

**University of Guelph
College of Biological Sciences
Department of Integrative Biology**

**COURSE OUTLINE
DEVELOPMENTAL BIOLOGY (ZOO*3050)
WINTER 2015**

Teaching Team

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Teaching Assistant TBA

Course Schedule

Lectures: 8:30-9:50AM Tuesday/Thursday Room RICH2520

Labs: 2:30-5:20PM Room SCIE 2313
**On-line tutorial completed in week of January 5th
**First lab session in week of January 12th

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.

Learning Outcomes

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 10¹⁴ cellular entity.

By the end of this course, students 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.

Course Objective:

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.

Course Format:

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.

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 lab reports will be graded by TAs. Rubrics for the marking evaluations of both reports will be provided. Late submissions are penalized at a rate of 10% per day.

Resources

Required Texts

- Gilbert, S.F. 2013. *Developmental Biology*. Sinauer Associates, Inc., Sunderland, Massachusetts. (10th edition). This book can be purchased in the book store.
- **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
- ZOO*3000 *Developmental Biology Laboratory Manual* (sold in the first week of class, **\$10 cash**)

Library Reserve

- Gilbert, S.F. 2003. Developmental Biology. Sinauer Associates, Inc., Sunderland, Massachusetts. (7th edition). Call number: **QL 955 G48 2003**.
- Gilbert, S.F. 2006. Developmental Biology. Sinauer Associates, Inc., Sunderland, Massachusetts. (8th edition).
- Gilbert, S.F. 2009. Developmental Biology. Sinauer Associates, Inc., Sunderland, Massachusetts. (9th edition).
- Scadding, S.R. and Ackerley, S.K. 2003. Developmental Biology Laboratory Manual. University of Guelph (6th edition). Call number: **UGM PSN 03757**
- Mathews, Willis W. 1982. Atlas of Descriptive Embryology. Call number: **QL 956.M38 1986**
- Carlson, B.M. 1988. Patten's Foundations of Embryology. Call number: **QL 955.P23 1988**
- Pechenik, J. A. 2010. A Short Guide to Writing about Biology. Call number: **QH 304.P43 2010**

Courselink and other websites

- A D2L site has been created for this course and it can be found by going to: <https://courselink.uoguelph.ca/shared/login/login.html>. This site contains all lecture material, a discussion board, on-line tutorials and other pertinent information.
- Additional information can be found on the developmental biology course website: <http://www.uoguelph.ca/devobio/>
- Another site with material intended as a supplement to the course textbook is at: <http://www.devbio.com/>

Undergraduate Calendar

- This is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate programs. It can be found at: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/>

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 Introduction to developmental biology
- 2 Development of germ cells & the 'mechanics' of development
- 3 Gametogenesis
- 4 Mammalian oogenesis
- 5 Fertilization
- 6 Cell division, blastulation and gastrulation
- 7 Gastrulation – a comparative review (amphibians; fish; birds; mammals)

- 8 Gastrulation – continued – the ‘early gene morphogen signals’
- 9 Determination of the primary sexual phenotype
- 10 Differentiation – therapeutic cloning, nervous system
- 11 Differentiation – patterning in the spinal cord
- 12 Differentiation – neural crest cell migration
- 13 Differentiation – neurogenesis
- 14 Differentiation – endoderm development
- 15 Differentiation – mesoderm development - paraxial
- 16 Differentiation – mesoderm development - intermediate
- 17 Differentiation – mesoderm development – lateral plate (splanchnic)
- 18 The tetrapod limb
- 19 Medical aspects of developmental biology
- 20 Mechanisms of evolutionary change: Biotic and Abiotic interactions

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 Final Lab Exam (in SCIE 2313)
- Week 13 Report 2 due

Important Dates

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| Lab Report 1 | Due February 27 th | |
| Mid-term exam | 8:30-9:50, February 12 th | Room RICH 2520 |
| Final Lab Exam | Week of March 23 rd | Room SCIE 2313 |
| Lab Report 2 | Due Week of March 30 th | |
| Final Written Exam | TBA | |

Mark Allocation

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| On-line Tutorials | 10% |
| Lab Report 1 | 10% |
| Lab Report 2 | 10% |
| Mid-term Exam | 20% |
| Final Lab Exam | 20% |
| Final Written Exam | 30% |

Exams

Any student who claims medical, psychological or compassionate grounds as a reason for missing an examination (lab exam, midterm, or final) **MUST** obtain appropriate certification as outlined in the 2011-2012 Undergraduate Calendar under Section VIII: Undergraduate Degree Regulations and Procedures – Academic Consideration and Appeals. Once the documentation is approved by the instructor, a student with appropriate certification will be granted an exemption from the midterm or lab exam. There will not be any deferred midterm exam. The marks for any missed lab exam or the midterm will be prorated based upon the marks from the remainder of course. There will be no make-up lab exam. 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.

Missing classes (lecture or laboratory) for any reason does not excuse you from learning that material. You will be expected to make up any material missed by private study and reading.

Important Policies and Procedures

When You Cannot Meet a Course Requirement

Students who are absent from classes during the semester will be expected to make up for missed lecture and lab material on their own. Students who do not write the mid-term or final lab exam for medical or other authorized reasons will **not** be assigned a separate test, but will have their final mark based on a proportionate adjustment of their completed term work. When, for legitimate reasons, an exam is missed, **make sure** that you have given the instructor supporting documentation in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Drop Date

The last date to drop one-semester courses, without academic penalty, is March 7th.

For regulations and procedures for Dropping Courses, see the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

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.

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment.

Students requiring service or accommodation, whether due to an identified, ongoing disability or a

short-term disability should contact Student Accessibility Services (SAS) as soon as possible. For more information, contact SAS at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: <http://www.csd.uoguelph.ca/csd/>

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:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

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.

Academic 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:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>