Principles of Development
BIOL 3153FA01

Lectures: Dr. Glenys Gibson (she/her/hers)
Hear my name

Office: BIO 302
Office hours: M 11:00-12:00 AM, 3:00-4:00 PM; W 3:00-5:00 PM**
E-mail: glenys.gibson@acadiau.ca

Lecture: T Th 9:30-10:50, BAC 138
Lab: BIO 240
FA01 Th 1:00-3:50 PM
FA02 Th 6:30-9:20 PM

** Or by appointment. Office hours can be in person or on Teams.

Evaluation	Percentage	Date
Weekly quizlets	5%	Throughout the term (see Moodle)
Discussions (in class)	5%	Throughout the term
Two midterms	20% each (40% total)	Oct. 8, Nov. 5
Final exam	25%	December exam period
Limb assignment	5%	Nov. 14 (due at the end of the lab)
Lab exam	20%	Nov. 28

Part 1: Course Information

Course Description

Developmental biology is a dynamic, complex and rapidly changing field of study. The goal of this course is to provide you with a snapshot into the fascinating world of an embryo by helping you learn the basic principles by which an animal body plan is constructed.

Topics include: fertilization; gastrulation, germ layers and body axes; genetic regulation of development; cell signaling; maternal effects; development of the germ layers into organ systems such as the nervous system (ectoderm), vertebrae, heart and gonads (mesoderm) and pharynx and gut (endoderm).

Lectures and labs are integrated. In the lecture, we learn the concepts, and in the lab, you will be able to reinforce those concepts with live embryos (where available), microscope slides, models, etc. The labs are designed to reinforce lecture material and therefore, they will help you understand the principles of development but also, will give you an appreciation for the diversity of mechanisms by which animals form.

Prerequisite BIOL 2013 with at least a C- (60%)

Course Materials & Requirements

Access to course Moodle page and Vaughn Memorial Library's Biology LibGuide

There is no required text for this course and I will be posting online resources, when available. If you find a great online, free resource that you think will help students learn or review the material, **please let me know** and I'll post the link on Moodle. I have a variety of textbooks- if you'd like to borrow one (short term) let me know.

Lab handouts will be available on MOODLE before the lab.

For lectures and labs, you'll need paper, pencils, and colour pencils/ markers in the following colours:

- light blue (ectoderm proper)
- dark blue (neural ectoderm)
- yellow (endoderm)
- red (mesoderm)
- green (chordamesoderm)

Course Structure

Lectures will take place Tuesdays and Thursdays from 9:30AM-10:50AM. Please check Self Service/ Course Catalogue for the location.

Labs will be held on Thursday afternoons (FA01 1-3:50 PM) and evenings (FA02 6:30-9:20 PM) in BIO 240.

Student Learning Outcomes

1. Understand the basic principles by which animals develop and apply them to explain how animal form is constructed.
2. Explain the importance of developmental biology in evolution (e.g., Evo-Devo), and the importance of the environment in regulating development of a normal phenotype (e.g., Eco-Devo).
3. Explain the mechanisms by which cell signaling, cell migration, differentiation and stem cells generate and maintain complex structures in the vertebrate body plan.

Also see Appendix 1.

How to Meet the Learning Outcomes

1. Education is not a spectator sport. Attend lectures, take notes, ask questions. Please note- I will not be live streaming or recording lectures. If you are feeling sick, stay at home. Get the notes from someone in class and once you've reviewed them and the lecture slides (available on MOODLE), please ask if you have any questions and I'll be happy to help you.
2. Participate in class discussions and group work. Simply discussing what you just learned is an excellent way to remember the material and to learn to apply key concepts in new ways.
3. Labs reinforce lecture content and provide a wonderful opportunity for you to learn about embryos. The labs are designed to reinforce lecture material, so please take advantage of that time.

Part 2: Course Plan

I will do my best to follow the course plan below, but I also reserve the right to amend the course plan with reasonable notice, and in consultation with the class, if needed. Lecture slides and lab handouts will be available on MOODLE.

