

## **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](mailto: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.

### **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.

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

Lecture pdf’s will be available, 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**

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 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 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.

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

There are two exams: a midterm on Monday Feb 27 and a final during the exam period. Both are required to pass the course. The midterm will cover material up to and including Feb 13. 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 March 2. 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 9            **Overview of neural development and early vertebrate development**
- Jan 12, 16      **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 19, 23      **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 26, 30      **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 2, 6        **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 9, 13      **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 16      no lecture  
Feb 20, 23      reading break  
**Mon Feb 27      Midterm exam**
- Mar 2,6      **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 9, 13      **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 16, 20      **Synaptogenesis**  
Discussion paper: “*Trans-synaptic Tenascin signaling in neuromuscular synapse organization and target choice*”  
<http://www.nature.com/nature/journal/v484/n7393/full/nature10923.html>
- Mar 23, 27      **Maturation**  
Discussion paper: “*Synaptic Pruning by Microglia Is Necessary for Normal Brain Development*”  
<http://science.sciencemag.org/content/333/6048/1456>
- Mar30-Apr6      **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>