

MCB 410 Developmental Biology, Stem Cells and Regenerative Medicine, Spring 2019 Syllabus

Welcome to MCB 410! This upper-level course examines how a single cell (the fertilized egg) gives rise to a complete organism.

Our goals are for you:

- (i) to share our enthusiasm about this fascinating field
- (ii) to understand the scientific discovery process that leads to our current understanding of development and regeneration;
- (iii) to think critically about experimental evidence
- (iv) to apply what you learned in your future career and everyday life

We will be emphasizing how the study of model organisms has driven the explosion of knowledge about developmental mechanisms, and the amazing extent to which these mechanisms have been conserved evolutionarily. We will also explore recent advances in stem cell research, regeneration and regenerative medicine.

Lectures (11:00AM - 11:50AM, MWF at 166 Bevier Hall):

Lectures will present key concepts as well as the experiments and methodologies scientists use to understand developmental phenomena. We will also have in-class discussions, activities, and student presentations to promote active engagement with the course material. Because lectures will be used to expand upon the material presented in the textbook and to provide important contextual information, it is critical for you to attend lectures.

Readings:

Textbook: the required textbook for assigned readings is:

Principles of Development, 5th Edition by Lewis Wolpert and Cheryll Tickle (Oxford University Press)

Copies are on reserve at the Funk ACES library and the MCB Learning Center.

For students seeking more information, additional textbooks include Developmental Biology by Scott Gilbert; Molecular Biology of the Cell by Alberts et al.; Molecular Cell Biology by Lodish et al. Please see the "Class Readings & Links" page on Moodle to access a previous edition of the Gilbert text on-line.

Other readings: primary research papers that will be discussed in class will be posted on Moodle as pdf files.

Paper Discussions

There will be 10 paper discussion classes when we discuss primary research articles. Primary articles and questions will be posted one week before the class meets to discuss the paper; the questions will help you to read the paper and prepare for the discussion.

Exams:

Exams 1-3 will be held on the following classes **at 166 Bevier Hall**:

Exam 1 (lectures 1-10): Friday, Feb 8;

Exam 2 (lectures 11-20): Wednesday, March 6;

Exam 3 (lectures 21-30): Monday, April 8;

Final exam (lectures 31-40): date and location TBA.

Exams will cover material presented in class and in the assigned readings, and they will consist of a mixture of short answer and experiment-based questions.

Conflict exams will be given only for qualifying excused absences (scheduled course for credit, sporting events for University athletes, employment, travel to conferences, graduate/medical school interviews, students with DRES academic accommodations), for which documentation will be required. Please submit your request at least one week before the exam. Conflict exams will only be given before the officially scheduled exam.

Grades:

The grades of all four exams (100 points each; 400 points total), will make up 4/5 of the course grade. The remainder of the grade (100 points) will consist of participation and contribution to the 10 paper discussion classes (10 points per class). For excused absence, a make-up assignment can be completed to get credits for the missing class.

Academic integrity:

Any infraction of academic integrity (as outlined in the University's Student Code) will result in a grade of zero on the assignment/ exam in question or, at the discretion of the instructor, a more severe penalty.

Jan 14 Introduction: model organisms, types of experiments, Key concepts. [Chapter 1](#)
 Jan 16 Germ cells, cytoplasmic determinants. [pp409-413](#)
 Jan 18 Germ cells (Continued). [pp413-423](#)
 Jan 23 Germ cells, Hatched and Ephrussi. [Paper discussion, P69,70](#)
 Jan 25 Fertilization. [pp424-429](#)
 Jan 28 Sex determination, Dosage compensation, Imprinting. [pp430-442, 420-423](#)
 Jan 30 C. elegans I: cell lineages. [pp235-239](#)
 Feb 1 C. elegans II: asymmetric division, PAR genes. [pp239-248](#)
 Feb 4 C. elegans III: heterochronic mutants, apoptosis. [pp237-238, 248-253](#)
 Feb 6 RNA interference. [Paper discussion](#)
 Feb 8 Exam I

Feb 11 *Drosophila*- setting up Body axes. [pp. 37-54](#)
 Feb 13 *Drosophila* embryonic patterning. [pp. 66-76](#)
 Feb 15 *Drosophila* embryonic patterning. [Paper discussion](#)
 Feb 18 Boundaries and compartments. [pp. 77-87](#)
 Feb 20 Hox genes and homeotic transformations. [pp. 90-95, 215](#)
 Feb 22 Hox genes. [Paper discussion](#)
 Feb 25 Morphogens and patterning. [pp. 27-29, 476-489](#)
 Feb 27 Tissue movement and morphogenesis. [pp. 368, 380-383, 385](#)
 Mar 1 Cell fate specification/Eye development. [pp494-497](#)
 Mar 4 Tissue movement. [Paper discussion](#)
 Mar 6 Exam II

Mar 8 Xenopus gastrulation. [pp103-111; 383-387](#)
 Mar 11 Xenopus organizer, mesoderm induction. [pp144-164](#)
 Mar 13 Chick and mouse. [pp114-125; 185-200](#)
 Mar 15 Neural crest cells. [Paper discussion](#)
 Mar 25 Somatogenesis [pp207-222](#)
 Mar 27 Left-Right Asymmetry [pp. 226-229](#)
 Mar 29 L-R asymmetry. [Paper discussion](#)
 Apr 1 Growth control in development and cancer [pp. 569-588](#)
 Apr 3 Development and evolution [Chapter 14](#)
 Apr 5 Post-embryonic development and adaptation, [paper discussion](#)
 Apr 8 Exam III

Apr 10 Stem cells. [pp322-342.](#)
 Apr 12 Somatic cell nuclear transfer; Induced pluripotent stem cells. [pp343-355](#)
 Apr 15 Stem cells. [Paper discussion](#)
 Apr 17 Limb development [pp. 447-476](#)
 Apr 19 Regeneration overview, Limb regeneration [pp. 594-609](#)
 Apr 22 Neural stem cells and neural fate specification. [pp520-543](#)
 Apr 24 Axon navigation and regeneration. [pp544-563](#)
 Apr 26 Branching morphogenesis and lung, kidney and pancreas regeneration [pp. 498-503](#)
 Apr 29 Heart development and cardiac regeneration [pp. 504-507, 609-612](#)
 May 1 Regenerative Medicine. [Paper discussion](#)
 TBA Final exam