



## ZOO\*3050 Developmental Biology

Winter 2020

Section(s): C01

Department of Integrative Biology

Credit Weight: 0.50

Version 1.00 - November 01, 2019

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### 1 Course Details

#### 1.1 Calendar Description

This course will focus on the development of vertebrates and invertebrates from fertilized egg to adult. It will examine fertilization, cell differentiation into tissues and organs, regulation of cell growth, and transmission of developmental information to the next generation.

Throughout, the course will emphasize the evolutionary mechanisms that have shaped developmental patterns in animals.

**Pre-Requisites:** MBG\*2040, BIOL\*2400 is strongly recommended.

#### 1.2 Course Description

This course deals with the development of animals. It considers how a single fertilized egg gives rise to hundreds of different cell types, how these differentiated cells are organized into tissues and organs, how the growth of cells is regulated, and how an adult transmits the instructions for making an organism from one generation to the next. Throughout, the emphasis is on the principles and key concepts that govern the process of development in vertebrates and invertebrates as well as the evolutionary mechanisms that shaped developmental patterns in animals.

#### 1.3 Timetable

- Lectures: Tuesday/Thursday 8:30-9:50AM, Room ROZH 103

- Labs:

Wednesday 2:30 - 5:20 PM; Thursday 10:00 AM - 12:50 PM; Thursday 2:30 - 5:20 PM; Friday 11:30 AM - 2:20 PM, Room SSC 2313

\*\*On-line tutorial completed in week of January 6<sup>th</sup> (Week 1)

**\*\*First lab session in week of January 13<sup>th</sup> (Week 2)**

## 1.4 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 Instructional Support Team

**Instructor:** Roy Danzmann  
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## 3 Learning Resources

### 3.1 Required Resources

#### Developmental Biology (Textbook)

- Barresi & Gilbert. 2019. Developmental Biology. Sinauer Associates, Inc., Sunderland, Massachusetts. (12th edition).
- This book can be purchased in the book store.
- You can also use the 10<sup>th</sup> or 11<sup>th</sup> edition of this book.
- Available "used"
- Note: A considerably cheaper (~60% of the list price) 'on-line' version of the textbook may be purchased directly from the publisher. Email: [orders@sinauer.com](mailto:orders@sinauer.com)
- Another site with material intended as a supplement to the course textbook is

at: <http://www.devbio.com/>

### Lab Manual (Lab Manual)

- ZOO\*3050 Developmental Biology Laboratory Manual
- Sold in the first week of class - \$10 cash

### Courselink (Website)

<https://courselink.uoguelph.ca>

- A D2L site has been created for this course.
- This site contains all lecture material, a discussion board, on-line tutorials and other pertinent information.

## 3.2 Additional Resources

### Developmental Biology (Textbook)

- Barresi & Gilbert. 2019. Developmental Biology. Sinauer Associates, Inc., Sunderland, Massachusetts. (12th edition). Call number: **QL 955 G48 2019**.
- Available on reserve

### Developmental Biology (Textbook)

- Gilbert, S.F. 2016, 2014, 2010. Developmental Biology. Sinauer Associates, Inc., Sunderland, Massachusetts. (11th, 10th and 9th editions). Call number: **QL 955 G48**
- Available on reserve

### Atlas of Descriptive Embryology (Textbook)

- Mathews, Willis W. 1982. Atlas of Descriptive Embryology. Call number: **QL 956.M38 1986**
- Available of reserve

### Patten's Foundations of Embryology (Textbook)

- Carlson, B.M. 1988. Patten's Foundations of Embryology. Call number: **QL 955.P23 1988**

- Available on reserve

### **A Short Guide to Writing about Biology (Textbook)**

- Pechenik, J. A. 2010. A Short Guide to Writing about Biology. Call number: **QH 304.P43 2010**
  - Available on reserve
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## **4 Learning Outcomes**

- To enable students to appreciate and understand some of the universal molecular and cellular events and processes that occur as an animal develops from an egg and a sperm into an adult organism.
- By the end of this course, students should have an increased understanding of the gene signaling and gene regulatory events controlling developmental processes, and how the expression of these genes determine morphogenic and physiological transitions in development. Students should also have an appreciation of how environmental factors can interact with the genome to alter or vary the outcome of developmental events. Finally students should gain a heightened 3-D insight of how vertebrate and invertebrate bodies are produced from a single cell and increase to sizes spanning up to a  $10^{14}$  cellular entity.

