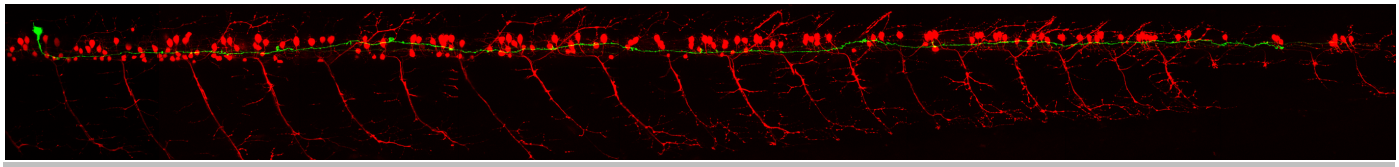

Biology 466/566 – Developmental Neurobiology – Winter 2020

Instructor: Judith Eisen
Class meeting: TR 12:00-1:20 pm Price Science Commons and Research Library B042
Office hours: by appointment in 315 Huestis
eisen@uoregon.edu; for correspondence please use BI466/566 in the subject line

Course description: This course will explore mechanisms underlying nervous system development and how these mechanisms fail in some neurodevelopmental disorders. The course is based on primary research literature, drawing on examples from different organisms to illustrate basic principles about cellular and molecular mechanisms underlying nervous system development. The course will emphasize critical reading of the literature and critical thinking. Students will be required to present papers from the literature and to complete regular homework assignments. During the course, students will develop original research proposals that will use the types of experimental approaches covered in the course to address unanswered questions about neural development. Students will present these proposals orally and submit them as a final written research project.

Learning objectives:

- Gain an understanding of mechanisms underlying nervous system development, including similarities and differences between different animal taxa;
- Explore how alterations in some aspects of neural development can result in human neurodevelopmental disorders and the importance of animal research for elucidating underlying mechanisms;
- Become proficient at reading, discussing and presenting primary research literature and critically evaluating data and conclusions;
- Develop the ability to formulate hypotheses about the mechanistic bases for biological phenomena;
- Become proficient at designing experimental strategies to test hypotheses about the mechanistic bases for biological phenomena;
- Learn to work with a group to give an oral presentation and to discuss primary research literature critically;
- Learn to work individually to develop a compelling oral presentation that identifies a scientific question, proposes a hypothetical answer to this question, and describes a novel experimental strategy to test this hypothesis;
- Learn to write a concise and compelling research proposal that identifies a scientific question, proposes a hypothetical answer to this question, and describes a novel experimental strategy to test this hypothesis

Course website: All course materials will be available through Canvas (canvas.uoregon.edu) under BI 466/566 (Winter 2020; 26018, 26019).

Course format: The course will be a combination of lectures, in class exercises, discussions, and student presentations. I will post figures for my presentations on Canvas before class. These figures are NOT a substitute for coming to class. If you must miss class, it is your responsibility to obtain notes of the class discussion from a classmate.

Office hours: I will not hold regular office hours, but I welcome talking with students by appointment. Please email me (eisen@uoregon.edu) to schedule an appointment using BI466/566 in the subject line.

Readings: Assigned readings for each class session are listed in the course syllabus. Pdf files for all assigned readings are posted on Canvas. In some cases, pdf files of papers that provide background or additional information are also posted on Canvas. To supplement the required readings, two books are on reserve in the Price Science Commons and Research Library: 1) SF Gilbert (2014) *Developmental Biology*, an excellent reference to review animal development; 2) DH Sanes, TA Reh & WA Harris (2012) *Development of the Nervous System*, an excellent reference for some aspects of nervous system development. The syllabus for this course is "tentative" because if new papers pertinent to the course are published during the term, we may use them instead of the papers listed in the syllabus; any changes will be announced in advance.

Grading policy:

Homeworks: 25% There will be six homework assignments that will cover assigned readings and material covered in class. Homeworks will be available on Canvas. You should answer the questions and upload them to Canvas. Homeworks will typically be posted following the class meeting prior to when they are due. Homeworks will be due at 11:45am on the days listed in the syllabus. Late homeworks will not be accepted.

Class Participation: 10% Class participation is crucial for the success of this course. Attendance will be taken and students will be expected to come to class having read and thought about the assigned material and prepared to participate in all class activities. As you read the assigned articles, please keep in mind that some of the topics we will cover are controversial. Therefore, you should think critically about what you are reading, continually question how the authors of an article arrived at their conclusions, what assumptions they made, whether their data seem credible, and what future experiments could support or refute their conclusions. This type of critical thinking will be necessary for your original reseach proposal.

Research article presentation: 15% Each student will work in a small group (typically 3-4 students) to present a research article or articles to the class. The articles that will be discussed in the student presentations are listed in the course syllabus and posted on Canvas. These may change, depending on the number of students in the course; any changes will be announced in advance. Each member of the class is also expected to participate in developing a written critique for another presentation group. Graduate students are expected to organize and lead the presentation groups.

