

BI410/510 Stem Cells: Disease and Regenerative Medicine, Fall 2019

Instructor:

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Classroom Hours: Mon/Weds 10am-11:20
Classroom Location: Price Science Commons B040
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Course Overview:

Stem cells exist in all living organisms, are critical for your everyday life and have a much longer life span than other cell types in your body. In the past 20 years, they have been both glorified and vilified in the popular media. This course will take a closer look at these cells from the developmental, cellular and molecular angle. We will look more closely at the scientific possibilities that these cells provide, as well as explore their potential in regenerative medicine. In addition, we will explore what happens when these cells are improperly regulated, which can lead to cancer. In our final lecture, we will explore the scientific and ethical debates surrounding using stem cells in regenerative medicine.

The course approach will be very different from lecture-based classes. Material learned in Bi320 Molecular Genetics, Bi328 Developmental Biology Bi428/538 Developmental Genetics will help you relate basic principles and experimental methods to primary research papers. Be prepared to challenge yourself, participate, and explore one of the most exciting areas of biology.

Class Format:

Classes are held Mondays and Wednesdays, from 10:00-11:20am. The Monday class will consist of a lecture relevant to the week's selected paper. These lectures will cover stem cell-related principles, background on the week's paper, and an introduction to techniques used in the paper. On Wednesdays, we will have a brief in-class quiz on the material covered in the previous lecture and the paper being discussed. The quiz could also cover material from earlier weeks. Following the quiz, student groups will present the week's paper in a "journal club" format and encourage discussion among all members of the class. Some weeks, we will be accompanied by the senior author from the selected publication, either in person or via Skype, where we will be able to ask them questions about the selected publication. The quiz will be briefly reviewed the following Monday.

Reading Materials:

There is no required textbook. Some of the lecture materials are taken from the text, Developmental Biology, Gilbert, 10th edition. This textbook (9th edition) is on reserve at

the Science library. The 6th edition is also freely available online. (<http://www.ncbi.nlm.nih.gov/books/NBK9983/>)

The paper for each week will be available in PDF format on Canvas (including supplemental material). All the chosen papers (including high resolution figures) are also available online through UO library institutional access. Use the digital object identifier (doi) in the schedule below to quickly link to each paper (<http://dx.doi.org/>). Any other supporting papers (reviews, etc.) will also be uploaded to Canvas.

The lectures will be posted on Canvas the day they are given.

Grading:

1) Weekly Quizzes:

There will be seven weekly quizzes of 15 minutes duration. You may refer to a printed copy of the paper and any hand-written notes during the quizzes. Your six highest scores will count towards your final grade. Combined, the quizzes will comprise **30%** of your grade. (300 points)

2) Paper Presentation and Discussion:

As groups of four to five, students will be responsible for presenting and leading discussions on the week's paper. This requires preparing a presentation (Powerpoint, PDF, or otherwise) of the figures in the paper. You will need to present the significance, background, the questions being addressed, hypotheses, aims, and conclusions derived from the paper. Each group **MUST** meet with me in advance to discuss their preparation. At that meeting, you will bring a draft of your presentation and discussion points your group intends to raise that week. It is your responsibility to coordinate a meeting time.

Your grade will be assigned based on your ability to present the content of the paper in a clear and concise manner and to encourage discussion. All group members must participate. **20%** of your course grade will be based on this presentation. (200 points)

3) Research Proposal:

As individuals, each student will prepare a 2-3 page research proposal on a topic of interest in the field of stem cell biology. This requires identifying an interesting unresolved question, proposing a hypothesis to explain it, and describing an experimental approach to test that hypothesis. The written proposal is due on the date of the course final exam (TBA). You will also defend your proposal, with slides, through a presentation to the rest of the class. **20%** of your grade will be based on the written proposal (200 points) and **15%** for the oral presentation (150 points).

4) Participation:

This course depends on productive discussions among the entire group. Those who consistently participate in both paper discussions and in Q/A sessions during the

student presentations will be rewarded with full credit worth **15%** of your final grade.
(150 points)

Class Schedule:

Date	Class content	Week's Paper/Quiz the Expert
Oct 2	Lecture #1: Introduction, Course Goals and Syllabus, Scientific Process and Paper Analysis	
Oct 7	2019 Knight Campus Distinguished Lecture on Monday, October 7, from 10:30am-12:00pm in the EMU Crater Lake Rooms	Nat Cell Biol. 2016 Apr;18(4):349-55. doi: 10.1038/ncb3332. Epub 2016 Mar 21.
Oct 9	Lecture #2: Review: Stem Cells and Plasticity, Stem Cell-Related Disease Mechanisms	Tissue-specific designs of stem cell hierarchies.
Oct 14	Quiz #1, Lecture #3: Homeostatic Stem Cells: Developmental Programs and Coordinated regulation	
Oct 16	Quiz #2 / Paper Discussion	Development 2018 doi: 10.1242/dev.166579 Published 27 November 2018 Transcriptional response to Wnt activation regulates the regenerative capacity of the mammalian cochlea
Oct 21	15' Review / Lecture #4: Homeostatic Stem Cells: Adult Maintenance Programs Niche requirements	
Oct 23	15' Quiz #3 / Paper Discussion	Cell Stem Cell. 2016 Dec 1;19(6):725-737. doi: 10.1016/j.stem.2016.08.009. Induction of Expandable Tissue-Specific Stem/Progenitor Cells through Transient Expression of YAP/TAZ
Oct 28	15' Review / Lecture #5: Engineering Regeneration to Fix Injury and Disease	
Oct 30	15' Quiz #4 / Paper Discussion/	PNAS. 2011 Sep 13;108(37):E674-80. doi: 10.1073/pnas.1107019108. Mechanical regulation of vascular growth and tissue regeneration in vivo.
Nov 4	15' Review / Lecture #6: A do-over: Recapitulating Development to Fix Disease	
Nov 6	15' Quiz #5/ Paper Discussion	Stem Cell Reports. 2018

		Jan 9;10(1):101-119. doi: 10.1016 j.stemcr.2017.11.012 In Vitro Induction and In Vivo Engraftment of Lung Bud Tip Progenitor Cells Derived from Human Pluripotent Stem Cells.
Nov 11	15' Review / Lecture #7: How do stem cells know what to do?	
Nov 13	15' Quiz #6 / Paper Discussion	Nat Commun. 2019 Mar 5;10(1):1044. doi: 10.1038/s41467-019-09010-6. Stem cell proliferation is induced by apoptotic bodies from dying cells during epithelial tissue maintenance
Nov 18	15' Review / Lecture #8: Intrinsic regenerative Power--Organ and Organismal Differences	
Nov 20	15' Quiz #7 / Paper Discussion	Science. 2011 Apr 22;332(6028):458-61. doi: 10.1126/science.1199010. Hippo pathway inhibits Wnt signaling to restrain cardiomyocyte proliferation and heart size
Nov 25	15' Review / Lecture #9: The Great Stem Cell Controversy: Dolly, CRISPR and Beyond	
Nov 27	<i>No class</i>	
Dec 2	Student Presentations	
Dec 4	Student Presentations	
FINAL- TBA	Student Presentations/Due date for written research proposal	