

BIOL 467 – Neural Development

Lectures: Mondays and Thursdays from 8:30-9:50, Cunningham Building 146

Office hours: Cunningham 259c, Thurs 3-4

Course coordinator: Bob Chow (250-472-5658), 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 Course Spaces. Contact me if you have any difficulty accessing any of the material.

Evaluation

(1) Discussion paper assignments	12.5%
(2) Discussion paper quizzes	12.5%
(3) In-class assignments	5%
(3) Midterm exam	35%
(4) Final exam	35%

Discussion paper assignments (12.5%)

An assignment consisting of a few questions will be given for each Discussion paper. Assignments are to be handed in at the beginning of the Discussion paper lecture (preferred), or sent by email before class if you are not present. Late assignments will not be accepted as assignments will be discussed in class.

Discussion paper quizzes (12.5%)

A short quiz (6 marks) 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 (5%)

The class will be broken into groups assigned by the instructor and given a few questions related a specific figure(s) in the Discussion Paper. Answers will be handed in for grading and discussed in lecture.

Exams (70%)

There are two exams: a midterm on Thursday Feb 13 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. 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 Feb 24. 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 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 Midterm exam**
- Feb 17, 20 reading break

- Feb 24,27 **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 2, 5 **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 9, 12 **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 16, 19 **Maturation**
Discussion paper: “*Synaptic Pruning by Microglia Is Necessary for Normal Brain Development*”
<http://science.sciencemag.org/content/333/6048/1456>
- Mar 23,26,30 **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 2 open