Bi281H Honors Biology I: Biochemistry and Cell Physiology Fall 2023, 5 credits

Lecture Instructor: Dr. David Garcia, dmgarcia@uoregon.edu Lab Instructor: Dr. Laurel Pfeifer-Meister, lpfeife1@uoregon.edu

Class meetings: MWF 10:00am-10:50am, Tykeson 32

Lab meetings: (one of the following) T 9:00-11:50, T 1:00-3:50, W 1:00-3:50, R 9:00-11:50, or

R 1:00-3:50, Klamath 21

Course Materials:

(1) Pratt & Cornely *Essential Biochemistry* (5th edition, previous editions OK, 4th edition readings also listed). Online material is not required.

(2) iClickers

Website: All course content will be available on Canvas. Log into <u>canvas.uoregon.edu</u> using your DuckID. <u>Canvas support page</u>. Canvas and Technology Support phone (541-346-4357) or by Live Help webpage.

Course description

The BI 280H sequence is an accelerated introduction to biological science that integrates the teaching of biological principles with an understanding of how those principles were derived. Each course in the series emphasizes the scientific reasoning used to arrive at key conclusions, and each gives practice in this kind of thinking. Each course includes both lectures and a weekly 3-hour lab period. The main ideas in the lectures and the lab exercises are linked to allow students to grasp the same concepts in different contexts. The lab exercises minimize mechanical data collection, instead encouraging analysis and deduction. The pace is accelerated compared to the BI 210 series.

BI 281H asks how cells work, focusing first on the properties of proteins that make them major structural elements and catalysts within cells. The course then examines a central challenge that cells face: how to convert consumed energy into a form capable of driving the energy-requiring reactions that life depends on. Throughout, the course asks how cells coordinate their repertoire of chemical reactions so as to be both energetically efficient and able to respond to changes in their environment.

Course pre-requisites

C-, P or better in CH223, CH226H or equivalent.

Course objectives

This course is designated as a Natural Science Core Education course. At UO, core education is designed to provide a broad, interdisciplinary education that helps students think critically and creatively, communicate clearly, and reflect ethically. In this class, students will learn and practice *critical thinking* and *written communication* about how cells work, through problemsolving in lectures and labs, quizzes, homework, lab reports, and exams. Students will use experimental evidence, logical reasoning, and modeling to draw conclusions about the mechanisms that cells use to respond to their environment; and students will acquire the skills to design and interpret experiments that test specific hypothesis.

Expected learning outcomes

- 1. Survey key molecular and cellular features shared by all organisms on earth, revealing how life can be understood in physical and chemical terms.
- 2. Begin to develop intuition and analytical tools to think about life quantitatively and molecularly.
- 3. Introduce several key, universal systems that are shared across organisms including serine proteases, hemoglobin, glycolysis/gluconeogenesis, the citric acid cycle, the electron transport chain, and ATP synthase.
- 4. Apply quantitative reasoning and analysis to biological science problems.

By doing so, students will have achieved the first three of the *Biology Department* undergraduate major learning outcomes:

- 1. An understanding of the process and application of scientific inquiry; the ability to develop well-reasoned hypotheses and to design experiments by which to test them.
- 2. An ability to apply mathematical and statistical approaches to understanding biological information; an ability to interpret graphical representations of biological information.
- 3. An ability to use modeling and simulation to study biological systems.

Students will also learn two of the five Fundamental Concepts listed in the fourth *Biology Department undergraduate major learning outcomes* (broad-based knowledge):

- **Structure and function**: basic units of molecule structure give rise to the functions of all living things.
- Pathways and transformations of energy and matter: Biological systems grow and change through chemical transformation pathways that are governed by the laws of thermodynamics.

Estimated student workload

In addition to attending class (3hr/week) and lab (3hr/week) and participating in these activities, students are expected to spend 2hr/week reading materials for online lecture quizzes (generally from the textbook) and lab handouts, ~3.5hr/week completing pre-lab assignments, lab reports and lab puzzles, and 3hr/week on ungraded practice problems to prepare for the three exams. After accounting for weeks with no labs or lecture due to holidays, this is ~140 hours of work for the term. Together, with 10 hours for engaging with the teaching staff in office hours, review sessions or via email, a total of 150 hours of engagement is expected in the course. Please plan accordingly.

Absences

This is a face-to-face course. Attendance is important because we will develop our knowledge through in-class activities that require your active engagement. We'll have discussions, small-group activities, and do other work during class that will be richer for your presence, and that you won't be able to benefit from if you are not there. Students may miss five classes this term

and one lab session, regardless of the reason with no penalty. This means we do not have "excused" or "unexcused" absences. Please stay home and use one of your five lecture absences or one lab absence if you are sick.

