

Biology 596: Stem Cell and Regenerative Biology

Tuesdays and Thursdays
12:30-13:45, NLS 132

Instructor:

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Office Hours: Tues., Thurs. 14:00-15:00

Course Objectives: The course will provide students with knowledge of wide-ranging topics related to stem cell and regenerative biology, including: a brief history of the field, research on animal models of regeneration, tissue engineering, and the political and ethical issues surrounding the stem cell debate. As part of the learning objectives of this course students will be able to:

- 1) List the properties that define a stem cell;
- 2) Explain how stem cells are derived for scientific research;
- 3) Compare and contrast tissue-specific stem cell types (e.g., blood, skin), and the basic mechanisms that regulate them;
- 4) List common and extrapolate potential clinical use(s) of stem cells;
- 5) Compare and contrast invertebrate and vertebrate animal models of regeneration research; and,
- 6) Assess the ethical and political issues related to stem cell research.

Prerequisites: Biology 366 and credit or concurrent registration in Biology 366L is required for this course.

Organization: The course will be composed of two lectures per week. Students are expected to complete assigned readings prior to class. We will discuss 9-10 primary literature papers. All students should be ready to participate in class discussions and to provide, when required, a short written assignment that will be due at the beginning of the paper discussion.

Required reading:

StemBook. Open-access collection of original, peer-reviewed chapters covering topics related to stem cell biology. Chapters required for class will be specified in the course schedule. StemBook can be accessed at <http://www.stembook.org>.

NIH Stem Cell Information Home Page. In *Stem Cell Information* [World Wide Web site]. Bethesda, MD: National Institutes of Health, U.S. Department of Health and Human Services. Available at <http://stemcells.nih.gov/index>.

Other required reading materials will be posted on Blackboard.

Additional resources and recommended reading:

Lodish et al. Molecular Cell Biology. 6th Ed., W.H. Freeman & Co. 2008. This book is not required but it will come in handy to review concepts that will be discussed throughout the course. If you have completed the course prerequisites you should have a copy of this book. I am also working on making a copy available on library reserve.

Christopher Thomas Scott. Stem Cell Now. This book is written for a lay audience but it is an excellent primer for all of the topics that we will discuss during the course and provides an excellent historical overview. The paperback version of this book is inexpensive (\$11.70). Used copies can be found for a few dollars at on-line book retail stores.

<http://www.hhmi.org/biointeractive/stemcells/index.html>

<http://www.cirm.ca.gov/for-the-public>

<http://www.isscr.org/>

Primary literature discussions: Please read the assigned research papers and be prepared to discuss them in class. When assigned, you will have to write a summary of the article (no longer than two double-spaced pages; worth a total of 10 points) that should include:

1. A description of the major question, problem or technical issue addressed in the paper (2 points)
2. Identification of the hypothesis or idea leading the authors to perform the experiments described (2 points)
3. Selection and explanation of the experiment you think is the most important or interesting (2 points)
4. Identify any future or unanswered questions (2 points)
5. A proposal of a hypothesis to explain this new question(s) or identification of experiments that could address unanswered questions presented in the article (2 points)

Examples of this type of summary will be posted on Blackboard.

Grading: There will be three exams during the course. The exams will each cover one-third of the material, including basic concepts learned from discussion of the primary literature. Graduate students enrolled in the course will be required to contribute to in class explanation of advanced techniques related to the research articles.

The final cumulative grade will be based on:

Quizzes	5%
Papers and class participation:	20%
Midterm exam 1:	25%
Midterm exam 2:	25%
Final exam (non-cumulative):	25%

Your lowest quiz score will be dropped.

Final grades will likely be assigned according to a straight percentage distribution: A = 90-100%; B = 80-89.9%; C = 70-79.9%; D = 60-69.9%; F = <60%. The instructor may alter the grading scheme at his discretion.

Make-up policy: Note in advance when paper discussions and exams are taking place. This will give you time to make arrangements in advance for any conflicts in your schedule. There will be no make-up exams or assignments unless the student provides a valid written excuse (e.g., a note from the doctor, funeral home, etc.). Prior notice must be given to the instructor if possible or the instructor must be notified (preferably by e-mail) as soon as possible.

