Introduction to Biochemistry Syllabus

Department of Biochemistry & Molecular Biology

BIOC 2300, Fall 2026

Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.

We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Kathryn Vanya Ewart (Instructor/Coordinator)	vewart@dal.ca	Book meeting
Shawn Xiong (Instructor)	shawn.xiong@dal.ca	TBD
Dina Rogers (Teaching Assistant)	BIOC 2300@dal.ca	n/a

Course Description

This online course surveys basic topics and concepts of Biochemistry. The structures, properties and metabolic inter-relations of proteins, carbohydrates and lipids are considered together with an introduction to nutrition and metabolic control. Although mammalian examples predominate some consideration of special aspects of biochemistry of microbes and plants is included.

Note

Students are advised to also take CHEM 2401.03

Course Prerequisites

BIOL 1010.03 (or equivalent), CHEM 1011.03 (or equivalent) and CHEM 1012.03 (or equivalent); all with grades of C or higher, or instructor's consent.

Course Exclusions

BIOC 2200.03

Notice regarding in-person exams

Although the course is delivered online, **the exams are in person**, as noted below. Midterm exams will be held **on campus** on **weekday evenings**, as described below, and the final exam will be written **on campus** at a time and location to be indicated in the Dalhousie University **final exam schedule**.

Student Resources/Course Material

- Study materials, including PDF files of lecture notes, lecture videos, assigned readings and links to relevant videos are made available in **Brightspace**.
- A **textbook is required** in this course and must be purchased in digital or printed form. It is “Biochemistry” by R.L. Miesfeld and M.M. McEvoy and published by W.W. Norton & Company.
- The 2nd edition of this textbook is fully available in digital format.
- You are welcome to use either the 1st or the 2nd edition of the physical textbook if that is the option chosen. However, if the 1st edition or a used textbook is purchased, it will be necessary to purchase access to Norton Smartworks separately.

- The textbook is available from the Dalhousie Bookstore at: https://bookstore.dal.ca/CourseSearch/?course[]=SUB,202710,BIOC,BIOC2300,01

    - The 2nd edition in digital format is recommended because it is available with Smartworks included for $102.96.

    - Physical textbooks in looseleaf and hardback formats are also available for purchase but are more expensive.

- Following purchase, use the link provided on Brightspace to acquire, register, and access Norton Online materials.

- Within our class, there are multiple ways to keep in touch with the instructional team. In the table on the next page, we highlight the purpose of each method of communication:

Method of Communication	Purpose	Advantage
Brightspace Discussion Board	Ask any questions on the course content & administration.	Fast response, easily accessible, open for everyone to see and share.
Course email: BIOC2300@dal.ca	Ask short course content-related questions.	Managed by our teaching assistant; response within 48 hours; only for short content questions
Dr. Ewart's Office Hours: Book Meeting	• Ask questions on course administration • Request 1-to-1 or 1-to-a-few meetings for content assistance, exam review, etc.	• Short, efficient and effective • Confidential if 1-to-1
Dr. Xiong's Office Hours: TBD	• Request 1-to-1 or 1-to-a-few meetings for content assistance, exam review, etc.	• Short, efficient and effective • Confidential if 1-to-1
Dr. Ewart's email: vewart@dal.ca Dr. Xiong's email: shawn.xiong@dal.ca	If our office hours do not fit your schedule, we can meet at a time that works for you.	Flexible and private.
Anonymous Feedback: Anonymous feedback	This form allows you to provide constructive feedback so that we can improve throughout the course.	Easy to complete, anonymous, and concerns can be addressed immediately.

Course Structure

The course will involve several components.

1. **Lecture files and videos:** As noted above, lecture material will be available as PDF files and in video form in Brightspace. These will include practice questions.

2. **Graded homework assignments:** Homework assignments will be given on a regular basis and these will be completed in the Smartwork portal within the Norton textbook environment. These are low-stakes evaluations with generous deadlines. However, please be mindful of the deadlines as they approach.

