

## **BI410/510 Stem Cells: Disease and Regenerative Medicine, Spring 2017**

### **Instructor:**

Anne E. Powell, Ph.D.  
Assistant Professor of Biology

Classroom Hours: Mondays and Wednesdays 10am-11:20

Classroom Location: Price Science Commons B042

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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, 10<sup>th</sup> edition. This textbook (9<sup>th</sup> edition) is on reserve at the Science library. The 6<sup>th</sup> 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 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 Wednesday, June 14<sup>th</sup>. 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
April 3	Lecture #1: Introduction, Course Goals and Syllabus, Scientific Process and Paper Analysis	
April 5	Lecture #2: <b>Review: Stem Cells and Plasticity, Stem Cell-Related Disease Mechanisms</b>	<p><a href="#">Nat Cell Biol.</a> 2016 Apr;18(4):349-55. doi: 10.1038/ncb3332. Epub 2016 Mar 21.  <b>Tissue-specific designs of stem cell hierarchies.</b></p> <p><a href="#">Nat Rev Mol Cell Biol.</a> 2016 Mar;17(3):170-82. doi: 10.1038/nrm.2015.27. Epub 2016 Jan 28.  <b>Pluripotent stem cells in disease modelling and drug discovery.</b></p>
April 10	Quiz #1, Lecture #3: <b>Homeostatic Stem Cells: Developmental Programs- Coordinated regulation</b>	
April 12	Quiz #2 / Paper Discussion	<p><a href="#">Development.</a> 2017 Feb 15;144(4):590-600. doi: 10.1242/dev.139956. Epub 2017 Jan 13.  <b>Rspodin 1 is required for specification of hematopoietic stem cells through Wnt16 and Vegfa signaling pathways.</b></p>
April 17	15' Review / Lecture #4: <b>Homeostatic Stem Cells: Adult Maintenance Programs- Niche requirements (Dr. Tiffani Jones)</b>	
April 19	15' Quiz #3 / Paper Discussion (Dr. Tiffani Jones)	<p><a href="#">Curr Biol.</a> 2014 Jun 2;24(11):1199-211. doi: 10.1016/j.cub.2014.04.007. Epub 2014 May 8.  <b>Local control of intestinal stem cell homeostasis by enteroendocrine cells in the adult Drosophila midgut.</b></p>
April 24	15' Review / Lecture #5: <b>Reprogramming Differentiated Cells to Stemness</b>	
April 26	15' Quiz #4 / Paper Discussion	<p><a href="#">Nat Biotechnol.</a> 2007 Oct;25(10):1177-81. Epub 2007 Aug 27.</p>

		<b>Direct reprogramming of genetically unmodified fibroblasts into pluripotent stem cells.</b>
May 1	15' Review / Lecture #6: <b>A do-over: Recapitulating Development to Fix Disease</b>	
May 3	15' Quiz #5/ Paper Discussion	<u>Nature</u> . 2014 Dec 18;516(7531):400-4. doi: 10.1038/nature13863. Epub 2014 Oct 29. <b>Modelling human development and disease in pluripotent stem-cell-derived gastric organoids.</b>
May 8	NO CLASS- WORK ON PROPOSAL	
May 10	NO CLASS- WORK ON PROPOSAL	
May 15	15' Review / Lecture #7: <b>Stemness gone awry: Cancer And Stem Cells</b>	
May 17	15' Quiz #6 / Paper Discussion	<u>Nature</u> . 2015 Sep 3;525(7567):114-8. doi: 10.1038/nature14669. Epub 2015 Aug 12. <b>PIK3CA(H1047R) induces multipotency and multi-lineage mammary tumours.</b>
May 22	15' Review / Lecture #8: <b>Intrinsic regenerative Power- Organ and Organismal Differences</b>	
May 24	15' Quiz #7 / Paper Discussion	<u>Gastroenterology</u> . 2017 Feb;152(3):533-545. doi: 10.1053/j.gastro.2016.10.047. Epub 2016 Dec 19. <b>Hippo Signaling in the Liver Regulates Organ Size, Cell Fate, and Carcinogenesis.</b>
May 29	NO CLASS- MEMORIAL DAY- WORK ON PROPOSAL	
May 31	Student Presentations	7 presenters
June 5	Student Presentations	6 presenters
June 7	Student Presentations	7 presenters
June 12	Student Presentations/Due date for research proposal	6 presenters

Paper Discussions						
	12-Apr	19-Apr	26-Apr	3-May	17-May	24-May
Kaye	Gould	Crawford	Christoffersen	Camel	Forde	
Moss	Antonson	Gaura	Fu	Levandowsky	Brown	
Sanderson	Ross	Matthews	Liou	Pellitier	Leis	
Zaidan	Warren	Pham	Porteus	Shurvinton-Bradley	Sarao	
		Stutzer	Song			

## Presentations

31-May	5-Jun	7-Jun	12-June
Christoffersen	Kaye	Crawford	Brown
Fu	Ross	Moss	Forde
Levandowsky	Sanderson	Gaura	Pellitier
Liou	Warren	Gould	Leis
Camel	Zaidan	Matthews	Sarao
Stutzer	Song	Pham	Porteus
Antonson		Shurvinton-Bradley	