Cell phones: Please turn off your cell phones prior to lecture.

Academic dishonesty:

Plagiarism in any form will not be tolerated. No credit will be awarded for plagiarized work and students who plagiarize will be reported to the Center for Student Rights and Responsibilities. If you are unclear of the definition of plagiarism, please see an Instructor or the University Catalog.

Cheating will not be tolerated. Students who cheat will be reported to the Judicial Procedures Office.

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Day	Date	Topic	Reading
Tues.	Aug. 31	Introduction to stem cells	NIH Stem Cell Primer 2009; ISSCR Primer
Thurs.	Sep. 2	Embryonic Stem Cells	NIH Early Development; Rossant, Cell 132, 2008. Solter, Nature Rev. Gen. 7, 2006. Thomson PlosGenetics Interview
Tues.	Sep. 7	Paper presentation I	Thomson et al., Science 282, 1998.
Thurs.	Sep. 9	Inducing pluripotency	StemBook: Cellular and nuclear reprogramming Ch. 1 Jaenisch & Young, Cell 132, 2008.
Tues.	Sep. 14	Paper presentation II	Takahashi et al., Cell 131, 2007.
Thurs.	Sep. 16	Epigenetics	StemBook: Epigenetics Ch. 2 and 3
Tues.	Sep. 21	Paper presentation III	TBA
Thurs.	Sep. 23	Adult stem cells & stem cell niches	Fuchs, Cell 137, 2009. Morrison & Spradling, Cell 132, 2008. StemBook: Renewal Ch. 3
Tues.	Sep. 28	Paper presentation IV	Tumbar et al., Science 303, 2004.
Thurs.	Sep. 30	Exam I	
Tues.	Oct. 5	Hematopoietic Stem Cells	Access Medicine Ch. 13: Hematopoiesis StemBook: Niche biology, homing, and migration Ch. 1 Kiel & Morrison, Nat. Rev. Immunology 8, 2008. Weissman & Shizuru, Blood 112, 2009.
Thurs.	Oct. 7	Paper presentation V	TBA
Tues.	Oct. 12	Neural Stem Cells	StemBook: Niche biology, homing, and migration Ch. 2 Zhao, Deng, & Gage, Cell 132, 2008.
Thurs.	Oct. 14	Paper presentation VI	TBA
Tues.	Oct. 19	Muscle and Cardiac Stem Cells	Shi & Garry, Genes & Development 20, 2006. Wu, Chien, and Mummery Cell 132, 2008.
Thurs.	Oct. 21	Paper presentation VII	Tanaka et al. Cell Stem Cell 4, 2009.
Tues.	Oct. 26	Stem Cells and Diabetes	TBA
Thurs.	Oct. 28	Paper presentation VIII	TBA
Tues.	Nov. 2	Exam II	
Thurs.	Nov. 4	Cancer Stem Cells	Clarke and Fuller, Cell 124, 2006. Zhou et al., Nat. Rev. Drug Discov. 8, 2009.
Tues.	Nov. 9	Paper presentation IX	Al-Hajj et al. PNAS 100, 2003.
Thurs.	Nov. 11	Veteran's Day: NO CLASS	
Tues.	Nov. 16	Therapeutic Prospects and Tissue Engineering	StemBook: Tissue engineering Ch. 1, 2 and 4
Thurs.	Nov. 18	Short presentations I	
Tues.	Nov. 23	Short presentations II	
Nov. 25-26 Thanksgiving Recess			
Tues.	Nov. 30	Animal Models of Regeneration	StemBook: Cellular and nuclear reprogramming Ch. 2 Sanchez Alvarado & Tsonis, Nature Rev. Gen. 7, 2006. Brookes & Kumar, Annu. Rev. Cell Dev. Biol. 4, 2008.
Thurs.	Dec. 2	Paper presentation X	Chera et al., Dev. Cell 17, 2009.
Tues.	Dec. 7	The Stem Cell Debate: Politics and Ethics	The Pew Forum on Religion & Public Life Issues: Bioethics http://pewforum.org/bioethics
Thurs.	Dec. 9	Exam III	