

**Macromolecules of Biochemical Interest
SC/CHEM (BIOL/BCHM) 3051 3.0
Fall 2024
Department of Chemistry, York University**

Course Director:	Prof. Philip Johnson Office: CB414, email: pjohnson@yorku.ca
Classes:	Tuesday and Thursday 2:30-3:50 (24 classes in total)
Location:	LSB 103
Office Hours:	Tuesday and Thursday 4:00-5:00, CB414
Prerequisites:	SC/CHEM 2021 & either SC/CHEM 2050 or SC/BCHM 2020 or SC/BIOL 2020

Course Description:

A discussion of the structures and functions of naturally occurring macromolecules including nucleic acids, proteins, polysaccharides and related macromolecular conjugates.

Purpose and Objectives of the Course; Learning Outcomes:

The purpose of the course is to expand the student's knowledge into the chemical, biochemical and structural properties of biologically relevant macromolecules. In particular, attention will be given to the chemical, biochemical and structural characteristics of carbohydrates, nucleic acids, proteins, as well as macromolecular complexes of these molecules, and both recent advances and landmark reports in the literature will be discussed. At the end of the course, the students should be able to:

1. Communicate effectively with chemists and biochemists in the field using proper nomenclature.
2. Identify structural characteristics of carbohydrates, nucleic acids and proteins in isolation and in complex with other macromolecules.
3. Explain which and how analytical tools can be used to probe the structural features of macromolecules.
4. Read, understand and summarize important points from scientific literature.

Text: There is no required textbook for the course. A recommended textbook for CHEM 3051 is Lehninger Principles of Biochemistry, Nelson & Cox, 7th ed., and is available at the York U. Bookstore in several formats (e.g., print and e-book). This is the same textbook for SC/BIOL 2020.

A number of biochemistry textbooks are available in the Steacie Library including: *Biochemistry*, Horton, Moran, *et al.*; *Biochemistry*, Stryer and Berg; *Fundamentals of Biochemistry*, Voet, Voet & Pratt; *Introduction to Protein Structure*, Branden & Tooze; *Biochemistry*, McKee and McKee.

Several textbooks on Nucleic Acids are available in the Steacie Library including: *Nucleic Acids in Chemistry and Biology* by Blackburn & Gait and *Principles of Nucleic Acid Structure* by W. Saenger.

Website: An eClass site is set up for this course and the course notes and other useful information will be posted there.

Lectures will be recorded and posted to eClass

If you have any questions about eClass see:

<https://eclass.yorku.ca/eclass/my/>

Make sure you are subscribed with the correct email address as important course announcements will be posted on eClass in the course of the semester.

Please do not use the eClass email function to communicate with me.

Marking scheme:	Midterm Exam	25%	Tuesday October 29
	Final Exam	40%	
	Peer-assessed assignment	10%	
	Virtual reality exercises	25%	

Virtual reality exercise:

This term you will participate in a virtual reality exercise worth 25% of the total grade. The activity will consist of three separate exercises (10%) in which you will experiment with the visualization and manipulation of macromolecules in Virtual Reality (VR). There will also be a group VR project worth 15% of the final grade. No prior experience with VR is expected. The VR section will be run under the instruction of Drs. Belozarov and Jackson.

Grading: The grading scheme for the course conforms to the 9-point grading system used in undergraduate programs at York (e.g. A+=9, A=8, B+=7, B=6, C+=5, C=4, D+=3, D=2, E=1, F=0). A letter grade for the course will be assigned based on the final percentage grade (A+=90-100, A=80-89, B+=75-79, B=70-74, C+=65-69, C=60-64, D+=55-59, D=50-54, E=40-49, F=0-39).

Academic Honesty:

York students are required to maintain high standards of academic integrity and are subject to the Senate Policy on Academic Honesty.

<https://www.yorku.ca/secretariat/policies/policies/academic-conduct-policy-and-procedures/>

Students should also review materials on the Academic Integrity website.

<http://www.yorku.ca/academicintegrity/students/index.htm>

Access/Disability:

York University is committed to principles of respect, inclusion, and equality of all persons with accessibility needs across campus. The University provides services for students with accessibility needs (including physical, medical, learning, and psychiatric needs) needing accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University.

If you are in need of these services, please register with accessibility services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs. Please note that registering with accessibility services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs.

Additional information is available at the following websites:

Student Accessibility Services: <https://accessibility.students.yorku.ca>

York Accessibility Hub: <http://accessibilityhub.info.yorku.ca/>

Student Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at - <http://secretariat-policies.info.yorku.ca/policies/disruptive-andor-harassing-behaviour-in-academic-situations-senate-policy/>

Notes:

- (1) **email policy.** All emails must include the name of the sender. Emails should be sent from your yorku email address and should include “Chem 3051” in the subject line. Messages from accounts like fuzzy_bunny@hotmail.com or similar may not receive a reply, probably because the email will be sent to my spam folder.
- (2) There will be **no make-up for a missed exam**. If you miss the Midterm Exam, its value will be added to the Final Exam.
- (3) **Re-grade policy:** If, after graded exams are returned, there is a question concerning the grading of the exam, the entire exam should be returned. The *entire* exam may be re-graded. All requests for re-grading must be made in writing and must be submitted to Dr. Johnson no later than the end of lecture one

week after the exam is returned to the class. The request should identify the question of concern and briefly explain the scientific reason why your answer merits further consideration.

Course Outline:

1. Carbohydrates
 - Chemistry, primary structure determination and a survey of representative polysaccharides.
2. Nucleic Acids
 - RNA and DNA chemistry, sequencing and three-dimensional structures.
3. Proteins and Macromolecular Complexes
 - Chemistry and three-dimensional structures of proteins.
 - A discussion of protein-DNA, protein-RNA, and protein-carbohydrate complexes.
4. Lipids
 - A discussion of the chemistry, structures and biologically relevant interactions.
5. Biochemically Important “Small” Macromolecules
 - Molecules such as the vitamins and important co-factors etc...
6. Scientific Literature
 - A discussion of relevant scientific literature, both current and “classic”, will be ongoing throughout the course.