Proposal assignments: Each student will be required to write and to present an original research proposal that uses approaches similar to those covered in the course to address an unanswered question in the field of nervous system development. Students will develop their proposals throughout the course, as indicated on the class schedule. The components of this proposal development process will contribute to the final course grade as follows:

(1) Title, abstract, specific aims: ***2.5%***
(2) REVISED title, abstract, specific aims: ***2.5%***
(3) Outlined experimental design & expected outcomes: ***2.5%***
(4) Feedback on group member's aims, design and outcomes: ***2.5%***
(5) Oral presentation: ***15%***
(6) Written research proposal: ***25%***

Grading for undergraduate and graduate students: Undergraduate and graduate students will be graded separately, based on different expectations of their background knowledge in scientific approaches. Graduate students will be expected to organize and lead research article presentations. Expectations for the research proposal and scope of the project will also be different for undergraduate and graduate students. Undergraduates will be expected to describe a single experimental strategy to address an unanswered question. Graduate students will be required to write a longer proposal that employs

several independent approaches to address a well-defined research question, similar in scope to a professional predoctoral research fellowship proposal.

Etiquette: Please silence your cell phone during class. You are encouraged to discuss your work with others, but all work you submit for a grade must be your own.

Inclusiveness: UO is working to create inclusive learning environments. Please notify me if there are aspects of instruction or design of this course that result in barriers to your participation. You may also wish to contact the Accessible Education Center (541-346-1155; uoaec@uoregon.edu).

Academic Integrity: All students are expected to conform to the student conduct code (http://dos.uoregon.edu/conduct). You are encouraged to discuss ideas with each other. However, all submitted written work, including answers to homework questions and components of the research proposal must be your original work. Proper citation of sources is required in all written work and oral presentations. If you do not know how to properly cite literature, please ask.

Student-Directed Employee: UO is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment, including sexual assault, domestic and dating violence and gender-based stalking. As a Student Directed-Employee, I will direct students who disclose sexual harassment or sexual violence to resources that can help and will only report the information shared to the university administration when the student requests that the information be reported (unless someone is in imminent risk of serious harm or a minor). As the instructor of this course, I am required to report all other forms of prohibited discrimination or harassment to the university administration.

Week(Class)	Date	Learning objective	Readings and assignments
Nervous system patterning and specification			
1 Tu (1)	Jan 7	Explain nervous system induction	Background readings: Hogan (1995); Weinstein (1997); Sanes et al. (2006)
1 Th (2)	Jan 9	Learn how the anteroposterior axis is established	Nordstrom et al. (2002) [background reading: New (1955)] **Homework 1 due: 11:45am**
2 Tu (3)	Jan 14	Learn about the origin of neural tube defects	Wallingford et al. (2013) [additional resources: Pyrgaki et al. (2010); Copp et al. (2013)]
2 Th (4)	Jan 16	Learn how the dorsoventral axis is established	Briscoe & Ericson (2000); Helms & Johnson (2003); Le Dreau & Marti (2012) **Homework 2 due: 11:45am**
3 Tu (5)	Jan 21	Compare invertebrate & vertebrate motoneuron specification	Pfaff et al. (1996); Thor & Thomas (1997)
3 Th (6)	Jan 23	Discuss the origin of neural crest cells	Baggiolini et al. (2015) **PRESENTATION GROUP 1** **Homework 3 due: 11:45am**
Neural stem cells and glia			
4 Tu (7)	Jan 28	Understand stem cells and glia	Taupin & Gage (2002); Alvarez-Buylla et al. (2001); Zuchero & Barres (2015); Abdullah et al. (2012)
4 Th (8)	Jan 30	Discuss involvement of glia in schizophrenia	Windrem et al. (2017) **PRESENTATION GROUP 2** **Homework 4 due: 11:45am**
5 Tu (9)	Feb 4	Describe temporal patterning of insect neuroblasts	Doe & Goodman (1985); Isshiki et al. (2001) [additional background: Skeath (1999)] **Proposal title, background, specific aims due:11:45am**
5 Th (10)	Feb 6	Discuss temporal patterning of vertebrate CNS progenitors	Dias et al. (2014); Mattar & Cayouette (2014)
6 Tu (11)	Feb 11	Proposal writing workshop: refining specific aims	Group discussions of specific aims **Feedback on group member's specific aims due: 11:45am**
Axon guidance, synapse & circuit formation, and neuronal survival			
6 Th (12)	Feb 13	Learn about axon guidance & synapse formation	Koppers et al. (2019) [background Chilton (2006); Dickson (2002)]
7 Tu (13)	Feb 18	Identify mechanisms of synapse and circuit assembly	Scheiffele et al. (2000) **Revised title, background, specific aims due:11:45am**
7 Th (14)	Feb 20	Discuss role of synapses in schizophrenia	Jiang et al. (2018) [background Hayashi-Takagi (2017)] **PRESENTATION GROUP 3** **Homework 5 due: 11:45am**
8 Tu (15)	Feb 25	Understand the basis of neuronal competition and survival	Davies (2013); Lichtman & Coleman (2000); Je et al. (2013) [additional background: Purves & Lichtman (1985)]
Microbial influences on neural development			
8 Th (16)	Feb 27	Learn how microbes affect host neural development	Heijtz et al. (2011) **Outlined experimental design & expected outcomes due: 11:45am**
9 Tu (17)	Mar 3	Discuss role of host-associated microbes in schizophrenia	Zhu et al. (2019) **PRESENTATION GROUP 4** **Homework 6 due: 11:45am**
Student projects			
9 Th (18)	Mar 5	Proposal writing workshop: refining experiment design	Group discussions of experimental design and expected outcomes **Feedback on group member's design & outcomes due:11:45am**
10 Tu (19)	Mar 10	Research oral presentations	
10 Th (20)	Mar 12	Research oral presentations	
11 W	Mar 18		**WRITTEN RESEARCH PROPOSAL DUE: 8am**