### **4.1 Course Learning Outcomes**

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

1. Understand the process of gamete fusion and pronuclei interactions that activate development
2. Understand the nature of genes regulating the sex determination process
3. Understand gene signaling events that regulate early cleavage and gastrulation events in development
4. Understand how the three main germ layers in development (ectoderm, endoderm & mesoderm) are formed and which anatomical structures are derived from these three germ layers
5. Understand gene signaling events that direct the process of limb development
6. Understand how environmental factors may alter gene imprinting events and the

consequences of such influences upon development

7. Gain a heightened appreciation for the nature of genetic mutations in altering developmental programmes
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## 5 Teaching and Learning Activities

### 5.1 Course Content

- This course deals with the development of animals. It considers how a single fertilized egg gives rise to hundreds of different cell types, how these differentiated cells are organized into tissues and organs, how the growth of cells is regulated, and how an adult transmits the instructions for making an organism from one generation to the next. Throughout, the emphasis is on the principles and key concepts that govern the process of development in vertebrates and invertebrates as well as the evolutionary mechanisms that shaped developmental patterns in animals.
- Developmental Biology has a: i) lecture component; and ii) laboratory component. The laboratory component consists of 5 laboratories including two projects that require a formal report. Students are expected to attend class and take complete notes. Class material will also be supplemented through required textbook readings. In the lab, developmental biology is studied through experimental examination of live specimens, preserved specimens, slides and models. Attendance and participation in the laboratories and completion of the on-line modules is mandatory. These exercises are completed in the week before the laboratory. All components of the laboratory including on-line modules must be complete in order to receive credit for the lab. Excuses for absence are only adequate when properly documented.

### 5.2 Tentative Lecture Topics

Note: The list of lecture topics below is meant to indicate the topics to be covered and in what order. It is meant as a guideline only.

1. What is developmental biology (Chapter 1)
2. Differential gene expression and genome organization (Chapters 3 & 25)
3. Cell-Cell communication and differentiation (Chapters 2, 3, 4 & 5)
4. Sex determination, gametogenesis, and fertilization (Chapters 6 & 7)
5. Cell division, blastulation, gastrulation, and body polarity (Chapters 8 - 12)
6. Ectoderm, Neural Crest, Mesoderm, Endoderm (Chapters 13 - 18 & 20)

7. Limb Development (Chapter 19)
8. Post-embryonic development (Chapters 21 & 22)

### 5.3 Important Dates

- Jan. 7: First day of class
- Jan. 14: Tutorial 1 due
- Jan. 28: Tutorial 2 due
- Feb. 4: Tutorial 3 due
- Feb. 7: Lab report 1 draft due (11:00 PM PEAR system)
- Feb. 13: Midterm Exam
- Feb. 17-21: Winter break
- Feb. 25: Tutorial 4 due
- Feb. 28: Lab report 1 peer review due (11:00 PM PEAR system)
- Mar. 6: Lab report 1 final draft (11:00 PM PEAR system)
- Mar. 10: Tutorial 5 due
- Mar. 25-27: Lab report 2 due (11:00 PM on your lab day via dropbox)
- Apr. 1-3: Lab Exam
- Apr. 2: Last lecture
- Apr. TBD (6-20): Final Exam

