

BIOL 467 – Neural Development

Lectures: Mondays and Thursdays from 8:30-9:50

Zoom link to lectures: this is accessed directly through Brightspace (you must have previously activated your UVic Zoom license at uvic.zoom.us).

Office hours: please send me email any time with questions

Course coordinator: Bob Chow bobchow@uvic.ca

Course goals

- (i) To provide an overview of nervous system development, from the early induction of neural progenitors to circuit development.
- (ii) To introduce students to a wide range of model organisms and research tools used in neuroscience research.
- (iii) To help students develop critical thinking and problem-solving skills, by placing a heavy focus on evaluating the primary literature and experimental design.

Course description

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.

Reading material

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 | 15% |
| (2) Discussion paper quizzes | 7.5% |
| (3) In-class assignments | 7.5% |
| (3) Midterm exam | 35% |
| (4) Final exam | 35% |

Discussion paper assignments (15%)

An assignment consisting of a few questions will be given for each Discussion paper. Assignments are posted in Brightspace>>Assignments. The deadline for uploading your completed assignment is 8:30 AM on the day of the Discussion paper lecture for that assignment. As the assignment questions will be discussed in class, late submissions will not be accepted. The best 9 (of 10) assignments (including missed assignments) will be used for the final grade for this section.

Discussion paper quizzes (7.5%)

A short quiz ~5 minute quiz will be given at the beginning of each Discussion paper lecture with questions based on the paper will be administered in Brightspace>>Quizzes. Scores from your best 9 (of 10) quizzes (including missed quizzes) will be used for the final grade of this section. More detailed instructions will be provided.

In-class assignments (7.5%)

For each Discussion paper lecture, the class will be broken into groups in Zoom and each group assigned a couple of questions relating to different parts of the Discussion Paper. A link to a Google Doc will be provided in the chat section and groups will have 10-15 minutes to prepare their answer. Using simultaneous real time editing everyone can edit text to the document. You do not need to sign up or have a Google account. The completed assignment will be discussed in lecture and graded. Scores from your best 9 (of 10) in-class assignments will be used for the final grade of this section. A bonus (automatic 100% for in class-assignments and quizzes for that week) will be given to the group providing the best answer to a common question that all groups answer.

Exams (70%)

There are two exams: a midterm on Feb 25 and a final during the exam period. Both are required to pass the course. The midterm will cover material up to and including the 5th Discussion Paper (Feb 22). 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 March 1. 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.

Tentative lecture schedule:

- Jan 11 **Overview of neural development and early vertebrate development**
- Jan 14, 18 **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 21, 25 **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 28, Feb 1 **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>
- Feb 4, 8 **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 11, 22 **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>

Feb 15, 18 reading break

Thurs Feb 25 Midterm exam

Mar 1, 4 **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 8, 11 **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 15, 18 **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 22, 25 **Maturation**
Discussion paper: “*Synaptic Pruning by Microglia Is Necessary for Normal Brain Development*”
<http://science.sciencemag.org/content/333/6048/1456>

Mar29 Apr1,8 **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>

Apr 12 open