

Course Syllabus
Department of Biochemistry and Molecular Biology
BIOC 4404 - Gene Expression - Fall 2023

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.

Instructor: Dr. Jamie Kramer - jkramer@dal.ca

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.

Course Prerequisites: BIOC 3400

Lectures: Lectures will be held on Tuesdays and Thursdays in the Collaborative Health Education Building (CHEB), room C266, from 8:35 am to 9:55 am.

Contact Information:

E-mail - will be checked 9:00 am to 4:30 pm most days except weekends and holidays. Answered within 24 hours. For class purposes use @dal.ca email addresses only.

Office hours - by appointment only.

Brightspace Discussion Forum - Under the topic "general questions", you can create threads and post questions about class material. These are moderated by the instructor, but accessible to the whole class.

Learning Objectives

By the end of this course student will be able to:

1. Discuss the processes governing gene transcription in prokaryotic and eukaryotic cells.
2. Describe the mechanisms that govern chromatin structure and explain the role of chromatin in gene regulation.
3. Discuss the topics of epigenetics and epigenomics.
4. Describe the processing and translation of RNA and explain the role of non-coding RNA in gene regulation.
5. Read primary scientific literature at sufficient depth to provide an accurate summary and comment on the overall conclusion and importance of the work.
6. Apply concepts and knowledge about gene regulation and scientific methods to interpret novel datasets.

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. Selected chapters of both textbooks are available in Course Reading on Brightspace.
2. **Course Brightspace Page** - this will be essential for accessing all course content.
3. **Primary scientific literature** will be used for topics that are not covered in textbooks.

Course Assessment and Policies

Quizzes	20%	First 15 minutes of class on Tuesdays, see schedule below
Mid-term Exam 1	30%	Sept 28, CHEB C266, 8:00-9:55
Mid-term Exam 2	30%	Nov 2, CHEB C266, 8:00-9:55
Conference Talk	20%	Held during the last three weeks of class

Quizzes – 20%

Quizzes will be held during the first 20 minutes of class on Tuesdays. There will be 6 quizzes in total. Quiz dates are indicated in the schedule below. Quizzes are made up of multiple choice, fill in the blank, or short answer questions. Each quiz will be weighted equally towards the final grade. The lowest quiz score will be dropped. There will be no make-up quizzes and missed quizzes will be scored as zero.

Exam 1 - 30% - Sept 28. 8:00 am - 9:55 am, covers lectures 1-7

Exam 2 - 30% - Nov. 2 8:00 am - 9:55 am - covers lectures 8-16

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.

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. Students will select their own paper, following guidelines that will be provided by the instructor and subject to approval by the instructor. 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. Participation marks will be awarded.

Week	Lecture	Date	Topics (may vary)	Quizzes
1	1	05-Sep	Introduction - course structure and content Transcription in bacteria - bacterial promoters and RNA polymerase	
	2	07-Sep	Transcription in Bacteria - Transcription factors, Lac Operon, Bacteriophage lambda	Quiz
2	3	12-Sep	Transcription in Bacteria - gene networks, alternative sigma factors, quorum sensing	
	4	14-Sep	Transcription in Eukaryotes - promoters, regulatory elements	Quiz
3	5	19-Sep	DNA binding domains. Methods for analysis of gene expression	
	6	21-Sep	Methods for analysis of cis regulatory elements	Quiz
4	7	26-Sep	Identifying and characterizing novel long range <i>cis</i> elements in eukaryotes	
		28-Sep	Exam 1 - in class - 8:00-9:55	
5	8	03-Oct	Epigenetics and chromatin - definitions and types of epigenetic modifications, DNA methylation during development, genomic imprinting	
	9	05-Oct	Epigenetics and chromatin - histone modifications, chromatin states, and the epigenome.	Quiz
6	10	10-Oct	Epigenetics and Chromatin - inheritance of histone modifications	
	11	12-Oct	Epigenetics and Chromatin - nucleosome positioning and the analysis of chromatin accessibility	Quiz
7	12	17-Oct	Epigenetics and chromatin - transgenerational epigenetic inheritance	
	13	19-Oct	RNA - mRNA processing and quality control	Quiz
8	14	24-Oct	RNA – translation regulation, RNA interference	
	15	26-Oct	RNA - RNA binding proteins, RNA modifications, and lncRNAs	Quiz
9	16	31-Oct	Review and conference talk discussion	
		2-Nov	Exam 2 - in class - 8:00-9:55	
11		7-Nov	Conference Talks (4)	
		9-Nov	Conference Talks (4)	Quiz
		Nov 13-17	Fall Study Break	
12		21-Nov	Conference Talks (4)	
		23-Nov	Conference Talks (4)	Quiz
13		28-Nov	Conference Talks (4)	
		30-Nov	Conference Talks (4)	Quiz
14		05-Dec	Conference Talks (3)	

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/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.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.

Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

South House Sexual and Gender Resource Centre: <https://southhousehalifax.ca/about/>

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>