

Advanced Cell Biology

Syllabus

Department of Biology
BIOL 4020.03 Winter 2025

11:35 - 12:55 Monday, Wednesday

LSC Room C214

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.

Course Instructor(s)

Name	Email	Office Hours
Patrice Côté	patrice.cote@dal.ca	By appointment Office: LSC (Biology) Room 7124

Course Description

From the calendar: This advanced class focuses on how the animal cell interacts with its environment and integrates information to proceed with an appropriate course of action. Consequences of disrupting signaling pathways are also examined. Lectures are supplemented with assigned readings of original research articles for discussion in class.

Expanded description: For a cell to function normally, it is crucial that information from the environment be properly integrated. As such, the failure of signaling mechanisms is often responsible for developmental abnormalities and devastating conditions such as cancer and inflammatory diseases. The importance of cell signaling (or signal transduction) has manifested itself in recent years by the explosion in the number of publications in the area and has become unavoidable to anyone willing to pursue work in virtually all the branches of life science. Through a systematic review of structural and functional aspects of signaling pathway components, and by discussing original articles in class, the

participants will gain the practical knowledge necessary to decipher and critically analyze current research in this complex field.

Course Prerequisites

BIOL 2020.03 or BIOA 2001.03 with a minimum grade of B- or instructor's consent.

Prerequisite knowledge/skills (with keywords)

- Recall the terminology of cell biology. (*scientific terminology*)
- Explain how proteins are composed of various domains that confer function. (*proteins, macromolecules*)
- Recall the structure, dynamics, and roles of organelles and cytoskeletal components. (*membranes, cell, organelles, cytoskeleton*)
- Recall the fundamentals of cell signalling. (*cell signalling*)

NOTE: The above is intended as a guide for students to assess their preparation for this course. It is not meant to be a comprehensive or exhaustive list.

Course Structure

Course Delivery

The content of Advanced Cell Biology course is delivered in person and consists in lectures (usually ~1 hr / wk), in-class article preparation (20 min / wk) and presentation (80 min / wk).

Typical weekly schedule

An original research article will have been posted on Brightspace the preceding week and the students will have had time to read it entirely and to analyze in depth their assigned section.

On Day 1: 55 minute lecture and 25 minute *jigsaw*.

Jigsaw groups consist in groups formed with students from the four teams – see EVALUATION section above – that have analyzed in depth a section of the article assemble to explain the section to each other. For example, one student from each team may have analyzed the introduction of a paper

Between Day 1 and Day 2: Teams assemble at a mutually convenient time to thoroughly explain their section of the paper to the other members of the team and to prepare their presentation.

On Day 2: PRESENTATION DAY. For each component of the article, the teams that will be presenting on this day will be announced by the instructor at the beginning of the class. The presenting students will then have 10 minutes to finalize their presentations before the presentations begin.

Lecture Content

The lecture content includes the study of pathways and molecular interactions that are relevant to the capture, transmission, and interpretation of signals. In studying these pathways and interactions we will constantly go back to how they are involved in four key processes in higher vertebrates namely,

- Glucose homeostasis
- Phototransduction
- The Cytoskeleton
- Cell Division and Cancer

In most cases the topic of the article of the week will be aligned with the lecture. Please note however that the final exam will be on the lecture content only.

We may also have guest lecturers occasionally.

Course Materials

Relevant materials will be available on the course Brightspace site.

Recommended Textbook: Kramer IM, Signal Transduction, 3rd Ed., ©2015, Elsevier Science & Technology, 1126p., PRINT ISBN: 9780123948038, EBOOK ISBN: 9780123948199

This document is available for FREE as an electronic book via the Dalhousie University Libraries. The link is posted on the course Brightspace site.

Also recommended: Lim W, Mayer B, and Pawson T, Cell Signaling Principles and Mechanisms, 1st Ed., ©2015, Garland Science, 400p. ISBN 9780815342441

Assessment

(T) team based, (I) individual

	Weight (% of Final)	Date
LECTURE COMPONENT		
Final Exam (I)	30	TBD by Registrar
ARTICLE/VIDEO COMPONENT		
Team presentations (T)	32	On Wednesdays
Scientist interview project (T)	20	See Instruction document
Attendance/participation/peer evaluations (I)	15	see "Evaluation" and "Important Dates" sections
Article proposal (I)	3	see "Evaluation" and "Important Dates" sections
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TOTAL	100	

There is NO midterm exam

Feedback

In addition to providing a basic understanding of cell signalling, the ultimate goal of this course is to give participants the necessary tools to understand cell biology articles, to critically assess the findings reported in these papers and to communicate your interpretation of these findings. Timely and constructive feedback is essential in order for one to improve his/her abilities in this regard and you will benefit from two types of feedback.

1) Presentation feedback from instructor

At the end of the class on Wednesdays (presentation day), I will provide a brief comment to the presenter (in private) on the quality of the presentation and will provide tips on how the presentation could be improved.

