Cellular and Integrated Metabolism

Syllabus

Department of Biochemistry and Molecular Biology

BIOC 3300 Winter 2026

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Barbara Karten	bkarten@dal.ca	TBA
Neale Ridgway	nridgway@dal.ca	TBA

Course Description

This course covers carbohydrate, lipid, and nitrogen metabolism, emphasizing metabolic regulation and integration in an interconnected network to achieve homeostasis within the cell and whole organism. Aspects of organelle biochemistry, pathway compartmentalization, and cell signaling are considered. Tutorials use case studies to develop understanding of physiological roles of metabolic pathways.

Course Prerequisites: BIOC 2300.03 (with a grade of B- or higher) and BIOL 2020.03 and BIOL 2030.03 and CHEM 2401.03 and CHEM 2402.03; or instructor's consent.

Student Resources

Peer Mentorship: Upper year students offer regular mentorship sessions focusing on study techniques, general practice of core concepts of biochemistry, and career development.

Course Structure

Course Delivery: The course has 30 lectures, 3 review sessions, and 10 tutorials. The entire course will be delivered in person. Lecture notes will be posted before the lecture on the course Brightspace page. The lectures and tutorials will not be recorded. Tutorials use case studies, experimental data, and practice problems to engage students in active learning and reinforce concepts and materials from the lectures.

Students registered in the class will be able to access all course materials via **Brightspace** at https://dal.brightspace.com/; you can access this site using your Dal NetID and Password. If you need assistance using Brightspace, please contact the Help Desk at 902-494-2376 or helpdesk@dal.ca.

Questions related to content should be addressed to the instructor of that part of the course. Question related to the tutorial section of the course should be addressed to the Teaching Assistants (bioc3300.ta@dal.ca). Questions related to general course organization and management, class policies, exam schedules, medical issues, should be addressed to the coordinator (B. Karten) at bkarten@dal.ca

Lectures: 3x per week, 50 min each. Schedule appended below and posted on Brightspace.
Tutorials: Weekly, 1.5 h each, in person. Schedule appended below and posted on Brightspace.

Course Materials

Many textbooks on Biochemistry and Cell Biology describe the content of this course and can be used as complementary resources. The recommended textbook is Fundamentals of Biochemistry, 6th edition, by Destin Heilman and Stephen Woski, Wiley. https://www.wileyplus.com/chemistry/voet-fundamentals-of-biochemistry-life-at-the-molecular-level-6e-978eprof22582/

Assessment

Assessment of Lecture Component: Two midterm exams (50 min each) held during the lecture time-slot will cover content in the lectures, as outlined in the lecture schedule. The final examination (3 hours) is scheduled by the Registrar's Office during the exam period and will cover content from the entire course. Midterms and final exams will have both multiple choice and short answer questions. Neither the mid-term tests nor the final exam will be returned to students, but viewing may be arranged during office hours or by appointment.

Alternate grading scheme: If a midterm exam grade is lower than a student's grade on the corresponding part of the final exam, that midterm grade will be replaced by the grade for this part of the final exam. Both midterm grades will be replaced by the final exam grades for the corresponding sections of the final if this is beneficial for the student.

Assessment of Tutorial Component: Tutorials provide students with the opportunity to practice and apply the course material through case studies and practice problems. Students will be divided into 4 groups for tutorials. Tutorials for groups A and C will be Tuesdays from 2:30 to 4 pm in alternating weeks. Tutorials for groups B and D will be Tuesdays from 4 pm to 5:30 pm in alternating weeks (see schedule). Each tutorial will start with a short quiz worth 2% of the final grade.

Assessment	Weight (% of final grade)	Date
Midterm 1 (in lecture)	18%	February 9, 2026
Midterm 2 (in lecture)	18%	March 20, 2026
Quizzes (in tutorial)	5x 2%	see schedule
Assignment	14%	Due March 31, 2026
Final examination***	40%	Scheduled by Registrar
Total	100	

*** ***Note that regardless of the total mark, a passing grade in the final examination is required in order to pass the course. All exams are in-person.***

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Missed midterms: A student who misses a midterm test or a quiz due to illness should notify the instructor and the course coordinator as soon as possible, and **must submit a Student Declaration of Absence Form** through the course Brightspace page within three (3) calendar days following the midterm exam. There will be ***no make-up midterm exams!*** Missed midterm exams will be prorated to the corresponding section of the final exam if an SDA was submitted.

