

Developmental Biology Syllabus

Department of Biology

BIOL 3050 Fall 2024

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Meghan Martin	MeghanMartin@dal.ca	By Appointment; LSC 4014
Margaret Cooper	mhcooper@dal.ca	By Appointment; LSC 4130

Course Description

Lectures describe development as a sequence of processes and events, in which 'simple' structures such as fertilized eggs are progressively transformed into complex organisms. These events are governed by developmental 'rules' which have been determined through experimental study of animal and plant model organisms. Laboratories use live material whenever possible.

Course Prerequisites

BIOL 2020 and BIOL 2030

Course Structure

Lectures

Monday, Wednesday, and Friday 1:35-2:25 - Rowe Management Building Rm. 1007

Laboratories

Tuesday, Wednesday, or Thursday 2:35-5:25 - LSC 4016

Course Delivery

Delivery of the lecture component will involve primarily in-person lectures. Asynchronous online content will be used when necessary. Delivery of the laboratory component will involve in-person laboratory sessions. Tests will be in-person, during scheduled lecture times.

Course Materials

The text required for this class is *Principles of Development, 6th Ed., 2019; by Wolpert et al.* Specific sections of the text will be assigned as readings ahead of specific lectures and labs. Copies of the text are on Reserve in the Killam Library if you don't wish to purchase one. The 4th and 5th editions of the text can also be used, however, you will be responsible for determining the appropriate sections and pages to read.

We also recommend that you consider purchasing the text *A Student Handbook for Writing in Biology; 6th ed., 2021 by Karin Knisely*, which is available in the reference section of the University Bookstore. This text is relatively inexpensive and is a very good reference text to consult when writing your laboratory reports.

There is no printed lab manual for this course. Your labs will be posted on Brightspace throughout the term. This will allow flexibility in how you can view the lab information during your lab session. If you have a tablet or small laptop that you normally carry with you, you can view the introductory portion of the lab electronically during lab and only print the Lab Exercises that you will hand in at the end of lab. If you prefer to have a hard copy with you in lab, simply print the entire lab. I should warn everyone though that WiFi in the Life Sciences Centre is notoriously poor. So, if you plan to view an electronic copy of the lab during your lab session, make sure it is downloaded to your device prior to coming to lab. **It is mandatory that every student has the lab information with them in some form during their lab sessions and that everyone has a printed copy of the Lab Exercises.**

Assessment

Component	Weight (% of final grade)	Date
<u>Lecture</u>		
Test I (50 minutes)	10 %	October 2 nd
Organogenesis Article Analysis	7.5%	October 25 th
Test II (50 minutes)	15 %	October 30 th
Flower Assignment	7.5 %	November 19 th
Test III (50 minutes)	20 %	December 4 th
<u>Lab</u>		
Pre-Lab Quizzes	3 %	Throughout term
Lab Assignments	22 %	Throughout term
Lab Report	15 %	November 7 th

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

Grade	Mark	Definition	
A+ A A-	90-100 85-89 80-84	Excellent	Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
B+ B B-	77-79 73-76 70-72	Good	Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with the literature.
C+ C C-	65-69 60-64 55-59	Satisfactory	Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience.
D	50-54	Marginal Pass	Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills (except in programs where a minimum grade of 'C' is required).
F	0-49	Inadequate	Insufficient evidence of understanding of the subject matter; weakness in critical and analytical skills; limited or irrelevant use of the literature.

Course Policies on Missed or Late Academic Requirements

To avoid any misunderstanding or confusion during the term, please note the following policies which will be enforced by the staff of Biology 3050. These regulations have been put in place to try to ensure fair and equal treatment for all. Extenuating circumstances can arise however, so please feel free to contact Miss Martin or Dr. Cooper if you have problems with any of these regulations at any time during the term.

