MCB*3010 Dynamics of Cell Function and Signaling

Winter 2024
Section(s): 01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - January 05, 2024

---

1 Course Details

1.1 Calendar Description

This course examines the dynamic properties of cells as they relate to cell-cell and cell-substrate interactions and elaborates on the fundamentals of intracellular signal transduction during these interactions. Topics will include the function and regulation of signalling modules, the cytoskeleton, and membrane component in the context of cellular interactions with other cells and with the extracellular matrix. These concepts will be integrated to develop a deeper understanding of dynamic cellular function within different tissue environments and physiological settings.

Pre-Requisites: MCB*2050

1.2 Timetable

This course will be delivered in person

Tuesday and Thursday, 11:30AM to 12:50 PM, MACN 113

Timetable and location is subject to change. Please see Courselink for the latest information on tutorial day and time.

.

1.3 Final Exam

There will be no final exam in this course.

---

2 Instructional Support

2.1 Instructional Support Team

Instructor: Jenna Penney
Email: penneyj@uoguelph.ca
Office: SC1 3516
Office Hours: Office hours by appointment

2.2 Teaching Assistants

Teaching Assistant (GTA): Michael Woods
Email: mwoods04@uoguelph.ca

---

3 Learning Resources

3.1 Required Resources

Courselink (Website)
https://courselink.uoguelph.ca/shared/login/login.html
This course will be run using courselink, please monitor for the more up-to-date information

3.2 Recommended Resources

Molecular Biology of the Cell 6th ed. (2016) Alberts, Johnson, Lewis, Morgan, Raff, Roberts, Walter; Garland Science. ISBN (978 0 81 534432 2). (Textbook)
Please note this is a supplementary textbook and not required

---

4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. 1. Apply advanced understanding of the molecular mechanisms of cellular signaling to dissect the
   molecular systems that control key cellular processes (cell-cell interactions, cell-ECM interaction,

cell motility, cell migration, cell differentiation).
2. Evaluate the evidence implicating the function of cellular signaling components in cellular
processes.
3. Critically assess the methods and approaches used to analyze cell signaling pathways.
4. Construct testable hypotheses about the protein-protein interactions that control cellular
functions – cell division, cell motility, endocytosis, phagocytosis, membrane trafficking.
5. Design experimental approaches to characterize protein function within signaling cascades.
6. Analyze signaling cascades, and diverse cell types, as central components of physiological
processes, including aspects of development.

---

5 Teaching and Learning Activities

5.1 Lecture

Topics:

COURSE STRUCTURE

1. Signaling (examples: Cell-cell and Cell-ECM Adhesion)

a. Enzyme-couples Cell Surface Receptors
b. Receptor recycling and degradation
c. Posttranslational modification
d. Feedback regulators

Readings 6th edition

Ch.15 p. 850-880
Ch.19; p. 1042-1046, 1074-1081

2. Cytoskeleton

a. Structure, dynamics and regulation
b. Motors and movement (intracellular cargo)

Readings 6th edition

Ch.16 p. 889-960

3. Extracellular matrix (ECM)

a. ECM structure
b. ECM function

Readings 6th edition

Ch.19 p. 1047-1074, 1081-1087

4. Cell-cell interactions

a. Cadherins, selectins, ICAMs, and integrins
b. Cell-cell communication
c. Signaling

Readings 6th edition

Ch.19 p. 1035-1042, 1047-1057

5. Signaling in cell motility

a. Cytokinesis
b. Cell polarity
c. Phago- and endocytosis
d. Cell migration/ Chemotaxis

Readings 6th edition

Ch.17 p. 996-1004
Ch.16 p. 940-960
Ch.13 p. 730-741
Ch.19 p. 1040-1042, 1066-1070

Ch.21 p. 1185-1186

6. Cell differentiation and tissue development

a. Development/Gastrulation
b. Endoderm/ Gut Epithelial Differentiation
c. Ectoderm/Neural Differentiation
d. Mesoderm/Muscle differentiation
e. Stem Cells

Readings 6th edition

Ch.19 p. 1042
Ch.21 p. 1145-1155, 1182-
1190, p. 1198-1213,
Ch.22 p. 1217-1234, 1247-1260

DATE	***LECTURE #***	***TOPICS***
Jan. 9	1	Course structure, signaling -RTKs
Jan. 11	2	Ras/MAPK, PI3-K, Notch, Hedgehog etc.
Jan. 16	3	Cytoskeleton
Jan. 18	4	Regulation of Cytoskeleton
Jan. 23	5	Motor Proteins
Jan. 25	REVIEW	Topics for Quiz #1
Jan. 30	QUIZ #1	
Feb. 1	6	ECM - the basal lamina
Feb. 6	7	ECM and connective tissue
Feb. 8	8	Cell Adhesion and ECM
Feb. 13	REVIEW	Topics for Quiz #2
Feb. 15	QUIZ #2	
Feb. 20/22	SPRING BREAK	NO LECTURE
Feb. 27	9	Cytokinesis
Feb. 29	10	Cell Polarity
Mar. 5	11	Cell Migration

Mar. 7	REVIEW	Topics for Quiz #3
Mar. 12	QUIZ #3	
Mar. 14	12	Patterning- Tissue Development
Mar. 19	13	Neural Development- Signaling
Mar. 21	14	Endoderm - Development
Mar. 26	REVIEW	Topics for Quiz #4
Mar. 28	QUIZ #4	
April 2		EXTRA CLASS IN CASE OF CANCELATION

---

6 Assessments

6.1 Assessment Details

Quiz #1 (25%)
Date: Thu, Feb 1, in class
Topics 1-2

Quiz 2 (25%)
Date: Tue, Feb 27, in class
Topics 3-4

Quiz #3 (25%)
Date: Thu, Mar 14, in class
Topic 5

Quiz #4 (25%)
Date: Tue, Apr 2, in class
Topic 6

---

7 Department of Molecular and Cellular Biology Statements

7.1 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

7.2 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

7.3 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.selfregulationskills.ca/

7.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/index.html. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar. (https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml)

7.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

8 University Statements

8.1 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.

8.2 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 grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 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.

8.5 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

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

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).