Overall learning outcomes**

By the end of this course, you will be able to demonstrate an understanding of:

- 1. how DNA directs the synthesis of proteins, including how protein synthesis is regulated
- 2. how variations in DNA sequence affect proteins and thereby phenotype
- 3. how DNA is inherited and thereby specifies the phenotypes of subsequent generations
- 4. how to design and interpret experiments that test #1-3.

## Learning objectives and optional readings for each lecture

You are responsible for understanding the material presented in pre-lecture videos, lecture, and lab. The listed "Optional readings" may contain more - or fewer - details than necessary and are just suggestions.

Lecture	Learning objectives	Optional readings
1. DNA is necessary & sufficient to confer heritable traits	<ul> <li>learning is iterative - expect to feel confused: ask lots of questions, &amp; work on solving the assigned problems</li> <li>be able to interpret and design experiments that test necessity and sufficiency</li> <li>be able to interpret and design experiments that identify DNA as the chemical responsible for heredity</li> </ul>	Biology2e (Links to an external site.) section 14.1
2. DNA has a structure remarkably suited to making copies of itself	<ul> <li>science is iterative: guess at possible models, determine what new data would distinguish between these models, design experiments to get this new data</li> <li>understand how the structure of DNA allows accurate copies to be made (ensuring heritability)</li> <li>be able to interpret and design experiments that distinguish between conservative, semi-conservative, and dispersive models of DNA replication</li> </ul>	Biology2e (Links to an external site.) section 14.2 & 14.3
<ol> <li>Replicating a molecule of DNA requires a set of ordered operations</li> </ol>	<ul> <li>understand the ordered, enzymatic steps of DNA replication: initiation, unwinding, synthesis of RNA primers, new DNA strand synthesis, removal of RNA primers, filling in gaps, and completing the phosphate backbone</li> <li>understand the "end replication problem" that linear chromosomes face and how telomerase solves it</li> <li>understand how, in the lab, DNA polymerases are used to amplify and thereby detect trace amounts of a specific DNA sequence ("PCR")</li> </ul>	Biology2e (Links to an external site.) section 14.4 & 14.5
4. DNA sequences can change - mutants and mutations	<ul> <li>understand that and how the sequence of bases in DNA can change (mutations/mutants)</li> <li>be able to design and interpret experiments that measure mutation rates and/or determine whether a chemical is a mutagen</li> <li>be able to design and interpret experiments that determine whether mutations occur spontaneously or in response to an environmental challenge</li> </ul>	Biology2e (Links to an external site.) section 14.6 <u>Griffiths</u> 461-3 Download Griffiths 461-3
5. DNA has separable units of function that can encode proteins	<ul> <li>be able to design screens for auxotrophic mutants in E. coli and Neurospora</li> <li>be able to design and interpret experiments that distinguish whether a mutation is recessive or dominant to wild type</li> </ul>	<u>Griffiths 187-90</u> Download Griffiths 187-90

