

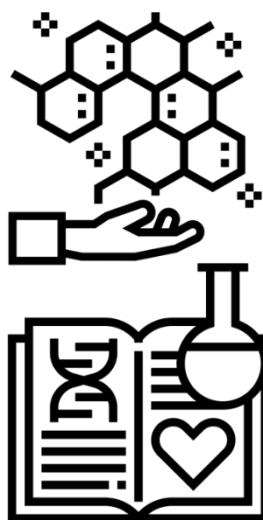
BIOC 3101

Unlocking Metabolism: Pathways, Enzymes, and Control [0.5 credit]

CHEM 4401

Physical Aspects of Biochemistry [0.5 credit]

BIOC 3101 and CHEM 4401 are cross listed for Fall 2025 semester



Instructor

David McMullin, PhD (you can call me David)
david.mcmullin@carleton.ca

Office: Steacie (Chemistry) Building, Room 420

Class Meetings – Wednesday and Friday, 11:35 AM – 12:55 PM
Location- Consult Carleton Central

Office Hours – Fri 1:30 – 3:00 PM, Steacie Building, Room 420

Website

Course **BIOC 3101** on [Brightspace](#)

There you will find the course outline, course content including links to any required readings/viewing, progress checklists, assignments and evaluations, discussion forums, and all communication from me outside of lectures.

You are responsible for reviewing the site regularly for the latest content.

Course Description

BIOC 3101 [click to see the official course calendar description](#)

CHEM 4401 [click to see the official course calendar description](#)

BIOC 3101 [0.5 credit]**Unlocking Metabolism: Pathways, Enzymes, and Control**

This course examines biological macromolecules as well as their chemistry, structure and function. Enzymatic reactions and their regulation, as well as carbohydrate, lipid and protein metabolism, is emphasized. Students apply knowledge of course concepts to relevant scientific problems (disease, development).

Prerequisites: (BIOC 2200 or BIOL 2200), and (CHEM 2203 and CHEM 2204) or (CHEM 2207 and CHEM 2208) or permission of the Institute.

Precludes additional credit for CHEM 3401 (no longer offered), CHEM 4401.

CHEM 4401 [0.5 credit]**Physical Aspects of Biochemistry**

Chemistry, structure and function of nucleic acids, proteins, carbohydrates, and lipids. Thermodynamics of biological systems, chemical mechanisms and organic transformations. Intended for Chemistry Majors.

Prerequisites: CHEM 2103 and CHEM 2204

Precludes additional credit for BIOC 2200, BIOL 2200, BIOC 3101, CHEM 3401 (no longer offered).

Teaching Modality

In Person Only: This course will be delivered in person.

Teaching Assistant

Skye (Roufan) Wang
ruofanwang@cmail.carleton.ca

How Can I Get Help?

There is no such thing as a poor question! Your success in this class is important to me! If there are aspects of this course that prevent you from learning or excludes you, please let me know as soon as possible. Together we will develop strategies to meet both your needs and the requirements of the course. If you have a question about the course content, future classes, university life, careers, or just need to chat, please contact me by one of the following methods:

1) **Office hours**– In person every Friday from 1:30 – 3:00 PM in my office, 420 Steacie Building. You can also email me to make an appointment at an alternative time.

2) **Send me a message** - I respond to student queries during regular business hours (Mon – Fri, 8:30am - 4:30pm) and you can typically expect a response within 24 hours (weekend and holidays excluded). I strive for transparency in communication and want everyone to benefit equally from my responses to student questions.

Questions and concerns of a professional or personal nature should be sent to me by email or addressed during a private meeting (office hours or scheduled appointment).

The university also offers many resources to help you succeed in your studies (and beyond). A few key points of contact are listed below. If you are in need to help, please don't hesitate to let me know, I'm happy to point you in the right direction.

Useful Links (presented in alphabetical order):

- [Career Services](#)
- [Carleton University Students' Association \(CUSA\)](#)
- [Centre for Student Academic Support \(CSAS\)](#)
- [Health and Counseling Services](#)
- [Paul Menton Centre](#)
- [Sexual Assault Support Services](#)
- [Science Student Success Centre \(SSSC\)](#)
- [Wellness Centre](#)

Resources and Requirements for this Course

You will need an internet-capable device and internet connection to complete this course. Our course Brightspace page will act as the central hub for the course, all material will be posted directly on the page or can be accessed via links provided there. Outlines for each course topic will be posted; I encourage you to download and annotate these.