Your success is genuinely important to us. If challenges come up for you this term around attendance, please contact us as soon as you can. Together we can identify what resources or strategies might be available to support you and your learning.

Grading Policy

- Letter grades will be determined based on total points, not on individual exams and assignments. Getting:
 - o >90% of the points (900) guarantees an A-
 - o >80% (800), B-
 - o >70% (700), C-
 - o >60% (600), D-
 - o And <60% (600), F

In the event that scores are skewed downward, the final scores will be curved with breaks between each bin determined by "jumps" in the grade data that separate groups of students. This curve is designed so that it can only help you. If the entire class receives >90%, every student would receive an A-.

• Late policy: late work will not be accepted for most assignments (e.g., pre-lecture quizzes, pre-labs, lab puzzles; this is because we immediately post keys for each assignment when the due date closes). Lab reports may be turned in late with a 10% deduction per day up to 1 week late.

Summary of class components

Component	Points	Number	Total	% points
Clicker/Lecture attendance (*you may miss up to 5	1.5	25-5*	30	3%
classes)				
Pre-class quizzes	2	25	50	5%
Exams (*low exam dropped)	300	3-1*	600	60%
Pre-lab	5	8	40	4%
+Lab report (*low score dropped)	20	9-1*	160	16%
Lab puzzles (*low score dropped)	20	7-1*	120	12%
		TOTAL	1,000	100%

+ Grading Rubric for Lab Reports (20 points each)

Points	16-20	10-15	0-10
(20	(Good-Excellent)	(Satisfactory)	(Unsatisfactory)
Total)			

Each lab report	Participates constructively in group work and class discussion throughout the lab; regularly seems engaged.	Sometimes participates constructively in group work and class discussions; occasionally seems disengaged.	Does not participate constructively in group work and class discussions; frequently demonstrates lack of interest.
	All work is completed and shows evidence of a strong understanding of the material; answers are well written, demonstrate the ability to synthesize course information.	Most of the work is complete and shows evidence of a sufficient understanding of the material; answers are mostly understandable but unorganized and/or unclear in a few places.	Not all questions have been answered; those answered show lack of understanding of material; writing is confusing, vague, and/or lacks effort.

Teaching Philosophy

- Trust students to take initiative for their own learning.
- Provide multiple opportunities per week for interactions with instructors.
- Be organized, clear, and consistent.
- Do not try to artificially limit student access to outside material: embrace that students will have access to the Internet and their peers, just as they will throughout their careers.
- Have many opportunities to get small numbers of points.

People

- David Garcia (lecturer; dmgarcia@uoregon.edu)
- Laurel Pfeifer-Meister (lab instructor; lpfeife1@uoregon.edu)
- Amberly Buer (GE, amberlyb@uoregon.edu)
- Zac Bush (GE, zbush@uoregon.edu)
- Natalie Jaeger (GE, njaeger2@uoregon.edu)
- Sanjana Basak (Biology Tutor, sbasak@uoregon.edu)
- Zealon Gentry-Lear (Biology Tutor, <u>zmg@uoregon.edu</u>)
- Lauren Grover (Biology Tutor, lgrover@uoregon.edu)
- Olivia Hougham (Biology Tutor, <u>oeg@uoregon.edu</u>)
- Michelle Lopez Padilla (Biology Tutor, mlopezpa@uoregon.edu)
- Nolan Smith (Biology Tutor, nsmith16@uoregon.edu)

Getting Help

- For questions about grades and personal issues, please email David or Laurel.
- Office Hours: see help session <u>page</u> on Canvas.

Detailed description of components (graded and ungraded)

Clicker questions/lecture attendance (graded)

- Objectives:
 - Expand on biochemical content
 - o Develop skills to reason about biochemistry
 - o Develop a community of scholars
 - o Provide a low-stress way to accumulate points in the class
- What is it (typically)?
 - Lecture with embedded clicker questions to encourage active engagement and occasional worksheets
 - Need to answer at least one clicker question during the lecture time to get full attendance points
- When to do it?
 - o In lecture on Monday, Wednesday, Friday from 10:00 to 10:50 am
 - You may miss up to five classes without penalty. If you forget your clicker but do show up to class, this will still be considered an unexcused absence.

