

## Course outline: Developmental Biology, BIOL 309

Lectures: Mondays and Thursdays, 1:00-2:20, Cunningham 146

Labs: Cunningham 240

Course coordinator: Bob Chow [bobchow@uvic.ca](mailto:bobchow@uvic.ca)

Office hours: Mondays/Thursday 2:30-3:30. If you cannot make these times, send me an email and we can set up another time to meet either in person or Zoom.

Lab instructor: tbd

Lectures will not be recorded or broadcast on Zoom.

Lecture pdf's will be posted on Brightspace, but note the following:

- **before the lecture:** a “*pre-lecture pdf*” will be posted. It will be missing slides that contain answers to in-class questions
- **after the lecture:** it will be replaced by a “*post-lecture pdf*” containing all of the slides

## **BIOL 309 Course description**

This course examines animal development and will focus on cellular and molecular mechanisms that underlie developmental processes. A solid understanding of basic principles in molecular and cellular biology is required. Effort will be made to highlight relevance of developmental biology to our understanding of disease and lectures will incorporate recent discoveries from the primary literature.

## **Learning outcomes**

The learning outcomes fall into two categories:

1) Mechanism - understand the cellular and molecular basis of animal development, focusing on the following areas:

- Fertilization/early cleavage
- Invertebrate early development
- Vertebrate early development
- Fly axis specification and patterning
- Eye development/disease
- Neural crest and neuronal development
- Vertebrate limb development
- Germ cell determination

2) Experimental Biology - develop skills to:

- (i) evaluate the primary scientific literature
- (ii) develop hypotheses based on pre-existing observations/knowledge
- (iii) design experiments to test hypotheses.
- (iv) perform experimental manipulations and procedures addressing mechanisms covered in class unique to vertebrate development
- (v) perform experimental manipulations and procedures addressing mechanisms covered in class unique to invertebrate development

## **Reading material**

- (i) Textbook: Gilbert, Developmental Biology, 13<sup>th</sup> edition (lectures draw from, but do not strictly follow text). See last page of course outline for assigned reading schedule.
- (ii) reading material will also be drawn from the primary literature, review articles and other sources, which will be posted on Brightspace.

## **Evaluation**

- |                  |     |
|------------------|-----|
| (1) Lab          | 40% |
| (2) Midterm exam | 30% |
| (3) Final exam   | 30% |

## **Lab**

The lab component is broken down into 2 sections: (i) a practical lab and (ii) a journal article review/“dry” lab (each worth 17% of final grade). There will be 5 practical labs and 4 journal article review/dry labs. Detailed information (including lab schedule) is posted in the **BIOL 309a Lab Manual**, which can be purchased from the UVic Bookstore. Breakdown of the lab grade:

<u>Wet lab</u>	<u>17%</u>	<u>Dry lab (journal article review)</u>	<u>18%</u>
In class assignments	5%	Pre-lab quizzes	4%
Lab report	12%	Oral presentation	5%
		Paper/mini-proposal	9%

Wet and dry lab participation grade (5 %) - this grade will cover participation in dry lab (brainstorming questions, involvement in class discussion) and wet labs (i.e. complete all procedure steps, make observations on the specimens provided during the lab period and contribute to laboratory discussions).

## Midterm and Final exams

**There are two exams in the course: a midterm and a final. Both must be taken to pass the course.**

The midterm will be held on Monday Feb 26. It will cover material up to and including Feb 15.

The final exam will be similar in format and length to the midterm exam and will be held during the exam period. The final exam is not cumulative and will cover material starting from “Fly development” through to the end of the course.

Exams will test understanding of fundamentals, concepts and mechanisms underlying developmental systems as well as ability to develop hypotheses and to design experiments to test them. Format for both exams: mostly short answer, I will go over in more detail in class. The exams will cover anything presented in the lectures and may draw from related observations from the wet labs.

To pass the course, students must:

- 1) Complete the midterm and final exams, and the scientific formal report and mini-proposal.
- 2) Score a grade of 50 points, or greater, combined across all assessments.

If #1 is not completed, the student will automatically fail the course and receive a grade of “N” on their transcript. N is a failing grade and factors into the GPA as a value of 0. If a student completes 1, their final grade will be entered as percentage value.

## Important general background reading from the textbook

*Introduction to Developmental Biology:*

**pp 1-9** of the textbook (Chapter 3, Developmental Biology, 13<sup>th</sup> edition)

*Basic molecular biology:*

**pp 49-86** covers important basic molecular biology background material that will be referred to through the course. This includes a review of the “central dogma” of gene expression, i.e. gene >> transcription [mRNA] >> translation [protein]

*Cell-cell signaling, adhesion, signal transduction pathways:*

**pp 87-93, 106-129** describes the major cell-cell signaling pathways that are discussed in the class (e.g. Hedgehog, Wnt, Notch, TGF-beta, FGF, tyrosine receptor kinase, etc...)

*Experimental techniques discussed in the course:*

- a good description of some of the techniques that will be referred to in the course can be found on pages **17-20, 46-47 51-52**

- in situ hybridization
- chromatin immunoprecipitation/sequencing
- deep sequencing, RNA seq
- forward/reverse genetics
- Crispr/Cas9 gene editing
- Gal4/UAS system
- cre-lox system
- single cell RNA sequencing

