

## ***Mechanisms of Signal Transduction Syllabus***

**Department of Biochemistry & Molecular Biology**

***BIOC 4305/5305 Winter 2025***

*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 instructors**

Dr. Kirill Rosen (KR) (Coordinator) kirill.rosen@dal.ca

Dr. Thomas Pulinilkunnil (TP) tpulinil@Dal.Ca

Dr. Petra Kienesberger (PK) pkienesb@Dal.Ca

### **Course Description**

The goal of this course is to introduce the key concepts of signal transduction. Topics include regulation of cell signalling by receptors and protein kinases, lipids in signalling, nutrient signalling and signalling pathways in energy metabolism, apoptosis, autophagy, cell cycle and disease.

### **Course Prerequisites For Undergraduate Students**

BIOC 3700, 3300.03, 3400.03

### **Course Structure**

**Lectures:** 10:05-11:25 am Wednesday and Friday. The course will be delivered synchronously via Microsoft Teams.

**Essay:** Students will be expected to write a two-page essay (single-spaced, 12pt font, 1-inch margins) plus one page for figures, charts and tables, summarizing the current state of knowledge on one of the topics of the course selected by course instructors. Students will be evaluated based on: clarity (10%), adherence to the scientific review style and grammar (20%), accuracy of capturing the state of the field (60%), and figure design and use (10%).

**Seminar (specific to BIOC 5305):** The student will present a manuscript on one of the topics of the field. Manuscripts will be selected by course instructors. The presentation will take 20 minutes plus 5 minutes for questions. Students are expected to interpret all experimental data, understand the contribution of the work to the field and identify shortcomings of the study.

Students will be evaluated based on comprehension of the presented material, responses to questions as well as their presentation style (audiovisual, voice, mannerisms).

**Essay (specific to BIOC 5305):** Students will be expected to write a two-page essay (single-spaced, 12pt font, 1-inch margins) explaining the principles of the key techniques used in the paper presented by them during the seminar and how these techniques contributed to the study. Students will be evaluated based on: clarity (10%), adherence to the scientific review style and grammar (20%), and accuracy of describing the principles of the methods and their contribution to the study (70%).

### Course Materials

**Textbook:** No textbook required

**Course Website:** None

### Assessment

Component	Weight (% of final grade)	Date
Quiz	4%	January 24
Online exam on TP's and PK's material	24%	February 12
Online exam on PK's material	28%	March 7
Online exam on KR's material	34%	TBA (during the final exams period)
Written essay on selected subjects in the field of Cell Signalling	10%	Submission deadline: March 1

**Note:** BIOC 4305 students are expected to attend critical seminar given by the graduate students (please see below). Some of the exam questions will be on the material presented during the seminar.

#### Course Assessment - BIOC 5305

Quiz	3%	January 24
Online exam on TP's and PK's material	20%	February 12
Online exam on PK's material	23%	March 7
Online exam on KR's material	26%	TBA (during the final exam period)
Written essay on selected subjects in the field of Cell Signalling	8%	Submission deadline: March 1
Critical seminar	10%	February 5, April 4
Written essay on experimental methods used in the field of Cell Signalling	10%	Submission deadline: March 20

**Assignments** (please see essay description above)

### **Other course requirements**

No other requirements

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

#### **For undergraduate students:**

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

#### **For graduate students**

<b>A+</b> (90-100)	<b>B+</b> (77-79)	<b>F</b> (<70)
<b>A</b> (85-89)	<b>B</b> (73-76)	
<b>A-</b> (80-84)	<b>B-</b> (70-72)	

### **Course Policies on Missed or Late Academic Requirements**

A student who misses an evaluation component of a course (midterm test, assignment, presentation, lab, etc.) due to illness should, if possible, notify the instructor, course coordinator, or department office either prior to, or within 48 hrs. of the scheduled time or due date for that component. The student must also submit a Student Declaration of Absence Form (through the course Brightspace page or to their instructor via e-mail) within three (3) calendar days following the last day of absence. Special 'make-up' tests (if offered) will normally be written within 7 calendar days after the missed test. Absence for non-medical reasons is not ordinarily acceptable unless prearranged with the instructor. A missed evaluation component for which no satisfactory arrangement has been made will be given a mark of zero. The Student Declaration of Absence form can only be submitted up to two (2) separate times per course during a term. Students who exceed this limit must inform their course instructor(s) and will be required to register with an Advisor at Student Academic Success (SAS). If students have recurring short-term absences and do not register with SAS, it is at the instructor(s)' discretion to disallow any further Student Declarations and deny alternate coursework arrangements.

### **Course Policies related to Academic Integrity**

Please see the University policy on Academic integrity below.

### **Learning Objectives**

1. Understand the concept of signal transduction
2. Understand the role of signalling networks in key aspects of cell biology
3. Understand the roles of various aspects of metabolism and metabolite signalling in cellular homeostasis

4. Identify key types of regulators of signal transduction
5. Understand the fundamental concepts of cell signalling and metabolism involved in the pathology of diabetes
6. Understand the key physiological roles of cell death and autophagy
7. Understand the roles of oncogenes and tumour suppressor genes in the control of the key aspects of cancer cell biology
8. Learn to write reviews on specific subjects in the field of Cell Signalling

**Objectives/Learning Outcomes specific to BIOC 5305**

9. Learn to critically examine, present and discuss published studies in the field of Cell Signalling
10. Understand the basis of key experimental methods used in the field of Cell Signalling

**Course Content**

Jan 8	Introduction to cell signalling (TP)
Jan 10	Signalling pathways in glucose metabolism and growth (TP)
Jan 15	Amino acid sensing, and mTOR signalling (TP)
Jan 17	Signalling pathways in lipid metabolism (PK)
Jan 22	Randle Cycle and ketone body signalling (TP)
Jan 24	TCA cycle signaling (TP) ( <b>Online quiz during class hours</b> )
Jan 29	Cell cycle signaling in health and disease (TP)
Jan 31	Receptor tyrosine kinase signalling, part 1 (PK)
Feb 5	<b>Seminar: graduate students' presentations (KR)</b>
Feb 12	<b>Online exam on TP's and PK's material during class hours</b>
Feb 14	Receptor tyrosine kinase signalling, part 2 (PK)
Feb 26	Signalling pathways in insulin resistance (PK)
Feb 28	Adipokine, myokine and cardiokine signalling (PK)
March 5	Lysophospholipid & GPCR signalling (PK)
March 7	<b>Online exam on PK's material during class hours</b>

March 12	Mitochondria-mediated signalling mechanisms of apoptotic cell death (KR)
March 14	Death receptor-mediated signalling mechanisms of apoptotic cell death (KR)
March 19	Signalling mechanisms of non-apoptotic cell death (KR)
March 21	Autophagy-dependent signalling mechanisms of cell survival (KR)
March 26 survival	Signals generated by cell-extracellular matrix adhesion as regulators of cell (KR)
March 28	Signalling mechanisms of cancer progression (KR)
April 2	Signalling mechanisms of tumor angiogenesis (KR)
April 4	<b>Seminar: graduate students' presentations (KR)</b>

## 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](mailto:elders@dal.ca). Additional information regarding the Indigenous Student Centre can be found at: [https://www.dal.ca/campus\\_life/communities/indigenous.html](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](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](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](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](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](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.