Illness and Extensions:

There will be times during your term when you will have deadlines in several different courses at the same time. **PLAN AHEAD. WORK CONSISTENTLY.** Your time at University should, among other things, teach you to develop effective time management skills and study habits. On the other hand, unforeseen events such as personal/family crisis, or illness can occur during the term. These occurrences are unavoidable and the staff of BIOL 3050 will be most understanding. Special arrangements for examinations and assignments in the event of illness or other exceptional circumstances will be made at the discretion of the teaching staff. Alternate arrangements will be considered provided that:

- a student who misses class work (i.e. exam, deadline for submission of an assignment, etc.) because of illness **NOTIFIES THE INSTRUCTOR ON THE DAY IN QUESTION**, and submits a Student Declaration of Absence (SDA). *A maximum of two SDA may be used in this course throughout the term.*
- a student who, for medical reasons (e.g., scheduled day surgery, physiotherapy etc.), anticipates missing class work notifies the instructor at least one week in advance;
- a student who misses class work due to other exceptional circumstances **NOTIFIES THE INSTRUCTOR ON OR BEFORE THE DAY IN QUESTION** and is willing to produce appropriate documentation upon request.

Late Assignments:

Any material submitted for evaluation after the designated deadline, where an extension has not been granted, will have marks **DEDUCTED AT THE RATE OF 5% PER DAY LATE.** Assignments can be submitted up to the point when feedback has been provided to the rest of the class.

Course Policies related to Academic Integrity

You are expected to abide by Dalhousie University's policies on academic integrity.

There will be times in lab when you work as a group, but **every lab assignment that you submit must be independent and entirely your own wording**. The use of generative AI or large language models (e.g. ChatGPT) in this class would undermine your development of thinking and writing skills, and therefore will not be considered appropriate. The lab reports submitted for this class will be assessed using Turnitin plagiarism software.

You will do formal group work for the lecture-based assignment "Flower Development". ***This is the only assignment for which you will make a group submission.***

Other Course Policies

Running of Labs:

- a) Labs will start promptly at 2:35 with a pre-lab overview of the material you will be studying and clarification of any instructions if necessary. You will each work at your own pace and can feel free to leave or take a break whenever you wish, but the lab will be closed at 5:30 and at that time, everyone will be expected to submit their assignments for evaluation and will be asked to leave.
- b) You will select a bench position where you will be expected to sit for the entire term. You are each responsible for the proper use, maintenance and storage of the microscopes located at your seat. Before leaving the lab, put away all equipment, tidy up your work area and wash and dry all dirty glassware as instructed.
- c) Pairs of students will be assigned slide boxes containing all the prepared slides for the term. You will be expected to check that all the slides are in your box before you start each lab, and to likewise ensure that all slides are in their proper slots when you leave.
- d) We will be using live animals in three of the lab sessions (sea urchins to study fertilization and early development, zebrafish to study early development, and planaria to study regeneration). If you have strong objections to working with this material, please speak to the Instructor in advance to make alternate arrangements for the lab.

Grade Changes:

We do not encourage requests for considerations of grade changes with the weekly submissions from the laboratory sessions. These small assignments are graded by the teaching assistants using an outline provided by the Instructor. While every effort has been made to ensure that the assessments are fair and as objective as possible, some individual variation in evaluations is inevitable. However, each week's material is worth only a few marks towards your total grades so any minor variations would be

insignificant. Overall, prolonged discussions over fractions of points takes time away from the current week's activities and can create an unhealthy, confrontational atmosphere. **ON THE OTHER HAND**, we **DO ENCOURAGE** discussion about "where you went wrong" so that you will not make the same mistakes the next time and you will learn and improve. In all cases, the procedure is to approach the person who graded your material and to do so as soon as possible after receiving the evaluation. **THERE WILL BE NO CONSIDERATIONS OF GRADE CHANGES FOR LAB ASSIGNMENTS BEYOND 1 WEEK AFTER YOUR ASSIGNMENT IS RETURNED** (i.e., do not bring assignments for re-evaluation at the end of term!). With respect to exams given during the lecture portion, requests for grade reassessment must be done in writing. The written request must be made within one week of the date the exam was returned.

