Macromolecules of Biochemical Interest
SC/CHEM (BIOL/BCHM) 3051 3.0
Fall 2022
Department of Chemistry, York University

Course Director:	Prof. Philip Johnson Office: CB414, email: pjohnson@yorku.ca
Classes:	Monday, Wednesday, Friday 9:30-10:20, (36 classes in total)
Location:	Monday: Curtis Lecture Hall F Wednesday: Ross S137 Friday: Dahdaleh Building (DB) 0016
Office Hours:	Wednesday 10:30-11:20
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 (eg. 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 1	20%	Friday October 7
Midterm Exam 2	20%	Friday November 11
Final Exam	25%	
Peer-assessed assignment	10%	
Virtual reality exercise	25%	

Virtual reality exercise:
This term you will participate in a virtual reality exercise worth 20% 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. Belozerov 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-honesty-senate-policy-on/

Students should also review materials on the Academic Integrity website.
http://www.yorku.ca/academicintegrity/students/index.htm

Access/Disability:

Students with disabilities, including physical, medical, systemic, learning and psychiatric disabilities may need accommodation in exam requirements. Students are encouraged to notify the course director and to seek advice from the Counseling and Development Centre. Failure to notify the course director of your needs in a timely manner may jeopardize the opportunity to arrange for academic accommodation.

While all individuals are expected to satisfy the requirements of their program of study and to aspire to achieve excellence, the university recognizes that persons with disabilities may require reasonable accommodation to enable them to perform at their best. The university encourages students with disabilities to register with Student Accessibility Services to discuss their accommodation needs as early as possible in the term to establish the recommended academic accommodations that will be communicated to Course Directors through their Letter of Accommodation (LOA). ***Please let me know as early as possible in the term if you anticipate requiring academic accommodation so that we can discuss how to consider your accommodation needs within the context of this course***. Sufficient notice is needed so that reasonable steps for accommodation can be discussed. Accommodations for tests/exams normally require three (3) weeks (21 days) before the scheduled test/exam to arrange.

Additional information is available at the following websites:
Counselling & Disability Services - http://cds.info.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 Midterm Exam 1, its value will be split between Midterm Exam 2 and the Final Exam. If you miss Midterm Exam 2, 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 1 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