



## Biology 466/566 – Developmental Neurobiology – Winter 2022

Instructor: Judith Eisen

Class meeting: TR 12:00-1:20 pm Price Science Commons and Research Library B040

**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.

**Course website:** All course materials will be available through Canvas ([canvas.uoregon.edu](https://canvas.uoregon.edu)) under BI 466/566 (Winter 2022; 23405, 23474).

### 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

**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.

**Contacting the instructor:**

**Office hours:** I look forward to meeting with each of you during my office hours, from 1:30-2 Thursdays in PSC B040; this is right after class in the same room. I realize that this time will not work for everyone, thus I will also be available to meet by appointment either in person or via Zoom. You can schedule a meeting with me by email or by talking with me before or after class.

**Instructor contact information:** [eisen@uoregon.edu](mailto:eisen@uoregon.edu); for correspondence please use BI466/566 in the subject line

**Course format:** The course will be a combination of lectures, in class exercises, discussions, and student presentations. I will post notes for my presentations on Canvas before class. I will also post annotated notes after class, when appropriate. If you must miss class and need more information than is contained in the notes, please feel free to schedule an in person or Zoom appointment to talk with me about the material.

This course is scheduled to be entirely in person. However, if I am ill but still able to teach, we will hold classes on Zoom; the link will be provided at the time. There may be specific circumstances under which students cannot attend in person. I will try to be accommodating and make the class available on Zoom, but will need to know as far in advance as possible.

**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 unless you discuss it with the instructor in advance.

**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 research proposal. If you cannot attend particular classes, let me know in advance and in lieu of participating in class discussions those days, you can write a paragraph summarizing the key points of the assigned paper(s) and email it to me.

**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%*
- (2) *Feedback on group member's title, abstract, specific aims: 2%*
- (3) *REVISED title, abstract, specific aims: 2%*

- (4) *Outlined experimental design & expected outcomes: 2%*
- (5) *Feedback on group member's aims, design and outcomes: 2%*
- (6) *Oral presentation: 15%*
- (7) *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.

### **Course Participation Guidelines:**

**Participate and Contribute:** Students are expected to participate by sharing ideas and contributing to the collective learning environment. Engage in ethical dialogue that widens our perspectives and deepens our knowledge. This entails preparing, following instructions, and engaging respectfully and thoughtfully with others. More specific participation guidelines and criteria for contributions will be provided for each specific activity.

**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. Some of the papers we discuss may be controversial, so disagree respectfully with your colleagues.

**Interact Professionally:** Our learning environment provides an opportunity to practice being professional and rigorous in our contributions. As much as possible, use correct spelling, grammar, and style for academic and professional work. Use discussions and activities as opportunities to practice the kind and quality of work expected for assignments. Moreover, seize the chance to learn from others and develop your interpersonal skills, such as mindful listening and awareness of one's own tendencies.

**Expect and Respect Diversity:** All classes at the University of Oregon welcome and respect diverse experiences, perspectives, and approaches. What is not welcome are behaviors or contributions that undermine, demean, or marginalize others based on race, ethnicity, gender, sex, age, sexual orientation, religion, ability, or socioeconomic status. We will value differences and communicate disagreements with respect. We may establish more specific guidelines and protocols to ensure inclusion and equity for all members of our learning community.

**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; <https://aec.uoregon.edu/>).

**University Covid Policies:** Everyone associated with the course is expected to adhere to UO Covid-19 regulations (<https://coronavirus.uoregon.edu/covid-19-regulations>) and the COVID Containment Plan for Classes (<https://provost.uoregon.edu/covid-containment-plan-classes>). Anyone who is ill should not attend class, regardless of whether they have tested positive for Covid-19. Anyone who has been exposed to Covid-19 must follow UO exposure scenarios and guidance (<https://coronavirus.uoregon.edu/covid-exposure>).

**Academic Disruption:** In the event of a campus emergency that disrupts academic activities, course requirements, deadlines, and grading percentages are subject to change. Information about changes in this course will be communicated as soon as possible by email, and on Canvas. If we are not able to meet

face-to-face, students should immediately log onto Canvas and read any announcements and/or access alternative assignments. Students are also expected to continue coursework as outlined in this syllabus or other instructions on Canvas.

**Academic Integrity and Reporting:**

**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.

**Assisting Employee:** I am an Assisting Employee under the University's Prohibited Discrimination and Retaliation Policy. As an Assisting Employee, I will direct students who disclose prohibited discrimination and harassment, including sexual harassment or violence, to resources that can help and will only report the information shared to the university administration if the student requests that the information be reported (unless someone is in imminent risk of serious harm or a minor).

