

**Faculty of Science Course Syllabus (Section A)  
Department of Biochemistry and Molecular Biology  
BIOC 5404 - Gene Expression - Fall 2021**

**Instructor:** Dr. Jamie Kramer - [jkramer@dal.ca](mailto: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* - 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.

**Lectures**

Lectures will be held on Tuesdays and Thursdays in the Sir Charles Tupper Medical Building, room 14B02, from 8:35 am to 9:55 am.

**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 Exclusions:** 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 and the both text books will be placed on reserve at Dalhousie libraries.
3. **Course Brightspace Page** - this will be essential for accessing all course content.
4. **Primary scientific literature** will be used for selected topics that are not covered in textbooks.

## Course Assessment and Policies

Quizzes	20%	Asynchronous, 24 hour access period, 15 minute time limit
Exam 1	15%	Asynchronous, 72 hour access period, 2.5 hour time limit
Exam 2	15%	Asynchronous, 72 hour access period, 2.5 hour time limit
Journal Club	50%	Held during the last three weeks of class

### **Quizzes – 20%**

Quizzes will be performed asynchronously and will be available on the course Brightspace page. There will be 7 quizzes in total and each quiz will be available for 24 hours starting prior to the Tuesday lecture (i.e. starting Mondays at 8:00 am). Quiz dates are indicated in the schedule below. Once started, the quiz must be completed within 15 minutes. All quizzes are made up of multiple choice and/or fill in the blank 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. The quizzes are open book, but must be done independently.

### **Mid-term Exam 1 - 15% - Oct 7 6:00 am - Oct 10 - 6:00 am - covers lectures 1-8**

### **Mid-term Exam 2 - 15% - Nov 4 6:00 am - Nov 7 - 6:00 am - covers lectures 9-15**

The mid-term exams will be written asynchronously on the course Brightspace page. Students will have a 72 hour period to access the exam. Once started, the exams must be completed within 2.5 hours. The exams will consist of short and long answer questions. There will be no make-up exams and missed exams will be scored as zero. The exams are open book, but must be done independently.

**Journal Club – 50%** - 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 during lecture times over the last three 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	Lec 1	07-Sep	Introduction - course structure and content Transcription in bacteria - bacterial promoters and RNA polymerase	
	Lec 2	9-Sep	Transcription in Bacteria - initiation, elongation, and termination Methods - detecting bulk RNA and protein	
2	Lec 3	15-Sep	Transcription in Bacteria - Transcription factors, Lac Operon, Bacteriophage lambda	Quiz 1 (Sept 14-15)
	Lec 4	17-Sep	Transcription in Bacteria - gene networks, alternative sigma factors, quorum sensing	
3	Lec 5	21-Sep	Transcription in Eukaryotes - promoters, regulatory elements Methods - investigating cell type specific gene regulation	Quiz 2 (Sept 20-21)
	Lec 6	24-Sep	Transcription in Eukaryotes - trans acting factors	
4	Lec 7	28-Sep	Transcription in Eukaryotes - combinatorial control, signal integration, signaling pathways	Quiz 3 (Sept 27-28)
		30-Sep	National Day for Truth and Reconciliation	
5	Lec 8	05-Oct	Circadian gene regulation - Dr. Deniz Top	Quiz 4 (Oct 4-5)
		07-Oct	<b>Mid-term Exam 1 (available for 72 hours - Oct 7 8:00 am - Oct 10 - 8:00 am)</b>	
6	Lec 9	12-Oct	Epigenetics and chromatin - definitions and types of epigenetic modifications	
	Lec 10	14-Oct	Epigenetics and chromatin - DNA methylation, genomic imprinting, histone modifications, epigenomics and chromatin states	
7	Lec 11	19-Oct	Epigenetics and chromatin - inheritance of histone modifications, methods for measuring chromatin accessibility, nucleosome positioning	Quiz 5 (Oct 18-19)
	Lec 12	21-Oct	Epigenetics and chromatin - transgenerational epigenetic inheritance	
8	Lec 13	26-Oct	RNA - mRNA processing - splicing and splicing regulation (drosophila sex determination)	Quiz 6 (Oct 25-26)
	Lec 14	28-Oct	RNA - mRNA quality control, RNA editing, non-coding RNA genes, X inactivation	
9	Lec 15	02-Nov	RNA - RNA interference, RNA binding proteins, RNA modifications (the epitranscriptome), methods for analysis of RNA-protein interactions.	Quiz 7 (Nov 1-2)
		04-Nov	<b>Mid-term Exam 2 (available for 72 hours - Nov 4 8:00 am - Nov 7 - 8:00 am)</b>	
10		STUDY BREAK - Nov 8-12		
11		16-Nov	Journal Club	
		18-Nov	Journal Club	
12		23-Nov	Journal Club	
		25-Nov	Journal Club	
13		30-Nov	Journal Club	
		02-Dec	Journal Club	

## Section B - University Policies and Statements

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

### 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)

## Section C- 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>

**Dalhousie COVID-19 information and updates:** <https://www.dal.ca/covid-19-information-and-updates.html>