

Biology 3252/Chemistry 3251-FDF: Biochemistry I

Course outline

2020F

THE BASICS

- Lecturer: Dr. D. Law
- Office: Virtual
- email: dlaw@lakeheadu.ca
- Office hour: Thursdays in Zoom, 11:30 AM to 12:30 PM, or by email appointment.
- Phone: Make an appointment by email to talk with me on Zoom.

Please use the lakeheadu.ca email address above to contact me, not the email within D2L. I will check my email daily Monday to Friday, and will try to respond to your questions as quickly as possible during those days

Class info

All material is posted on MyInfo/D2L; check there for the latest course updates and information. Biochemistry I is a synchronous Zoom course. The lectures are “live” but are also recorded, so you can watch (and rewatch, if desired) these as many times as you like.

Calendar description

Chemistry 3251 Biochemistry I

Chemistry and metabolism of monosaccharides, disaccharides and polysaccharides. Chemistry of amino acids and proteins. Structure and reaction of fatty acids, triacylglycerols and phospholipids. Structure and properties of nucleotides and polynucleotides of DNA and RNA.

- Credit Weight: 0.5
- Prerequisite(s): [Chemistry 2231](#)
- Cross-List(s): [Biology 3252](#)
- Offering: 3-3; 0-0
- Notes: An additional fee (see Miscellaneous Fees) is required for this course.
- Course Classifications: Type C: Engineering, Mathematical and Natural Sciences

OBJECTIVES

A. Scientific concepts

By the end of this course, you will:

- know how biological macromolecules are formed from subunit building blocks
- recognize the biological and chemical properties of the four major classes of biomacromolecules and be able to identify their subunits
- know how metabolism is organized for maximum efficiency
- be able to distinguish macromolecule properties and functions in vivo
- know how macromolecules are synthesized and degraded
- become familiar with the nomenclature of biochemistry
- improve and expand your critical understanding of major concepts in biochemistry

B. Practical scientific techniques

By the end of this course, you will:

- develop hands-on laboratory skills in modern biochemical techniques
- increase your skills in distilling and presenting scientific information you acquire in the laboratory as a written report
- become familiar with many techniques required for dissecting the function of biomacromolecules and metabolic pathways in vivo

C. Broader learner outcomes

By the end of this course, you will:

- gain an understanding of how the diverse fields of biology and chemistry intersect in the multidisciplinary field of biochemistry
- increase your knowledge of biochemistry and biotechnology by attending public seminars given by experts in their fields
- understand how knowledge of biochemistry is of critical importance to human health
- know some of the fascinating history of advances in our understanding of biochemistry

ZOOM LECTURES

My lectures are live

All lectures and labs will be delivered live (synchronously) via Zoom.

This is new territory for all of us, and we should all try to be patient and kind to others during these lectures. That includes me; while I've used Zoom previously (probably like all of us), I'm still learning what works and what doesn't when teaching remotely.

Links to each lecture will be posted in advance in Calendar. You have to be signed into D2L for this link to work. This will ensure that I can see your real name in Zoom.

Be courteous in Zoom

You all likely know this, but mute your audio if you're not participating. It's up to you whether to turn on your video or not during the lecture. I'm OK either way.

Participate in class

I ask a lot of questions during lectures. I welcome volunteers to answer; turn on your video and/or audio to do so, whatever you're comfortable with. I also plan to call on students by name to answer some simple questions during class, so be prepared for that. This isn't to embarrass you but rather to make you more comfortable participating in group work, which will be a major part of your university life and future career.

Do the review questions in the breakout rooms

I will end each lecture with some relevant questions. We'll answer these in breakout groups of around 2 students each. One person per group will turn on video and audio to answer their question. I'm not expecting perfect answers but want you to think about the questions and answers. Participating in the breakout rooms is excellent prep for answering similar questions that might appear on the midterms and final exam.

Ultimately, you should answer all of the questions I post to prepare for the next exam.

Attend lectures synchronously to receive participation marks

Lectures will be recorded and posted on the D2L site and thus available for you to review. However, you have to be present during the synchronous lectures to participate in the iClicker questions and receive participation marks.

LECTURE AND LAB SCHEDULE

Lecture schedule (approximate and subject to change)

Day	Mo.	Date	Featuring	Topic
W	Sept.	7	Intro	Review of biochemical concepts, macromolecule classes
M		14	Intro	Introduction to metabolism
W		16	Lipids	Intro/functions; fatty acid nomenclature
M		21	Lipids	Synthesis and degradation
W		23	Lipids	Phospholipids, cholesterol, steroids
M		28	Lipids	Membranes; lipids and your health
W		30	Proteins	intro; R-groups; structure
M	Oct.	5	Midterm 1	Midterm on metabolism and lipids
W		7	Proteins	Assay and purification
		12, 14	Proteins	No classes: Fall break week
M		19	Proteins	Purification methodology (continued) and characterization
W		21	Proteins	Physical characterization and uses of pure protein
M		26	Proteins	Protein detection methods
W		28	Nucleic acids	intro, history, structure of nucleotides; central dogma
M	Nov.	2	Midterm 2	Midterm on proteins
W		4	Nucleic acids	Nucleotide biosynthesis; DNA replication
M		9	Nucleic acids	RNA synthesis; RNA processing; control of gene expression
W		11	Nucleic acids	Transfer RNA and translation: making protein
M		16	Nucleic acids	Tools for manipulating and quantifying DNA and RNA

W	18	Carbohydrate s	Intro and functions
M	23	Carbohydrate s	Glycolysis: the reactions; energetics and regulation
W	25	Carbohydrate s	Gluconeogenesis; TCA cycle I
M	30	Carbohydrate s	TCA cycle II; intro to oxidative phosphorylation I
W	Dec. 2	Carbohydrate s	Oxidative phosphorylation II; the pentose phosphate pathway
M	7	Review	Catch-up / review