<ul><li>6. The genetic code is non- overlapping, not separated by commas, and triplet</li></ul>	<ul> <li>be able to to design and interpret complementation tests</li> <li>be able to design and interpret experiments that use auxotrophs to identify the order of enzymes/genes acting in a biosynthetic pathway</li> <li>be able to design and interpret experiments that distinguish whether a genetic code has codons that overlap</li> <li>be able to design and interpret experiments that distinguish whether a genetic code has "commas"</li> <li>be able to predict and interpret the effects of 1 bp insertions and deletions on comma-less codes, comma-containing codes, and codes with fully overlapping codons</li> </ul>	Meneely Download Meneely Griffiths and Crick Download Griffiths and Crick
	<ul> <li>be able to design and interpret screens for suppressor mutations</li> </ul>	
7. The genetic code is degenerate, unambiguous, and universal; mutations can alter zero, one, or multiple amino acids within a protein	<ul> <li>understand what properties make the genetic code "degenerate", "unambiguous", and "universal"</li> <li>be able to explain and interpret evidence that RNA is the intermediary between DNA and protein production</li> <li>determine the effects that DNA sequence changes within protein-coding sequence have on amino acid sequence</li> <li>understand the effects that DNA sequence changes within protein-coding sequence can have on that protein's function (can cause it to lose or to gain function)</li> <li>understand how to distinguish between null and hypomorph mutations</li> </ul>	Biology2e (Links to an external site.) section 15.1 Hartwell et al. Download Hartwell et al.
8. Changes to a protein's amino acid sequence may cause the protein to lose or gain function - or may have no effect	<ul> <li>understand "haploid" and "diploid" and be able to use genetic nomenclature (e.g. "m/+", "+/+", "m/m")</li> <li>be able to interpret evidence that a gene is haploinsufficient</li> <li>understand how to distinguish among the different types of mutations - nulls, hypomorphs, hypermorphs, dominant negatives, and neomorphs - and understand why doing so is important (e.g. for knowing how to treat disease patients)</li> </ul>	The suggested Hartwell et al reading for lecture 7 is useful for lecture 8 too!
9. DNA for each gene is transcribed into RNA by RNA polymerase	<ul> <li>be able to design and interpret "pulse-chase" experiments</li> <li>understand the properties of RNA polymerase, including how and where it starts transcribing</li> <li>be able to design and interpret experiments that identified the DNA sequences ("promoters") that are necessary and sufficient to initiate transcription in <i>E.</i> <i>coli</i></li> <li>understand what a "consensus" sequence is</li> <li>understand the relationship between promoter</li> </ul>	

	sequence and transcription frequency	
	sequence and transcription frequency	
10. Non-amino-acid-coding DNA sequences denote the start and stop sites for transcription and translation	<ul> <li>be able to recognize and create "dyad symmetry" in a DNA sequence and hairpins/stem-loops in RNA</li> <li>be able to design and interpret experiments that identify E. coli TX terminators</li> <li>be able to draw RNA pols transcribing mRNAs as ribosomes translate them (as happens in prokaryotes ONLY)</li> <li>understand the relationship between RBS sequence and translation frequency</li> </ul>	Biology2e (Links to an external site.) section 15.2 & 15.5
11. Aminoacyl-tRNA synthetases and the ribosome allow mRNAs to be translated into protein	<ul> <li>understand what it means for genes to be in an "operon" (prokaryotes)</li> <li>understand what an "ORF" ("open reading frame") is</li> <li>understand the "second genetic code" – how are tRNAs charged with the correct amino acid?</li> <li>understand how there can be fewer tRNAs than amino-acid-coding codons</li> <li>understand the steps of translation elongation and how translation stops</li> </ul>	Biology2e (Links to an external site.) section 15.5
12. Regulatory pathways, AND gates, OR gates, activators, repressors, cis, trans		
13. How prokaryotic repressors work (example: response of the <i>lac</i> operon to lactose)		
14. How prokaryotic activators work (example: response of the <i>lac</i> operon to glucose). AND gates and OR gates revisited.		
15. Eukaryotic DNA is organized into chromatin within a special compartment (nucleus)		
16. Eukaryotic RNAs undergo significant modification before being translated		

## **Teaching philosophy**

- be organized, clear, and consistent
- provide multiple opportunities per week for active learning, problem-solving
- provide multiple opportunities per week for interactions with instructors
- provide multiple opportunities to earn points

## **Grading Rubric**

	number	work on this with		number in final grade calculation	points each	points in final grade calculation (total = 1000)
pre-lecture quizzes	28	yes	5	23	2	46
in-lecture clicker questions	28	yes	7	21	1	21
post-lecture quizzes	28	yes	5	23	6	138
weekly lecture- based homeworks	9	yes	1	8	35	280
final exam	1	NO	0	1	135	135
pre-labs	8	yes	0	8	5	40
lab reports	9	yes	0	9	20	180
lab puzzles	9	yes	1	8	20	160

Anyone receiving 90% or more of the points will receive an A, 80%-90% a B, etc. We generally curve the course, but this will only improve your grade from the baseline above.

