

	School of Science
	BCHM 200 Introduction to Biochemistry
	Term: Winter 2024 Number of Credits: 3
Course Outline	

INSTRUCTOR: Ernie Prokopchuk, PhD

E-MAIL: eprokopchuk@yukonu.ca

OFFICE: A2015

OFFICE HOURS: Thurs & Fri 1:30-3:30 pm
or by appointment or any time my door is open

CLASS: Tues & Thurs 9:00 -10:20 am

ROOM: A2202

LAB: Wednesday 1:00-3:50 pm

ROOM: A2803

COURSE DESCRIPTION

This course will introduce students to the chemical structure and biological roles of the major molecular components of the cell: proteins, nucleic acids, carbohydrates, and lipids. Topics and processes are integrated through understanding biological macromolecules including protein structure, enzyme action, and intermediary metabolism with emphasis on catabolic processes. Examples and applications are drawn from medical, nutrition, agriculture, and biotechnology spheres. Students will further develop their investigative and technical skills through hands-on experiences in a laboratory setting.

COURSE REQUIREMENTS

Prerequisite(s): CHEM 210 (Organic Chemistry I), BIOL 201 (Cell Biology)

Recommended: CHEM 211 (Organic Chemistry II)

EQUIVALENCY OR TRANSFERABILITY

Receiving institutions determine course transferability. Find further information at:

<https://www.yukonu.ca/current-students/transfer-credit>

LEARNING OUTCOMES

After completing this course, students will be able to

- Use the basic vocabulary of biochemistry and conceptual knowledge of chemistry and biology to articulate the interdisciplinary nature of biochemistry in medical, laboratory, nutrition, agriculture, and biotechnology spheres.
- Draw and characterize the structures and chemical properties of amino acids, nucleotides, select monosaccharides, and lipids. This includes the chemistry of water, pH dependence, and buffers.

- Analyse and compare the underlying chemistry of key biochemical processes, including metabolism, bioenergetics, gene expression, and protein synthesis.
- Identify the molecules that represent the building blocks of the four classes of biomolecules to be studied in this course: proteins, nucleic acids, lipids, and carbohydrates, and relate these to their cellular roles.
- Describe the four levels of protein structure and describe the folding and forces that lead to these structures. List, discuss, use, and evaluate the major techniques used in separating proteins.
- Describe and experimentally examine how enzymes catalyze reactions, and how pH, temperature, inhibitors, and allosteric regulators can affect their function using the principles of protein structure, Michaelis-Menten Kinetics, and allostery.
- Investigate the chemical structures of DNA and RNA are utilized by the enzymes of replication, repair, transcription, and translation to regulate and express genetic information.
- Distinguish between aerobic and anaerobic carbohydrate metabolism. This includes the flow of energy and matter, the purpose(s), the mechanism of catalysis, and the conditions under which the reaction occurs.
- Demonstrate skills frequently used in biochemistry laboratories:
 - o work with an understanding and compliance of basic safety considerations and general procedures associated with a biochemistry laboratory
 - o dispense small volumes accurately using mechanical pipettes
 - o perform serial dilutions
 - o measure absorbance by visible spectroscopy
 - o use standard curves for quantification
 - o work as a team
 - o communicate biochemical experiments in written reports

COURSE FORMAT

Weekly breakdown of instructional hours

Three hours lecture, three hours lab. It is expected that this course will require 4 – 6 hours/week (on average) of homework, readings, and studying for the lecture component and 3 – 5 hours/week for readings, prelabs, and reports for the lab component. The actual time required will depend on the individual and some may need more or less time than these estimates.

Delivery format

Classes are delivered in-person (face-to-face).

Classes will be recorded with the intent to provide students with a way to revisit material covered in class. This may be helpful while studying or to review a topic covered in class. This also provides greater

flexibility to students who are unable to make the occasional class due to work, or other commitments, but please note that these recordings are not intended to be a substitute for regular class attendance. If the technology fails, recordings may not be available for a given day. Videos will only be available via the course Moodle page and only to students registered in the course.

Material will regularly be posted on the course LMS, Moodle. This material will include links to lecture capture videos, assignments, course announcements, links to online content, including the textbook on and suggested practice problems on OpenStax, a pdf of everything written on the screen during class, and other useful or interesting material related to the course. Please be aware that all course announcements and any other notifications generated by Moodle are sent to your Yukon University email address. It is essential that you regularly check this email account or set it to automatically forward to your preferred email account.

Labs are a mandatory component of the course. Students are expected to attend all lab sessions, complete the experiments, and submit the required reports. If a lab period is missed, the report for that experiment cannot be submitted unless arrangements are made with the instructor. The lab grade will be determined based on lab quizzes, pre-lab exercises, lab performance, and the lab reports. Expectations for the labs are outlined in the lab manual.