Lab schedule – Tuesdays 11.30am -2.30pm (via Zoom)

Lab day: Tues.	Lab	Pre-lab quiz	Reports and home assignments
Sept 8	Lab #1: Introductory lab (lab schedule, introduction, marking scheme, reports, data analysis etc.)	No	No
Sept 15	Lab #2: Properties of lipids and qualitative analysis	Pre-lab Quiz #1	Lab report on Lab#2 (due Sept 22) Home based related exercise to be completed and included in the report

Sept 22	Lab #3: Properties of bilipid membranes – Osmosis and diffusion	Pre-lab Quiz #2	Lab report on Lab #3 (due on Sept 29) Home based related exercise to be completed and included in the report
Sept 29	Lab #4: TLC of amino acids (building blocks of proteins)	Pre-lab Quiz #3	Lab report on Lab #4 (due on Oct 6)
Oct 6	Lab #5: Protein purification using ion exchange chromatography	Pre -lab Quiz #4	Lab report on Lab #5 (due on Oct 20) Home based related exercise to be completed and included in the report
Oct 13	No lab - Fall reading week		
Oct 20	Lab #6, Part I: Extraction of genomic DNA from plant tissues	Pre -lab Quiz #5	
Oct 27	Lab #6, Part II: Restriction digestion of DNA and gel electrophoresis	No	Lab report on Lab #6 (due on Nov 3) Home based related exercise to be completed and included in the report
Nov 3	Lab #7, Part I: Properties of carbohydrates -qualitative analysis	Pre- lab Quiz #6	

Nov 10	Lab #7, Part II: Properties of carbohydrates -qualitative analysis (cont'd..)	No	Lab report on Lab #7 (due on Nov 17) Home based related exercise to be completed and included in the report
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TEXTBOOKS

Both of the following are required:

- *Biochemistry Free for All 1.3* by Kevin Ahern, Indira Rajagopal and Taralyn Tan. [PDF available](#) at Oregon State U; Apple ecosphere people can also download an [Apple Books version](#) for iPad or Mac. Free of charge.
- The [iClicker Reef app](#) for your mobile device: CAD 22 for the fall term. Once you've installed it, link it to the course by searching for my name at the Lakehead University-Orillia campus and choosing "BIOL-3252-FDF: Biochemistry I". This will get you ready to participate and receive marks for the in-class polling that will start on Monday, Sept. 14. See further info below for how this works under "Student participation".

Library reserves: Normally, there are additional textbooks available at the library for you to consult if you'd like to learn more about biochemistry. Unfortunately, these aren't available this year due to COVID concerns. We'll use many online resources this year in class and lab, but the [Medical Biochemistry](#) page has reasonable resources related to the metabolism of the 4 major biomacromolecule groups. Usha and I will be using some of these and others this term.

MARKING SCHEME

Lecture material: 50% of final mark:

- Midterm exam 1: **10%**
- Midterm exam 2: **15%**
- Final exam (date TBA): **20%**
- Participation via iClicker: **5%**

Lab material: 50% of final mark:

- 5 lab reports @ 8% each (best 5 out of 6): **40%**
- 5 pre- lab quizzes @ 1% each (best 5 out of 6): **5%**
- Participation: **5%**
 - Lab attendance and pre-lab discussion: 2.5%
 - Home exercise completion and report submission: 2.5%

STUDENT PARTICIPATION

All course participation during lectures will be done using the **iClicker Reef** app for your smartphone/tablet/computer/other device. Buy it in either the [Android or iOS app store](#).

Bring either your device with the app on it to each class. You will use it to answer questions in class and receive participation marks.

To link your app to the course, search for the course under my name at Lakehead-Orillia: "BIOL-3252-FDF: Biochemistry I". Then add it to your list of courses. The cost is around \$22 for a 6-mo subscription.

Five percent of your final mark is allocated to participation. In each lecture, you will use the clicker to answer questions that are based on the course material using the iClicker during my lectures. The 5% participation mark will be equally weighted for

- attendance (2.5%), and
- correct answers (2.5%).

Therefore, to receive a high participation mark, you have to be both physically and mentally present in class!

You may miss 3 lectures without penalty to your participation mark. For example, if there are 15 classes where you vote with iClicker, you need to be present for 12 of these to receive full credit for attendance. Additional information on the technology will be given in the first class.

ACADEMIC DISHONESTY

Lakehead has a [Student Code of Conduct – Academic Integrity](#). All students in this course should read the Code and become familiar with it.

To summarize the relevant parts of the Code, the penalty for plagiarism or cheating on any part of this or any other course is zero for the work where the student is caught.

Serious or repeated plagiarism, including cheating on an examination or test, will result in a mark of zero for the course and may result in expulsion from Lakehead.

There are three particular places in this course where cheating might occur:

1. submitting written work that you did not research and write;
2. using written or electronic notes to confer with another person in a test or examination; or
3. voting electronically in place of another person using iClicker Reef.

Academic dishonesty for any of these areas will result in a mark of **zero** for the work concerned.

To ensure academic fairness for students who work hard, rest assured that the course instructors will take **every precaution** to ensure that potential cheaters are caught and subjected to the appropriate penalty.

IF ZOOM GOES DOWN...

If Zoom is offline during class or lab time, which [happens infrequently](#), we will use D2L's Virtual Classroom (VC) videoconferencing instead. If we can't connect via Zoom, I'll send an email invitation within 5 min to your lakeheadu.ca email account. You can check out VC yourself within D2L; at the top of the class D2L page, go to **Other Tools > Virtual Classroom**. This is the same VC system most of you are familiar with from my online review sessions in previous courses. It operates much like Zoom.