Students are not required to purchase textbooks or other learning materials for this course. While we will not be using one specific textbook for the course, any one of the following are highly recommended:

Biochemistry: A short course

4th (fourth) Edition (2015)

JL Tymoczko, JM Berg, Gatto, L Stryer

W. H. Freeman, New York

ISBN-10: 1319114636

Fundamentals of Biochemistry: Life At The Molecular Level

5th (Fifth) Edition (2016)

By Donald Voet, Judith G. Voet and Charlotte W. Pratt

John Wiley & Sons, Inc., Hoboken, New Jersey

ISBN: 978-1-118-91840-1

ISBN (Binder Ready Version (BRV)): 978-1-118-91843-2

Biochemistry, First Canadian Edition

Reginald H. Garrett, Charles M. Grisham, Stavroula Andreopoulos, William G. Willmore and Imed E. Gallouzi

2013

Nelson Education Ltd., Toronto, Ontario

ISBN-13: 978-0-17-656885-6

Biochemistry: An Integrative Approach

1st (First) Edition (2019)

John T. Tansey

John Wiley & Sons, Inc., Hoboken, New Jersey

ISBN-10: 1119402565

ISBN-13: 978-1119402565

Biochemistry, Seventh Edition

Reginald H. Garrett and Charles M. Grisham

Brooks/Cole, Belmont, California

2023

ISBN-10: 0357728459

ISBN-13: 978-0357728451

Biochemistry, Fourth Edition

Christopher K. Mathews, K.E. van Holde, Dean R. Appling and Spencer J. Anthony-Cahill
Pearson Canada Inc., Don Mills, Ontario
2012
ISBN-10: 0138004641
ISBN-13: 978-0138004644

Lehninger Principles of Biochemistry, Eighth Edition

David L. Nelson and Michael M. Cox
W. H. Freeman and Company, New York, New York
2021
ISBN-10: 1319228003
ISBN-13: 978-1319228002

Biochemistry, Seventh Edition

Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto
Macmillan Learning, New York, New York
2015
ISBN-10: 1464126100
ISBN-13: 978-1464126109

Biochemistry: A Short Course, Fourth Edition

John Tymoczko, Jeremy M. Berg, Gregory J. Gatto Jr., Lubert Stryer
W. H. Freeman and Company, New York, New York
2018
ISBN-13: 978-1319248086

Metabolism at a Glance, Fourth Edition

J.G. Salway
John Wiley & Sons, Inc., Hoboken, New Jersey
2017
ISBN-10: 9780470674710
ISBN-13: 978-0470674710

What Are We Going to Learn in This Course?

Course Content

By the end of the semester students should be able to:

1. Understand and utilize the appropriate scientific vocabulary to effectively communicate biochemistry concepts covered in the course.
2. Describe and discuss the structure, chemistry, and function of the key biomacromolecules with a strong emphasis on the relationship between their structure and function.
3. Describe the catalytic properties, kinetics, and allosteric regulation of metabolic enzymes involved in the central metabolic pathways of carbohydrates, lipids, amino acids, and proteins.
4. Understand and analyze the regulation of these metabolic pathways, their integration under different conditions, and their relationship to the concept of metabolic flux.
6. Apply the above concepts to address both familiar and novel biochemistry problems.

Communication, Professionalism, and Metacognition

Throughout the semester students will:

1. Demonstrate the ability to effectively communicate and work collaboratively with peers to successfully address biochemistry-related problem sets and complete a term project.
2. Critically evaluate their performance in the course to identify strengths and personal limitations in their knowledge of biochemistry and/or study methods.
3. Demonstrate professional behavior by completing all course requirements on time; attending and being punctual at all required course activities; honestly completing course evaluations without attempting to seek an advantage by unfair means; by reporting any unethical behavior of peers to the course administration.

Course Overview

Below is a detailed week-by-week schedule for the semester. It is subject to change as required, please check the course Brightspace page for updates.

