



# MCB\*4010 Advanced Cell Biology

Winter 2018

Sections(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.50

Version 1.00 - December 20, 2017

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## 1 Course Details

### 1.1 Calendar Description

This course examines the cellular and molecular biology of signal transduction. The major theme is an understanding of how eukaryotic cells receive, transmit and respond to environmental signals. Topics will include cellular regulation of cell cycle progression and cell death as well as the consequences of deregulated signal transduction in terms of disease, primarily cancer.

**Pre-Requisite(s):** MCB\*2050 or MCB\*3010

### 1.2 Timetable

- Monday, Wednesday, Friday 10:30 – 11:20 AM (January 8<sup>th</sup> to April 6<sup>th</sup>, 2018)
  - MacKinnon (MCKN), room 117

### 1.3 Final Exam

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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## 2 Instructional Support

### 2.1 Instructor(s)

**Dr. Richard Mosser**

**Email:** rmosser@uoguelph.ca  
**Telephone:** +1-519-824-4120 x58059  
**Office:** SC1 3463  
**Office Hours:** By appointment.

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## 3 Learning Resources

A textbook is not required for this course.

## 3.1 Required Resources(s)

### **Courselink (Website)**

<https://courselink.uoguelph.ca>

Lectures and other resources for this course will be available on the MCB\*4010 CourseLink web page. Please check it regularly.

### **Research Papers (Readings)**

A set of assigned research papers will be used for the student presentations and quizzes.

### **Lecture Notes (Notes)**

The lecture notes will include references to research articles and current review papers.

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## 4 Learning Outcomes

There will be a series of lectures on the topics of signal transduction, cell cycle regulation, apoptosis and cancer. Each topic series will be followed by student presentations. The presentations will complement the lectures by providing an overview of a particular topic through the in depth examination of a current research publication. All of the presentation papers are articles published within the last 3 years in the journal Cancer Cell.

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Describe the molecular components and mechanisms controlling signal transduction pathways responsible for regulating cell proliferation and cell death.
  2. Explain how mutations in genes controlling signal transduction pathways responsible for regulating cell proliferation and cell death contribute to the process of carcinogenesis.
  3. Develop an understanding of the contributions made by key researchers that led to our current understanding of the mechanisms controlling cell signalling, cell cycle regulation and the control of cell death.
  4. Describe the methods commonly used by cell biologists to study aspects of cell signalling with emphasis on the regulation of the cell cycle and cell death.
  5. Interpret and evaluate the use of these methods and their outcomes in the context of recent research in the field of cancer cell biology.
  6. Critically appraise the findings of recent research in cancer cell biology in terms of potential application to cancer therapy or diagnosis.
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## 5 Teaching and Learning Activities

Lectures will cover the 4 main topics of signal transduction, cell cycle regulation, apoptosis and cancer. Student presentations will complement the lectures topics by evaluating a recent publication in the journal Cancer Cell. Each presentation will have 4 parts: (i) an overview of the signaling pathway, (ii) the relationship of this signaling pathway to cancer, (iii) a description of the assigned paper and (iv) a discussion of the assigned paper. Students will have the opportunity to either give an in-class presentation on one of the 4 parts or submitting a written report on all 4 parts. Each student is also required to prepare one multiple-choice question related to their topic. These questions will be posted on CourseLink (Quizzes) and students will have two weekdays to complete the quizzes online. Assigned papers and instructions for

presentations, written reports and quizzes are available on CourseLink. IT IS CRITICAL THAT STUDENTS READ THESE INSTRUCTIONS. The midterm and final exam will cover the material presented in lecture only.

## 5.1 Lecture and Presentation Schedule

Week/Date	Lecture/Presentation # and topic
Week 1: Jan. 8 (M)	Course overview
Week 1: Jan. 10 (W)	Lecture 1 - cell signaling L1: Cell signalling overview
Week 1: Jan. 12 (F)	Lecture 2 - cell signaling L2: G protein couple receptors I: PKA, adenylyl cyclase
Week 2: Jan. 15 (M)	Lecture 3 - cell signaling L3: G protein couple receptors II: PLC $\beta$ , IP3/DAG, PKC
Week 2: Jan. 17 (W)	Lecture 4 - cell signaling L4: receptor tyrosine kinases, EGFR
Week 2: Jan. 19 (F)	Lecture 5 - cell signaling L5: Ras, SH2, SH3 domains
Week 3: Jan. 22 (M)	Lecture 6 - cell signaling L6: MAPK, Raf, SAPK, PLC $\gamma$ , PI3K, AKT, PTEN
Week 3: Jan. 24 (W)	Lecture 7 - cell signaling L7: TGF $\beta$ , SMADS, JAK-STAT
Week 3: Jan. 26 (F)	Lecture 8 - cell signaling L8: NF- $\kappa$ B, regulated proteolysis
Week 4: Jan. 29 (M)	No class
Week 4: Jan. 31 (W)	Lecture 9 - cell signaling L9: stress signaling
Week 4: Feb. 2 (F)	Presentation 1: MAP Kinases: Foster et al., (2016) Cancer Cell 29:477.
Week 5: Feb. 5 (M)	Presentation 2: PI3K/AKT/PTEN: Castel et al., (2016) Cancer Cell 30:229.
Week 5: Feb. 7 (W)	Presentation 3: TGF- $\beta$ : David et al., (2016) Cell 164:1015.
Week 5: Feb. 9 (F)	Presentation 4: NF- $\kappa$ B: Lim et al., (2016) Cancer Cell 30:925.

