Faculty of Science Course Syllabus
Department of Biochemistry & Molecular Biology

BIOC 4404.03: Gene Expression
Autumn 2017

Instructor: Richard A. Singer (Richard.singer@dal.ca) Tupper 9T2

Lectures: Tuesdays and Thursdays, 1:05 to 2:25, CHEB C-268

Laboratories and Tutorials: none

Course Description: Examples of gene expression and regulation are discussed for both prokaryotes and eukaryotes (and their viruses), with emphasis on current findings. The first part of the course describes prokaryotic paradigms in the study of gene regulation, while the second part introduces selected eukaryotic systems that illustrate general regulatory principles.

Course Prerequisites/Restrictions: BIOC 3400.03 or permission.

Course Objectives/Learning Outcomes:
- Distinguish between cis and trans regulation
- Distinguish between gene activation and gene repression
- Classify different regulatory mechanisms of gene transcription
- Identify the types of protein factors regulating bacterial gene expression
- Explain regulation by mRNA structure and stability
- Identify types of DNA and RNA elements regulating eukaryotic gene expression
- Explain how DNA and RNA elements regulate eukaryotic gene expression
- Identify different types of protein factors regulating eukaryotic gene expression
- Describe challenges and opportunities for gene regulation due to chromatin structure
- Distinguish among various mechanisms for the modulation of chromatin effects
- Recognize the implications of differential RNA splicing
- Identify effects of mRNA localization on the regulation of gene expression
- Explain regulation exerted by different mechanisms of translational control
- Specify methods to investigate gene regulation
- Acquire skills in reading and interpreting the primary scientific literature
- Evaluate the similarities and differences between different modes of gene regulation

Course Materials: Assigned readings in PDF form, mainly primary research papers and reviews, are available on the course page, http://www3.biochem.dal.ca/4404/. Up-to-date genetics and/or molecular biology texts can provide useful background reading.
Course Evaluations: There is one in-class written Early Evaluation (worth 0% of the final mark), one in-class Midterm test (30%) and a 3-hour Final Exam (70%), all of which comprise long-answer questions, possibly including data evaluation. The Midterm performance may be discounted if a higher percentage mark is obtained on the Final exam. (The Midterm can only improve your final mark.) The Early Evaluation (0%) provides feedback on performance before the course drop date.

Conversion of numerical grades to letter grades follows the Dalhousie Common Grade Scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
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<tbody>
<tr>
<td>A+</td>
<td>(90-100)</td>
</tr>
<tr>
<td>A</td>
<td>(85-89)</td>
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<tr>
<td>A-</td>
<td>(80-84)</td>
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<tr>
<td>B+</td>
<td>(77-79)</td>
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<tr>
<td>B</td>
<td>(73-76)</td>
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<tr>
<td>B-</td>
<td>(70-72)</td>
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<tr>
<td>C+</td>
<td>(65-69)</td>
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<tr>
<td>C</td>
<td>(60-64)</td>
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<tr>
<td>C-</td>
<td>(55-59)</td>
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<tr>
<td>D</td>
<td>(50-54)</td>
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<tr>
<td>F</td>
<td>(&lt;50)</td>
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</tbody>
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Course Policies: Department policy: a student missing an exam due to illness must notify the instructor or department office within 48 hours, and provide a valid medical certificate no more than 1 week after the scheduled exam (see Dal Academic Regulation 16.8 in the current Academic Calendar). Any 'make-up' exam is normally written within 7 calendar days of the missed exam. Absence for non-medical reasons is not ordinarily acceptable unless prearranged with the instructor. In the absence of satisfactory arrangements a missed exam is given a mark of zero.

Lecture Topics:

September
5 introduction; lac, multiple operators
7 lac, gal, ara: DNA conformation, CAP
12 more lac, gal, ara
14 lambda: basic circuitry
19 lambda: repressors, cII
21 lambda: antitermination, retroregulation
26 EARLY EVAL., and promoter specificity, sigma factors
28 mRNA 2’ structure, attenuation

October
3 ribosome production, trans’l control
5 eukaryotic RNAP III: TFIIIA 5S, tRNA
10 eukaryotic RNAP I: rRNA
12 eukaryotic RNAP II: TFIs, mRNA
17 activators and the Gal4 paradigm
19 MIDTERM
24 remote effects: enhancers, insulators
26 chromatin, nucleosomes
31 chromatin remodelers; Ac, Ub, Me

November
2 more chromatin; differentiation
7 Study Break (no class)
9 Study Break (no class)
14 differentiation: yeast cell type, HO
16 localization: Swi5, Ash1
21 heterochromatin, silencers
23 regulated mRNA splicing
28 translational control: eIF-2, Gcn4
30 translational control: eIF-4E, RNA binding
Faculty of Science Course Syllabus (Section B)

BIOC 4404: Gene Expression

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

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

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.


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 the office (Rm 3037, McCain Building), e-mail (elders@dal.ca) or leave message (902-494-6803).

Information: 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

University Grading Practices
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
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
Black Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html
International Centre: 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
Studying for Success: 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 Services: https://www.dal.ca/campus_life/health-and-wellness/health-services/services.html
Counselling: https://www.dal.ca/campus_life/health-and-wellness/counselling.html
Student Advocacy: https://www.dsu.ca/dsas

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