Pre-class quizzes (graded)

- Objectives:
 - o Prime students for the in-class discussion and work
 - o Provide a low-stress way to accumulate points in the class
- What is it?
 - o Simple questions, designed to get you thinking about the material
 - Based on the assigned readings
 - You get 50% of the points just for taking the quiz
- When to do it?
 - o Do the reading before taking the quiz
 - Quizzes open at 12 pm the two days before class and close at 9:30 am the day of class

Homework (ungraded)

- Objectives:
 - Provide skills practice
- What is it?
 - Questions covering the skills we cover in class
 - You will not turn this homework in; however, these problems provide essential practice for the skills in the class
- When to do it?
 - o Post-class
 - Due dates are assigned for each assignment to help you pace yourself through the course
 - o Keys will be posted on the due date for each assignment

Exams and Final (graded)

• Objective:

- o Assess student understanding of the material (summative assessment)
- What is it?
 - o In-person exams
 - O You may work together with your peers to study for the exam; however, the exam will be closed note/closed peer/closed internet, thus, the work you show must be your own. Cheating will be strictly prohibited. If we find evidence of cheating, both students will receive a zero on the question (and if more extensive, potentially a zero on the entire exams, which cannot be dropped).
 - The questions will build in complexity. The first question in a block will be straightforward; the last question in a block will be more challenging and may integrate multiple concepts.
- When to do it?
 - Exams 1 and 2 will be held during class time (see schedule). Exam 1 will cover
 Unit 1 content. Exam 2 will cover Unit 2 content.
 - o The Final (Exam 3) will be on Friday 12-8-23 from 10:15am-12:15pm in Tykeson 32. The Final will cover Unit 3 content (not cumulative).
 - Exam 2 and the Final may ask for application of certain concepts learned in earlier units to be applied to the Unit material that is being mainly tested (e.g. pKa)
 - o also see <u>Course Schedule</u> for dates/times/locations/unit content covered in each exam

<u>Note about exam grades</u>: Your lowest exam score, including the Final, will be dropped. We will automatically select the best two scores for you in calculating your final grade. If you do not take any of the three exams, it will automatically be chosen as your dropped one. *There are no make-up exams*.

Pre-lab quizzes (graded)

- Objectives:
 - o Prime students for the lab each week
 - o Provide a low-stress way to accumulate points in the class
- What is it?
 - o *Asynchronous* assignment with several simple questions, designed to get you thinking about the experiments being performed
 - o Based on the assigned readings and pre-lab videos
- When to do it?
 - o Do the reading and watch the video before taking the quiz
 - Quizzes open at 4 pm the Thursday before the following weeks lab and closes at
 9:00 am on Tuesdays for all lab sections

Lab reports (graded)

- Objectives:
 - o Explore the key principles of biochemistry and cell physiology introduced in lecture by encountering it from a different, and often "hands on," perspective

- Learn some basic biological lab techniques
- o Reinforce and elaborate upon topics through the manipulation of biological models, problem solving, and quantitative reasoning

• What is it?

- Many questions designed to prompt additional questions from you. This process
 of posing questions and finding solutions is an important part of the scientific
 method.
- o Based on the activities performed during lab.

• When to do it?

- o Attend your *synchronous* lab section in person in Klamath 21.
- o Perform your experiment and answer the questions posed along the way.
- O Summarize your data and findings at the end of lab if time allows by answering the report questions, otherwise at home. Finish it prior to the following week's lab (due at the beginning of your next lab section). Feel free to seek help on these questions during office hours or via email.

Lab puzzles (graded)

• Objectives:

- o Another opportunity for you to demonstrate what you learned during lab by applying the concepts to novel situations.
- Encourage group work and promote students teaching other students (the best way to learn).

• What is it?

- Canvas quiz with a 120-minute time limit (intended to take 60 minutes) designed to be taken as a small group
- Open book, open note, and open friend and a lower stake opportunity to prepare for the materials that will be asked about on the exams
- o Based on the activities performed during lab, but will often draw from the primary literature to introduce you to data from real experiments

• When to do it?

- After completing your lab report and reaching out to the teaching staff with any questions you might have.
- o Anytime between Thursday at 4 pm (following lab) and Monday at midnight. Be sure to have a 2 hr window available once you start.

