

CHEM/MBIO 2360
BIOCHEMISTRY I: BIOMOLECULES AND AN
INTRODUCTION TO METABOLIC ENERGY
FALL 2020

Note: there will be two UMLearn sites for this course; one for the lecture sections and one for each laboratory section. Please check both regularly.

Lecture Sections

Lectures A01
Diana Mlinar
Diana.Mlinar@umanitoba.ca
Office hours by appointment only.

Lectures A02
Dr. Sean McKenna
Sean.Mckenna@umanitoba.ca
Office hours to be announced after the start of term.

All students are required to purchase a mandatory course pack containing all of the lecture notes from the University of Manitoba Bookstore. Both lectures sections will be using these notes but note that revisions may be made during the course. ***A unique perforated tear-away page must be used as the cover page for the midterm examination. Exams will not be marked without this page.***

All other lecture-related material will be available to registered students through the UMLearn website. Lectures will be presented in your assigned lecture slot through the Zoom Platform, for which the link will be provided through the UMLearn site. Lectures will be recorded and posted on the UMLearn site for a limited time for students to view asynchronously. ***Material presented in class takes precedence over all other material.***

Laboratory

Dr. Ellert Nichols
406B Parker Building
Ellert.Nichols@umanitoba.ca

There will be no scheduled office hours this term for the laboratory. Discussion forums for each experiment and the lab exam will be set up in the B01-B87 sections of UM Learn for this course. Zoom meetings with Dr. Nichols can be scheduled on an as needed basis.

Except for the information contained in this document, all further online information respecting the laboratory will be found in the B01-B87 sections of this course on UM Learn.

The laboratory portion of CHEM/MBIO 2360 will be a mixture of online and in-person delivery. There are seven different experiments for which you will be provided data that you will use to prepare seven different lab reports. There will also be three in person, Core Skills Labs (I, II and III), that will provide you the opportunity to work with equipment commonly used in the biochemistry laboratory. The in-person laboratories will begin the Week of September 21 and students will be assigned to Core Skills Group (A, B, or C). The schedule for when each Group will report to the laboratory can be found in the B01-B87 sections of this course on UM Learn. Your Core Skills Group assignment and laboratory room number will be provided to you during the second week of September.

These Core Skills labs will be graded on a pass/fail basis and you must pass them in order to pass the laboratory.

Information about the seven online experiments will be available through the B01-B87 sections of UM Learn for this course. The laboratory manual for the Core Skills Laboratories will be available at the University Bookstore.

Please note that the Department of Chemistry no longer offers Lab exemptions.

Evaluation

Laboratory- practical		17.5%
Laboratory- exam	Monday Dec. 7, 6:00- 7:30 PM	12.5%
Midterm Exam	Monday Oct. 26 th , 6:00-8:00 PM	20%
Final Exam	TBA	50%

Students must receive a mark of at least 15/30 on the laboratory portion of the course (practical + exam) to get credit for the course.

There is no deferred midterm or lab exam. For students who do not complete the midterm or lab exam, the final exam will be pro-rated. **NO EXCEPTIONS.**

Mark Breakdown

A+	90-100%
A	80-89%
B+	75-79%
B	70-74%
C+	65-69%
C	57-64%
D	50-56%
F	0-49%

Previous Examinations

Previous midterm and final examinations are available in the course pack. ***No answers will be provided.***

Course Technological Requirements

Students enrolled in the course must ensure they satisfy the following minimum technological requirements:

- A computing device where one can create and edit documents,
- An internet connection capable of streaming videos and downloading software, and
- Access to a web-cam and microphone.

Professional Conduct

We recognize that these are unusual circumstances and some adjustments need to be made when working virtually. At the same time, we do want to remind you that University policies, such as the **Respectful Work and Learning Environment policy**, still apply, as do basic expectations around how students will engage with each other and all members of the University. This means that when participating in classes, online meetings, etc., students are expected to behave professionally, and follow the same basic norms as they would in person, such as being properly clothed, not being impaired, and participating respectfully. **Essentially, if you wouldn't do it in an in-person class, don't do it in a virtual setting.**

Please familiarize yourself with the UM Respectful Work and Learning Environment (RWLE)

[http://umanitoba.ca/admin/governance/media/Respectful Work and Learning Environment RWLE Policy - 2016 09 01.pdf](http://umanitoba.ca/admin/governance/media/Respectful_Work_and_Learning_Environment_RWLE_Policy_-_2016_09_01.pdf)

Section 2.5(c) of the Student Non-Academic Misconduct and Concerning Behaviour Procedure describes types of inappropriate or disruptive behaviour ([https://umanitoba.ca/admin/governance/media/Student_Non-Academic_Misconduct_and_Concerning_Behaviour_Procedure - 2018 09 01.pdf](https://umanitoba.ca/admin/governance/media/Student_Non-Academic_Misconduct_and_Concerning_Behaviour_Procedure_-_2018_09_01.pdf)).