2) Peer feedback

The peer evaluation form provides space for you to write a brief comment (less than 30 words) regarding your colleague's performance. It is not required that you write something unless you have given the person a mark of '0'. Positive comments are encouraged. Comments must be *respectful and helpful*, ie. it is essential that the comments be *constructive* and provide your peer with the information necessary to improve. Peer feedback will be anonymous: comments will be typed, compiled, and sent by email 3 times during the term (end January, February, March). I reserve the right to edit or delete comments if I find anything abusive or inappropriate.

Scientist interview project

Each team will make a 15 to 20-minute video or audio podcast episode where a scientist, who may be from Dalhousie University or from elsewhere – is interviewed. The target audience for the interview is fellow undergraduate students with a basic knowledge of biology. We will listen to all videos/audio podcasts during class time at the end of the semester.

Details on the requirements for the interview, marking criteria (rubric) and links to open-source video /audio editing tools will be provided on Brightspace.

Article proposal

Propose one original research article and one associated review article for discussion in future semesters of BIOL 4020. Details of this assignment are on Brightspace

Important dates

See **Appendix A** for important deadlines.

Conversion of numerical grades to final letter grades follows the

<u>Dalhousie Grade Scale</u>			
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 Policies on Missed or Late Academic Requirements

Communication

Documents, links, and announcements will be posted on Brightspace. It is your responsibility to check the BIOL 4020 Brightspace site and you Dalhousie email account often.

Evaluation

Evaluation of student performance will be based on four components: 1) Article presentation and discussion, 2) Class attendance, participation and peer evaluation, 3) Assignments such as the Scientist interview project and the Article proposal, and 4) Final exam.

Article Presentation and Discussion

We will be reviewing one article that is relevant to the weekly topic at hand. The papers will be important papers in the field of cell signalling (in the broadest sense). Teams of 4 or 5 participants will have one week to review the article and will be asked on the Wednesday lecture to describe a figure or table from the paper.

Policy on late assignments

5% per day late will be deducted from the mark given on an assignment.

Class attendance, participation and peer evaluation

It is essential in an interactive class such as Advanced Cell Biology that you be present in class. Attendance will be taken on presentation days and an absence with no valid reason* will cost you 2 points (out of a maximum of 4 points – arriving more than 20 minutes after the start of class will be considered an absence). Being physically present, however, is only part of the requirement and 3 points are allocated for attentiveness during presentations and respectful participation in discussions. This class is meant to be very interactive and is heavily team centered. It is therefore essential that everyone contribute to all aspects of the team activities including article preparation in your regular teams and

* **One (1) Student Declaration of Absence may be used during the semester (SEE THE LINK TO THE UNIVERSITY POLICY ON MISSED OR LATE ACADEMIC REQUIREMENTS DUE TO STUDENT ABSENCE AT THE END OF THE SYLLABUS).** After the SDA is used (SDAs are 'no questions asked') a 'valid reason' will be required should you miss a presentation day. 'Valid reasons' includes reasons that would be acceptable for missing an exam such as a medical reason, a wedding/death in the family, or another reasonable excuse such as an important appointment or important meeting that cannot be moved (in this case it is essential that you let me know in advance). Following the use of the SDA, students will lose 2 points per class missed without a valid reason.

within 'jigsaw' groups. To encourage everyone's participation, your peers will have the opportunity to grade your participation, just as you will have the opportunity to grade your peers and yourself. A 'peer evaluation form' will be provided and you will be required to provide a mark out of '2' for each member of your regular team and for the members of the jigsaw group that you interacted with. Failure to turn in the form on time will impact on your participation mark (1 point deducted per form turned in late).

Class attendance, participation and peer evaluation

It is essential in an interactive class such as Advanced Cell Biology that you be present in class. Attendance will be taken on presentation days and an absence with no valid reason

Attendance:	4
Participation:	3
Peer Evaluation (Regular Team component):	4
Peer Evaluation ('Jigsaw' component):	4
TOTAL:	15

Course Policies related to Academic Integrity

Policy on collaboration: Many assignments in this class are meant to be completed collaboratively in groups and those assignments are clearly designated as such. Individual assignments are *not* meant to be completed in groups. If plagiarism is found for individual assignments, a mark of zero will be assigned.

I reserve the right to use plagiarism software (e.g., Turnitin) as I see fit. The use of Large Language Model AI tools such as ChatGPT is allowed. However, it is mandatory to indicate whenever you use LLMs.

Learning Objectives

- Explain the nature and mode of transmission of signals between cells. (*hormones, cell adhesion*)
- Demonstrate how receptors capture signals (1st messengers) and transmit the information inside the cell. (*hormones, receptors, signal transduction*)
- Explain how signals are amplified inside cells by using second messengers. (*second messengers*)
- Explain how cells can distinguish between various signals. (*receptors, signal discrimination*)
- Describe the roles of calcium in cell signalling. (*calcium, gene regulation*)
- Explain the role of the cytoskeleton in cellular motility (*cytoskeleton*)

- Predict the consequences of abnormal cell signalling. (*hypothesis, prediction, cancer, apoptosis, cell division*)
- Design an experimental strategy to answer a simple question relating to cell signalling, including appropriate controls (*scientific method, hypothesis, experiment*)
- Compose a concise representation of a data set from an original research article. (*scientific literacy, science communication, data analysis, data interpretation*)

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.

Faculty of Science

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

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>