

CHEM F449
Biochemistry: Metabolism
Spring 2023

Lecture: Asynchronous; posted on Canvas
Recitation: Wednesday 12:00-1:00 via zoom– I will likely add another recitation slot after I send out a doodle poll.
Prerequisite: Chem F321X with grade C or better

Course Instructor:

Kriya Dunlap, Ph.D.
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Textbook: *Principles of Biochemistry* (2008) 8th Edition
David L. Nelson and Michael M. Cox
W. H. Freeman and Company, NY
ISBN-10: 1-4641-2611-9

*Most general biochemistry books provide adequate reading material with minimal difference in detail and depth on most topics.

Course Description: Welcome to Biochemistry: Metabolism. Biochemistry is the chemistry of living things. This course is an introduction to metabolism at the molecular level. Metabolism is the combination of both catabolism and anabolism. Catabolism is the breakdown of complex molecules into smaller units with the release of energy. Anabolism is the synthesis of complex molecules from smaller units and the storage of energy. In this course we will take an in-depth look at the molecular structures and classification of the three major macromolecules: carbohydrates, lipids, and proteins. We will then study their individual metabolic pathways and regulation, and finally we will look at the big picture and how all the metabolic pathways are tied together.

Catalog Description: This course is an introduction to metabolism at the molecular level and covers the molecular structures and classification of the three major macromolecules: carbohydrates, lipids, and proteins. Individual metabolic pathways and regulation will be studied, as well as the big picture and how all the pathways are tied together

Course Structure: Weekly lectures will be pre-recorded and posted on Canvas. We will cover approximately one chapter per week. Every Wednesday we will meet on zoom for a recitation session. You will be required to listen to the pre-recorded lectures prior to recitation. During recitation we will work problems together or in small group breakout sessions. Each chapter will be accompanied with a short, timed, open book, online, chapter quiz. Homework will consist of illustrating or creating a diagram of compounds or cycles covered in the chapter. At the end of the semester you will create a final project that will combine all of the components and cycles into a large metabolic pathway diagram, illustration, or poster. The final project can be used as your cheat sheet for a 1-hour on-line final.

Student Learning Outcomes:

- Identify, illustrate, and classify monomers of lipids, carbohydrates, and proteins.
- Differentiate chemical linkages in polymers of each macromolecule.
- Compare and contrast the different roles of macromolecules, i.e. as signaling molecules, structural functions, and/or energy storage.
- Identify reaction types in the common metabolic pathways.
- Illustrate monomers and ATP.
- Illustrate glycolysis, gluconeogenesis, the pentose phosphate pathways, the citric acid cycle, urea cycle, and beta-oxidation.
- Compare catabolism of different types of monomers.
- Identify where amino acids enter the metabolic pathways.
- Know the location of the metabolic pathways within the body and within the cell
- Identify important regulatory enzymes, coenzymes and co-factors involved in the major metabolic pathways
- Identify steps in the metabolic pathways that produce ATP or equivalent i
- Identify the steps in the major metabolic pathways that yield molecules for biosynthesis of other macromolecules.
- Interconnect all the pathways that you have illustrated into one metabolic pathways poster, illustration, photo, video etc.

Instructor's expectations: Students are required to listen to pre-recorded lectures posted on Canvas. Reading the corresponding text and attending recitation is highly recommended.

Recitation: During recitation we will work through problems, join breakout sessions, and discuss metabolic pathway illustrations and diagrams. Students will be required to turn in their recitation problems on canvas, either individually or as a group. Each problem set will be graded out of 10 points. We will work the problems together or in breakout sessions. Recitation problems will apply the knowledge obtained from the pre-recorded lectures and corresponding text. Recitation problems will be averaged

and scaled to 100 points at the end of the semester. Students may also be required to share/present their molecule and pathway diagrams throughout the course. Molecule and pathway diagrams are considered HW.

Canvas: <https://canvas.alaska.edu/>. Syllabus, student grades, chapter quizzes, zoom link for recitation, reading assignments and all other course material will be posted on the UAF Canvas website. Time sensitive information and reminders will be sent occasionally to all students using canvas so it is important that you regularly check your UA email address.

Final Exam: A final exam will be held during finals week. The final exam will be cumulative. More information will be available at a later date pertaining to the final and how it will be administered. In general, no work will be accepted after the final exam.

Quizzes: There will be a short timed canvas quiz after completing each chapter. Students will be informed when a quiz is made available. Quiz questions will test on lecture materials and will resemble problems worked in recitation. Quizzes will be graded out of 10 points. Quizzes will be averaged and scaled to 100 points at the end of the semester. There are no make-up quizzes.

Homework: Success in Biochemistry requires knowledge and understanding of complex metabolic pathways. Being able to draw or illustrate these pathways, as well as following the breaking and forming of chemical bonds will enhance your understanding of these systems. The time you spend on illustrating the flow of monomers in and out of these pathways will enhance your understanding without the need of traditional rote memorization. Effort spent on your homework will reduce the amount of work and time needed to invest into the final metabolic pathway project. HW will be averaged and scaled to 100 points at the end of the semester. No late homework will be accepted.

Final Project: The final project will be a diagram/ illustration/ animation of all of the metabolic pathways covered in the class, including where the macromolecules enter and exit the pathways (carbohydrates, lipids, amino acids). Parts of the pathway will be your homework throughout the class and will give you the opportunity to try different techniques. Some ideas include, powerpoint, drawing apps, molecular model kits, claymation, hand drawing, and chemical structure applications. Final project will be graded on the following criteria: 1. Completion 2. Accuracy of the molecule or pathway 3. Creativity 4. Appropriateness of the media or technique used, and 5. Presentation.