Week	Lecture	Laboratory
Sept. 4-6	Conceptual Toolkit	No lab
Sept. 9-13	Gametes & fertilization Echinoderms (e.g., sea urchins & sea stars)	Echinoderms & Squids
Sept. 16-20	*Drosophila* (both lectures)	*Drosophila* (fruit flies)
Sept. 23-27	Frogs 1 (fertilization through gastrulation) Frogs 2 (neurulation & organization centers)	Early Frog (fertilization through neurulation)

Sept. 30-Oct. 4	Sept. 30 National Day for Truth and Reconciliation (no lectures or labs) Frogs 3 (organization centers) Chick	Slightly Older Frog (Tailbud frog; organ systems)
Oct. 7-11	Oct. 8- **1st Midterm** (conceptual toolkit to Frogs 3) Mammals	Chick
Oct. 14-18	Oct. 14- Thanksgiving (no classes) Fall Study Week (no classes)	No lab
Oct. 21-25	Central Nervous System Fish development	Fish
Oct. 28-Nov. 1	Nerve growth (peripheral nervous system) Eye	No lab
Nov. 4-8	Nov. 5- **2nd Midterm** (chick to eye). Neural crest cells	No lab
Nov. 11-15	Nov. 11- Remembrance Day (no classes) Mesoderm 1- somites Limbs	Limb Development and Diversity
Nov. 18-22	Mesoderm 2- heart and blood vessels Mesoderm 3- gonads & germ cells	Review lab
Nov. 25-29	Endoderm- pharynx & gut Eco-Devo (ecological development and plasticity)	Nov. 28- **Lab Exam**
Dec. 2-4	Review (Q&A) Dec. 4 - last day of classes	

Part 3: Assessment and Grading

Lectures:

1) Weekly quizlets. Quizlets are small, friendly reviews that are designed to help you learn. At the end of each week, I will post (on MOODLE) a short quizlet with two goals: to help you review that week's material, and to give you examples of the sorts of questions you can expect on the midterm and final exams. They are due the Wednesday following the week you covered the material in lecture and you can redo them, if you like. Your top grade per quiz is the one that is recorded in the gradebook.

2) In class discussions. In most lectures, we'll work on questions in small groups to help you reinforce content just covered, and to help you learn to apply the content to new examples.

3) Midterms will be part online (MOODLE) and part on paper. Part A (MOODLE) will have a mix of short answer questions (similar to the quizlets) and part B (paper) will be short answer questions which give you an opportunity to explain major concepts or apply them in a new situation. The short answer questions will be similar to the ones we'll do in small groups in lecture. The midterms are not open notes.

4) The final exam will be similar to the midterm plus an essay question. Parts A and B (similar to the midterms) will be on the final third of the lecture content (i.e., content covered since the second midterm). The essay is cumulative and I expect you to draw on examples from material we've covered all term. Do not panic- we'll go through this in class so you'll know what to expect. As a class, we will pick essay topics sometime near the end of term. You can suggest major concepts that you've learned about all term, and the class will vote to pick the top three concepts. I'll make these into essay questions for the final,

give the questions to you before the final, and ask you to do one (of three) essay questions on the exam. This is an excellent way to help you focus your studying before the final.

Labs: **You are required to pass the lab to pass the course.**

1) Limb assignment- this is a short assignment that is to be completed in the limb lab, and submitted before your leave the lab.

2) Lab exam. The lab exam is on all lab material covered this term. The exam will be in a bell ringer format, where you go from station to station.

Part 4: Course Policies

Students are expected to attend all class sessions as listed above. If you are unable to do so for a valid reason, please let me know. You are responsible for getting the notes from another student in the lecture. Each class, we'll be having small group discussions. Participating in these will help you learn, help you retain, and help you prepare for the exams.

Attendance in labs is mandatory. If you have to miss a scheduled lab, please let me know in advance. Many labs involve live embryos. Embryos develop, so you will not be able to make that content up if you miss the lab.

Part 5: University Policies

University policies are available in the Acadia University Academic Calendar or through the Registrar's website: https://registrar.acadiau.ca/welcometotheregistrarsoffice.html

Equity, Diversity and Inclusion

Acadia University is committed to becoming a culturally safe and anti-oppressive community. This can only be achieved where there are simultaneous efforts to eliminate all forms of discrimination and harassment from our campus community, including the elimination of all discrimination, harassment and violence based on one's identity, including but not limited to, gender, race, class, ethnicity, sexual orientation, disability, gender identity, gender expression, and Indigeneity. The policy against harassment and discrimination, and resources for students who believe they may have experienced, or witnessed, discrimination or harassment, are available here: https://www2.acadiau.ca/student-life/equity-judicial/equity.html

