

**Department of Biochemistry and Molecular Biology**  
**BIOC 5404 - Gene Expression - Fall 2020**

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

**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* - will be held in a Collaborate Ultra session on Wednesdays 1:00 - 3:00 pm.

*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.

**Lectures**

Synchronous lectures will be held using Collaborate Ultra on Tuesdays and Thursdays from 8:35 am to 9:55 am. Lectures will be recorded and available for online viewing on Brightspace.

**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

**Course Exclusion**

BIOC 4404

**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. Discuss cutting edge methods used to study gene regulation.
6. Read primary scientific literature at sufficient depth to provide an accurate summary and comment on the overall conclusion and importance of the work.
7. Apply concepts and knowledge about gene regulation and scientific methods to interpret novel datasets.

### Course Materials

1. **Online Open Access Textbook:** Basic Cell and Molecular Biology: What We Know & How We Found Out - 3e. Gerald Bergtrom, University of Wisconsin, Milwaukee. This free interactive text is very useful to reinforce concepts discussed in lecture.
2. **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.
3. **Course Brightspace Page** - this will be essential for accessing all course content, including Collaborate Ultra synchronous lectures, and quizzes.
4. **Primary scientific literature** will be used for selected topics that are not covered in textbooks.

### Course Assessment and Policies

Quizzes	20%	During the first 20 minutes of class on (most) Tuesdays - specific dates below
Mid-Term	10%	Oct 8 - during class time 8:35 – 9:55
Journal Club	40%	Held during the last three weeks of class
Final exam	20%	Held during the University scheduled exam period

#### **Quizzes – 20%**

Quizzes will be held during Tuesday classes in the first 20 minutes of class time (8:35-8:55). Quizzes will be accessible on the course Brightspace page. In total there are 8 quizzes that will be multiple choice and/or short answer. Quiz days are indicated in the schedule below: Sept. 15, 22, 29, Oct. 6, 20, 27, Nov. 3, 17. 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.

**Journal Club – 40%** - Each student will prepare and deliver a 30 minute presentation to the class describing a series of 3-4 related research papers that are relevant to the course content. Students must independently investigate a research area and select the studies of focus for the journal club presentation, but the final choice of papers must be approved by the instructor. Presentations will be held synchronously during the last three weeks of class. Students will be expected to attend other students presentations. Participation marks will be awarded.

#### **Midterm exam - 10%**

The mid-term exam will be held during class time, 8:35-9:55, on Oct 8. The exam will consist of multiple choice and short answer questions. There will be no make-up mid-term. If the mid-term is missed the final exam will be worth 30% of the final grade.

#### **Final exam - 20%**

The final exam will be held during the final exam period scheduled by the University. Students who miss the final exam will have an opportunity to write a different exam at a date to be determined by the instructor.

**Course Content**

Week	Date	Topics (may vary)	Quizzes
1	08-Sep	Introduction to the course and basic review	
	10-Sep	Transcription in Bacteria - RNA polymerase, promoters, regulatory elements, methods for detecting bulk RNA and protein	
2	15-Sep	Transcription in Bacteria - gene networks, alternative sigma factors, Lac Operon	Quiz 1
	17-Sep	Transcription in Bacteria - bacteriophage lambda. Transcription in Eukaryotes - methods for cell-type specific analysis of gene expression	
3	22-Sep	Transcription in Eukaryotes - promoters, regulatory elements, methods to detect the interaction of proteins with DNA.	Quiz 2
	25-Sep	Transcription in Eukaryotes - initiation of transcription and the general transcriptional machinery, elongation through chromatin	
4	29-Sep	Transcription in Eukaryotes - transcription factors, coactivators, corepressors, transcriptional responses to signals.	Quiz 3
	01-Oct	Circadian gene regulation, Guest Lecture by Dr. Deniz Top	
5	06-Oct	Review Lecture	Quiz 4
	08-Oct	<b>Midterm</b>	
6	13-Oct	Epigenetics and chromatin - definitions and types of epigenetic modifications, methods for measuring DNA methylation and chromatin structure	No Quiz
	15-Oct	Epigenetics and chromatin - epigenomics and chromatin states, inheritance of chromatin state through cell division	
7	20-Oct	Epigenetics and chromatin - X inactivation, imprinting and transgenerational epigenetic inheritance	Quiz 5
	22-Oct	Epigenetics and chromatin - environmental epigenetics and neuroepigenetics	
8	27-Oct	RNA - mRNA processing - splicing and splicing regulation (drosophila sex determination)	Quiz 6
	29-Oct	RNA - mRNA quality control, RNA editing, non-coding RNA genes	
9	03-Nov	RNA - RNA interference, RNA binding proteins, RNA modifications (the epitranscriptome), methods for analysis of RNA-protein interactions.	Quiz 7
	05-Nov	RNA - translation and regulation of translation	
10	STUDY BREAK - Nov 9-13		
11	17-Nov	Journal Club	Quiz 8
	19-Nov	Journal Club	
12	24-Nov	Journal Club	
	26-Nov	Journal Club	
13	01-Dec	Journal Club	
	03-Dec	Journal Club	

## University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

### Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

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

### Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (until April 30, 2021).

Information on regular policy, including the use of the Student Declaration of Absence can be found here:

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html).

### Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of 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.

**Information:** [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

### Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

**Information:** [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.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.

**Code:** [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

### 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

**Statement:** <http://www.dal.ca/cultureofrespect.html>

### 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 (1321 Edward St) ([elders@dal.ca](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

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

[https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

### **University Grading Practices**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

## **Student Resources and Support**

### **Advising**

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

### **Academic supports**

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

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

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

### **Other supports and services**

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

### **Safety**

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

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

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

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