

Gene Expression Course Syllabus

Department of Biochemistry and Molecular Biology

BIOC 4404 Fall 2024

Course Instructor	Email	Office Hours
Jamie M. Kramer	jkramer@dal.ca	By appointment. Please e-mail with questions.

Course Description

This course is centered around the central dogma that genetic information is passed from DNA to RNA to protein. We focus on the different mechanisms that regulate this flow of information in prokaryotic and eukaryotic cells. Specific topics include transcription, translation, chromatin, epigenetics, and non-coding RNA.

Prerequisites - BIOC 3400

Course Structure

The course will be delivered through in person synchronous lectures on Tuesdays and Thursdays, 8:35-9:55, Sir Charles Tupper Medical Building, Room 14B02. **Lectures will NOT be recorded.**

The course is organized in 3 modules:

Module 1 - Transcription – Week 1-4 – Exam Oct 1, 2024.

Module 2 - Epigenetics and post-transcriptional gene regulation – Week 5-9 – Exam Oct 31, 2024

Module 3 - Conference talk assignments – Week 10-12

A detailed schedule is provided below. **There will be no in person lecture during Week 1 (Sept 3 and 5), but there will be required reading and a quiz for this week (information on this will be distributed by e-mail).**

Course Materials

1. *Optional Textbooks*: Fundamental Molecular Biology, 2e, by Lizabeth A. Allison and Molecular Biology of the Gene, 7ed, by James D. Watson. Some illustrations covered in lecture are derived from these textbooks. These textbooks are available at the University library but are not on reserve. Selected chapters of both textbooks are available in Course Readings on Brightspace.

2. *Course Brightspace Page* - this will be essential for accessing all course content. All course lecture slides and reading material will be posted

3. *Primary scientific literature* will be used for topics that are not covered in textbooks.

Assessment

Tests/quizzes

Quizzes – 20% - There will be 6 quizzes in total which will be available on Brightspace for specific times and dates. Quiz due dates are indicated in the schedule below. Quizzes are comprised of multiple choice, short answer, and long answer questions. Each quiz will be weighted equally towards the final grade. There will be no make-up quizzes and missed quizzes will be scored as zero. Quizzes are completed outside of class time, on Brightspace. The quizzes are "open book" and may be done in groups. The purpose of the quizzes is to encourage students to review the material, and to provide practice for the exams.

Exam 1 - 30% - Oct 1, 8:00 am - 9:55 am, covers lectures 1-6

Exam 2 - 30% - Oct 31, 8:00 am - 9:55 am - covers lectures 7-14

The exams will occur in person during an extended class period from 8:00 - 9:55. They will consist of short and long answer questions. You will have 1:55 to complete the exam. Students who miss exams due to a legitimate medical (or other) reason will be required to write a make-up exam that will be scheduled at the instructor's convenience.

Assignments

Conference Talk – 20% - Each student will prepare and deliver a 10-minute presentation to the class describing a research paper related to topics and techniques discussed in the course. Papers and presentation times will be randomly assigned by the instructor. Presentations will be held in-person during the normal lecture times in the last four weeks of class. Students will be expected to attend other students' presentations and participation marks will be awarded for attendance and engagement in the form of questions.

Final exam

This course has NO final exam.

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 Content and Schedule

Week	Lecture	Date	Topics (may vary)	Quizzes
1		03-Sep	NO CLASS – Reading assignment	
		05-Sep	NO CLASS – Reading assignment	Quiz 1 – Brightspace – due Sept 8
2	1	10-Sep	Transcription in Bacteria	
	2	12-Sep	Transcription – eukaryotic cis regulatory elements	Quiz 2 – Brightspace – due Sept 15
3	3	17-Sep	Transcription – eukaryotic trans acting elements	
	4	19-Sep	1. DNA binding domains (Guest Lecture - Jordan Cucksey). 2. Methods for analysis of gene expression	Quiz 3 – Brightspace – due Sept 22
4	5	24-Sep	Methods for analysis of gene expression	
	6	26-Sep	Identifying and characterizing novel long range <i>cis</i> elements	
5		01-Oct	Exam 1 - in class - 8:00-9:55	
	7	03-Oct	Epigenetics and chromatin - definitions and types of epigenetic modifications, DNA methylation during development, genomic imprinting	
6	8	18-Oct	1. Bacterial Epigenetics (Guest Lecture - Jordan Cucksey) 2. Histone modifications, chromatin states, and the epigenome.	
	9	10-Oct	Inheritance of histone modifications	Quiz 4 – Brightspace – due Oct 13
7	10	15-Oct	Nucleosome positioning and the analysis of chromatin accessibility	
	11	17-Oct	Epigenetics and Chromatin - transgenerational epigenetic inheritance	Quiz 5 – Brightspace – due Oct 20
8	12	22-Oct	A messenger RNA's journey, Non-coding RNA in Gene regulation	
	13	24-Oct	RNA binding proteins and RNA modifications	Quiz 6 – Brightspace – due Oct 27
9	14	29-Oct	Regulation of translation	
		31-Oct	Exam 2 - in class - 8:00-9:55	
10		5-Nov	Conference Talks (4)	
		7-Nov	Conference Talks (4)	
		Nov 11-15	Fall Study Break	
11		19-Nov	Conference Talks (4)	
		2-Nov	Conference Talks (4)	
12		26-Nov	Conference Talks (4)	
		28-Nov	Conference Talks (4)	

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/original-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.