Late policy: late work will not be accepted. (This is because we immediately post keys for each assignment when the due date closes).

## This class is governed by UO community standards. We expect everyone to:

• Respect the dignity and essential worth of all individuals.

• Promote a culture of respect. This includes not distracting others during class time (e.g. no side conversations, no cell phone usage).

- Respect the privacy, property, and freedom of others.
- Reject bigotry, discrimination, violence, or intimidation of any kind. Practice personal and academic integrity and expect it from others.

• Do your own work. Cheating, plagiarism and any other form of academic dishonesty will not be tolerated. Group work is allowed on many, though not all, assignments (see table above). However, all work you turn in should be your own. Exactly copying text and/or graphs is not permitted.

## General university policies

Eating and drinking are prohibited in classrooms: you must therefore remain masked at all times while in class!

#### Academic Disruption due to Campus Emergency

In the event of a campus emergency that disrupts academic activities, course requirements, deadlines, and grading percentages are subject to change. Information about changes in this course will be communicated as soon as possible by email, and on Canvas. If we are not able to meet face-to-face, students should immediately log onto Canvas and read any announcements and/or access alternative assignments. Students are also expected to continue coursework as outlined in this syllabus or other instructions on Canvas.

In the event that the instructor of this course has to quarantine, this course may be taught online during that time.

#### **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 comply with vaccination policyLinks to an external site.
  - 2. *Must <u>wear face coveringsLinks to an external site.</u> in all indoor spaces on UO campus*
  - 3. Complete weekly <u>testingLinks to an external site</u>. if not fully vaccinated or exempted
  - 4. <u>Wash handsLinks to an external site.</u> frequently and practice social distancing when possible
  - 5. Complete daily <u>self-checksLinks to an external site.</u>
  - 6. Stay home/do not come to campus if feeling symptomaticLinks to an external site.
  - 7. Complete the UO <u>COVID-19 case and contact reporting form (Links to an</u> <u>external site.)</u> 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:
  - Vaccinated and Asymptomatic students: Quarantine not required, but daily selfmonitoring before coming on campus is advised; sign up for testing through MAP 3-5 days after exposure if advised you are a contact."
  - 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 <u>MAPLinks to an external site.</u>, if asymptomatic, or through University Health Services (541-346-2770) or your primary care provider, if symptomatic.

• Symptomatic students: stay home (do not come to class/campus), complete the online <u>case and contact form (Links to an external site.)</u>, 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.
  - o <u>University Health ServicesLinks to an external site</u>. or call (541) 346-2770
  - <u>University Counseling CenterLinks to an external site</u>. or call (541) 346-3277 or (541) 346-3227 (after hrs.)
  - <u>MAP Covid-19 TestingLinks to an external site.</u>
  - <u>Corona CorpsLinks to an external site</u>. or call (541) 346-2292
  - o <u>Academic AdvisingLinks to an external site</u>. or call (541) 346-3211
  - o Dean of StudentsLinks to an external site. 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 <u>case and contact reporting form (Links to an external site.)</u> if you test positive or are a close contact of someone who tests positive."

#### Accessible Education

The University of Oregon is working to create inclusive learning environments. Please notify Tory as soon as possible if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You are also encouraged to contact the Accessible Education Center in 360 Oregon Hall at 541-346-1155 or <u>uoaec@uoregon.edu</u>. . Please provide a notification letter from the Accessible Education Center (<u>http://aec.uoregon.edu/Links to an external site.</u>) outlining your approved accommodations.

