MBG*4040 Genetics and Molecular Biology of Development

Fall 2018
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - August 24, 2018

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1 Course Details

1.1 Calendar Description

This course provides an examination of the genetic mechanisms that underlie organismal development. The molecular biology of cell determination and differentiation and the genetic control of morphogenesis and pattern formation will be emphasized.

Pre-Requisite(s): MBG*3040

1.2 Timetable

Lectures: Tuesday & Thursday 11:30 am – 12:50 pm SSC

1304 Laboratory: Thursday 2:30 pm – 4:20 pm SSC 4101

1.3 Final Exam

Currently scheduled for Wednesday, Dec. 5, 7-9 pm. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructor(s)

Andrew Bendall
Email: abendall@uoguelph.ca
Telephone: +1-519-824-4120 x53491
Office: SC1 3459
Office Hours: Dr Bendall is available immediately following scheduled lectures and by pre-arranged appointment. Please send an email to arrange a meeting time.

Scott Ryan
Email: sryan03@uoguelph.ca

Telephone:	+1-519-824-4120 x52919
Office:	SC1 3456
Office Hours:	Dr Ryan is available immediately following scheduled lectures and by pre-arranged appointment. Please send an email to arrange a meeting time.

2.2 Teaching Assistant(s)

Teaching Assistant:	Afshan Sohail
Email:	sohaila@uoguelph.ca

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3 Learning Resources

3.1 Required Resource(s)

Laboratory Manual (Lab Manual)
Available on D2L

Research Articles (Readings)
Citations to primary research articles for in-class presentations will be provided ahead of time. It will be each student's responsibility to locate these articles using library resources.

3.2 Recommended Resource(s)

Developmental Biology (Textbook)
Scott F. Gilbert (2016) *Developmental Biology*, 11th edition. Sinauer Associates.

The 10th edition (2013) may also be used if you have one; page numbers will be given for both 11th and 10th editions, wherever possible. Copies of the 10th edition have been placed on 2-hour reserve at McLaughlin library.

3.3 Additional Resource(s)

Principles of Development (Textbook)
Lewis Wolpert, 2011. *Principles of Development* (4th edition) Oxford University Press

Available at the library reserve desk

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4 Learning Outcomes

Learning Goals & Rationale

This course will provide an exploration of the genetic and molecular mechanisms that underlie the processes by which animals develop from a single cell into a multicellular organism. In addition to being a fascinating and aesthetically pleasing subject, modern developmental biology represents a synthesis of many of the subjects you have already studied, including cell and molecular biology, genetics, and evolution. Thus, you will be reviewing, reinforcing, and synthesising many of the concepts you have learned in other classes. In the context of various model organisms, topics will include principles of developmental biology, tissue

patterning, morphogenesis, size control, cell differentiation, and organogenesis. The molecular underpinnings of these embryological processes involve mechanisms of cell-to-cell communication and differential gene expression and these areas will be dealt with in some detail. Finally, the idea of the evolutionary conservation of developmental control genes will be a common theme in this course.

4.1 Course Learning Outcomes

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

1. Apply an advanced understanding of the major regulatory mechanisms that impact gene expression and function
2. Demonstrate knowledge of the modalities of the major signalling pathways during vertebrate development, including proteins that have a positive and negative effect on transduction of the major ligand families (BMP, FGF, Hedgehog, Notch, Wnt).
3. Define discrete stages of cell fate restriction during development
4. Distinguish between cell-autonomous and non-cell-autonomous gene functions
5. Describe the actions of maternal gene products in Drosophila axial patterning
6. Contrast mechanisms of dorsal-ventral patterning in Drosophila and vertebrate embryos
7. Describe morphogenetic processes in the vertebrate central nervous system, skull, and limbs and link to the action of key genes and cell types
8. Describe the guidance cues for migrating embryonic cells
9. Recognize the conservation of developmental control genes across distantly related phyla
10. Evaluate different kinds of evidence in developmental biology
11. Identify the experimental advantages of different model organisms
12. Critically assess the methodology of modern developmental biology
13. Describe and justify suitable experimental controls

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5 Teaching and Learning Activities

5.1 Tentative Lecture and Laboratory Schedule

Week	Date	Instructor	Lecture Topic	Lab exercise
1	Sep 6	AB	Course introduction	
	Sep 11		Nuclear cloning and the paradigm of differential gene expression	
	Sep 13		Differential gene expression II	No lab this week

	Sep 18		Fates, potentials, and early development in selected invertebrates	
2		AB		
	Sep 20		Evidence in developmental biology: the case of the myogenic determinant	Chick development – early
	Sep 25		Cell-cell communication	
3		SR		
	Sep 27		Signal transduction pathways in development	Chick development –late
	Oct 2		Stem cells - biology	
4		SR		
	Oct 4		Stem cells - medicine	AER ablation
	Oct 9		Study Break (no lecture)	
5				
	Oct 11		Midterm exam	Signaling pathway inhibition
	Oct 16		Neurogenesis	
6		SR		
	Oct 18		Presentation groups 1 & 2	Limb dissection & RNA extraction
	Oct 23		Neural crest	
7		SR		
	Oct 25		Presentation groups 3 & 4	RT-PCR & midterm review
	Oct 30		Disorders of neural development	
8		SR		

	Nov 1		Presentation groups 5 & 6	Gel run
	Nov 6		Drosophila axis specification	
9		AB		
	Nov 8		Presentation groups 7 & 8	Analysis of lab exp’ts
	Nov 13		Axis formation in the amphibian embryo	
10		AB		
	Nov 15		Presentation groups 9 & 10	Lab exam (written)
	Nov 20		Development of the tetrapod limb	
11		AB		
	Nov 22		Presentation groups 11 & 12	
	Nov 27		Evolutionary-developmental biology I	
12		AB		
	Nov 29		Evolutionary-developmental biology II	

*Specific sections of the course textbook and identity of assigned research articles will be available on the course D2L site on a rolling basis.

5.2 Important Dates

Sept. 6 (Thurs) First lecture & course introduction

Sept. 20 (Thurs) First lab

Oct. 11 (Thurs) Midterm exam, in class

Nov. 2 (Fri) Last day to drop one-semester courses (40th class day)

Nov. 15 (Thurs) Laboratory exam, during normal lab hours (SSC4101)

Nov. 29 (Thurs) Last lecture

Dec. 5 (Wed) Final exam

6 Assessments

6.1 Methods of Assessment

Assessment	% of final grade	Date	Course activity	Learning outcomes assessed
Midterm	20%	Oct. 11	Lect. 1-9	1-5, 10
Class presentation	20%	schedule on D2L		(1-8)*, 10-13
Lab exam (written)	20%	Nov. 15	Labs 1-6	7, 10-13
Final exam	40%	TBA	Lect. 1-17 Pres. 1-12	1-4, 6-11

*depending on specific paper

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7 Course Statements

7.1 Grading

Missed lecture or laboratory material as a result of absence is your responsibility. Grades will be assigned according to the standards outlined in the University of Guelph Undergraduate Calendar.

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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.
- 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: Chemistry & Physics Help and 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.
- Student Health Services is located on campus and is available to provide medical attention.
- 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.

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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

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.
