BIOC*3560 Structure and Function in Biochemistry

Winter 2021
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - January 06, 2021

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1 Course Details

1.1 Calendar Description

This course develops the understanding of biochemical processes by examining the molecular mechanisms underlying the regulation of specific cellular and physiological systems. Examples may include: oxygen binding and transport; regulation of enzyme function; carbohydrate and lipid metabolic pathways and metabolic integration; structure of membranes and membrane proteins; and membrane transport and signaling.

Pre-Requisites: BIOC*2580

1.2 Course Description

This course develops the understanding of biochemical processes by examining the molecular mechanisms underlying the regulation of specific cellular and physiological systems. Examples may include: oxygen binding and transport; regulation of enzyme function; carbohydrate and lipid metabolic pathways and metabolic integration; structure of membranes and membrane proteins; and membrane transport and signalling.

These are difficult and unusual times for all students. Please contact the course instructor regarding any issues (technical, accessibility, personal/compassion) you are having with the course.

1.3 Timetable

Lectures will be delivered asynchronously. They will be uploaded to CourseLink and YouTube every Monday, Wednesday, and Friday during the semester.

Class is "scheduled" for 9:30AM to 10:20AM. Lectures will be made available at, or before, that time.

1.4 Final Exam

There will not be a final exam for W21.

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	John Vessey
Email:	jvessey@uoguelph.ca
Office Hours:	Office hours will be hosted virtually via Virtual Classroom and will occur during scheduled class time (Monday, Wednesday, Friday @ 9:30AM). Specific dates and times of office hours will be posted the week in advance. No appointment is necessary.

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3 Learning Resources

3.1 Required Resources

Computer & Internet (Equipment)

The four quizzes will not utilize the Respondus lockdown browser.

Students registered with the SAS, or students with constrained internet bandwidth or computer access, are requested to contact the instructor or through their SAS advisor for accommodations.

Courselink (Website)

There is a Courselink site for this course. Course-related information will be posted there.

3.2 Recommended Resources

Textbook (Textbook)

Lehninger Principles of Biochemistry By Nelson and Cox 7th or 6th Edition; Freeman Publishers

Available at the Bookstore and on reserve at the library.

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4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Describe structure/function relationships of proteins at the amino acid level, and how this contributes to ligand-binding and enzyme activity.
2. Describe the regulation of proteins by post-translational modifications and allosteric affectors.
3. Explain how regulatory enzymes are controlled in the regulation of pathways of carbohydrate and fatty acid metabolism in mammals. Explain the biochemical mechanisms that mediate signaling of these pathways at the tissue, organ and organism level.
4. Describe how proteins and lipids define the structure and function of biological membranes. Explain the ways in which substances can be transported across membrances and the energy requirements for such transport.
5. Describe the biochemical mechanisms by which signals are propagated across the membrane and within a cell.

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5 Teaching and Learning Activities

5.1 Lecture

Topics: Part A - Regulation of Protein Function

The Oxygen-binding Proteins

Protein-ligand Interactions I

Myoglobin Structure/Function

Protein-ligand Interactions II - Hemoglobin

Cooperative Ligand Binding / Hill Equation

Hemoglobin and O2/H+/CO2 Transport

Topics: Part B - Regulation of Enzymes

Enzyme review

Allosteric Enzymes

Reversible Covalent Modification

Glycogenphosphorylase & synthase

Proteolytic Cleavage

Cyclin-dependent Kinases

Topics: Part C - Carbohydrate Metabolism

Glycolysis

Gluconeogenesis

Regulation of both

Topics: Part D - Lipid Metabolism

Fatty Acid Catabolism

Oxidation of Fatty Acids

Ketone bodies

Fatty Acid Biosynthesis

Triacylglycerol Metabolism

Topics: Part E - Membranes

Membrane lipids

Membrane organization

Membrane proteins

Membrane dynamics

Topics: Part F - Biological Signalling

Introduction to Biosignaling

Gated Ion Channels

Receptor Enzymes

G Protein-coupled Receptors

Steroid Hormone Receptors

5.2 Research Article

Stieglitz et al. Structure of the E. coli Aspartate Transcarbamoylase Trapped in the Middle of the Catalytic Cycle (2005) *Journal of Molecular Biology* 352, 478-486.

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6 Assessments

6.1 Assessment Details

Quiz #1 (25%)
Date: Fri, Jan 29, 9:30 AM - 10:30 AM
Quiz #1 will cover the material presented in the first 3 weeks of the semester.

Quiz #2 (25%)
Date: Fri, Feb 26, 9:30 AM - , 10:30 AM
Quiz #2 will cover the material presented in weeks 4 through 6 of the semester.

Quiz #3 (25%)
Date: Fri, Mar 19, 9:30 AM - , 10:30 AM
Quiz #3 will cover the material presented in weeks 7 through 9 of the semester.

Quiz #4 (25%)
Date: Mon, Apr 12, 9:30 AM - , 10:30 AM
Quiz #4 will cover the material presented in weeks 10 through 12 of the semester.

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7 Department of Molecular and Cellular Biology Statements

7.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. B.Sc. Academic Advising or Program Counsellors

7.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. http://www.learningcommons.uoguelph.ca/
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help

7.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. http://www.selfregulationskills.ca/

7.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/index.html. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information

policies please see the Undergraduate Calendar.
(https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml)

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be

asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

8.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
