MCB*4010 Advanced Cell Biology

W22

Winter 2022
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 2.00 - January 10, 2022

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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-Requisites: MCB*3010

1.2 Course Description

This course builds on the fundamental concepts of cell biology covered in MCB*2050 and MCB*3010 by examining a select set of advanced concepts of cell biology, with the underlying theme of understanding how organelles in cells are formed and maintained, how they interact with other organelles and/or cellular structures, their dynamic behaviours and movements, including their inheritance during cell division, and, ultimately, how they are turned over (degraded).

General topics include nuclear envelope architecture and remodelling, intracellular trafficking of messenger RNA, tail-anchored membrane protein biogenesis, and the structure and function of endoplasmic reticulum subdomains, including ER-organelle membrane contact sites. Discussions will emphasize original research literature and the experimental approaches employed to study these cellular processes, as well as in the context of disease.

1.3 Timetable

- Classes commence Monday, January 10.
- Based on current public health guidelines, the first two weeks of lectures will delivered remotely, i.e., lectures from January 10th - 24th will be synchronous ('Live') and will be held using Zoom during scheduled class times (@10:30 AM - 11:20 AM) on Mondays, Wednesdays and Fridays. ***Note all times shown in this course outline are Eastern Standard Time (EST).***
- Synchronous lectures will be recorded and posted on CourseLink.
- As of January 26th, lectures will be held in-person in Rozanski Hall, Room 105 during the scheduled class time (@10:30 AM - 11:20 AM) on Mondays, Wednesdays and Fridays. ***Note: location of lectures is subject to change.***
- In person lectures will NOT be streamed or recorded.
- It is strongly recommended that students attend all lectures in order to participate in class discussions and ask questions.
- Lecture slides and allied (published) primary research literature and reviews, including those pertaining to the 'Research Paper Summary' assignments, as well as lecture recordings of synchronous lectures during the first two weeks of the semester, will be posted on Courselink.
- Students are responsible for all content covered in lectures, and any and all supplemental materials (e.g., primary research literature and reviews) provided.

1.4 Final Exam

Wednesday, April 13th, 8:30 AM - 10:30 AM (EST).

- Location of the Final Exam to be determined.
- Please see WebAdvisor for the latest information on any possible changes to the Final Exam scheduling.
- Additional details on the Final Exam are provided below in the '***Assessment***' section.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Terry Van Raay
Email: tvanraay@uoguelph.ca
Telephone: 519-824-4120 x 52864
Office: SSC 3247

Office Hours:

- By appointment. Please e-mail Dr. Van Raay to arrange a meeting.
- Details on any scheduled office hours offered during the semester, such as those held prior to the Midterm and/or Final Exams, will be announced in class.

Office Hours:

Office Hours:

- By appointment. Please e-mail Dr. Van Raay to arrange a meeting.
- Details on any scheduled office hours offered during the semester, such as those held prior to the Midterm and/or Final Exams, will be announced in class.

Office Hours:

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3 Learning Resources

- There is no assigned textbook(s) for this course, although students needing information on any background material that was covered in the prerequisite cell biology courses (e.g., MCB*2050 and MCB*3010) are encouraged to refer to the resource materials used in these courses.
- Lecture slides and allied (published) primary research literature and reviews, including the three papers selected for the 'Research Paper Summary' assignments (see '***Assessment***' section for details), will be provided on Courselink as PDFs, which can be viewed and printed using Adobe Acrobat Reader.
- All lecture materials are solely for the use of W22 MCB*4010 students and may not be reproduced or disseminated to others without the written permission of the instructor.

3.1 Required Resources

CourseLink (Website)
https://courselink.uoguelph.ca

- There is a CourseLink website set up for this course, which students can access from their CourseLink homepage.
- All lecture materials (i.e., PDFs of slides) and primary research papers and reviews, including those selected for the 'Research Paper Summary' assignments, as well as allied course assessments, will be available on the CourseLink.
- All course announcements and updates are also provided on the CourseLink.

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4 Learning Outcomes

- The depth of understanding in this course will be equivalent to an advanced, fourth year undergraduate course. Toward that end, the course will build on concepts covered in previous (prerequisite) cell biology-focused courses (i.e., MCB*2050 and MCB*3010) by addressing recent advances in the cellular and molecular mechanisms underlying selected topics of organelle biogenesis and intracellular trafficking (see '***Activities***' section for details). A significant portion of the material discussed in lectures will be derived from recent primary research articles and reviews.

4.1 Course Learning Outcomes

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

1. Understand and appreciate the ultrastructure, molecular components, and mechanisms underlying the cellular processes involved in the formation, maintenance, and/or turnover of organelles and/or macromolecular machinery.
2. Understand the applications and limitations of the experimental approaches used by modern cell biologists to study various aspects of organelle biogenesis and intracellular macromolecular dyanmics, with an emphasis on evaluating the experimental design, data analysis, and conclusions presented in current research literature.
3. Appreciate the diversity and complexity of the structure and function of selected organelles and the intracellular trafficking of macromolecules, such as proteins and mRNA, in the context of organelle-organelle interactions, protein translocation across membranes, intracellular movement, and membrane re-modelling.
4. Critically appraise the findings presented in recent research literature on selected topics of cell biology in terms of how these process relate to cellular function in general and,

when applicable, in the context diseases that are caused by defects in these cellular processes.

5. Communicate, effectively, an understanding of recent research in cell biology in written form.

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5 Teaching and Learning Activities

5.1 Tentative Lecture Schedule

- Lectures will comprise of presentations by the instructor; however, students will be continuously encouraged to ask questions and discuss lecture topics in class.
- Lecture numbers and corresponding lecture topics listed below are approximate and subject to change.

