

# Regenerative Medicine: Principles, Paradigms and Practice

BISC 486

Lecture Syllabus, Fall 2017

## Course description

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This course will consider the molecular and cellular processes that generate, maintain and repair our body systems with a special emphasis on stem cell biology. We will review how knowledge gained here is being directed towards clinical endpoints in the rapidly developing area of regenerative medicine. Lectures will review experimental approaches to knowledge acquisition and therapeutic translation selecting key examples including those pioneered by USC scientists.

BISC 486 is a participatory course. Students will propose a topic-of-interest for a final paper.

Lecturer: Professor Andrew McMahon, BCC 312, (323) 442-7847

Email: [amcmahon@med.usc.edu](mailto:amcmahon@med.usc.edu)

Office hours: Mondays 4:30pm to 5:30pm, Location TBA

Lecture: Mondays 5.30pm to 8.20pm in VKC 111

## Recommended textbook (on reserve in library)

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As yet, there is no textbook that appropriately covers the scope of this class. However, the texts below provide excellent, complementary overviews of material in the first part of the course. None of the texts are required although all texts will provide useful conceptual and factual reference sources. All texts will be on reserve in the library:

*Principals of Development*, Lewis Wolpert/ Cheryll Tickle, Fourth Edition

*Development Biology*, Scott F. Gilbert, Tenth Edition

*Langham's Medical Embryology*, T.W. Sadler, Thirteenth Edition

*The Developing Human*, Keith L. Moore/T.V.N. Persaud/Mark G. Torchia, Tenth Edition

*Larsen's Human Embryology*, Schoenwolf/Bleyl/Brauer/Francis-West, Fifth Edition

*Essential Developmental Biology*, Jonathan M.W. Slack, Third Edition

## Recommended preparation

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Students should have a good working knowledge of cell biology, molecular processes and genetics.

Prerequisite courses: one of the following - BIO 220, BIO 221 or BIO 320. Prerequisite may be waived in certain circumstances following discussion with the lecturer.

## Grading

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|-------------------------|------|
| Participation           | 10%  |
| Mid term                | 15%  |
| Pre-assigned paper quiz | 25%  |
| Term research paper     | 30%  |
| Final exam              | 20%  |
|                         | 100% |

**Exams:** There will be one midterm covering material over approximately one-third of the course. There will be a comprehensive final exam during the final exam period covering additional lecture material. Exams will combine multiple-choice with written responses.

**Pre lecture assignment:** Each lecture will be supplemented by the study of a groundbreaking paper of particular relevance to that day's class. Each class will start with a 20' quiz on the topic of the assigned paper.

**Term Research Presentation:** Students will write an 8-10 page paper on a topic of their choosing that is not covered directly in the course but is relevant to the goals of the course. The paper will draw on the primary literature for relevant background material. Papers will be written in the format of an illustrated mini-review. Several examples will be provided as guides. Students are encouraged to provide a critical overview of the field and suggest approaches to further our understanding (a basic science topic) or to apply our understanding towards a therapeutic goal (translation science topic).

**Class Participation:** Students are expected to be in attendance for the duration of the class and to actively participate in the class. Accordingly, students will be graded on their participation.

**Out of Class Visit:** Interested students are encouraged to attend an out of class informational visit to the Eli and Edythe Broad CIRM Center for Regenerative Medicine and Stem Cell Research at the Keck School of Medicine. The timing of the visit will be determined once student schedules are known.

## **Policies**

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**Missed exams:** Missed exams will receive a grade of zero unless the student has an excused absence due to a documented medical or family emergency. At the discretion of the instructor, a missed exam a) may be retaken as a written exam, b) may be retaken as an oral exam or c) may be given a prorated score based on performance in the rest of the course.

**Regrades:** If you would like to contest a grade on an exam or assignment, you must submit a written explanation of why you think the grade was incorrect. Please note that the ENTIRE exam or assignment may be subject to reevaluation and your score may therefore go up, go down or remain the same. Regrade requests must be submitted to the instructor within two days of when the exam/assignment is returned.

**Late assignments:** Due dates are written in the schedule. Late assignments will only be accepted in exceptional circumstances.

**Academic honesty:** Academic integrity policies of the university will be strictly followed. Infractions can result in severe penalties. See Scampus for these policies.

**Schedule:** Due to the vagaries of life, it may be necessary to make some adjustments in the course schedule.

**Statement for students with disabilities:** Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

**Statement on academic integrity:** USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A:

<http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

## Lecture and Reading Schedule

| Week | Date  | Topic  | Reading   |
|------|-------|--|---|
| 1    | 08/21 | <b>Developmental Principles and Approaches 1:</b> complexity, fate, determination, differentiation, potency, constancy of the genome | Gilbert, Chapter 1<br>Wolpert, Chapter 1<br>Paper as assigned             |
| 2    | 08/28 | <b>Developmental Principles and Approaches 2:</b> lineage, polarity, growth, cell interactions, epigenetic control of gene activity  | Gilbert, Chapter 1 and 2<br>Wolpert, Chapter 1<br>Paper as assigned       |
| 3    | 09/04 | <b>Labor Day - no class</b>  |   |
| 4    | 09/11 | <b>Experimental Tool Box:</b> in situ hybridization, transgenics, FACS, imaging  | Gilbert, Chapter 1-3<br>Wolpert, Chapter 1,3<br>Paper as assigned         |
| 5    | 09/18 | <b>Human Development 1:</b> cleavage, cell diversity, germ layers and gastrulation   | Gilbert, Chapter 8, 9<br>Wolpert, Chapter 3, 4<br>Paper as assigned       |
| 6    | 09/25 | <b>Human Development 2:</b> axial organization, organogenesis,<br><b>MIDTERM</b>   | Gilbert, Chapter 9, 10,<br>Wolpert, Chapter 4, 5, 11<br>Paper as assigned |
| 7    | 10/02 | <b>Human Development 3:</b> stem cells in organ maintenance and injury repair  | Gilbert, pg. 319-331<br>Wolpert, Chapter 10<br>Paper as assigned          |
| 8    | 10/09 | <b>Pluripotent Stem Cells:</b> embryo and induced  | Wolpert, Chapter 10<br>Paper as assigned                                  |
| 9    | 10/16 | <b>Regeneration</b>  | Gilbert, Chapter 16<br>Wolpert, Chapter 14<br>Paper as assigned           |
| 10   | 10/23 | <b>Therapeutic Approaches 1:</b> stem cell transplants   | Paper as assigned   |
| 11   | 10/30 | <b>Therapeutic Approaches 2:</b> transplants of stem cell-derived cell types   | Paper as assigned   |
| 12   | 11/06 | <b>Therapeutic Approaches 3:</b> stem cells and genetic modification   | Paper as assigned   |
| 13   | 11/13 | <b>Therapeutic Approaches 4:</b> stem cells, organoids and disease modeling  | Paper as assigned   |
| 14   | 11/20 | <b>Therapeutic Approaches 5:</b> cancer stem cells and improving the pharmaceutical model<br><b>TERM RESEARCH PAPER DUE</b>          | Paper as assigned   |

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| <b>15</b> | 11/27 | <b>Therapeutic Approaches 6:</b> the practical pathway to a cell-based therapy | Paper as assigned |
| <b>16</b> | 12/11 | <b>FINAL EXAM</b> - 4.30-6.30pm  |                   |