		Week 1 [Sept. 1-5]	Week 2 [Sept. 8-12]	Week 3 [Sept. 15-19]	Week 4 [Sept. 22-26]	Week 5 [Sept. 29 - Oct. 3]	Week 6 [Oct. 6-10]	Week 7 [Oct. 13-17]
Knowledge Acquisition		Welcome and Introduction	Biomacromolecules	Biomacromolecules	Proteins and enzymes	Nitrogen and protein metabolism	Catch up	Review and Midterm
Homework (10%)				Homework 1		Homework 2		Homework 1 + 2 Due Oct. 15 th 5PM
In Class Session TB 340	Wed	Welcome And Orientation	Fatty acids	Carbohydrates	Protein structure and function	Amino acid metabolism	Catch up lecture	Review
	Fri	Introduction to metabolism	Lipids and membranes	Amino acids	Enzymes: kinetics and controls	Protein metabolism	Class time for term project	Midterm Exam (To Be Completed During Class Time)
Metabolic Disease Term Project (40%)			Introduction To Term Project				Enzyme Infographic Due Oct. 9 th 5PM	
Formal Assessments (50%)				Sept. 16 th Registration Deadline		Sept. 30 th Withdrawal with Refund Deadline		Midterm Oct. 17 th

Course Overview (continued)

Below is a detailed week-by-week schedule for the semester. It is subject to change as required, please check the course Brightspace page for updates.

	Week 8 [Oct. 20-24]	Week 9 [Oct. 27-31]	Week 10 [Nov. 3-7]	Week 11 [Nov. 10-14]	Week 12 [Nov. 17-21]	Week 13 [Nov. 24-28]	Week 14 [Dec. 2-5]	Final Exams [Dec. 8-20]
Knowledge Acquisition	Reading Week	Carbohydrate metabolism	Carbohydrate metabolism	Carbohydrate metabolism	Fatty Acid metabolism and Integration	Catchup and Review	Catchup and Review	
Homework (10%)			Homework 3		Homework 4		Homework 3-4 Due Dec. 5 th 5PM	
In Class Session TB 340		Glycolysis	Citric Acid Cycle	Glycogen metabolism	Fatty Acid metabolism	Catch up lecture	Review	
Wed								
Fri		Gluconeogenesis	Oxidative Phosphorylation	Pentose Phosphate Pathway	Integration of metabolism	Class time for term project	No class, Monday schedule	
Metabolic Disease Term Project (40%)			Wiki Briefing Draft Due Nov. 7 th 5PM				Wiki Briefing Final Due Dec 5 th 5PM	
Formal Assessments (50%)				Nov. 15 th Last Day To Withdraw From Course (WDN)				Final Exam Date TBD

Grading Breakdown

Component	Deliverable and Due Date	Weight
Homework	Homework's 1 and 2 – Due October 15 Homework's 3 and 4 – Due December 5	10%
Term Project	Information sheet (Infographic) – Due October 9 Wiki Briefing Draft – Due November 7 Final Wiki Briefing – December 5	40%
Midterm	In class on October 17	20%
Final Exam	Date TBD during final examination period	30%

Homework (10%)

There will be four homework assignments to be completed this semester. Each one is associated with the lecture material. Students can utilize any resource to answer the questions provided except Artificial Intelligence (AI) tools, see *Use of Artificial Intelligence (AI) In Course* policy below.

Format and Due Date

- Homework is open book and can rely on any resource available except for AI tools.
- Questions will be predominantly multiple-choice, true or false, mix and match, fill in the blank, ordering, and/or figure labeling.
- You will earn points for each question you answer correctly but will only have one attempt at each question.
- Each homework assignment is worth 2.5%.
- Homework assignments are to be submitted on *Brightspace*.
- These are good practice for formal assessments (midterm/final exam)

Homework 1 and 2: due by **5:00 PM Oct 15th**

Homework 3 and 4 are due by **5:00 PM Dec 5th**

Formal Assessments (50%)

Midterm

- Friday Oct 17th from 11:35 AM to 1:00 PM
- During class time
- 20% of final grade

Final Exam

- 30% of final
- Date and time TBD
- 3h exam during the **final exam period (Dec 8 – 20)**
- The final exam is **cumulative** and will cover material from the entire course. Approximately 30% of questions will be drawn from topics prior to the midterm and the remaining 70% of questions after the midterm.

The weighting of these exams is somewhat flexible, if your final exam grade is higher than that of your midterm grade, it will be used to replace half of that midterm grade. This means that your final exam can be worth up to 40% of your final grade. This adjustment will be calculated and applied automatically at the end of the semester.

Exam Format (midterms and final)

- Exams are to be completed **individually**.
- Questions will be multiple choice, short and long written answer type questions but may also include all question types seen in the homework assignments.