   Smartwork Homework information:
   - Eleven homework assignments are given in the semester, worth just under two points each, for a total of 20 final marks.
   - The average length of each homework assignment is estimated to be 1 hour for a student who has learned the material. However, students can take more time if needed and can save partially completed homework when interrupted to resume their work at a different time (before the deadline).
   - Each question has three attempts with a penalty for each incorrect answer that lowers the grade for that question by 11-15%.
   - Homework assignments cannot be accessed to complete them after the deadlines but can still be reviewed online for learning purposes.
   - Due dates: There are three due dates for sets of Smartwork homework assignments, which are October 19th, November 18th, and December 15th.

3. **Independent study**: This course will require substantial independent study of the material in order to develop broadly based and in-depth knowledge of the methods and concepts covered.

4. **Exams:** There will be two midterm and one final exam. All exams are written **in person.** They will be held at the following dates and times:
   - **Midterm 1:**
     - Covering lectures 2-11
     - Monday, October 19th at 7:00 p.m., Rowe Management Building room 1028
   - **Midterm 2:**
     - Covering lectures 12-22
     - Wednesday, November 18th at 7:00 p.m., Rowe Management Building room 1028.
   - **Final exam:**
     - Cumulative, covering the entire course
     - Date and time to be listed within the Dalhousie Final Exam schedule information later in the semester

5. **Communication and assistance:**
   The TA can assist students with questions by email, as indicated above. Appointments for consultation or extra help can also be set up by scheduling a meeting using the links above. As noted above, students who cannot meet in these intervals are welcome to contact instructors by email to schedule different meeting times.

Assessment

Evaluation will include the following components:

Assessment*	**Deadlines and exam dates**	**Weight (%)**
Online homework assignments using Smartworks	Sets of homework assignments will be due on October 19th, November 18th, and December 15th	20
Midterm exam 1 (non-cumulative)	Monday, October 19th at 7:00 p.m., Rowe Management Building room 1028	20
Midterm exam 2 (non-cumulative)	Wednesday, November 18th at 7:00 p.m., Rowe Management Building room 1028.	20
Final exam (cumulative)	In the Dalhousie final exam schedule, (date and location TBA)	40

Notes:

- If **both midterm exams are written**, the midterm exam with the higher grade of the two will count for the entire midterm mark (40%).
- If **only one midterm exam is written**, that exam will be worth 40%.
- If **no midterm exams are written**, the final exam will be worth 80%.

Conversion of numerical grades to final letter grades follows the **undergraduate*** Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

- Please note, even though the course does not strictly require an explanation of absence nor the submission of SDA (for greater accessibility), it still operates under the guidance of the university policies on short and long leaves of absence.
  • In accordance with the short leave of absence policy, students can submit a maximum of two separate Student Declaration of Absence forms per course during a term and one SDA for the final exam.
  • For major or chronic illness and other long-term or recurring absences, students should seek professional care, refer to the University's Student Accommodation Policy, and register with an advisor at the Advising and Access Services Center.

- Homework assignments cannot be submitted after the set deadlines. Therefore, the declaration of absence has no effect on these assignments.

- There will be **no make-up midterm** exams. If a midterm exam is missed, then the remaining midterm will count for 40% of the final grade. If no midterm exams are written, the final exam will automatically count for 80%. Therefore, the declaration of absence has no effect on the midterm exams in this course.

- The final exam is compulsory. If missed, a make-up exam must be written.

- Travel for holidays will not be accommodated.

Course Policies related to Academic Integrity

Students are expected to complete their homework assignments independently and without the use of generative AI.

Learning Objectives

Learning Objectives

Welcome to Introduction to Biochemistry (BIOC 2300), where you will begin to learn how life works at the molecular level. Biochemistry is at the nexus of the physical, natural and medical sciences, yet has developed its own language and culture that are distinct from those disciplines. The knowledge and tools of biochemistry (along with the closely related discipline of molecular biology) will continue to be at the forefront of discoveries in medicine and biotechnology, driving advances in such areas as molecular and personalized medicine, nanotechnology, agriculture, environmental remediation, and evolution. The concepts and skills obtained in this course will prepare students for more advanced training in biochemistry & molecular biology for careers in biotechnology, biomedical research, medicine, and other health professions.

