

Regenerative Medicine: Principles, Paradigms and Practice

BISC 486

Lecture Syllabus, Fall 2023

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. Lectures will review experimental approaches to knowledge acquisition and therapeutic translation selecting key examples including those pioneered by USC scientists. We will review how knowledge is directed towards clinical endpoints, where regenerative medicine stands today and what we can expect in the future.

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

Lecturer: Professor Andrew McMahon, BCC 312, HPC Campus

Email: amcmahon@med.usc.edu

Lecture: Mondays 5.30pm to 8.20pm in DMC (formerly CPA) 156

Office hours: Mondays 4:30pm to 5:30pm in courtyard café area behind Doheny Library UPC

Recommended textbook (on reserve in library)

While there is no textbook directly covering all the material for this course, the texts below provide excellent, complementary overviews of material in the first part of the course. No required textbooks, all texts below provide useful conceptual and factual reference sources and will be available in the library

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

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

A general understanding of cellular organization, cell regulatory control 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	40%
	100%

Exams: There will be one midterm covering material over approximately half of the course. Exams will combine multiple-choice and 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. There will be 11 assigned papers and the lowest score will be dropped.

Term Research Paper: Students will write a 12-14-page final paper (including figures and references) on a topic of their choosing. The paper may explore any area covered in the course in more depth or any other topic agreed on in consultation with the lecturer that is relevant to the goals of BISC 486. Topics may be basic research or translational research focused. The paper will draw on the primary literature for relevant background material (3 pages) and focus on discussing two selected papers that provide critical insight into the problem considering the methods, key results, and conclusions drawn by the investigators. (8-9 pages) Choosing contrasting approaches to the same general problem makes for a lively term paper. Each term paper will conclude with a final “Discussion and Future Perspectives” section (1-2 pages) that provides your own thoughts on the research (significance, problems, differences between studies, what do you see as next steps to clarify research and/or move the problem forward). Typically term papers should be supported by 20-30 relevant references from the literature. The reference list should be followed by an “Acknowledgements” section recognizing any others for critical input, if the students used generative AI or other language-based AI models how research here was incorporated into the term paper and a final statement that the text was written directly by the student. **Preliminary outlines will be due for instructor consideration and approval by Sunday October 20th** and should be submitted any time prior to this date directly to the instructor amcmahon@med.usc.edu. **All students must have received instructor approval by Sunday October 27th. All final term papers are due to 5pm on Friday December 1st.**

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 on 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 *University* policies. In particular, the term paper must represent the scholarly work of the student directly. The use of generative AI in researching the topic should be acknowledged in a statement at the end of the class paper. Please see University guidelines on AI in the classroom.

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 the principles expounded in the USC Student Handbook (<https://policy.usc.edu/studenthandbook/>)

Lecture and Reading Schedule

Week	Date	Topic	Reading
1	08/21	Developmental Principles and Approaches 1: complexity, fate, determination, differentiation, potency, constancy of the genome	Gilbert, Chapter 1 Wolpert, Chapter 1
2	08/28	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
	09/04	Labor Day - no class	
3	09/11	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	09/18	Human Development 1: cleavage, cell diversity, germ layers and gastrulation	Gilbert, Chapter 8, 9 Wolpert, Chapter 3, 4 Paper as assigned
5	09/25	Human Development 2: axial organization, organogenesis,	Gilbert, Chapter 9, 10, Wolpert, Chapter 4, 5, 11 Paper as assigned
6	10/02	Human Development 3: adult stem cells in organ maintenance and injury repair	Gilbert, pg. 319-331 Wolpert, Chapter 10 Paper as assigned
7	10/09	MIDTERM Pluripotent Stem Cells: embryo and induced pluripotent stem cells	Wolpert, Chapter 10 Paper as assigned
8	10/16	Regeneration of complex systems	Gilbert, Chapter 16 Wolpert, Chapter 14 Paper as assigned
9	10/23	Therapeutic Approaches 1: hematopoietic stem cells (HSCs), HSC transplants and genetic engineering of HSCs	Paper as assigned
10	10/30	Therapeutic Approaches 2: directed stem differentiation and directed cell programming for CNS therapies	Paper as assigned
11	11/06	Therapeutic Approaches 3: disease modelling and organoids advancing the pharmaceutical model	Paper as assigned
12	11/13	Therapeutic Approaches 4: cancer stem cells and stem cell directed cancer modeling	Paper as assigned
13	11/20	Therapeutic Approaches 5: the pathway to cell-based therapies	Paper as assigned
14	11/27	Therapeutic Approaches 6: overview of promising clinical trials and FDA approved treatments	
	12/01	TERM PAPER DUE BY 5.00pm	