Course Schedule

Readings: page numbers for Essential Biochemistry 5th or 4th edition by Pratt & Cornely. Pre-class Quiz (Q): quiz to be done before class starts (numbers correspond to the lecture #) Homework (numbers correspond to the week #)

UNIT 1: BIOLOGY IS JUST CHEMISTRY

Week	Date	Торіс	Reading 5th edition	Reading 4th edition	Quiz	HW	Lab
1	9/27 Molecular driving forces 10-12, 27- 10-12, 24- 36 (1.3, 2.1, 2.2) Q1	H1	Life at the Molecular Level (due online at the				
1	9/29	Amino acids and Acids & Bases		33-42 (2.3, 2.4); 86-94 (4.1)		НІ	beginning of lab wk 2; 10/3-5) No pre-lab or lab puzzle.
	10/2	pKa's and Proteins		33-42 (2.3, 2.4); 86-94 (4.1)		H2	Pre-Lab (due 10/3 at 9am)
2	10/4	Protein structure	95-107 (4.2, 4.3)	94-103 (4.2, 4.3)	Q4		Amino acids (due beginning of lab wk 3; 10/10-12) Puzzle (due 10/9 midnight)
	10/6	Protein structure+folding	107-113 (4.4, 4.5, 4.6)	104-108 (4.4, 4.5, 4.6)	Q5		
	10/9	Protein folding	107-113 (4.4, 4.5, 4.6)	104-108 (4.4, 4.5, 4.6)	Q6		Pre-Lab (due 10/10 at 9am) Protein structure (due beginning of lab wk 4; 10/17-19) Puzzle (10/16midnight)
3	10/11	Protein Recognition	184, 287- 291 (6.4, 10.1)	170, 260- 264 (6.4, 10.1)	Q7	Н3	
	10/13	Enzymes 1: Catalysts	167-179 (6.1, 6.2)	154-165 (6.1, 6.2)	Q8		
4	10/16	Enzymes II: mechanism of serine protease	180-188 (6.3, 6.4, 6.5)	166-175 (6.3, 6.4 6.5)	Q9		See below in Unit 2

UNIT 2: MOLECULAR MACHINES

Week	Date		Reading	Reading 4th edition	Quiz	HW	Lab
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4	10/18	EXAM 1				H4	Pre-Lab (due 10/17 at 9 am) Enzyme Activity (due beginning of lab wk 5;
	10/20 Enzymes III: Michaelis 198-208 (7.1, 7.2) Representation (7.1, 7.2) Representation (7.1, 7.2)	Q10		10/25-27) Puzzle (due 10/23 midnight)			
	10/23	Enzymes IV: regulation	209-222 (7.3, 7.4)	195-206 (7.3, 7.4)	Q11		Pre-Lab (due 10/24 at 9
5	10/25	Hemoglobin cooperativity	126-135 (5.1, 5.2)	122-129 (5.1, 5.2)	Q12	Н5	am) Enzyme Kinetics (due beginning of lab wk 6; 10/31-11/2) Puzzle (due 10/30 midnight)
	10/27	Hemoglobin allostery	126-135 (5.1, 5.2)	122-129 (5.1, 5.2)	Q13		
	10/30	Cytoskeleton (Structure and Motor Proteins)	136-153 (5.3, 5.4)	130-146 (5.3, 5.4)	Q14		Pre-Lab (due 10/31 at 9am) Allostery & Cooperativity (due beginning of lab wk 7; 11/7-9) Puzzle (due 11/6 midnight)
6	11/1	Membrane proteins	263-273 (9.2, 9.3)	240-248 (9.2, 9.3)	Q15	Н6	
	11/3	Signaling	287-297 (10.1, 10.2)	260-268 (10.1, 10.2)	Q16		
7	11/6	REDOX review	428-432 (15.1)	385-389 (15.1)	Q17		See below in Unit 3

UNIT 3: FIGHTING ENTROPY

Week	Date	Topic	5th	Reading 4th edition	Quiz	HW	Lab
7	11/8	EXAM 2					Pre-Lab (due 11/7 at 9am) Membrane Permeability and Transport (due
/	11 17 10	Veterans Day obs., no lecture				Π/	beginning of lab wk 8; 11/14 16) Puzzle (due 11/13 midnight