At the end of this course, you will be able to:

1. Use your knowledge of fundamental principles of chemistry and physics (e.g. molecular bonding, thermodynamics, kinetics) to explain important concepts in biochemistry.
2. Describe the four major types of macromolecules in living systems.
3. Describe and interrelate the hierarchical levels of protein structure (1° to 4°) and provide examples of how this structure relates to the function (or dysfunction) of various classes of proteins.
4. Explain how enzymes can increase the rates of biochemical reactions at the molecular level, and how enzymes may be inhibited and regulated.
5. Understand the basic chemistry of genetic material and genomic organization.
6. Outline the major pathways by which precursor biomolecules (carbohydrates, lipids, amino acids) are synthesized and degraded, and the key points at which these pathways are regulated.
7. Describe how organisms obtain, store, and utilize energy through metabolic interconversion of biomolecules.
8. Understand how metabolic pathways are controlled to maintain homeostasis of organisms under normal physiological conditions, and how this may be disrupted by certain pathological states.
9. Relate/apply the fundamental biochemical concepts to your life and your daily activities.

Course Accessibility

- In accordance with the Student Accommodation Policy, the aim is to provide an accessible educational environment.

- Students are eligible for accommodations based on protected characteristics such as religion. If you have religious, cultural, or community-significant observances that conflict with course requirements, please reach out to discuss alternatives for completing the course requirements.

- To begin the process of requesting a formal academic accommodation, please contact the Student Accessibility Centre.

Course Content

Date	Item	Topic
NOTE: Graded homeworks will be given in Brightpace. Please be aware of notices. (20%)		
September 8th-13th	Lecture 1	Introduction to the Course
	Lecture 2	What is Biochemistry?
September 14th-20th	Lecture 3	Physical Biochemistry 1: Energy Conversion in Biological Systems
	Lecture 4	Physical Biochemistry 2: Water in Biological Systems
	Lecture 5	Protein Structure 1: Amino Acids to Primary Protein Structure
September 21-27th	Lecture 6	Exploring pH, pKa, and Protein Charge Through Worked Problems
	Lecture 7	Protein Structure 2: Secondary to Quaternary Structure
	Lecture 8	Basic Methods for the Study of Proteins
September 28th-October 4th	Lecture 9	Classes of Protein and Protein-Ligand Binding
	Lecture 10	Enzymes 1: Overview, Structure, and Function
	Lecture 11	Enzymes 2: Reaction Mechanisms
October 5th-11th	Lecture 12	Enzymes 3: Kinetics and Regulation
	Lecture 13	Nucleic Acids 1: Structures of DNA and RNA
	Lecture 14	Nucleic Acids 2: Genomics
October 12th-18th	Lecture 15	Lipid Structure and Function
	Lecture 16	Carbohydrate Structure and Function 1: Monosaccharides
	Review	Exam review session on Teams (TBA)
October 19th	Exam	Midterm exam on lectures 1-11 at 7:00-8:30 p.m. in person (20%)
October 19th-25th	Lecture 17	Carbohydrate Structure and Function 2: Glycobiology
	Lecture 18	Introduction to Metabolism & Glycogenesis
October 26th-November 1st	Lecture 19	Glycogenolysis
	Lecture 20	Glycolysis 1
	Lecture 21	Glycolysis 2
November 2nd-15th (regular week + study week)	Lecture 22	Citrate Cycle
	Lecture 23	Oxidative Phosphorylation 1
	Lecture 24	Oxidative Phosphorylation 2
November 18th	Exam	Midterm exam on lectures 12-22 at 7:00-8:30 p.m. in person (20%)
November 16th-22nd	Review	Exam review session on Teams (TBA)
	Lecture 25	Gluconeogenesis
November 23rd-29th	Lecture 26	Pentose Phosphate Pathway
	Lecture 27	Fatty Acid Oxidation 1
	Lecture 28	Fatty Acid Oxidation 2
November 30th-December 6th	Lecture 29	Fatty Acid Synthesis 1
	Lecture 30	Fatty Acid Synthesis 2
	Lecture 31	Amino Acid Metabolism
December 7th-9th	Review	Exam review sessions on Teams (TBA)
December exam period	Exam	Final exam on entire course (concentrating on material since midterm 2) in person at time and location TBA (40%)