### 5.4 Laboratory Exercises

- Week 1: Tutorial 1
  - Week 2: Lab 1. Basic Laboratory Observations
  - Week 3: Tutorial 2
  - Week 4: Lab 2. Mitosis, Meiosis and Fertilization
  - Week 5: Tutorial 3
  - Week 6: Lab 3. Cleavage and Gastrulation
  - Week 7: WINTER BREAK
  - Week 8: Tutorial 4 /Report 1 Due
  - Week 9: Lab 4. Neurulation and Organogenesis
  - Week 10: Tutorial 5
  - Week 11: Lab 5. Zebrafish Development
  - Week 12: Report 2 due
  - Week 13: Final Lab Exam (SSC 2313)
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## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Tutorial Quiz 1	1.5
Tutorial Quiz 2	1.5
Tutorial Quiz 3	1.5
Midterm Exam	20
Lab Report 1	12.5
Tutorial Quiz 4	1.5
Tutorial Quiz 5	1.5
Lab Report 2	10
Lab Exam	20
Final Exam	30
Total	100

### 6.2 Assessment Details

#### Tutorial Quiz 1 (1.5%)

**Date:** Tue, Jan 14, Online

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: online tutorials

#### Tutorial Quiz 2 (1.5%)

**Date:** Tue, Jan 28, Online

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: online tutorials

#### Lab Report 1 first draft (4%)

**Date:** Fri, Feb 7

**Learning Outcome:** 1

- Course content: Lab manual, primary literature

- Mark determined by average of 2 peer reviews

**Tutorial Quiz 3 (1.5%)**

**Date:** Tue, Feb 11, Online

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: online tutorials

**Midterm Exam (20%)**

**Date:** Thu, Feb 13, In class

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: Lectures & readings

**Lab Report 1 Peer Review (2.5%)**

**Date:** Fri, Feb 28

- Your reviews of your peer's drafts will be assessed.
- Course content: Lab manual, primary literature

**Tutorial Quiz 4 (1.5%)**

**Date:** Tue, Mar 3, Online

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: online tutorials

**Lab Report 1 Final Draft (6%)**

**Date:** Fri, Mar 6

- Course content: Lab manual, primary literature

**Tutorial Quiz 5 (1.5%)**

**Date:** Tue, Mar 17, Online

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: online tutorials

**Lab Report 2 (10%)**

**Date:** Week of March 23

**Learning Outcome:** 6



- Course content: Lab manual & primary literature
- Due at 11 PM in dropbox on your lab day

**Lab Exam (20%)**

**Date:** Week of March 30

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: Lab manual & online tutorials

**Final Exam (30%)**

**Date:** TBD, TBD

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

- Course content: Lectures & readings

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## 7 Course Statements

### 7.1 Grading

- Quizzes: Online tutorials and quizzes must be completed by 11:00 PM on the date indicated to receive credit.
- Lab reports: Students will work in groups and perform two experiments with live animals (sea urchin embryos and zebrafish embryos). Each student will be responsible for producing two independent lab reports written in the format of a scientific paper. The first lab report will be peer reviewed using the on campus Peer Evaluation And Review (PEAR) system. You will receive the average mark of your two reviews (4% final mark). Your reviews will also be evaluated (2.5%). A final draft of lab report 1 will then be submitted and assessed by your TAs (6%). The second lab report will be graded by TAs and will be submitted online via dropbox by 11:00 PM on the date indicated. Late reports will accrue a penalty of 10% per day including weekends.
- Lab Exam: The lab exam will be performed during your final lab session.
- Midterm and Final Exams: Are in scheduled during class or exam times. If there is no adequate excuse for absence from a lab exam or midterm, a mark of zero will be awarded. Failure to write the final exam will result in an INCOMPLETE course evaluation, and will require a make-up exam to be completed. This will

be administered at a time and place designated by the registrar. Failure to obtain documentation for missing the final exam will result in a zero grade being awarded.

## 8 Department of Integrative 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/>

## 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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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>

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