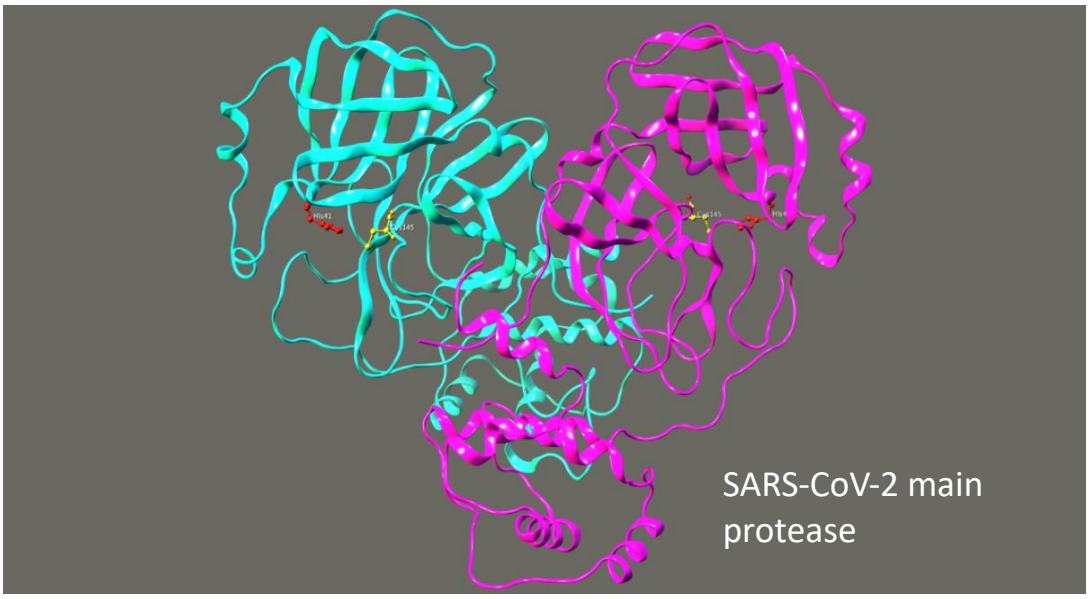
BIOC 3103 - Practical Biochemistry I

BIOC 3103 Fall 2020 is a blended fully online lab-based course facilitated through synchronous meetings (workshops, office-hours, presentations) during the normally scheduled lab time and asynchronous activities (video-recorded lab demonstrations, virtual labs such as Molecular Operating Environment, an integrated-computer aided molecular design platform, tutorials, and discussion forums) on cuLearn. The students will have remotely access through VPN to all applications (including MOE) available in the Biology computer lab (Tory 402). There will be a virtual desktop setup with the Science student lab image hosted by ITS. The students will study a key protein in the life cycle of the virus that causes COVID 19 (SARS-CoV-2 main protease) and its α-ketoamide inhibitors.



Instructor: Professor Bruce McKay (Bruce.McKay@carleton.ca)
Laboratory coordinator: Dr. Mihaela Flueraru (mihaela.flueraru@carleton.ca)

Course Description

This laboratory course will be concerned with the investigation of the biochemical properties of macromolecules (carbohydrates, lipids, proteins and nucleic acids) with heavy emphasis on research (computational project, poster presentation and career exploration assignment) and well-written scientific reports.

Learning outcomes

By the end of this course, students will:

- Demonstrate advanced understanding of some of the modern techniques used in experimental biochemistry and molecular biology: basic molecular modeling/visualization programs, Infrared spectroscopy, polarimetry, HPLC, UV/VIS spectroscopy, fluorescence spectroscopy, chromatography, gel electrophoresis (SDS PAGE and agarose gel electrophoresis), Western Blot, enzyme kinetics, recombinant DNA techniques with the help of the video demonstrations created by the lab coordinator
- Generate and test hypotheses, analyze data using appropriate statistical methods, quantitative modeling and simulation tools and appreciate the limitations of conclusions drawn from experimental data.
- Develop the ability to think scientifically and evaluate information critically by relating acquired knowledge to new problems or trouble-shooting questions.
- Perform calculations for solution preparation, serial dilutions, and analyzing data.
- Know the proper procedures and regulations for safe handling and use of chemicals

- Communicate scientific information orally using strategies appropriate for scientific audiences.
- Prepare academic quality scientific reports and keep a laboratory notebook - flowcharts, MSDS, experiment objectives).
- Widen the knowledge and understanding of the different career pathways with a science degree.
- Collaborate effectively as part of a team to solve problems, debate different points and interact productively with all team members.

Experiments

Exp. 1 Quantification of total phospholipids in serum by enzymatic colorimetric/fluorometric assay - video lab demonstration
Exp. 2 Structural Characterization of Oligosaccharides (identification tests, HPLC, IR, polarimetry, anthrone assay) – video lab demonstration
Exp. 3 Separation, purification and quantification of the major egg white proteins (lysozyme, ovotransferin, ovalbumin and ovomucoid) – video lab demonstration
Exp. 4 Extraction and purification of two gene cloning plasmids (pRS413 and LITMUS 38i) and their digestion with a restriction endonuclease (EcoRI) – video lab demonstration
Exp. 5 Studying the structure of lysozyme/ovalbumin and mutants using computational tools – virtual lab
Project: Investigation of SARS-CoV-2 main protease and its α-ketoamide inhibitors using Molecular Operating Environment (MOE) – virtual lab

Course grading

Assessment type	Weight %
1. **Tutorial** worksheets	**10**
2. Online Laboratory Notebook (flowcharts, MSDS) – CuLearn submission	10
3. Online Quizzes (CuLearn)	10
4. Two formal laboratory reports (Exp. 3 and Exp. 4 - CuLearn submission)	25
5. Online Mid-term Exam (problem sets that focus on the interpretation and analysis of the Exp.1 and Exp.2 data)	10
6. Career Exploration Assignment and oral presentation (synchronous activity)	5
7. Research project and Poster Presentation (computational lab MOE) – synchronous and asynchronous activities	10
8. Online Final Exam	20