

BB451/551: Biochemistry (3 Credits)

Winter 2019

Day and Time	Monday, Wednesday, and Friday 12:00 noon – 12:50 pm, LInC 128	
Instructor	Dr. Victor Hsu 2143 Ag. Life Sci. Bldg. (ALS) (541) 737-4398 hsuv@onid.orst.edu	
Office Hours	MW 1:00–2:00 pm or by appointment	
Teaching Assistants	Heather Forsythe	James Miyasaki
Office Hours Additional Hours Weeks 2/5/8	Thursdays, 4:00 pm – 5:00 pm, ALS 2023 Fridays, 10:00 am – 11:00 am, ALS 2023	Wednesdays , 3:00 pm – 4:00 pm, ALS 2031 Thursdays, 2:00 pm – 3:00 pm, ALS 2031
Course Objectives	This course in general biochemistry is intended to integrate information about metabolic pathways with respiration (respiratory control) and initiate the student into a microscopic world where blueprints are made of deoxyribonucleic acids, factories operate using enzymes, and the exchange rate is in ATPs rather than Dollars or Euros. Beyond explaining terms, and iterating reactions and metabolic pathways, this course strives to establish that the same principles that govern the behavior of the world around us also govern the transactions inside this microscopic world of the living cell. And by studying and applying these principles, we begin to understand cellular and bodily processes that include sensory mechanisms.	
Learning Resources	The textbook we will be using is <i>Biochemistry Free For All</i> by Ahern, Rajagopal and Tan, Version 1.3 Both the iBook and the PDF version can be downloaded at: http://biochem.science.oregonstate.edu/content/biochemistry-free-and-easy Readings are posted in the schedule below. It is expected that assigned reading be done <i>BEFORE</i> lecture. The lecture notes will be posted on Canvas (BB_451_X001_W2019).	
Course Policies	Prerequisites: BB 450 or BB 450H is required. Students are expected to have mastered the simple organic chemistry of functional groups, general chemistry problem solving in stoichiometry, pH and equilibrium calculations, and basic algebraic skills such as equation solving and use of exponentials and logarithms. Incompletes: Take this course only if you plan to finish it in a timely manner (during this term). An "Incomplete" will only be given when there is a strong and compelling case for doing so (e.g., health reasons, military commitment, etc.).	

Learner Outcomes	<p>The intention of this course is for the student to:</p> <ul style="list-style-type: none">Acquire the specialized language of biochemistry.Retain the concepts fundamental to biochemistry.Apply and describe concepts fundamental to biochemistry.Analyze and assess information concerning concepts fundamental to biochemistry.Communicate an understanding of key concepts relevant to biochemistry and the ability to use these concepts to solve problems in biochemistry via performance on written examinations.Demonstrate the ability to communicate and produce quality critical analysis of reported biochemical research results (BB551).
Learner Expectations	<p>First and foremost, we expect everyone to respect one another. Among other things, this means that only one person speaks at a time, and that each of you put forth an honest effort in class.</p> <p>Advance preparations, including reading assigned textbook pages before lectures are given.</p> <p>Prepare for exams by studying lecture notes posted on Canvas and the readings in the text.</p> <p>If there is difficulty in understanding concepts or problems, the student is expected to get help from and ask questions to the professor <i>before</i> it is too late.</p> <p>Recognition that an understanding of a complex topic like biochemistry requires considerable background prior to the class, a considerable amount of information to be acquired in the class, and sufficient time and effort to put these together to master the material.</p> <p>Eating, chewing gum noisily, using cell phones, etc. is inconsiderate to both the person lecturing and other students listening to the lecture. Thus, these activities are prohibited.</p> <p>Arrive to class on time, prepared and with all necessary materials. Be aware that significant time is required for studying the assigned readings, lectures, and notes throughout the term.</p>
Course Evaluation	<p>Fulfillment of the student learning outcomes will be assessed through a set of exams and weekly assignments. There will be three non-cumulative exams worth 75 points each and a cumulative final worth 150 points. The exams will be given on the dates and times indicated, <i>no exceptions</i>. A weekly assignment to identify the topic/concept that you found most difficult to understand/comprehend that week and to write a test question and answer based on that topic/concept will be submitted via Canvas by 11:59 pm each Friday (assigned 0, 2, or 4 points/week). There will also be opportunities for in-class participation (4 points each, up to 28 points). Final grades will be assigned using a curved scale.</p> <p>BB 551 students will be required to write a paper. BB 551 grades will be based on 443 points plus 50 points for the paper. The paper assignment entails a critical analysis of a <i>recent, full-length, primary</i> research publication, dealing with any topic covered this term. The appropriateness of the article should be discussed with the instructor prior to Feb 15th. The paper should take the form of a written Journal Club</p>

