MOLECULAR BIOLOGY 3M03
Fundamental Concepts of Development
Winter 2021

Course Details

Instructor:
Dr. Roger Jacobs LSB 429 *jacobsr@mcmaster.ca*
Office hours: TBA, - in person or Microsoft Teams

Undergraduate Coordinator:
Dr. Mihaela Georgescu LSB 119 *mgeorg@mcmaster.ca*

Lab Demonstrators:
TBA

Lectures: Mon and Wed 10:30, Location To Be Determined
Lab: Tues and Wed 2:30. LSB
Text: **Developmental Biology** - Barresi & Gilbert 11th or 12th Edition
Shared or Electronic copy is sufficient. Text is on Reserve at Thode

Laboratory Manual
Laboratory handouts will be available on Avenue to Learn.

Course Description

Advances in developmental biology using genetic and molecular approaches will be discussed in the context of classical experiments. Various model systems (mice, fruitflies, worms) are examined and related to human development.

Two lectures, one tutorial or lab (three hours); one term
Prerequisite(s): BIOLOGY 2B03 (or ISCI 2A18 A/B), BIOLOGY 2C03 or MOLBIOL 2C03 .
Live lectures complemented with recorded lectures with closed captions. Tests scheduled during class time.

Participation in live labs is required.

Outline:
This course explores fundamental mechanisms underlying development, from structural and molecular genetic perspectives. Lecture material will be complemented by laboratory demonstrations, research papers and videos posted to Avenue.
The first part of the course will focus on early development in classical model systems (sea urchin and fly) will begin by examining how pattern and identity is established in early embryogenesis by discussing both classical and contemporary experiments. The second part of the course will examine specific processes underlying cellular diversity and morphogenesis relevant to vertebrate and human development. The third and final part of the course will focus on current research

topics and trends, such a role of environment in shaping developmental processes, and how developmental concepts are being applied to a wider range of issues in human health. The laboratory modules will employ model organisms: C. elegans, Sea Urchin, Chick embryo, Zebrafish and Drosophila. We will explore how cells acquire their fate, and build the intricate morphology of the maturing embryo and the adult form.

Course Objectives

By the end of this course students will be able to:

- Interpret or propose the design of experiments in developmental biology that uncover the physical and molecular mechanisms of development
- Relate the principles of development revealed by model systems to issues of human development
- Interpret research data and explain research outcomes to suggest generalisable principles or mechanisms of development
- Analyse and communicate primary research literature in development.
- Explain the mechanisms of major developmental events, such as fertilisation, induction, gastrulation, neurulation, pattern formation and organogenesis.

Course Evaluation

10% 2 Class Assignments
25% Midterm I Feb 5, in class
25% Midterm II March 18, in class
20% Final Exam (During final exam period)
20% - Laboratory Component
Experimental design: 3%
Lab assignment: Chick 1%
Lab assignment: *Drosophila* Lab 5%
Lab assignment: Zebrafish 2%
Lab Report: *C elegans* 8%
In Lab Participation 1%

This course may use proctoring software (TBD) for tests/exams. This software may require you to turn on your video camera, present identification, monitor and record your computer activities, and lockdown your browser during the exam. This software may be required to be installed before the exam begins. If you have questions about whether this software will be used, or concerns about the use of this software, please contact your instructor.

Course Schedule

Part I: The Developmental Biology Landscape

1. Examination of early events underlying the development of an organism from a single cell
2. Compare and contrast common model organisms in developmental biology
3. Explore cell lineage, differentiation, specification vs. commitment and determination, lineage dependent mosaic development vs. regulatory development, morphogens

Lecture	Date	Lab	Lecture	Reading (12thEd)
1		No Lab	Introduction, Gametes	
2			Fertilisation, Early embryogenesis- Urchins	
3			Sea Urchin gastrulation	
3		Intro to lab	Early Embryogenesis- Amphibians	
4			Early Embryogenesis- Gastrulation, Organiser	
5		Experimental Design	Early Embryogenesis – Axis formation-Flies to Humans	
6			Early Embryogenesis –Humans	
7		Sea Urchin	Neurulation- Mammals	
8			Somites and somitogenesis	
9		No Lab	M I D T E R M in Class	

Part II: Organogenesis

1. More about cell type specification and tissue morphogenesis underlying organ development
2. Concepts of differentiation, specification vs. commitment and determination, lineage dependent mosaic development vs. regulatory development
3. Review of modern developmental biology research underlying each topic

Lecture	Date	Lab	Lecture	Reading (12thEd)
1		Chick	Limb development	
2			Limb development	
3			Neural Development	
4			Reading	
5			Week	
6		Drosophila	Neurotrophic factors	
7			Myogenesis	
8		Drosophila	Myogenesis	
9			Stem cells and Regeneration	
10		Zebrafish	Gland Morphogenesis	
11			Heart Development	
12			M I D T E R M in Class	

Part III: Special Topics in Developmental Biology

1. Exploration of modern questions in developmental biology
2. Critical evaluation of research literature
3. Impact of developmental biology insights on medicine and policy

Lecture	Date	Lab	Lecture	Reading (12thEd)
1		C. elegans	Evolutionary developmental biology	
2		C. elegans	Teratology	
3			Congenital disease, ethics and policy	
4			Review Session	
			Registrar Scheduled Final Exam	

IMPORTANT NOTE

* *The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If any modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes. Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.*

** Due to the nature of labs involving live animals, sometimes the laboratory schedule does not go as planned. We may have to try some experiments and demonstrations again during the "no lab" weeks. We will notify you if that is the case.

Policy on missed work, extensions, late penalties and missed exams:

If you are absent from the university for a minor medical reason, lasting fewer than 3 days, you may report your absence, once per term, without documentation, using the McMaster Student Absence Form. Absences for a longer duration or for other reasons must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted. When using the MSAF, report your absence to Mihaela Georgescu. Immediately after using the online tool, students MUST **contact Mihaela Georgescu (mgeorg@mcmaster.ca)** regarding the nature of the relief. Failure to do so may negate the opportunity for relief. **It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work.**

Normally, a missed lab will be completed with your lab -mate's data and both labs and assignments may be given an extension for submission. Please note that the MSAF may not be used for term work worth 25% or more, nor can it be used for the final examination.

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript

(notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures- guidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

Authenticity/Plagiarism Detection

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. Avenue to Learn, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster’s use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

Courses with an On-line Element

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, Echo360, Microsoft Teams, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Online Proctoring

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx, Echo360, Microsoft Teams or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

Requests for Relief for Missed Academic Term Work

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

View the McMaster Student Absence Form (MSAF) for more information.

Academic Accommodation for Religious, Indigenous or Spiritual Observances (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.