Learning Outcomes

- Identify a few major researchers in the development of the field of Developmental Biology and outline how our understanding of embryonic development has changed over time.
- Know the characteristics of the major experimental model organisms
- Identify and define the major stages in the development of model organisms
- Demonstrate an understanding of selected molecular techniques used in the field of Developmental Biology
- Demonstrate an understanding of the process of gamete production and fertilization
- Understand the steps involved in cleavage and gastrulation and also identify the types of cell movements involved in gastrulation
- Distinguish between germ layers and list what tissues/organs develop from each germ layer
- Describe mechanisms by which embryonic cells communicate and their role in regulating embryonic development
- Describe the mechanism of gene expression regulation and explain their importance in controlling developmental processes
- Outline the processes involved in generating a nervous system
- Outline the process involved in limb development
- Identify and differentiate between mechanisms used to develop a complex, multicellular organism.
- Outline the differences and similarities between plant and animal development and demonstrate an understanding for the basis for these differences
- Demonstrate an understanding of the process of pollination and fertilization
- Describe the structure of apical meristems and their role in development
- Demonstrate an understanding of the principal mechanisms that regulate leaf, flower and root development
- Explain the significance of hormones in plant development and describe the role of each of the five major hormones in development
- Identify embryonic structures in slide preparations, photographs and diagrams
- Relate the appearance of two-dimensional microscope sections to three-dimensional embryos
- Carry out simple experiments using selected model species
- Write formal laboratory reports

Week	Lecture Content	Text Pages - <i>Principles of Development</i> 6th Ed.	Labs
Sept 3-6	Introduction to Developmental Biology Basic Concepts of Developmental Biology and Model Organisms	1-24, 94-98, 115-131	
Sept 9-13	Development of Germ Cells Fertilization and Egg Activation Preventing Polyspermy & Imprinting and Parthenogenesis	397-412 412-418	Gametogenesis Pre-lab Quiz: 0.5% In-lab Assignment: 2%
Sept 16-20	Cleavage Morphogenesis Morphogenesis cont.	98-100, 102-103, 105-107, 110-113, 254-255, 280-289 99-115, 171-173, 255-256, 271-315	Fertilization and Cleavage Pre-lab Quiz: 0.5% In-lab Assignment: 3%
Sept 23-27	Setting up the Body Axes Cell Specification and Determination Exam Review	142-150, 165-167, 173, 183-195, 227-231 6-8, 17-35, 476, 492-497	Gastrulation and Neurulation Pre-lab Quiz: 0.5% In-Lab Assignment: 3%
Sept 30-Oct 4	<i>September 30 University Closed - Truth and Reconciliation</i> Oct 2 - Test: Through Morphogenesis (10%) Specification and Patterning of the Germ Layers	 150-165, 173-178, 195-198	Zebrafish Core Facility Attendance: 1%
Oct 7-11	Cell Differentiation Neural Induction and Patterning Neural Induction and Patterning cont.	333-353, 376-382 165-171, 173-178, 198-200, 205-226, 320-323, 505-518	Planaria Regeneration I Pre-lab Quiz: 0.5% In-lab Assignment: 0.5%
Oct 14-18	<i>October 14th University Closed - Thanksgiving</i> Organogenesis (Limb and Eye Development) Organogenesis (Limb and Eye Development) cont.	 452-480, 492-497, 674-679	Planarian Regeneration II Assignment (5%)
Oct 21-25	Arabidopsis as a Model Species Phytohormones Oct 25 - Organogenesis Article Analysis Due (10%) Establishing the Body Plan	611-612 612-621	Embryogenesis in Angiosperms Pre-lab Quiz: 0.5% In-lab Assignment: 2%
Oct 28-Nov 1	Exam Review Oct. 30 - Test 2: Setting up Body Axes through Organogenesis (15%) Establishing the Body Plan cont.	 612-621	Early Seedling Development
Nov 4-8	Meristems in the Shoot and Root <i>Group Flower Assignment Meeting</i> Meristems in the Shoot and Root cont.	622-628, 633-635 636-646 622-628, 633-635	No Lab - Lab Report Due (15%)
Nov 11-15	Reading Break		
Nov 18-22	Development of Lateral Organs Nov 19 - Flower Development Assignment Due (5%) Flower Development Leaf Development	628-633 636-646	Root System Development I Pre-lab Quiz: 0.5%
Nov 25-29	Patterning the Epidermis: Stomata, Trichomes, and Root Hairs Patterning the Epidermis: Stomata, Trichomes, and Root Hairs cont. Gametophyte development and fertilization		Root System Development II In-lab Assignment: 5.5%
Dec 2	Exam Review		
Dec 3 (Tues)	Exam Review		
Dec 4 (Wed)	Dec. 4 - Test 3 - Plant Section (20%)		