	<p>presentation, in which the student presents a clear summary and critical analysis of the paper. The following questions should be considered and addressed: Is the paper a significant contribution to the knowledge base? If so, why? If not, why not? Are experimental methods clearly described? Do the authors adequately consider alternative models? Are the conclusions drawn justified based on the reported results? What are the most important future directions for the work? <i>Substantiate your opinions by citing other work from the literature.</i> Recommended length of paper: 2–3 pages. Due before 11:59 pm on Friday, March 8th.</p>
<p>Statement Regarding Students with Disabilities</p>	<p>Please note: “Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.”</p>
<p>Statement of Expectations for Student Conduct</p>	<p>The University statement on student conduct and community standards can be found at: http://studentlife.oregonstate.edu/code.</p> <p><i>Cheating or plagiarism by students is subject to the disciplinary process outlined in the Statement of Expectations for Student Conduct (http://studentlife.oregonstate.edu/studentconduct/offenses-0)</i></p> <p>Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:</p> <ul style="list-style-type: none"> ◆ Cheating – use or attempted use of unauthorized materials, information or study aids ◆ Fabrication – falsification or invention of any information ◆ Assisting – helping another commit an act of academic dishonesty ◆ Tampering – altering or interfering with evaluation instruments and documents ◆ Plagiarism – representing the words or ideas of another person as one’s own <p>Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.</p> <p><i>“The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student’s freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office.”</i></p>

Schedule

Week 1	1/7, 1/9	Citric Acid Cycle	Chapter 6.2, pp. 542–561
	1/11*	Oxidative Phosphorylation	Chapter 5.2, pp. 411–467
Week 2	1/14	Oxidative Phosphorylation	Chapter 5.2, pp. 430–467
	1/16	Pentose Phosphate Pathway	Chapter 6.1, pp. 521–536
	1/18* ¹	Lipids & Membranes	Chapter 2.7, pp. 221–263
Week 3	1/21	Martin Luther King, Jr Day: no class	
	1/23	Midterm Exam #1	
	1/25*	Fatty Acid Metabolism	Chapter 6.3, pp. 565–591
Week 4	1/28	Fatty Acid Metabolism	Chapter 6.3, pp. 565–591
	1/30	Membrane & Lipid Synthesis	Chapter 6.3, pp. 565–591
	2/1*	Steroid Synthesis	Chapter 6.4, pp. 595–614
Week 5	2/4	Nitrogen Metabolism	Chapter 6.5, pp. 618–658
	2/6, 2/8*	DNA, RNA, and Genetic Information	Chapter 2.5, pp. 167–185
Week 6	2/11	Midterm Exam #2	
	2/13	Purine & Pyrimidine Metabolism	Chapter 6.6, pp. 662–691
	2/15* ²	Deoxyribonucleotide Synthesis	Chapter 6.6, pp. 662–691
Week 7	2/18, 2/20	DNA Replication	Chapter 7.2, pp. 705–727
	2/22* ³	DNA Repair	Chapter 7.3, pp. 731–746
Week 8	2/25	Recombination	Chapter 7.3, pp. 731–746
	2/27	Transcription	Chapter 7.4, pp. 749–763
	3/1*	RNA Processing	Chapter 7.5, pp. 768–777
Week 9	3/4	Midterm Exam #3	
	3/6	Translation	Chapter 7.6, pp. 780–800
	3/8* ⁴	Protein Synthesis	Chapter 7.6, pp. 780–800
Week 10	3/11, 3/13	Gene Regulation	Chapter 7.7, pp. 804–824
	3/15*	Signalling	Chapter 7.8, pp. 828–852
Finals Week (Tuesday)	3/19	Final Exam, 9:30 am	

*: Question of the week due, submitted via Canvas before 11:59 pm.

¹: Last day to add the class; ²: BB551 Last day for journal article approval

³: Last day to change to or from S/U grading, or to withdraw from the course

⁴: BB551 Written paper due, submitted via Canvas before 11:59 pm

Readings from *Biochemistry* by Berg, Tymoczko, Stryer, 8th Ed (7th Ed)