Also see the “Tools and Techniques” module in Brightspace

**Tentative lecture schedule:**

<b>Date</b>	<b>Topics</b>	<b>11<sup>th</sup> Edition</b>	<b>12<sup>th</sup> Edition</b>	<b>13<sup>th</sup> Edition</b>
Jan 6, 9	Fertilization/early cleavage	218-247	216-240	211-240
Jan 13-20	Invertebrate early development	11-19, 45-65, 95-139, 238-239, 251-254, 265-268, 311-332	14-25, 39-46, 247-250, 303-323	14-25, 35-43, 251-257, 335-356
Jan23-Feb10	Vertebrate early development	333-364, 380-411, 143-153, 167-179	8-12, 114-115, 263-266, 325-399	9-12, 14-25, 258, 357-389, 398-399, 401-427, 431, 725-728
Thurs Feb 13	TBA + Q & A review for midterm			
Feb 17, 20	Reading break			
Mon Feb 24	<b>Midterm exam</b> (all material up to and including Feb 13)			
Feb27-Mar10	Fly axis specification and patterning	277-309	48-50, 273-301	43-45, 303-330, 728-737
Mar10-20	Eye development	108-111, 520-527	109-112, 122, 493-497, 745	99-101, 113, 581-587
Mar 24-27	Neural crest and neuronal development	413-437, 463-508	401-420, 441-480	525-548, 549-566; 481-500
Mar 31	Vertebrate limb development	613-651	571-605	663-700
Apr 3	Germ cell determination	181-193	179-198	175-195

## Appendix: Policies & Additional Information

**UVic Territory Acknowledgment:** We acknowledge and respect the ləkʷəŋən peoples on whose traditional territory the university stands, and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.

### Missed tests and exams:

Students who miss a test or exam are expected to contact their instructor as soon as possible. Valid excuses for missed tests include illness, emotional trauma, and UVic-sponsored sporting activities. If a student misses the midterm, a make-up exam will be re-scheduled in consultation with the instructor. If a student misses the final exam, they are required to submit a request for academic concession, with associated documentation, as outlined in the UVic Calendar (<https://www.uvic.ca/registrar/students/appeals/acad-concession/index.php>). Students are reminded that final exams in the Faculty of Science run from April 7 through April 25. Final exams will not be rescheduled for students who make travel plans that conflict with the officially scheduled final exam for this course. Please note that no supplemental tests or exams will be offered in this course.

### Important Dates:

Last day for 100% reduction of tuition fees for standard courses – Sun. Jan. 1  
Last day for adding second term courses – Wed. Jan 22  
Last day for 50% reduction of tuition fees for standard courses – Sun. Feb. 9  
Last day for withdrawing from 2nd term courses without penalty of failure – Thu. Feb. 28  
Reading Break – Mon. Feb. 17 until Fri. Feb. 21  
Last day of classes – Fri. Apr. 4  
Exam period – Apr. 7–25

### Important UVic links:

Academic important dates: <https://www.uvic.ca/calendar/dates/>  
Academic calendar: <https://www.uvic.ca/calendar/undergrad/>  
Academic concession guidelines:  
<https://www.uvic.ca/calendar/undergrad/index.php#/policy/BymcP73U9>  
Academic accommodations: <https://www.uvic.ca/accessible-learning/index.php>  
Academic integrity:  
[https://www.uvic.ca/calendar/undergrad/index.php#/policy/Sk\\_0xsM\\_V](https://www.uvic.ca/calendar/undergrad/index.php#/policy/Sk_0xsM_V)

### Academic Integrity:

As a teacher, mentor, scientist, researcher, and member of the University of Victoria community, academic integrity is of the highest importance to me. Students are required to abide by all academic regulations set out in the University calendar, including standards of academic integrity. Violations of academic integrity (e.g. cheating and plagiarism) are considered serious and may result in significant penalties.

Please read the following—you are expected to abide by the terms outlined here:  
<https://www.uvic.ca/services/advising/assets/docs/tri-fac-student-code-of-conduct.pdf>  
[https://www.uvic.ca/calendar/undergrad/index.php#/policy/Sk\\_0xsM\\_V](https://www.uvic.ca/calendar/undergrad/index.php#/policy/Sk_0xsM_V)  
<https://www.uvic.ca/students/academics/academic-integrity/index.php>

To help avoid plagiarism and cheating, please read the UVic Libraries' plagiarism guide:  
<https://www.uvic.ca/library/research/citation/plagiarism/>

Note that use of AI software, such as ChatGPT, is not permitted for the scientific literature project. I reserve the right to use plagiarism detection software or other platforms to assess the integrity of student work.

Before handing in coursework for evaluation, students will be required to complete the Integrity Matters module that is available in Brightspace:  
<https://bright.uvic.ca/d2l/le/discovery/view/course/132610>

### **Code of Conduct:**

All staff and students are responsible for adhering to a code of conduct, including academic integrity. The University of Victoria is committed to promoting critical academic discourse while providing a respectful and supportive learning environment. All members of the university community have the right to this experience and the responsibility to help create such an environment.

Please be advised that, by logging into UVic's learning systems or interacting with online resources, and course-related communication platforms, you are engaging in a university activity. All interactions within this environment are subject to the university expectations and policies. Any concerns about student conduct may be reviewed and responded to in accordance with the appropriate university policy.

### **Copyright statement:**

All course content and materials are made available by instructors for educational purposes and for the exclusive use of students registered in their class. The material is protected under copyright law, even if not marked with a ©. Any further use or distribution of materials to others requires the written permission of the instructor, except under fair dealing or another exception in the Copyright Act. Violations may result in disciplinary action under the Resolution of Non-Academic Misconduct Allegations policy (AC1300). Students may not distribute lecture notes or any exams or quizzes from the course without permission of the instructor, and to do so, through note-sharing sites or other means, violates the Policy on Academic Integrity.

### **Course Grade and Academic Transcript:**

Grades for all UVic courses are submitted as percentiles. A student's academic transcript will include the percentile grade and a letter grade plus the class average and the number of students registered in the course at the time of the final exam. Percentiles will be rounded to the nearest whole number; a grade of xx.5 will be rounded up. Percentile grades will be converted to letter grades on the student's academic transcript according to the table given below.

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