#### Academic Misconduct

The University Student Conduct Code (available at <u>conduct.uoregon.eduLinks to an external</u> <u>site.</u>) defines academic misconduct. Students are prohibited from committing or attempting to commit any act that constitutes academic misconduct. By way of example, students should not give or receive (or attempt to give or receive) unauthorized help on assignments or examinations without express permission from the instructor. Students should properly acknowledge and document all sources of information (e.g. quotations, paraphrases, ideas) and use only the sources and resources authorized by the instructor. If there is any question about whether an act constitutes academic misconduct, it is the students' obligation to clarify the question with the instructor before committing or attempting to commit the act. Additional information about a common form of academic misconduct, plagiarism, is available at <a href="https://researchguides.uoregon.edu/citing-plagiarismLinks">https://researchguides.uoregon.edu/citing-plagiarismLinks</a> to an external site.

#### Inclement Weather

It is generally expected that class will meet unless the University is officially closed for inclement weather. If it becomes necessary to cancel class while the University remains open, this will be announced on Canvas and by email. Updates on inclement weather and closure are also communicated in other ways described here: <u>https://hr.uoregon.edu/about-hr/campus-notifications/inclement-weather/inclement-weather-immediate-updatesLinks</u> to an external site.

#### **Reporting Obligations**

Both Tory and Laurel have "assisting employee" status. For information about our reporting obligations, please see <u>Employee Reporting ObligationsLinks to an external site</u>. on the Office of Investigations and Civil Rights Compliance (OICRC) website. Students experiencing sex or gender-based discrimination, harassment or violence should call the 24-7 hotline 541-346-SAFE [7244] or visit <u>safe.uoregon.eduLinks to an external site</u>. for help. Students experiencing all forms of prohibited discrimination or harassment may contact the Dean of Students Office at 5411-346-3216 or the non-confidential Title IX Coordinator/OICRC at 541-346-3123. Additional resources are available at <u>investigations.uoregon.edu/how-get-supportLinks to an external site</u>. I am also a mandatory reporter of child abuse. Please find more information at <u>Mandatory Reporting of Child Abuse and NeglectLinks to an external site</u>.

#### Mental Health and Wellness

Life at college can be very complicated. Students often feel overwhelmed or stressed, experience anxiety or depression, struggle with relationships, or just need help navigating challenges in their life. If you're facing such challenges, you don't need to handle them on your own--there's help and support on campus.

As your instructors, if we believe you may need additional support, we will express our concerns, the reasons for them, and refer you to resources that might be helpful. It is not our intention to know the details of what might be bothering you, but simply to let you know we care and that help is available. Getting help is a courageous thing to do—for yourself and those you care about.

University Health Services help students cope with difficult emotions and life stressors. If you need general resources on coping with stress or want to talk with another student who has been in the same place as you, visit the Duck Nest (located in the EMU on the ground floor) and get help from one of the specially trained Peer Wellness Advocates. Find out more at health.uoregon.edu/ducknest.

University Counseling Services (UCS) has a team of dedicated staff members to support you with your concerns, many of whom can provide identity-based support. All clinical services are free and confidential. Find out more at counseling.uoregon.edu or by calling 541-346-3227 (anytime UCS is closed, the After-Hours Support and Crisis Line is available by calling this same number)."

#### **Basic** Needs

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course is urged to contact the Dean of Students Office (346-3216, 164 Oregon Hall) for support.

This UO webpage includes resources for food, housing, healthcare, childcare, transportation, technology, finances, and legal support: <u>https://blogs.uoregon.edu/basicneeds/food/Links\_to\_an\_external\_site.</u>

#### Accommodation for Religious Observances

The university makes reasonable accommodations, upon request, for students who are unable to attend a class for religious obligations or observance reasons, in accordance with the university discrimination policy which says "Any student who, because of religious beliefs, is unable to attend classes on a particular day shall be excused from attendance requirements and from any examination or other assignment on that day. The student shall make up the examination or other assignment missed because of the absence." To request accommodations for this course for religious observance, visit the Office of the Registrar's website (<u>https://registrar.uoregon.edu/calendars/religious-observancesLinks to an external</u> <u>site.</u>) and complete and submit to the instructor the "Student Religious Accommodation Request" form prior to the end of the second week of the term.