Grading:

Quizzes

100 pts

Recitation problems	100 pts
Homework	100 pts
Final Project	100 pts
<u>Final Exam</u>	<u>100 pts</u>
Total	500 pts (max.)

Letter Grade	Percentage Grade
A+	94.5 - 100
A	90.5 - 94.4
A-	87.5 - 90.4
B+	84.5 - 87.4
B	80.5 - 84.4
B-	77.5 - 80.4
C+	74.5 - 77.4
C	70.5 - 74.4
C-	67.5 - 70.4
D+	64.5 - 67.4
D	60.5 - 64.4
D-	57.5 - 60.4
F	57.4 or lower

Computer access: This course is an online class and therefore, access to a computer is required. Most campuses have computer labs and computer access for their students. At UAF, Chemistry computer lab (REIC 172) is available for course related activities – www.uaf.edu/chem/instrumentation/policies. Currently, the Department of Computing and Communications (DCC) maintains two open labs on campus: the Bunnell Lab, and the Node (Rasmussen library). The Node has 24-hour access.

Amending this Syllabus: The instructor may make changes to this syllabus. Any changes will be clearly communicated via email sent to your UAF e-mail account and posted on Blackboard and course website.

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website: <https://sites.google.com/alaska.edu/coronavirus/uaf?authuser=0>. Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Support Services: There are a large number of resources available to help students that may be having difficulty in the course or with a particular topic. CHEM 321 TAs keep regular office hours, which can be found on the Chemistry Learning Center calendar: www.uaf.edu/chem/clc/ and will be posted on Blackboard once available. Tom Green and I both hold regular office hours. Students can also make an appointment to see me for help if office hours do not fit with the student's schedule.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uafmathstatlab@gmail.com, Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, <https://www.ctc.uaf.edu/student-services/student-success-center/>)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Protection: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve

problems, please go to the following site: <https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/>.

Disabilities Services: I will work with the Office of Disabilities Services to provide reasonable accommodations for students with disabilities. If you have a disability and require special assistance, please contact the instructor as soon as possible. Students with disabilities must provide documentation of the disability and a written statement indicating any special arrangements that need to be made.

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling [6 free counseling sessions] (907-474-7043, <https://www.uaf.edu/chc/appointments.php>, Whitaker 203)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.edu, Wood Center 119)

Cheating/Academic Dishonesty: The Chemistry & Biochemistry Department Policy on Cheating is: *“Any student caught cheating will be assigned a course grade of F. The student’s academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.”* The Department considers performing unauthorized “dry labs” as cheating. Partnering during the lab is acceptable but lab reports must show your own calculations and ideas.

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact:
UAF Department of Equity and Compliance
1692 Tok Lane, 3rd floor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu

Additional syllabi statement for courses including off-campus programs and research activities:

University Sponsored Off-Campus Programs and Research Activities

We want you to know that:

1. UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.
2. Incidents can be reported to your university's Equity and Compliance office (listed below) or online reporting portal. University of Alaska takes immediate, effective, and appropriate action to respond to reported acts of discrimination and harassment.
3. There are supportive measures available to individuals that may have experienced discrimination.
4. University of Alaska's Board of Regents' Policy & University Regulations (UA BoR P&R) 01.02.020 Nondiscrimination and 01.04 Sex and Gender-Based Discrimination Under Title IX, go to: <http://alaska.edu/bor/policy-regulations/>.
5. UA BoR P&R apply at all university owned or operated sites, university sanctioned events, clinical sites and during all academic or research related travel that are university sponsored.

For further information on your rights and resources [click here](#).

TENTATIVE SCHEDULE

Week	Unit	Date	Chapter	Topic
1	0	1/17-20	Class intro	Watch intro video
		Jan 18	Recitation	Syllabus; meet and greet
2	1	1/23-27	7	Carbohydrates and Glycobiology
		Jan 25	Recitation	Drawing sugars; question/answer
3	2	1/30-2/3	10	Lipids
		Feb 01	Recitation	Drawing fatty acids; question/answer

4	3	2/6-10	13	Introduction to metabolism
		Feb 08	Recitation	Drawing ATP; question/answer
5	4	2/13-17	14	Glycolysis, Gluconeogenesis, and Phosphate Pathway
		Feb 15	Recitation	Drawing our first metabolic pathways; question answer
6	5	2/20-24	15	The metabolism of glycogen in animals
		Feb 22	Recitation	question/answer; final project discussion
7	6	2/27-3/3	16	The citric acid cycle
		Feb 29	Recitation	drawing/writing/creating the steps of the citric acid cycle; question answers
8	7	3/6-3/10	17	Fatty Acid Catabolism
		Mar 8	Recitation	drawing/writing/creating the 4 steps of beta-oxidation of a 16 carbon FA; question/answer
9		3/13-17	No classes	Spring Break
10	8	3/20-24	3	Amino Acids, Peptides, and proteins
		Mar 22	Recitation	
11	9	3/27-31	18	Amino Acid Oxidation and the production of Urea
		Mar 29	Recitation	drawing/writing/creating the urea cycle; question/answer
12	10	4/3-4/7	19	Oxidative phosphorylation

		Apr 05	Recitation	
13	11	4/10-14	21	Lipid Biosynthesis
		Apr 12	Recitation	
14		4/17-21	Metabolic poster presentation	
		Apr 19	Recitation	
15		4/24-28	Metabolic poster presentation	
		Apr 26	Recitation	
16	Final Exam week	5/2-5	Online Final	