Missed quizzes: If one quiz is missed, the grade of the other quizzes will be prorated to 10%. If additional quizzes are missed and the student submits an SDA, the remaining quizzes will be prorated to 10%. If more than one quiz is missed without submitting an SDA, the additional missed quizzes will receive a grade of zero.

The Student Declaration of Absence form can only be submitted up to two (2) separate times per course during a term and only for absences of 3 days or shorter. Students experiencing recurring and/or long-term absences are strongly encouraged to meet with a Faculty or Program Advisor and refer to the University Policies on Missed or Late Academic Requirements Due to Student Absence and Student Accommodation Policy. If students have recurring and/or long-term absences and do not register with the Student Accessibility Centre, it is at the instructor's discretion to deny alternate grading or coursework arrangements.

Missed Final Exam: Students must notify the course coordinator as soon as possible and no later than 48 hours after the scheduled exam in order to be considered for a make-up exam. The date and time of the make-up exam will be provided to qualified individuals within 72 hours after the scheduled exam. Additional or alternative final exams will only be held under exceptional circumstances such as unforeseen medium to long term disabilities.

Course Policies related to Academic Integrity

Policies regarding academic integrity will be posted as part of the instructions for each assignment.

All material posted on the Brightspace page is for your personal educational use only. Copying course material from this site for distribution outside of this site (e.g. uploading material to a commercial third-party or public website, or otherwise sharing these materials with people who are not part of the class) may be a violation of Copyright law. If you have questions regarding the use of materials, please contact the instructor/course coordinator.

Use of generative AI: Generative AI and large language models should assist human creativity and critical thinking, not replace them. The use of AI must be transparent and not circumvent the learning objectives. Uploading material from the Brightspace page to an AI or large language model carries the risk of IP/privacy violations and is not permitted. Reading, taking notes, and summarizing information are important skills and key steps to taking ownership of your learning. Students are allowed to use AI to support searching and gathering of information; however, overreliance on AI carries the risk of bias and is discouraged. Students are responsible for verifying accuracy, avoiding bias and avoiding IP or privacy violations.

Learning Outcomes

Knowledge Outcomes:

1. Demonstrate comprehensive knowledge of major metabolic pathways of carbohydrate, lipid, and nitrogen metabolism.
2. Connect metabolic pathways into a dynamic network.
3. Demonstrate understanding of the principles of bioenergetics, including thermodynamics of metabolic pathways and energy generation from nutrients.
4. Analyze the regulation of metabolic flux by different mechanisms, including substrate availability, enzyme activity, hormonal activity, and compartmentalization, and explain the effects on the cellular metabolic network.
5. Describe key cell signaling mechanisms and relate them to their effects on cellular metabolism
6. Demonstrate understanding of the function of cell organelles and membrane systems and relate them to nutrient metabolism and its regulation.
7. Explain how metabolic processes are integrated in various tissues and during different physiological and pathophysiological states.
8. Compare and contrast methods for collecting metabolic and signaling data

Skills Outcomes:

1. Problem Solving: Apply theoretical knowledge to practical scenarios such as case studies to solve complex metabolism and signaling problems.
2. Data Analysis, Interpretation and Presentation: Analyze and interpret metabolic data from primary literature or research labs.
3. Critical Analysis: Evaluate primary literature related to metabolic studies and assess the methodologies and conclusion drawn in metabolic research.
4. Communication: Present complex metabolic concepts clearly and concisely in written format.

