

Regenerative Medicine: Principles, Paradigms and Practice

BISC 486

Lecture Syllabus, Fall 2021

Course description

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

Email: amcmahon@med.usc.edu

Lecture: Mondays 5.30pm to 8.20pm

Office hours: Mondays 4:30pm to 5:30pm

Recommended textbook (on reserve in library)

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.

Principals of Development, Lewis Wolpert/ Cheryl Tickle/ Alfonso Martinez Arias, Sixth Edition

Development Biology, Scott F. Gilbert and Michael Barresi, Twelfth Edition

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

Langham's Medical Embryology, T.W. Sadler, Fourteenth Edition

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

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

Recommended preparation

Students should have a good understanding of cellular organization and function, 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

Participation	10%
Mid term	20%
Pre-assigned paper quiz	30%
Term research paper	<u>40%</u>
	100%

Exams: There will be one midterm covering material over approximately half of the course. 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 Paper: Students will write an 10-12-page paper on a topic of their choosing. The paper may explore an area not covered directly in the course that is nevertheless 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. Papers will present a critical overview of the topic, discuss the approaches, findings and significance of 2 or 3 research papers critical to our current understanding of the topic, and suggest approaches to further an understanding of the area (a basic science topic) or to apply our current understanding towards therapeutic goals (translational 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.

Policies

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	08/23	Developmental Principles and Approaches 1: complexity, fate, determination, differentiation, potency, constancy of the genome	Gilbert, Chapter 1 Wolpert, Chapter 1
2	08/30	Developmental Principles and Approaches 2: lineage, polarity, growth, cell interactions, epigenetic control of gene activity	Gilbert, Chapter 1 and 2 Wolpert, Chapter 1 Paper as assigned
	09/06	Labor Day - no class	
3	09/13	An Experimental Tool Box: cloning, in situ hybridization, genetics, transgenics, CRISPR, FACS, imaging, single cell and computational analysis	Gilbert, Chapter 1 and 2 Wolpert, Chapter 1 Paper as assigned
4	09/20	Human Development 1: cleavage, cell diversity, germ layers and gastrulation	Gilbert, Chapter 8, 9 Wolpert, Chapter 3, 4 Paper as assigned
5	09/27	Human Development 2: axial organization, organogenesis,	Gilbert, Chapter 9, 10, Wolpert, Chapter 4, 5, 11 Paper as assigned
6	10/04	Human Development 3: adult stem cells in organ maintenance and injury repair	Gilbert, pg. 319-331 Wolpert, Chapter 10 Paper as assigned
7	10/11	MIDTERM Pluripotent Stem Cells: embryo and induced pluripotent stem cells	Wolpert, Chapter 10 Paper as assigned
8	10/18	Regeneration of complex systems	Gilbert, Chapter 16 Wolpert, Chapter 14 Paper as assigned
9	10/25	Therapeutic Approaches 1: hematopoietic stem cells (HSCs), HSC transplants and genetic engineering of HSCs	Paper as assigned
10	11/01	Therapeutic Approaches 2: directed stem differentiation and directed cell programming for CNS therapies	Paper as assigned
11	11/08	Therapeutic Approaches 3: disease modelling and organoids advancing the pharmaceutical model	Paper as assigned
12	11/15	Therapeutic Approaches 4: cancer stem cells and stem cell directed cancer modeling	Paper as assigned
13	11/22	Therapeutic Approaches 5: the pathway to cell-based therapies	Paper as assigned
14	11/29	Therapeutic Approaches 6: overview of promising clinical trials and FDA approved treatments	
	12/03	TERM PAPER DUE	