

BIOL 467 – Neural Development

Lectures: Mondays and Thursdays from 8:30-9:50, DSB C118

Course coordinator: Bob Chow (250-472-5658), bobchow@uvic.ca

Office hours: Cunningham 259c, Thurs 2:30-4. If you cannot make these times, send me an email and we can set up another time to meet or have a Zoom call.

Learning Objectives

- (i) To gain a comprehensive understanding of the fundamental cellular and molecular mechanisms that underlie nervous system development, from the early induction of neural progenitors to circuit development and adult neurogenesis.
- (ii) To gain an appreciation of a wide range of model organisms and research tools used in neuroscience research.
- (iii) To develop critical thinking and problem-solving skills, by placing a heavy focus on evaluating the primary literature and experimental design.

Course layout

Ten topics will be covered that chronologically step through the different phases of neural development. Each topic will revolve around a research “Discussion” paper. The first lecture of a topic will provide an overview and background material and the second lecture will examine the Discussion paper in detail (quiz, group assignments and in-class discussion). The course requires a solid understanding of basic principles in molecular and cellular biology.

Lectures will **not** be recorded or broadcast on Zoom.

Lecture pdf’s will be available on Brightspace, but note:

- **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

Reading material

There is no textbook for the course. Reading material will be drawn from review articles, primary literature and other sources, which will be linked on Brightspace. Contact me if you have any difficulty accessing any of the material.

Evaluation

(1) Discussion paper assignments	12.5%
(2) Discussion paper quizzes	10%
(3) In-class assignments	7.5%
(3) Midterm exam	35%
(4) Final exam	35%

Discussion paper assignments (12.5%)

Weekly discussion paper assignments are posted in Brightspace>Assignments. The deadline for uploading your completed assignment on Brightspace is 8:30 AM on the day of the Discussion paper

lecture. As the assignment questions will be discussed in class, late submissions will not be accepted. Scores from your best 8 (of 10) quizzes will be used for the final grade.

Discussion paper quizzes (10%)

A short quiz will be given at the beginning of each Discussion paper lecture with questions based on the paper. Scores from your best 8 (of 10) quizzes will be used for the final grade.

In-class assignments (7.5%)

The class will be broken into groups assigned by the instructor and assigned a few questions relating to a specific figure(s) in the Discussion Paper. Answers will be handed in for grading and discussed in lecture. Scores from your best 8 (of 10) quizzes will be used for the final grade. Bonus question: winners get 0.25% added to their final grade (up to 2.5% total)

Missed assignments/quizzes

Accommodation for missed assignments (hand-in and in-class) and quizzes is met by having these grades based on the best 8 of 10 grades for each. There is no additional make-up for missed assignments/quizzes.

Exams (70% (midterm 35% + final 35%))

There are two exams: a midterm on Monday Feb 24 and a final during the exam period. Both are required to pass the course. The midterm will cover material up to and including Feb 10 (or 13th depending on if we complete Discussion Paper #5). The final exam is not cumulative and will be similar in format and length to the midterm exam. It will be held during the exam period and will cover material starting Feb 27 (i.e. the last 5 topics). Exams will test understanding of fundamentals, concepts and mechanisms as well as ability to develop hypotheses and to design experiments to test them. Exams will cover the Discussion papers and any material that is covered in lecture. Format for both exams is mostly short answer.

To pass the course, students must:

- 1) Complete the midterm and final exams
 - 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.

Tentative lecture schedule:

- Jan 6 **Overview of neural development and early vertebrate development**
- Jan 9, 13 **Neural induction**
Discussion paper: “*Depletion of three BMP antagonists from Spemann's organizer leads to a catastrophic loss of dorsal structures*”
<http://www.cell.com/developmental-cell/abstract/S1534-5807%2805%2900017-1?returnURL=http%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS1534580705000171%3Fshowall%3Dtrue>
- Jan 16, 20 **Patterning of the nervous system: morphogen gradients**
Discussion paper: “*Specified Neural Progenitors Sort to Form Sharp Domains after Noisy Shh Signaling*”
<http://www.sciencedirect.com/science/article/pii/S0092867413003450>
- Jan 23, 27 **Transcriptional control of neuronal organization**
Discussion paper: “*Motor neuron columnar fate imposed by sequential phases of Hox-c activity*”
<http://www.nature.com/nature/journal/v425/n6961/full/nature02051.html>
- Jan 30, Feb 3 **Neural progenitors, asymmetric cell divisions and fate choice**
Discussion paper: “*Notch signaling acts before cell division to promote asymmetric cleavage and cell fate of neural precursor cells*”
<http://stke.sciencemag.org/content/7/348/ra101.long>
- Feb 6, 10 **Gene regulatory networks and cell fate determination**
Discussion paper: “*A Gene Regulatory Network Controls the Binary Fate Decision of Rod and Bipolar Cells in the Vertebrate Retina*”
<http://www.cell.com/developmental-cell/abstract/S1534-5807%2814%2900484-5>
- Thurs Feb 13 completion of Discussion Paper #5 (if necessary) + Q&A for midterm
- Feb 17, 20 reading break
- Mon Feb 24 Midterm exam**
- Feb27, Mar3 **Axon guidance**
Discussion paper: “*Topographic Mapping from the Retina to the Midbrain Is Controlled by Relative but Not Absolute Levels of EphA Receptor Signaling*”
<http://www.sciencedirect.com/science/article/pii/S009286740000012X>
- Mar 6,10 **Dendrite branching and morphogenesis**
Discussion paper: “*An Extracellular Adhesion Molecule Complex Patterns Dendritic Branching and Morphogenesis*”
<http://www.cell.com/abstract/S0092-8674%2813%2901090-8>
- Mar 13,17 **Synaptogenesis**

Discussion paper: “*Trans-synaptic Teneurin signalling in neuromuscular synapse organization and target choice*”

<http://www.nature.com/nature/journal/v484/n7393/full/nature10923.html>

Mar 20, 24

Maturation

Discussion paper: “*Synaptic Pruning by Microglia Is Necessary for Normal Brain Development*”

<http://science.sciencemag.org/content/333/6048/1456>

Mar27-Apr3

Adult neurogenesis

Discussion paper: “*Roles of continuous neurogenesis in the structural and functional integrity of the adult forebrain*”

<http://www.nature.com/neuro/journal/v11/n10/abs/nn.2185.html>

Appendix: Policies & Additional Information

UVic Territory Acknowledgment: We acknowledge and respect the lək'wəŋən 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. 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

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)