Lecture Schedule: Mo, We, Fr, 8:35 to 9:25 am, LSC C236

Date	Day	Type	Lecture Topic	
7 Jan	W	Lect	1. Introduction to Metabolism	BK
9 Jan	F	Lect	2. Glycolysis	BK
12 Jan	M	Lect	3. Gluconeogenesis, Regulation of Glycolysis	BK
13 Jan	*T*	*Tutor*	*Tutorial 1: Groups A+B*	
14 Jan	W	Lect	4. Glycogen Metabolism, Pentose Phosphate Pathway	BK
16 Jan	F	Lect	5. Citric Acid Cycle	BK
19 Jan	M	Lect	6. Amino Acid Degradation and Urea Cycle	BK
20 Jan	*T*	*Tutor*	*Tutorial 1: Groups C+D*	
21 Jan	W	Lect	7. Electron Transport and Oxidative Phosphorylation	NR
23 Jan	F	Lect	8. Mitochondrial Transporters	NR
26 Jan	M	Lect	9. Nucleotides and One-carbon metabolism	NR
27 Jan	*T*	*Tutor*	*Tutorial 2: Groups A+B*	
28 Jan	W	Lect	10. Regulation of Fatty Acid Synthesis	NR
30 Jan	F	Lect	11. Fatty Acid Modification	NR
2 Feb	M	Lect	12. Regulation of Fatty Acid Oxidation	NR
3 Feb	*T*	*Tutor*	*Tutorial 2: Groups C+D*	
4 Feb	W	Lect	**Review**	NR/BK
6 Feb			**Munro Day**	
9 Feb	M		**Midterm 1: Lectures 1 - 12**	NR/BK
10 Feb	*T*	*Tutor*	*Tutorial 3: Groups A+B*	
11 Feb	W	Lect	13. Phospholipid Metabolism	NR
13 Feb	F	Lect	14. Triacylglycerol Metabolism	NR
			Study Break	
23 Feb	M	Lect	15. Cholesterol Synthesis and Regulation	NR
24 Feb	*T*	*Tutor*	*Tutorial 3: Groups C+D*	
25 Feb	W	Lect	16. Extracellular Lipid Transport: Lipoproteins	NR
27 Feb	F	Lect	17. Lipoproteins and Atherosclerosis	NR
2 Mar	M	Lect	18. Protein Synthesis, Targeting, Quality Control	BK
3 Mar	*T*	*Tutor*	*Tutorial 4: Groups A+B*	
4 Mar	W	Lect	19. Vesicular Trafficking and Secretion	BK
6 Mar	F	Lect	20. Membrane Contact Sites and Transport	BK
9 Mar	M	Lect	21. Protein Degradation	BK
10 Mar	*T*	*Tutor*	*Tutorial 4: Groups C+D*	
11 Mar	W	Lect	22. Endosomal system	BK
13 Mar	F	Lect	23. Lysosomes and Autophagy	BK
16 Mar	M	Lect	24. Nutrient-sensing signaling	BK
17 Mar	*T*	*Tutor*	*Tutorial: ALL GROUPS (review for midterm if schedule changed due to snow day)*	BK
18 Mar	W	Lect	**Review (Lecture if schedule changed due to a snow day)**	NR/BK
20 Mar	F	Lect	**Midterm 2: Lectures 13-24**	NR/BK
23 Mar	M	Lect	25. Cancer Metabolism	BK
24 Mar	*T*	*Tutor*	*Tutorial 5: Groups A+B*	
25 Mar	W	Lect	26. Fast-Feed Cycle, Organ Specialization	BK
27 Mar	F	Lect	27. Insulin and Glucagon Signaling	BK
30 Mar	M	Lect	28. Diabetes Type 1	BK
31 Mar	*T*	*Tutor*	*Tutorial 5: Groups C+D*	
1 Apr	W	Lect	29. Insulin Resistance and Diabetes Type 2	BK
3 Apr			**Good Friday**	
6 Apr	M	Lect	30. Adipose Tissue and Obesity	BK
7 Apr	*T*	*Tutor*	Tutorial: *ALL GROUPS*, Exam review	BK/NR
8 Apr	W	Lect	31. Central Control of Feed Intake/Wrap up	BK
9 Apr	T	Lect	Review	BK/NR

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: http://www.dal.ca/cultureofrespect.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.