Week 1	1/7, 1/9 1/11*	Citric Acid Cycle Oxidative Phosphorylation I	Chapter 17, pp. 495–518 (pp. 497–519) Chapter 18, pp. 523–559 (pp. 525–560)
Week 2	1/14 1/16 1/18* ¹	Oxidative Phosphorylation II Pentose Phosphate Pathway Lipids & Membranes	Chapter 18, pp. 523–559 (pp. 525–560) Chapter 20, pp. 601–612 (pp. 601–611) Chapter 12, pp. 341–362 (pp. 345–366)
Week 3	1/21 1/23 1/25*	Martin Luther King, Jr Day: no class Midterm Exam #1 Fatty Acid Metabolism	Chapter 22, pp. 643–673 (pp. 639–667)
Week 4	1/28 1/30 2/1*	Fatty Acid Metabolism Membrane & Lipid Synthesis Steroid Synthesis	Chapter 22, pp. 643–673 (pp. 639–667) Chapter 26, pp. 767–776 (pp. 759–767) Chapter 26, pp. 776–797 (pp. 767–786)
Week 5	2/4 2/6, 2/8*	Nitrogen Metabolism DNA, RNA, and Genetic Information	Chps 23/24, pp. 681–739 (pp. 673–731) Chapter 4, pp. 105–131 (pp. 109–133)
Week 6	2/11 2/13 2/15* ²	Midterm Exam #2 Purine & Pyrimidine Metabolism Deoxyribonucleotide Synthesis	Chapter 25, pp. 743–748 (pp. 735–745) Chapter 25, pp. 748–763 (pp. 745–755)
Week 7	2/18, 2/20 2/22* ³	DNA Replication DNA Repair	Chapter 28, pp. 827–845 (pp. 819–837) Chapter 28, pp. 845–852 (pp. 837–844)
Week 8	2/25 2/27 3/1*	Recombination Transcription RNA Processing	Chapter 28, pp. 852–856 (pp. 844–848) Chapter 29, pp. 859–876 (pp. 851–869) Chapter 29, pp. 876–890 (pp. 869–882)
Week 9	3/4 3/6 3/8* ⁴	Midterm Exam #3 Translation Protein Synthesis	Chapter 30, pp. 893–902 (pp. 887–897) Chapter 30, pp. 902–921 (pp. 897–933)
Week 10	3/11, 3/13 3/15*	Gene Regulation Sensory Systems	Chapter 31, pp. 925–938 (pp. 921–934) Chapter 33, pp. 961–979 (pp. 957–974)
Finals Week (Tuesday)	3/19	Final Exam, 9:30 am	

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Suggested Problems from
Biochemistry by Berg, Tymoczko,
Stryer, 8th Ed (7th Ed)

- Chapter 12: 1–17, 19
(All)
- Chapter 17: 1, 8, 9, 13, 17, 20, 22, 25, 31, 32, 34
(2, 6, 7, 10, 13, 15, 16, 19, 24, 25, 27)
- Chapter 18: 3–7, 9, 10, 12–14, 19, 22, 25, 27, 30, 33, 34, 38, 40, 45, 48, 50
(3–6, 8–12, 16, 19, 21, 23, 26, 29, 30, 34, 36, 41, 44, 45)
- Chapter 20: 20, 23, 24–26, 28, 30, 31, 38
(17, 19, 20–22, 24, 26, 27, 32)
- Chapter 22: 3, 5, 8–11, 16, 21, 24, 25, 27, 30, 35, 36, 44, 48
(2, 4, 7–10, 15, 19, 21, 22, 24, 27, 32, 33, 40, 44)
- Chapter 26: 1, 3, 5, 7, 15, 16, 18, 20, 29, 33, 34, 37, 38
(1, 3, 5, 7, 14, 15, 17, 19, 27, 31, 32, 34, 35)
- Chapter 23: 1, 5, 7, 10–13, 15, 16, 19, 21, 24, 26, 28, 32, 36
(1, 5, 7, 10–13, 15, 16, 19, 21, 24, 26, 28, 31, 34)
- Chapter 24: 1, 6–8, 13, 15, 16, 18, 30
(1–4, 11–13, 15, 26)
- Chapter 4: 1–8, 10–12, 17, 19
(1–8, 10–12, 15, 16)
- Chapter 25: 1–6, 9, 10, 12, 16, 19, 23, 26, 28, 33, 34, 36, 43
(1–6, 9, 10, 12, 15, 18, 20, 23, 25, 29, 30, 32, 38)
- Chapter 28: 2–4, 7–12, 14, 19, 20a–c
(2–4, 7–12, 14, 19, 28a–c)
- Chapter 29: 1–7, 14–16, 18, 22, 24
(1–7, 14–16, 18, 22, 24)
- Chapter 30: 1–6, 10–12, 17, 18, 21, 25, 29, 32
(1–6, 10–12, 18, 19, 21, 23, 27, 31, 34)
- Chapter 31: 1, 5, 6, 10, 12
(1, 5, 6, 10, 12)
- Chapter 32: 4–7
(4–7)
- Chapter 33: 1–6, 8–12
(1–11)