Metabolic Disease Term Project (40%)

This semester you will work together with an assigned group of peers to study a genetic disease that affects a metabolic pathway. The project consists of two parts summarized in the table below. Complete instructions, group/topic assignments, and submission details can be found on Brightspace.

	Deliverable and Due Date	Weight
Enzyme Characterization	Information sheet (Infographic) – October 9 at 5 PM	40%
Wiki Briefing	Draft – November 7 at 5 PM Final Report – December 5 at 5 PM	5% 55%

Policies

Attendance



Completion of the various course components and participation in the class dynamic are required.

Should a prolonged illness or life situation arise during the semester that compromises your ability to attend classes or complete work on an ongoing basis, please communicate with me as early (as soon as the difficulty arises) and openly as possible so that we can navigate the situation collaboratively.

What happens if I miss a...

1) Homework assignment

You are expected to complete the homework regularly as you progress through the course. Since these problems are completed on your own schedule and have extended deadlines (only twice per semester), missed homework will count as a 0 towards your grade.

2) Term Project Deadline

There is a 48 hour no questions asked grace period after each project deadline. After this, a late penalty of 10% per day will be applied.

3) Formal Assessments

If you must miss the midterm for any reason, you must complete the [Academic Consideration for Coursework Form](#) within 3 business days of the missed exam. Then schedule an appointment to see me in person and we can discuss alternatives. One option is to shift the weight of the missed midterm to the final exam, but there are also alternatives.

If you were unable to attend the regularly scheduled final exam, you may apply to the Registrar's Office (RO) for permission to defer the exam. This is at the discretion of the RO; I have no input into their decision. You can check the policy here: <https://carleton.ca/registrar/deferral/>

There is a charge for a deferred exam. Current charges can be found here: <https://carleton.ca/studentaccounts/tuition-fees/admin-charges/>

Accommodations

Your instructor and Carleton University are committed to providing access to the educational experience to promote [accessibility](#) for all individuals. You may need special arrangements to meet your academic obligations during the term.

Deferred/missed term work for short-term accommodation (5 days or less): Should you require short-term accommodation, please inform your course Instructor and submit the [Academic Consideration for Coursework Form](#).

Deferred/missed term work for longer term incapacitation (5 days or longer): Should you require accommodations for this course that are longer than the 5-day (short-term) period, please email me to discuss how/whether accommodation needs could be met for this course.

For an accommodation request, the processes are as follows:

For Disability:

- If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the [Paul Menton Centre website](#).

For Religious Obligation, Family Status, and/or Exceptional Life Circumstance:

- Please contact me, your instructor, with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation](#).

For Student Activities:

- Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the [Senate Policy on Accommodation for Student Activities](#).

Academic Integrity and Conduct

Academic integrity is defined as:

“A commitment even in the face of adversity to five fundamental values: honesty, trust, fairness, respect, and responsibility.” – Centre for Academic Integrity (1999)



Breaches of academic integrity are considered a serious offense at Carleton University and cannot be resolved directly with the course instructor. In the event of a suspected offense, the Dean of the Faculty will conduct a rigorous investigation as outlined in [section 10.1 of the Academic Regulations and the associated Academic Integrity Policy](#). Penalties are not trivial and may range from a reprimand to a suspension from all studies or expulsion from the University. Some common violations are listed below but please see the [registrar's webpage on academic integrity](#) and [download the complete academic integrity policy here](#) for further details.

Plagiarism – The University Senate defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This may include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- handing in the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs

Use Of Artificial Intelligence (AI) In Course - The use of AI (Chat GPT/Generative AI, Perplexity, etc) is not permitted for any assignments in the course (including Homework and Term Project). The use of AI is considered at the same level as plagiarism (see above) and will follow the Academic Regulations and the associated Academic Integrity Policy as Plagiarism. If it is required, you need to clarify "how" you are using it.

Examinations - attempting to read another student’s exam paper; purposefully leaving an exam paper exposed for others to read; communicating with others during an examination; bringing unauthorized materials to an exam; posing as another student to write an exam; improper access to examination materials.

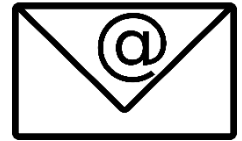
Other - collaboration on work otherwise indicated to be done as an individual, disruption of instructional time.