Week 6: Feb. 12 (M)	Presentation 5: Stress signaling: Woodford et al., (2016) Cell Reports 14:872.
Week 6: Feb. 14 (W)	MIDTERM EXAM: in class, includes lectures 1 - 9
Week 6: Feb. 16 (F)	Lecture 10 - cell cycle L1: cell cycle engine, cell fusion studies, MPF
Feb. 19 - 23	WINTER BREAK
Week 7: Feb. 26 (M)	Lecture 11 - cell cycle L2: CDK, <i>cdc<sup>ts</sup></i> mutants, Harwell ( <i>cdc28</i> ), Nurse ( <i>cdc2</i> , <i>wee1</i> , <i>cdc25</i> )
Week 7: Feb. 28 (W)	Lecture 12 - cell cycle L3: regulation of CDK activity, CDK substrates, APC, mitotic exit
Week 7: Mar. 2 (F)	Lecture 13 - cell cycle L4: G1/S transition, Whi5/SBF/Sic/SCF, Rb/E2F/p27/SCF
Week 8: Mar. 5 (M):	Lecture 14 - cell cycle L5: Checkpoints
Week 8: Mar. 7 (W)	Presentation 6: CDK regulation: Hydring et al., (2017) Cancer Cell 31:576.
Week 8: Mar. 9 (F)	Presentation 7: G1 entry: Goel et al., (2016) Cancer Cell 29:255.
Week 9: Mar. 12 (M)	Presentation 8: mitotic exit: Gulluni et al., (2017) Cancer Cell 32:444.
Week 9: Mar. 14 (W)	Lecture 15 – apoptosis L1: Overview, <i>C. elegans</i> CED genes
Week 9: Mar. 16 (F)	Lecture 16 - apoptosis L2: Caspases, intrinsic/extrinsic pathways
Week 10: Mar. 19 (M)	Lecture 17 - apoptosis L3: Apoptosis regulators, Bcl-2 proteins, IAPs
Week 10: Mar. 21 (W)	Presentation 9: Caspases: Gu et al., (2016) Cancer Cell 30:623.
Week 10: Mar. 23 (F)	Presentation 10: Bcl-2 proteins: Reyna et al., (2017) Cancer Cell 32:490.

Week 11: Mar. 26 (M)	Lecture 18 - cancer L1: properties of cancer cells, oncogenes / proto-oncogenes
Week 11: Mar. 28 (W)	Lecture 19 - cancer L2: oncogene activation, c-myc, tumor suppressor genes, p53
Week 11: Mar. 30 (F)	HOLIDAY – no class
Week 12: Apr. 2 (M)	Presentation 11: c-myc: Zhu et al., (2017) Cancer Cell 32:310.
Week 12: Apr. 4 (W)	Presentation 12: p53: Mello et al., (2017) Cancer Cell 32:460.
Week 12: Apr. 6 (F)	Lecture 20 - cancer L3: multi-step tumorigenesis, six essential acquired capabilities
Apr. 14 (Sat.)	FINAL EXAM 2:30 - 4:30 PM - includes lectures 10 - 20

## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Midterm Exam	30.00
Quizzes	10.00
Presentation or Written Report	20.00
Final Exam	40.00
Total	100.00

### 6.2 Assessment Details

#### Midterm Exam (30.00%)

**Date:** Wed, Feb 14, In class

- Course Content:
  - Lectures 1-9

#### Quizzes (10.00%)

- Quizzes are answered on CourseLink and must be completed within two weekdays after the class presentation
- Multiple-choice questions associated with each presentation. Each student must submit one question

### **Presentation or Written Report (20.00%)**

- See schedule for class presentations
- Either a 10 minute in class presentation or a 4-page written report on one of 12 assigned topics and associated article from the journal Cancer Cell

### **Final Exam (40.00%)**

**Date:** Sat, Apr 14, 2:30 PM - 4:30 PM, TBA

- Lectures 10-20

## **6.3 Important Dates**

- Jan. 8 (Mon.): First lecture, 10:30 AM, MCKN117
  - Jan. 19 (Fri.): Deadline for CourseLink sign-up for presentation/written report topics.
  - Jan. 29 (Mon.): NO CLASS
  - Feb. 14 (Wed.): Midterm Exam, in class
  - Feb. 19-23 (Mon. – Fri.): Winter break, NO CLASSES
  - Mar. 9 (Fri.): Course drop deadline (40<sup>th</sup> class day)
  - Mar. 30 (Fri.): Holiday, NO CLASS
  - Apr. 14 (Sat.): Final exam, 2:30-4:30 PM, location to be determined
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## **7 Course Statements**

### **7.1 Grading**

The instructor and a teaching assistant employed by the department of Molecular and Cellular Biology will mark the presentations, midterms and final exams. The teaching assistant is a graduate student in the department who is familiar with the content of the course. Students who do not write the midterm exam because of illness or compassionate reasons will have their final exam weighted at 70% rather than 40%. Written reports handed in late will be penalized 5% for every day that it is late.

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## **8 Department of Molecular and Cellular Biology**

### **Statements**

#### **8.1 Academic Advisors**

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

## 8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.  
<http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

## 8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.  
<https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.uoguelph.ca/~ksomers/>

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# 9 University Statements

## 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for [Academic Consideration](#) are detailed in the Undergraduate Calendar.

## 9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate

Calendar.

## 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

## 9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

## 9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.



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