Last Drop Day

Last day to drop a course and receive a "W". Please check the Acadia University calendar dates, which are available here: https://registrar.acadiau.ca/AcademicCalendars.html

Inform Your Instructor of Accommodations

Acadia University is dedicated to improving access to campus life for all students with disabilities. While we attempt to ensure that all courses are accessible, we recognize that there are barriers that need to be addressed on an individual basis. Students who require accommodations to complete coursework or otherwise fully participate in class should contact Accessible Learning Services directly as soon as possible. https://www2.acadiau.ca/student-life/accessiblelearning.html

The Use of Animals in Teaching and Research

The use of animals in teaching and research at Acadia University is done in accordance with guidelines on the care and use of animals published by the Canadian Council on Animal Care (CCAC). For more information on the CCAC, please visit their website at http://www.ccac.ca

Commitment to Integrity

It is standard practice in Biology to check exams and assignments for cheating and plagiarism. Cheating in the class and/or lab, including plagiarism, will not be tolerated. Please read the appropriate sections of the current Acadia University Academic Calendar: https://registrar.acadiau.ca/AcademicCalendars.html

Information on copy-write and course content from Acadia University is available through the Vaughan Memorial Library: http://libguides.acadiau.ca/c.php?g=433650&p=5027078

The spoken and written course content (including the syllabus, handouts, lectures, presentations, labs, assignments, quizzes, tests, and exams) are the intellectual property of the instructor and may only be copied for personal use. Sharing these materials or uploading them where they may be accessed by others is a violation of copyright. If you wish to make audio, video, or photographic recordings in class, you must first obtain the consent of the instructor and of any other persons (e.g., guest speakers, other students) who may be captured in such recordings. In the case of personal use by students with disabilities, the instructor's consent shall not be unreasonably withheld.

Part 6: Program Learning Outcomes

Foundations of knowledge		**Course specific examples**	**Proficiency** 1-Introduction 2-Reinforcement 3-Proficient
Scientific method, inquiry and hypothesis testing	Find, understand and apply information from the literature; understand how to use the scientific method to examine problems from different perspectives	Scientific method and experimentation are major topics in lectures.	2
Historical concepts and contributions by important figures	Explain foundational concepts in biology, Two-eyed Seeing, and ethical implications of scientific discoveries	Contributions of FDB (famous developmental biologists) is a major topic throughout the term; ethical considerations of our work is also discussed.	2
Biodiversity and ecology	Understand the genetic, taxonomic and ecosystem levels of biodiversity; focus on SW Nova including the Acadian Forest and Bay of Fundy ecosystems	Eco-devo (how the environment affects our development) is introduced; development of some coastal invertebrates is considered.	2
Genetics and evolution	Understand the chemical basis of heredity, genetics and genomics; integrate concepts across disciplines to understand evolution	Developmental genetics and tool kit genes considered; evo-devo is a major theme.	2
Human and environmental health	Understand form and function in health and disease within a One Health framework, integrating human and environmental health	Developmental disruptions, teratogens, and effects of environmental contaminants	2
Lab and field skills			
Experimental design	Gain experience in applying the scientific method	Reinforced in the lab	2
Safety	Work safely and productively in lab and field settings	Safe lab practices	2
Lab skills	Gain experience with basic and advanced lab techniques and understand their application in research, health science and industry	Microscopy, basic experimental design, making simple lab preps, photography, working with digital images.	2
Field skills	Gain experience in basic and advanced field skills and understand their application in ecology, conservation biology and environmental change		
Data acquisition, analysis and interpretations	Collect data, present results both qualitatively and quantitatively, and interpret outcomes in light of the literature	Data collection, analysis of group data, box plots, outliers and anomalies	2

Statistical analysis	Use R and or other programs to analyze biological data		
Professional skills			
Ethical practices	Demonstrate ethical conduct, apply principles of academic integrity, and understand the principles of EDI in science	EDI and ethical conduct of historical figures discussed in lecture; students follow principles of academic integrity throughout.	2
Collaboration and group work	Work effectively in groups within and across disciplines	Group work in lecture and lab; team-based experiment	3
Critical thinking	Analyze and evaluate information to make science-based decisions	Applied questions in lecture and on midterms; apply concepts in new scenarios.	2
Computer proficiency	Use common and discipline- specific software	Microscopy, MS Word, MS Excel	2
Scientific communication	Communicate science effectively to both scientific and general audiences	Oral communication in group work; written in lab reports and on exams with short answers and essay questions.	3