Lecture(s)	Lecture Topics
1	**Introductory class**
2-11	**Nucleus: New insights to nuclear envelope (NE) architecture and remodelling** NE assembly during open mitosis Nuclear pore complex assembly during interphase NE remodelling in response to external forces
12-22	**mRNA localization** Examples of mRNA localization and techniques used to study mRNA localization General mechanisms for mRNA localization Examples of active mRNA transport
23-34	**Tail-anchored (TA) membrane proteins**

Structure and functional roles of TA proteins
TA protein targeting signals, and pathways and mechanisms for targeting TA proteins
TA protein targeting: quality control

Endoplasmic reticulum (ER)

Nuclear envelope and peripheral ER
Mechanisms shaping the ER
ER subdomains: ER-organelle membrane contact sites

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6 Assessments

- Assessments for this course will comprise of three components: i) a Midterm Exam, ii) a 'Research Paper Summary' assignment, and iii) a Final Exam (see below for details).
- The Midterm Exam will be written in class during the scheduled lecture time and is compulsory. There will be no opportunity available to take the Midterm Exam at an alternate time, unless there is a direct conflict with a University-related academic and/or Varsity event. No other reasons will be accepted. Students with a scheduled academic/varsity conflict should inform the instructor at least one week prior to the Midterm Exam.
- If a student does not write the Midterm Exam because of illness or another valid reason, such as compassionate considerations, the weight of the missed exam will be transferred to the Final Exam. If the Midterm Exam is not written without a valid reason (provided no later than 3 days after the scheduled exam) a grade of 0% will be issued.
- Students who are unable to write the Midterm Exam may be required to write a separate Final Exam with proportionally more content from the Midterm Exam.
- Lecture numbers and corresponding lecture topics covered on the Midterm Exam and Final Exam are subject to change.

- A 'Research Paper Summary' assignment submitted late will be issued a grade reduction of 15% per day.
- Students must write the Final Exam at the scheduled date/time and location. Students who are unable to write the Final Exam at the scheduled time because of conflicts, or for other valid reasons, should contact their Academic Counsellor and request a deferred final examination; there is no opportunity available to take the Final Exam at an alternate time.
- The date/time and location of the Final Exam remains to be determined (i.e., please see WebAdvisor for the latest information on the Final Exam scheduling).
- Note: Assessments are subject to change; final assessments schedule will be presented in the final version of the Course Outline.

6.1 Assessment Details

Midterm Exam (30%)
Date: Wed, Mar 2, 10:30 AM - 11:20 AM, In class
Learning Outcome: 1, 2, 3, 4, 5

- The Midterm Exam will be held in class during the scheduled lecture time.
- The exam will consist of short- and long-answer, written-response questions, and will be based on lecture topics covered prior to exam.

Research Paper Summary Assignment (20%)
Date: Assignments due one week after completion of corresponding lecture topic, Assignments submitted via Dropbox on CourseLink
Learning Outcome: 1, 2, 3, 4, 5

- Four recently published, primary research papers will be assigned during the semester: one for each of the four general lecture topics scheduled to be covered in the course, i.e., Nucleus, mRNA Localization, TA Membrane Proteins, and Endoplasmic Reticulum; see '***Activities***' section for details on lecture topics and tentative schedule of lectures.
- Papers will be made available (as PDFs) on CourseLink before the end of each corresponding lecture section
- Students will be required to read and analyze (independently) each paper with the expectation of understanding the purpose of the work, methodologies, results, and conclusions, and how the study (paper) advanced the field with respect to the background information presented in lectures.

- Students will also select one of the first three assigned papers to write a summary based on the style and guidelines/format of a 'Spotlights' feature article in the ***Journal of Cell Biology***; additional details on writing a Research Paper Summary will be provided in class.
- The due dates for completed assignments will be one week following the last lecture related to the corresponding assignment and will depend on the course lecture schedule. Specific details on assignment due dates and times will be discussed in class.
- Completed assignments will be submitted via Dropbox on CourseLink.
- Questions specifically related to all four assigned papers will appear on the Final Exam.

Final Exam (50%)
Due: , Date/time and location of Final Exam to be determined
Learning Outcome: 1, 2, 3, 4, 5

- The Final Exam will consist of short- and long-answer written-response questions, and will be comprehensive, covering the entire the course; however, there will be an strong emphasis on the topics discussed in lectures that discussed in the later half of the course (i.e., that were not covered on the Midterm Exam), as well as all four papers assigned for the 'Research Paper Summary' assignment.

6.2 Important Dates

- January 10th (Monday) 10:30 AM-11:20 AM - Introductory lecture.
- February 21st-25th (Monday - Friday) - Winter break. No classes scheduled this week.
- March 2nd (Wednesday) - Midterm Exam. Held in class.
- April 8th (Friday) - Last lecture and one-semester course drop deadline for W22 semester.
- Final Exam Wednesday April 13 8:30-10:30 am

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7 Course Statements

7.1 Grading

Dr. Mullen will mark both the Midterm Exam and Final Exam, as well as the 'Research Paper Summary' assignments. Any dispute regarding the grading of the Midterm Exam or an assignment must be raised with Dr. Mullen within one week after the marks have been posted. Note that any request for regrading of either a question(s) on the Midterm Exam or an assignment will involve the entire exam or assignment being regraded (by Dr. Mullen) and, thus, the grade my go up, down, or remain unchanged. Grades will be assigned according to the standards outlined in the University of Guelph Undergraduate Calendar.

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.selfregulationskills.ca/

8.4 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)

8.5 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.

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 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

9.3 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

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 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

9.6 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

9.7 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.

9.8 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

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such

changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

9.10 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).

9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
