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
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 on or Zoom.

Lab instructor: Chris Anderson <christophera@uvic.ca>

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 Objectives
1) 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
   - Neural crest and neuronal development
   - Vertebrate limb development
   - Germ cell determination
2) Develop skills to:
   (i) evaluate the primary scientific literature
   (ii) develop hypotheses based on pre-existing knowledge
   (iii) design experiments to test hypotheses.

Reading material
(i) Textbook: Gilbert, Developmental Biology, 13th 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:

<table>
<thead>
<tr>
<th>Wet lab</th>
<th>17%</th>
<th>Dry lab (journal article review)</th>
<th>18%</th>
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<tbody>
<tr>
<td>In class assignments</td>
<td>5%</td>
<td>Pre-lab quizzes</td>
<td>4%</td>
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<tr>
<td>Lab report</td>
<td>12%</td>
<td>Oral presentation</td>
<td>5%</td>
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<td></td>
<td></td>
<td>Paper/mini-proposal</td>
<td>9%</td>
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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 an effort to visualize 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, 13th 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:

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<tbody>
<tr>
<td>Jan 8,11</td>
<td>Fertilization/early cleavage</td>
<td>218-247</td>
<td>216-240</td>
<td>211-240</td>
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<tr>
<td>Thurs Feb 15</td>
<td>TBA + Q &amp; A review for midterm</td>
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<td>Feb 19, 22</td>
<td>Reading break</td>
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<tr>
<td><strong>Mon Feb 26</strong></td>
<td><strong>Midterm exam</strong> (all material up to and including Feb 15)**</td>
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<tr>
<td>Mar 25-28</td>
<td>Neural crest and neuronal development</td>
<td>413-437, 463-508</td>
<td>401-420, 441-480</td>
<td>525-548, 549-566; 481-500</td>
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<tr>
<td>Apr 4</td>
<td>Vertebrate limb development</td>
<td>613-651</td>
<td>571-605</td>
<td>663-700</td>
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<tr>
<td>Apr 8</td>
<td>Germ cell determination</td>
<td>181-193</td>
<td>179-198</td>
<td>175-195</td>
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Appendix: Policies & Additional Information

UVic Territory Acknowledgment: We acknowledge and respect the lək̓ʷəŋən 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 11 through April 26. 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. 21
Last day for adding second term courses – Wed. Jan 24
Last day for 50% reduction of tuition fees for standard courses – Sun. Feb. 11
Last day for withdrawing from 2nd term courses without penalty of failure – Thu. Feb. 29
Reading Break – Mon. Feb. 19 until Fri. Feb. 23
Last day of classes – Mon. Apr. 8
Exam period – Apr. 11–26

Important UVic links:
Academic important dates: https://www.uvic.ca/calendar/dates/
Academic calendar: https://www.uvic.ca/calendar/undergrad/
Academic accommodations: https://www.uvic.ca/accessible-learning/index.php
Academic integrity: 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/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)