EVALUATION

Assignments	15 %
Midterm Test	20 %
Quizzes	5 %
Final Exam	30 %
Laboratory	30 %
Total	100%

Students must pass both the laboratory component (15/30) and the lecture component (35/70) in order to pass the course

Attendance

While attendance is not graded, it is strongly recommended. There is a strong correlation between regular attendance and academic performance.

Assignments

There will be at least 5 assignments due on an approximately bi-weekly basis. Assignments are worth 10% of the final grade based on the total mark obtained on all assignments. Assignments will involve a variety of questions or problems related to the course material. You will have at one week to complete each assignment. Late assignments will not be accepted (receiving a mark of 0) once graded assignments have been returned to the class, which usually happens at the next class.

Tests and Examinations

There will be one 80-minute midterm tests (February 27, 2024) held during scheduled class time worth 20% of the final grade. Short quizzes will be posted weekly on Moodle. All quizzes combined are worth

5%. The final examination (April 19, 2024, 9am-noon), worth 30% of the final grade, will cover material from the entire course, potentially including some content from the lab.

Laboratory component

The laboratory component of the course is worth 30% of the final grade. This will be based on lab performance (10%), pre-lab questions (10%), lab quizzes (5%), and lab reports (75%). The specific evaluation criteria for the lab are detailed in the lab manual.

COURSE WITHDRAWAL INFORMATION

The final day to withdraw without academic penalty is March 7, 2024.

TEXTBOOKS & LEARNING MATERIALS

Open educational resources will be used for the texts in this course in order to keep education as affordable as possible. Suggested readings in [Biochemistry Free for All](#), and on [Libretexts.org](#) will be listed on the Moodle page for the course.

The Laboratory Manual for Biochemistry 200 will be provided. You will need to provide your own notebook for use as a Lab Notebook. This must be a separate notebook, not the one you are using for course notes. More information will be provided in the first lab session.

Students will need to provide their own safety glasses. These MUST be clear (not tinted) and ANSI Z87.1 (or later) or CAS 94.1 (or later) certified; this information will be on the packaging. These are the same kind of safety glasses required in the Trades and can be purchased wherever such safety equipment is sold.

Lab coats are mandatory, and students can purchase these online ahead of time, or from the campus bookstore. Cotton lab coats are best, but most expensive. Blends are acceptable but 100% polyester must be avoided as these are quite flammable.

ACADEMIC INTEGRITY

Students are expected to contribute toward a positive and supportive environment and are required to conduct themselves in a responsible manner. Academic misconduct includes all forms of academic dishonesty such as cheating, plagiarism, fabrication, fraud, deceit, using the work of others without their permission, aiding other students in committing academic offences, misrepresenting academic assignments prepared by others as one's own, or any other forms of academic dishonesty including falsification of any information on any Yukon University document.

Please refer to Academic Regulations & Procedures for further details about academic standing and student rights and responsibilities.

Note that artificial intelligence tools such as Chat GPT can be useful in the same way as a web search or Wikipedia. They can be a starting point but cannot be used to do the work for you. Simply copying the output from something like Chat GPT and submitting it as your own work will be considered plagiarism the same as if you copied directly from a book, webpage, or classmate. Furthermore, appropriate referencing www.yukonu.ca

is expected in submitted work. You would not reference Chat GPT as it is not an actual source of information, much as you would not reference the results of a web search. References should be to the published scientific literature, or, when appropriate, to the popular scientific media.

ACCESSIBILITY AND ACADEMIC ACCOMMODATION

Yukon University is committed to providing a positive, supportive, and barrier-free academic environment for all its students. Students experiencing barriers to full participation due to a visible or hidden disability (including hearing, vision, mobility, learning disability, mental health, chronic or temporary medical condition), should contact [Accessibility Services](#) for resources or to arrange academic accommodations: access@yukonu.ca.

TOPIC OUTLINE

Week	Unit	Lecture Topics
1	Unit 0: Review	Introduction and Review
2	Unit 1: Aqueous Ionization	Predominant Species and Average Molecule, Isoelectric Point and Solubility
3	Unit 2: Proteins	Globular Protein Review, Bonds and Interactions, Amino Acids, Folding (Primary, Secondary, Tertiary and Quaternary Structure), Thermodynamics of Folding
4		
5	Unit 3: Enzymes	Activation Energy, Catalytic Mechanism, k_{cat} and % enzyme saturation, enzyme saturation, enzyme inhibition
6		
7	Unit 4: Energy Transfer	Biochemical Conventions and Definitions, Equilibrium and Steady State, Coupled Reactions and Threshold Energy, ATP in biosynthesis, High Energy Intermediates, Mitochondrial Structure, Oxidative Phosphorylation
8		
9		
10		
11	Unit 5: Metabolism	Metabolism, Glycolysis, anaerobic respiration, pyruvate dehydrogenase complex, the citric acid cycle, photosynthesis, plant metabolites
12		
13		

**Specific dates of topic coverage may be subject to change. Some topics may not be covered depending on time constraints.*