

Developmental Biology Syllabus

Department of Biology

BIOL 3050 Fall 2023

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
Sophia Stone	S.Stone@dal.ca	By Appointment; LSC 5132
Meghan Martin	Meghan.Martin@dal.ca	By Appointment; LSC 4014

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

Course Delivery

Delivery of the lecture component will involve in-person lectures and asynchronous online content. Delivery of the laboratory component will involve in-person laboratory sessions. Tests will be delivered online, via our Brightspace course site, with a 5-hour window on the test date.

Lectures

Monday, Wednesday, and Friday 12:35-1:25 - LSC-PSYCHOLOGY P5260

Laboratories

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

Course Materials

Although there is not a REQUIRED text assigned to the class, we strongly recommend that you purchase the text, ***Principles of Development, 6th Ed., 2019; by Wolpert et al.*** It is particularly helpful for the Animal Development section, has a good chapter on Plant Development and Dr. Stone will be referring to figures in the text during lecture. Specific sections of the text will also be assigned as recommended pre-lab reading. 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 4 th
Organogenesis Article Analysis	10%	October 25 th
Test II (50 minutes)	15 %	November 1 st
Flower Assignment	5 %	November 22 nd
Test III (50 minutes)	20 %	December 6 th
<u>Lab</u>		
Pre-Lab Quizzes	2.5 %	Throughout term
Lab Assignments	22.5 %	Throughout term
Lab Report	15 %	Week of November 6 th

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

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 Dr. Stone or Miss Martin 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 OR PROFESSOR 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 OR PROFESSOR 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.

To avoid excessive late deductions over a weekend, email the file to the Instructor when it is completed and submit the hard copy that Monday morning.

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 Urkund 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 in the cupboard in front of your position. 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 two of the lab sessions (i.e. sea urchins to study fertilization and 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!). In regards 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

Tentative Lecture and Laboratory Schedule (Subject to Change)

Week	Lecture Content	Text Pages - <i>Principles of Development</i> 6th Ed.	Labs
Sept 5-8	Introduction to Developmental Biology Basic Concepts of Developmental Biology and Model Organisms	1-24, 94-102, 115-131, 674-679	
Sept 11-15	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 18-22	Overview of early development Cleavage Morphogenesis	98-100, 105-107, 110-113, 254-255, 280-289 99-102, 105-110, 113-115, 171-172, 255-256, 271-315	Fertilization and Cleavage Pre-lab Quiz: 0.5% In-lab Assignment: 3%
Sept 25-29	Setting up the Body Axes Cell Specification and Determination Exam Review	142-150, 165-167, 183-195, 227-231 6-8, 17-35, 476, 492-497	Gastrulation and Neurulation Pre-lab Quiz: 0.5% In-Lab Assignment: 3%
Oct 2-6	<i>October 2nd University Closed - Truth and Reconciliation</i> Oct 4 - Test: Through Morphogenesis (10%) Specification and Patterning of the Germ Layers	150-165, 195-198	Planaria Regeneration I In-lab Assignment: 1%
Oct 9-13	<i>October 9th University Closed - Thanksgiving</i> Cell Differentiation Neural Induction and Patterning	165-171, 198-200, 205-221, 505-518	Planaria Regeneration II
Oct 16-20	Neural Crest Cells Organogenesis (Limb and Eye Development) Organogenesis (Limb and Eye Development) cont.	221-222, 223-226, 320-323, 333-353, 376-382 452-480, 492-497	Planarian Regeneration III Assignment (5.5%)
Oct 23-27	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 30-Nov 3	Exam Review Nov. 1 - Test 2: Setting up Body Axes through Organogenesis (15%) Establishing the Body Plan cont.		Early Seedling Development
Nov 6-10	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	No Lab - Lab Report Due (15%)
Nov 13-17	Reading Break		
Nov 20-24	Development of Lateral Organs Nov 22 - Flower Development Assignment Due (5%) Flower Development		Root System Development I Pre-lab Quiz: 0.5%
Nov 27-Dec 1	Leaf Development Patterning the Epidermis: Stomata, Trichomes, and Root Hairs Patterning the Epidermis: Stomata, Trichomes, and Root Hairs	628-633	Root System Development II In-lab Assignment: 6%
Dec 4	Gametophyte development and fertilization		
Dec 5 (Tues)	Exam Review		
Dec 6 (Wed)	Dec. 6 - Test 3 - Plant Section (20%)		

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at:

https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

Faculty of Science

Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

South House Sexual and Gender Resource Centre: <https://southhousehalifax.ca/about/>

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>