Conduct – Carleton university is committed to providing a safe environment for learning. It is a violation of the standards of academic integrity for a student registered in class to disrupt the

class or other period of instruction with any action or behaviour reasonably judged by the instructor, lab assistant, or teaching assistant to be detrimental to course instruction. *To ensure an optimum learning environment, students are expected to behave professionally at all times.* If a student exhibits obstreperous behavior in class and/or online and chooses not to refrain from such behavior at the request of the instructor, the student's behavior will be reported to the faculty.

E-mail and Online Etiquette

Your professor and the university are committed to ensuring a respectful and engaging community both in-person and online. [General netiquette guidelines can be found here.](#)



To facilitate efficient email communication, I ask that you follow these guidelines:

- Always use your official @carleton.ca e-mail address. I reserve the right to refuse to answer any e-mails not originating from university-issued addresses.
- Include the course code "BIOC 3101" in the subject line.
- Include your full name (first and last name) and student number.
- Use appropriate and professional language while being mindful of your tone. Profanities, disrespect, aggression, and threats will not be tolerated.
- Be clear and brief when writing your messages. Please realize that I receive many e-mails per day from students. By avoiding unnecessarily long e-mails, you demonstrate respect for our time and are most likely to receive a timely reply.
- If your issues are complex or you wish to discuss a matter in great depth, I suggest stopping by office hours or making an appointment to speak in person.

Equity Diversity and Inclusion (EDI)

Your instructor, [faculty](#), and [Carleton University](#) are committed to providing a safe environment conducive to personal and intellectual growth, free of injustice, discrimination, or harassment, and characterized by understanding respect, peace, trust, and fairness. This course aims to support learning and provide professional development opportunities that are inclusive to all, regardless of age, gender, race, ethnic origin, colour, religion, sexual orientation, marital status, and/or geographic location.

A commitment to EDI is a process that requires ongoing action and reflection. I recognize the importance of this commitment to promote a healthy classroom community and to support its members. Students and members of the teaching team of the class are committed and share the responsibility to:

- respect and value every person, including their unique characteristics, background, and experiences
- treat everyone equally, without preferential treatment

- appreciate the strengths and needs of each individual
- learn from (and with) a variety of different perspectives
- strive for open, transparent, and fair policies and communication
- regularly review and reflect upon the activities and outcomes of the course in terms of EDI and update as necessary.

As we grow and develop as a classroom community, I welcome your feedback on how we can improve our commitment to EDI. Please send your suggestions to me via email. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact me, your instructor, and/or the [Department of Equity and Inclusive Communities](#) as is appropriate.

Grades

Grades for each evaluation will be posted to the gradebook on Brightspace for your information and record keeping. Please note that the final grades will be tabulated outside of Brightspace, official final grades can be accessed via [Carleton Central](#) and will be posted according to [the official dates and deadlines of the university](#).

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Letter grades assigned in this course will have the following percentage equivalents as per university regulations (see [Academic Regulation 5.4 - Grading system](#) for further details). The final course grade is rounded up if the first decimal is 5 or higher or down if the first decimal is 4 or lower.

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59	F < 50
A = 85-89	B = 73-76	C = 63-66	D = 53-56	
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52	

DFR – Deferred Final Examination and/or final course work. An interim notation administratively assigned by the Registrar's Office upon approval of a request to write a deferred final examination or defer submission of final course work. DEF must be replaced by a final grade within the prescribed time or be replaced with F.

GNA – Grade not available. An interim notation administratively assigned by the Faculty when a grade is not available pending an Academic Integrity review and must be replaced with a final grade.

WDN – Withdrawn. No academic credit, no impact on the CGPA. WDN is a permanent notation that appears on the official transcript for students who withdraw after the full fee adjustment date in each term (noted in the Academic Year section of the Calendar each term). Students may withdraw on or before the last day of classes.



Intellectual Property

Materials created for this course (including, but not limited, to presentations and posted notes, labs, case studies, assignments, and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s). A student who publicly posts or sells an instructor's work, without the instructor's express consent, may be charged with misconduct under Carleton's Academic Integrity Policy and/or Code of Conduct, and may also face adverse legal consequences for infringement of intellectual property rights.

Land Acknowledgement

We acknowledge that, at Carleton University, we study, work, and research on the traditional, unceded territories of the Algonquin nation. In doing so, we acknowledge our responsibility to the Algonquin people and our responsibility to adhere to Algonquin cultural protocols.

Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working, and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit the [Sexual Violence Support website](#).