Students who have experienced sexual assault, relationship violence, sex or gender-based bullying, stalking, and/or sexual harassment may seek resources and help at [safe.uoregon.edu](http://safe.uoregon.edu). To get help by phone, students may also call either the non-confidential Title IX Coordinator/OICRC at 541-346-3123 or the Dean of Students Office 24-hour hotline at 541-346-SAFE [7244]. Students experiencing all forms of prohibited discrimination or harassment may find information and resources at [investigations.uoregon.edu](http://investigations.uoregon.edu) or contact the non-confidential Title IX Coordinator/OICRC at 541-346-3123 or the Dean of Students Office at 541-346-3216 for help. Specific details about confidentiality of information and reporting obligations of employees can be found at [investigations.uoregon.edu/employee-responsibilities](http://investigations.uoregon.edu/employee-responsibilities).

**Mandatory Reporting of Child Abuse:** UO employees, including faculty, staff, and GEs, are mandatory reporters of child abuse. This statement is to advise you that your disclosure of information about child abuse to a UO employee may trigger the UO employee's duty to report that information to the designated authorities. Please refer to the following link for detailed information about mandatory reporting: [Mandatory Reporting of Child Abuse and Neglect](#).

Week(Class)	Date	Learning objective	Readings and assignments
<b>Nervous system patterning and specification</b>			
1 Tu (1)	Jan 4	Explain nervous system induction	Background readings: Hogan (1995); Weinstein (1997); Sanes et al. (2006); Zeliadt (2018)
1 Th (2)	Jan 6	Learn how the anteroposterior axis is established	Nordstrom et al. (2002) [background reading: New (1955)] <b>Homework 1 due: 11:45am</b>
2 Tu (3)	Jan 11	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 13	Learn how the dorsoventral axis is established	Briscoe & Ericson (2000); Helms & Johnson (2003); Le Dreau & Marti (2012) <b>Homework 2 due: 11:45am</b>
3 Tu (5)	Jan 18	Compare invertebrate & vertebrate motoneuron specification	Pfaff et al. (1996); Thor & Thomas (1997)
3 Th (6)	Jan 20	Discuss the origin of neural crest cells	Nikaido et al. (2021) <b>PRESENTATION GROUP 1</b> <b>Homework 3 due: 11:45am</b>
<b>Neural stem cells and glia</b>			
4 Tu (7)	Jan 25	Understand stem cells and glia	Taupin & Gage (2002); Alvarez-Buylla et al. (2001); Zuchero & Barres (2015); Abdullah et al. (2012)
4 Th (8)	Jan 27	Discuss involvement of glia in schizophrenia	Windrem et al. (2017) <b>PRESENTATION GROUP 2</b> <b>Homework 4 due: 11:45am</b>
5 Tu (9)	Feb 1	Describe temporal patterning of insect neuroblasts	Doe & Goodman (1985); Isshiki et al. (2001) [additional background: Skeath (1999)] <b>Proposal title, abstract, specific aims due: 11:45am</b>
5 Th (10)	Feb 3	Discuss temporal patterning of vertebrate CNS progenitors	Dias et al. (2014); Mattar & Cayouette (2014)
6 Tu (11)	Feb 8	Proposal writing workshop: refining an hypothesis and developing experiments	Group discussions of experimental tests of hypotheses <b>Feedback on group member's title, abstract, specific aims due: 11:45am</b>
<b>Axon guidance, synapse &amp; circuit formation, and neuronal survival</b>			
6 Th (12)	Feb 10	Learn about axon guidance & synapse formation	Koppers et al. (2019) [background Chilton (2006); Dickson (2002)]
7 Tu (13)	Feb 15	Identify mechanisms of synapse and circuit assembly	Scheiffele et al. (2000) <b>Revised title, abstract, specific aims due: 11:45am</b>
7 Th (14)	Feb 17	Discuss role of synapses in schizophrenia	Jiang et al. (2018) [background Hayashi-Takagi (2017)] <b>PRESENTATION GROUP 3</b> <b>Homework 5 due: 11:45am</b>
8 Tu (15)	Feb 22	Understand the basis of neuronal competition and survival	Davies (2013); Lichtman & Coleman (2000); Je et al. (2013) [additional background: Purves & Lichtman (1985)]
<b>Microbial influences on neurodevelopment</b>			
8 Th (16)	Feb 24	Learn how microbes affect host neural development	Heijtz et al. (2011); Lins (2021) <b>Outlined experimental design &amp; expected outcomes due: 11:45am</b>
9 Tu (17)	Mar 1	Discuss role of host-associated microbes in schizophrenia	Zhu et al. (2019) <b>PRESENTATION GROUP 4</b> <b>Homework 6 due: 11:45am</b>
<b>Student projects</b>			
9 Th (18)	Mar 3	Proposal writing workshop: refining experiment design	Group discussions of experimental design and expected outcomes <b>Feedback on group member's experimental design &amp; outcomes due: 11:45am</b>
10 Tu (19)	Mar 8	Research oral presentations	
10 Th (20)	Mar 10	Research oral presentations	
11 F	Mar 18		<b>WRITTEN RESEARCH PROPOSAL DUE: 8am</b>