Academic Integrity

Academic integrity is taking responsibility for and being honest with your work and respecting the work of others. Since you are a member of the university community, we want you to learn what that responsibility and honesty entails and how we respect the work of others.

The Faculty of Science continues to uphold high standards of academic integrity. We know that our students support us in this endeavour and we count on each and every one of you to do your part. The same academic standards apply online, remote learning, and in class education. We expect all students to strictly adhere to instructions from their professors regarding what resources can and cannot be used during exams, to follow all rules professors decide to set.

To aid professors in ensuring that all forms of assessments have been administered fairly, the University will be electronically monitoring tests, quizzes and examinations, included, but not limited to overseeing chat-rooms, relevant predatory web-sites and, in so doing, we will analyze scholastic evidence of individual exams. E-monitoring tools may include one of the following: Respondus Lockdown Browser & Respondus Monitor; WebEx; Zoom or Microsoft Teams.

Please carefully review information with regards to academic integrity **be aware; be proactive; be smart and be honest.**

Academic Integrity Message from Associate Dean Krystyna Koczanski : <https://youtu.be/Ok-lilm4SeE>

UM Respondus Student Guide

<https://universityofmanitoba.desire2learn.com/d2l/le/content/6606/viewContent/1463719/View>

The Student Discipline By-Law may be accessed at:

http://umanitoba.ca/admin/governance/media/Student_Discipline_Bylaw_-_2009_01_01.pdf

The list of suggested minimum penalties assessed by the Faculty of Science for acts of academic dishonesty is available on the Faculty of Science webpage:

[Faculty of Science – Suggested Minimum Penalties for Acts of Academic Dishonesty](#)

Using Copyright material

Please respect copyright. We will use copyrighted content in this course. University guidelines state that copyrighted works, including those created by instructors of the course are made available for private study and research and must not be distributed in any format without permission. Since it is illegal, do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed.

Course Outline

Biochem I is an introductory course dealing with kinds of molecules encountered in biochemistry, and the concept of metabolic energy as a product of catabolism and a requirement for biosynthesis.

1. **Water:** structure of liquid water; hydrogen bonding; electrostatic and van der Waals interactions; the hydrophobic effect; detergents. Ionization of water; strong and weak acids and bases; ionization constants; calculation of pH, and understanding titration curves; Henderson-Hasselbalch equation; buffers.
2. **Amino Acids:** structures of the 20 common amino acids found in proteins; properties and classification of the R-groups; stereochemistry; ionization properties, titration curves, and calculation of pH.
3. **Protein Structure:** the peptide bond; amino acid sequence (primary structure); secondary structure and H-bonding: alpha-helix, beta-sheets; disulfide bonds; tertiary structure and the hydrophobic effect; quaternary structure; folding and denaturation of proteins; prosthetic groups; methods of protein purification.
4. **Enzymes:** catalysis; the enzyme-substrate complex; transition state theory; how enzymes lower the transition state; chiral specificity of enzymes; fundamentals of enzyme kinetics, and the Michaelis-Menten equation; inhibitors and their effects on kinetics; allosteric enzymes.
5. **Carbohydrates:** structures of simple sugars: aldoses and ketoses; naming, and stereochemistry; hemiacetal and acetal chemistry; cyclic forms of monosaccharides, Haworth structures, mutarotation and reducing sugars; sugar derivatives; glycosidic bonds; oligosaccharides; polysaccharides, including their physical properties.
6. **Nucleic Acids:** purines and pyrimidines; structures and naming of nucleosides and nucleotides; the nucleic acids; DNA structure, including the double helix,

Watson-Crick base pairs, denaturation; RNA and secondary structure; messenger, transfer and ribosomal RNA; mutations and oxidative damage to DNA.

7. **Lipids and Membranes:** properties of lipids; fatty acids and fats derived from them; storage and membrane lipids; phospholipids; glycolipids, including sphingolipids and gangliosides; steroids and terpenoids; beta-carotene and vision; cholesterol and other steroids; composition of biomembranes; facilitated diffusion and active transport mechanisms.
8. **Bioenergetics:** brief review of thermodynamic concepts; free energy as a means of understanding metabolism; standard free energy change and its measurement from equilibrium constants or cell potentials; redox reactions; biochemical electron carriers; ATP and its central role as storage form and source of free energy.
9. **Glucose metabolism:** glucose oxidation by cells as a source of ATP; detailed description of glycolysis and the tricarboxylic acid cycle; fate of pyruvate under anaerobic conditions; the electron transport chain; mechanism of oxidative phosphorylation; calculations of ATP yield.