



# **BIOC\*3560 Structure and Function in Biochemistry**

Winter 2024

Section(s): 01

Department of Molecular and Cellular Biology

Credit Weight: 0.50

Version 1.00 - December 21, 2023

---

## **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.

**Please contact me regarding any issues (medical, technical, accessibility, personal/compassion) you are having with the course.**

### **1.3 Timetable**

Mondays, Wednesdays, and Fridays from 9:30 am – 10:20 am in WMEM103.

The in-person lectures will be live-streamed and recorded using Zoom for viewing later. Students who are ill or would need to commute during poor weather are strongly encouraged to attend remotely.

Students will need to login to their UoG Zoom account to gain access to the live-streamed lectures.

## 1.4 Final Exam

Exam date is Mon, Apr 22, 8:30 AM - 10:30 AM.

Exam will be delivered online through Courselink with Zoom proctoring. A dedicated exam-writing space will be available for students who contact the instructor in January.

---

## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Steffen Graether  
**Email:** [graether@uoguelph.ca](mailto:graether@uoguelph.ca)  
**Telephone:** +1-519-824-4120 x56457

**Office Hours:** Tuesdays, 2:00 - 3:00 pm

**Office Hours:** Fridays, 3:00 pm - 4:00 pm

**Office Hours:** Tuesdays, 2:00 - 3:00 pm

**Office Hours:** Fridays, 3:00 pm - 4:00 pm

Office hours will be held via MS Teams and do not require an appointment. See CourseLink for the link.

If these times conflict with your academic schedule, we can arrange office hours by appointment. Please contact me by email.

## 2.2 Online Behaviour

**Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:**

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your online test (quiz, midterm or exam) or completing an online assignment for/with another student
- Stating false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors and/or TAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your user name and password
- Recording lectures without the permission of the instructor

## 2.3 Recording of Lecture Materials

By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote.

If a student prefers not to be distinguishable during a recording, they may:

1. Turn off their camera
2. Mute their microphone
3. Edit their name (e.g., initials only) upon entry to each session

# 3 Learning Resources

## 3.1 Required Resources

**Computer & Internet (Equipment)**

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 8th Edition; Freeman Publishers

Available at the Bookstore and on reserve at the library.

---

**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 effectors.
  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 membranes and the energy requirements for such transport.
  5. Describe the biochemical mechanisms by which signals are propagated across the membrane and within a cell.
  6. Analyze a scientific article and synthesize it so that the general public can understand the technique(s) used, the importance of the results and how it may apply to them.
-

# 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 O<sub>2</sub>/H<sup>+</sup>/CO<sub>2</sub> Transport

**Topics:** Part B - Regulation of Enzymes

Enzyme review

Allosteric Enzymes

Reversible Covalent Modification

Glycogen phosphorylase & 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.

## 5.3 Lay summary

Students will take a scientific article and write a short lay summary. Details will be provided in a course lecture.

---

# 6 Assessments

## 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Quiz #1	5
Quiz #2	5
Midterm	25
Quiz #3	5
Quiz #4	5
Lay Summary	10
Final exam	45
Total	100

## 6.2 Assessment Details

### Quiz #1 (5%)

Date: Wed, Jan 24 - Tue, Jan 30, Online

### Quiz #2 (5%)

Date: Wed, Feb 7 - Tue, Feb 13, Online

### MIDTERM (25%)

Date: Wed, Feb 28, 9:30 AM - 10:30 AM, Online

### Quiz #3 (5%)

Date: Wed, Mar 6 - Tue, Mar 12, Online

### Quiz #4 (5%)

Date: Wed, Mar 20 - Tue, Mar 26, Online

### Lay Summary (10%)

Date: TBA

### Final exam (45%)

Date: Mon, Apr 22, 8:30 AM - 10:30 AM, Online with Zoom proctoring

## 6.3 Online Assessments

### ONLINE QUIZZES:

The online quizzes are meant to ensure that students keep up with and have a chance to assess their understanding of the lecture material. Although these assignments are online, **STUDENTS ARE REQUIRED TO ANSWER THE QUESTIONS BY THEMSELVES**. The goal of the quizzes is to have students review and reflect on the material, and facilitate studying for the midterm and final exam in a lower-stakes format. As such, students will be given **three attempts** at the quiz over a period of one week. For each attempt, you will see your overall grade and the mark you received for each question (from which you can determine which questions you answered correctly and which you answered incorrectly) immediately after

submitting the quiz. The highest attempt out of the 3 will be used in the overall grade calculation. Since the questions are randomly selected, **each attempt will have different questions** but on a similar theme.

### **ONLINE MIDTERM AND FINAL EXAM:**

- This course requires the use of Zoom for live proctoring of course exams. You must download and install Zoom to complete the practice test (if provided) and course exam(s). The purpose of the practice test is to ensure that Zoom is set up properly and that you are comfortable using the software.
- Zoom is a video conferencing platform that can allow instructional teams to monitor academic integrity during online exams. The platform allows for instructor or TA review of live video during the examination.
- In order to use Zoom, you must meet the **technical requirements** (<https://opened.uoguelph.ca/instructor-resources/technical-considerations.aspx>). Visit our Technical Considerations page for guidance on preparing your online exam environment.
- Prior to your examination, you should ensure that you are running the most up-to-date version of Zoom.
- If you have any concerns about meeting system requirements, contact the Course Instructor to find alternative solutions or make alternative arrangements.
- Students must answer questions without the use of any aid (including generative AI) or asking a person for help. Use of any aid or asking for help may result in academic misconduct.

## **6.4 Lay Summary Assignment**

Note that students must not use generative AI (e.g. ChatGPT) to solely write the summary. Students, optionally, may use generative AI to create a first draft, but this draft must be edited and a comparison made to the AI version for a bonus mark. Details of the lay summary assignment and the use of generative AI will be provided during a lecture.

---

# **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>)

## 7.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

## 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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 Illness**

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

---