Legend	
Blue:	Dr. Ewart
Orange:	Dr. Xiong
Grey:	Both
Yellow:	Evaluations

Prior knowledge from CHEM 1011/1012 & BIOL 1010

The following tables highlight the prior knowledge you will need to ease into BIOC 2300. Please use the information provided here as a guide for review and catch-up. It is often much more helpful to assess your knowledge of these concepts through questions. Therefore, a prior knowledge inventory has been constructed in the form of an ungraded readiness test. Please see below for details.

CHEM 1011:	CHEM 1012:
Determining limiting reagents	Equilibrium and reaction quotient
Solution concentration: molarity	Equilibrium constant
Dilution	Relationship between the Equilibrium Constant and Gibbs Energy
Electron affinity	Apply Le Chatelier's Principle to predict the effect of perturbing an equilibrium
Electronegativity	Relate the Reaction Quotient to the Equilibrium Constant
Electrostaic interaction and ionic bonding	Calculate Gibbs Energy under standard and nonstandard conditions
Resonance	Enthalpy
Covalent bonding	Entropy
Non-covalent interactions	Gibbs free energy
Electronegativity and bond polarity	Assigning oxidation number
Molecular polarity and dipole moment	Identifiy oxidation and reduction processes
Column chromatography	Reduction potential and its relationship to Gibbs free energy
Delocalized electron model	Functional groups
Acid and base chemistry (strong vs weak)	Identify chiral centers
Ka and pKa	UV/Vis spectroscopy
pH	NMR
Buffer and buffer capacity	Beer's law
Henderson-Hasselbalch equation	Catalyst and its effect on activation energy and reaction rate

BIOL 1010:
Describe the process by which carbohydrates, lipids and proteins are assembled from monomers and identify their functional roles in the eukaryotic cell.
Describe the structure and function of the organelles found in eukaryotic cells, demonstrating an appreciation for the overall architecture of the cell.
Identify the components of biological membranes, including the various types of membrane proteins.
Explain the fluid mosaic model and describe how membranes exhibit selective permeability.
Describe the role of ATP as the energy currency in the cell and appreciate its importance for driving cellular work.
List the key products and features of glycolysis, the citric acid cycle, and oxidative phosphorylation and understand the flow of energy through the entire process.
Identify the mechanism by which a signal is transmitted into the cell via G protein Coupled Receptors and Tyrosine Kinase Receptors.
List several examples of second messengers and describe how each is involved in signal transduction pathways.
Describe the basic chemical structure of deoxyribonucleic acid (DNA) and how it differs from ribonucleic acid (RNA); what role does each molecule play in the transfer of information from genotype (DNA) to phenotype (protein) and the deciphering of the genetic code.
Describe the basic principles of DNA technology/Biotechnology, its applications and the ethical and societal implications of this technological revolution.
Describe the most basic similarities and differences between Bacteria, Archaea and Eukaryotes.
Describe the phenomenon of (primary) endosymbiosis and its role in the origins of mitochondria and plastids

Biochemistry Readiness Test

To help you review and assess your prior knowledge, we highly encourage you to practice the Biochemistry Readiness Test on Brightspace. Please note, this test is not for credit, but rather for you to learn by diagnosing any missing conceptual knowledge and thus providing a means for you to catch up and become better prepared for the upcoming course content.

Syllabus Appendix

Student supports, university policies, and guidelines are available at the following website:

Syllabus Appendix: Student Supports & University Statements, Policies, and Guidelines