Gene Expression Course Syllabus

Department of Biochemistry and Molecular Biology

BIOC 4404 Fall 2025

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, with a focus on eukaryotic cells. Specific topics include transcription, translation, RNA processing, chromatin, epigenetics, and non-coding RNA.

Prerequisites - BIOC 3400

Course Structure

The course will be delivered through in person on Tuesdays and Thursdays, 8:35-9:55, Sir Charles Tupper Medical Building, Room L10. **Classes will NOT be recorded.** A detailed schedule is provided below (subject to changes).

The course is organized in 3 parts:

Part 1: Gene expression from transcription to translation. This section covers fundamental mechanisms in regulation of transcription and translation. Lectures 1-9.

Part 2: Methods for analysis of gene expression. In this section we will explore techniques that are used for investigating gene expression. Lectures 10-12

Part 3: Analysis of cutting-edge literature from the gene expression field. This part of the course will draw on the knowledge from parts 1 and 2 to engage in a detailed analysis of primary scientific literature in the gene expression field. In each class (6 in total) a group of students will lead an in-depth discussion of the research described in the paper.

Course Materials

1. Useful 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. 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

Mid-term - 35% - Oct 16, 7:30 am - 9:55 am, covers lectures 1-6

The mid-term will occur in person during an extended class period from 7:30 am - 9:55 am. It will consist of short and long answer questions. 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.

Seminar - 25% - Weeks 8-10. Working in groups, students will lead an in-depth discussion focusing on a research publication in the gene expression field. Papers and groups will be randomly assigned.

Final Exam - 40% - Covers all lecture material. Scheduled during the final exam period – to be determined.

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

Lecture	Date	Topics (may vary)
1	23-Sep	Introduction – Transcription in Bacteria
2	25-Sep	Transcription – eukaryotic cis regulatory elements
	30-Sept	Truth and reconciliation day
3	2-Oct	Transcription – eukaryotic trans acting elements
4	7-Oct	Epigenetics, chromatin, and chromatin regulators
5	9-Oct	Histone modifications, chromatin states, and the epigenome.
6	14-Oct	Gene Regulation in Biology – Circadian Rhythms, long-term memory
	16-Oct	**Mid-term exam – 7:30 – 9:55**
7	21-Oct	A messenger RNA's journey – RNA processing in the nucleus and cytoplasm
8	23-Oct	Splicing, alternate splicing, and RNA interference
9	28-Oct	Regulation of translation
10	30-Oct	Methods for studying gene expression
11	4-Nov	Methods for studying gene expression
12	6-Nov	Methods for studying gene expression
	Nov 10-14	Fall Study Break
	18-Nov	Research Paper 1
	20-Nov	Research Paper 2
	25-Nov	Research Paper 3
	25-Nov	Research Paper 4
	4- Dec	Research Paper 5
	6-Dec	Research Paper 6
	9-Dec	Review/buffer day

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.