	8 11/15 Sugar I: glycolysis 366-382 (13.1) (13.1) Q18 Sugar II: fermentation 383-386, 344-347, 393-395 (13.2, 13.5) (13.2, 13.5)	Q18					
8		Н8	Pre-Lab (due 11/14 at 9am) Metabolism (due online 11/22 10 am) Puzzle (due 11/20 midnight)				
	11/17	Citric Acid Cycle I	403-416 (14.1, 14.2, 14.3)	362-374 (14.1, 14.2, 14.3)	Q20		
	11/20	Citric Acid Cycle II	416-421 (14.1)	374-379 (14.4)	Q21		
9	OXPHOS I: Electron transport 432-442 (15.2)	432-442 (15.2)	390-398 (15.2)	Q22	Н9	No Lab (Holiday)	
	11/24	Holiday, no lecture					
	11/27	OXPHOS II: Electron transport	443-450 (15.3, 15.4)	399-405 (15.3, 15.4)	Q23		Pre-Lab (due 11/28 at 9
10	11/29	Photosynthesis (light rxn)	458-470 (16.1- 16.2)	411-422 (16.1, 16.2)	Q24		am) Respiration and Photosynthesis (due online 12/1 10 am)
	12/1	Photosynthesis (dark)	471-477 (16.3)	422-428 (16.3)	Q25		No lab puzzle.
11	12/8	FINAL EXAM (Tykeson 32, Friday 10:15-12:15)					

Community

This class is governed by the UO community standards.

- Respect the dignity and essential worth of all individuals.
- Promote a culture of respect.
- 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.

Cheating

You are expected to do your own work. Cheating, plagiarism and any other form of academic dishonesty will not be tolerated. Group work is encouraged throughout this class, however, the work you turn in should be your own interpretation of the group discussion. Exactly copying text and/or graphs is not permitted. Please refer to the University of Oregon Student Conduct Code.

Other Course Policies

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

Open inquiry, freedom of expression, and respect for differences 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 remote 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.

Academic Disruption. 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.

Crises happen. If you are having problems that are interfering with your ability to do the work in this class, please let me know promptly. We are willing to make arrangements when the need is real and when you have done your best to deal with the situation in a timely manner. Make this request in writing to Laurel (lpfeifel@uoregon.edu), preferably ahead of time.

Academic integrity. We expect students to complete assignments and exams in a manner consistent with academic integrity as outlined in the Student Conduct Code: https://policies.uoregon.edu/vol-3-administration-student-affairs/ch-1-conduct/student-conduct-code. This includes cheating ("any act of deception by which a student misrepresents or misleadingly demonstrates that the student has mastered information on an academic exercise that the student has not mastered"), and plagiarism ("using the ideas or writings of another as one's own.") Finally, you do not have permission to post any course related material on outside private or public websites (i.e. coursehero, chegg, groupme, etc.). We have a zero tolerance policy for academic dishonesty. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures.

GenAI. You may use GenAI programs (e.g., ChatGPT), to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity.

Students may not use GenAI tools in this course to produce course materials or assignments in whole or in part. All work you submit for this course toward completion of course requirements must be your own original work done specifically for this course and without substantive assistance from others, including GenAI. Work you've completed for previous courses or are developing for other courses this term also should not be submitted for this course. In accordance with UO policy, if we believe you've handed in work created all or in part by GenAI, we will submit a report of suspected academic misconduct to the Office of Student Conduct and Community Standards for that office to make a determination of responsibility and, if warranted, assess a grade penalty. If you have any questions or doubts, please ask!

Discrimination and Harassment. Any student who has experienced sexual assault, relationship violence, sex or gender-based bullying, stalking, and/or sexual harassment may seek resources and help at safe.uoregon.edu. To get help by phone, a student can also call either the UO's 24-hour hotline at 541-346-7244 [SAFE], or the non-confidential Title IX Coordinator at 541-346-8136. From the SAFE website, students may also connect to Callisto, a confidential, third-party reporting site that is not a part of the university. Students experiencing any other form of prohibited discrimination or harassment can find information at respect.uoregon.edu or aaeo.uoregon.edu or contact the non-confidential AAEO office at 541-346-3123 or the Dean of Students Office at 541-346-3216 for help.

Reporting. We are Assisting Employees under the University's Prohibited Discrimination and Retaliation Policy. As such, if you disclose to us, we will respond to you with respect and kindness. As part of that support, we will direct students who disclose prohibited discrimination and harassment, including sexual harassment or violence, to resources that can help and will only report the information shared to the university administration if the student requests that the information be reported (unless someone is in imminent risk of serious harm or a minor). Please note the difference between 'privacy' and 'confidentiality.' As an Assisting Employee we can offer privacy because we are not required to report certain information to the university. However, we 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 we as assisting employees receive may still be accessed by university or court proceedings.

For information about our reporting obligations as an employee, please see <u>Employee Reporting Obligation</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 safe.uoregon.edu 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 investigations.uoregon.edu/how-get-support.

We are also a mandatory reporter of child abuse. Please find more information at <u>Mandatory</u> Reporting of Child Abuse and Neglect.