BIOL 369 Developmental Biology

Lecture Schedule and Syllabus, Fall 2009

MWF 2:20-3:20
OlinRice 300

Instructor: Mary Montgomery, Associate Professor in Biology
Contact: montgomery@macalester.edu
Office: OlinRice 218 **Phone**: x6425 **Office hours**: By appointment

Text: Scott Gilbert *Developmental Biology* 8th edition (http://8e.devbio.com/)

Course webpage: http://moodle.macalester.edu

COURSE DESCRIPTION: This course aims to integrate organismal, cellular, genetic and molecular approaches to the study of animal development. We will analyse a diversity of mechanisms, ranging from ones that set up pattern formation in the unfertilized egg to those governing morphogenesis of organ systems. Evolution of developmental mechanisms will also be discussed. The lab component will incorporate both descriptive and experimental embryological techniques. Three lecture hours and 3 1/2 hr lab per week. (5 credits) **Prerequisites**: Cell Biology and Genetics II.

Developmental Biology is an incredibly fascinating field of study that has undergone a major revolution in the last several years to become one of the hottest areas in biology. This has been due in part to rapid advances in cell and molecular genetic approaches, as well as in computer technologies and the various genome projects. Developmental biologists are still grappling with questions raised earlier this century by brilliant researchers with infinite patience, remarkable hands and keen powers of observation. Since then the field has been building on the knowledge gained by these early workers; we are now starting to understand the molecular basis underlying many of the developmental processes they described, and finding that these molecular interactions are often conserved among organisms as different as flies and humans. It really is a very exciting and challenging time for developmental biology and it is hard to imagine what could be more fascinating than contemplating, exploring, and learning about how something as complex as the human body could have developed from a single fertilized egg. It is my hope that you will become as enchanted by the study of this incredible phenomenon as I am.

COURSE SCHEDULE

Date	Topic	Reading from Gilbert
Sept 9	Overview of development	1: 3-16; 2: 25-26
Sept 11	Structure of gametes & Fertilization	2: 30-31; 7: 175-209
Sept 14	Sea urchin development	8: 211-229
Sept 16	Evolution of developmental patterns	2: 42-46
Sept 18	Experimental embryology	3: 49-62
Sept 21	Experimental embryology	2: 39-40; 3: 65-66
Sept 23	Genes and development	4: 77-92
Sept 25	Genes and development	4: 92-99
Sept 28	Amphibian development and Primary induction	10: 291-306
Sept 30	Primary induction	10: 306-316
Oct 1	Fish development	11: 325-336
Oct 5	Avian development	11: 336-348
Oct 7	Mammalian development	11: 348-357
Oct 9	Catch Up & Review	
Oct 12	***Exam One***	
Oct 14	How to build a fly: Part 1	9: 253-266
Oct 16	How to build a fly: Part 2	9: 266-275
Oct 19	How to build a fly: Part 3	9: 275-283
Oct 21	How to build a fly: Part 4	9: 283-290
Oct 23	***Mock review of NSF Grant Proposals***	
Oct 26	Neurulation and ectoderm	12: 373-394
Oct 28	Neurulation and ectoderm ***FINAL PROJECT: ROUGH DRAFT DUE***	12: 394-401
Oct 30	FALL BREAK	
Nov 2	Mesoderm: somites and muscle	14: 443-455
Nov 4	More on mesoderm	1^0 lit
Nov 6	Differential gene expression: level of DNA	5: 101-124
Nov 9	Differential gene expression: level of RNA	5: 125-138
Nov 11	Catch Up & Review	
Nov 13	***Exam Two***	
Nov 16	Neural crest	13: 408-419
Nov 18	Neuronal specification and axonal guidance	13: 424-436

Nov 20	More on neural crest/axonal guidance	1^0 lit
Nov 23	The germ lineage	19: 593-602, 603-606
Nov 25	Embryonic stem cells / cloning ***FINAL PROJECT DUE***	21: 684-691; 1^0 lit
Nov 27	THANKSGIVING BREAK	
Nov 30	Reproductive medicine	21: 663-665; TBA
Dec 2	Primary sex determination	17: 529-539
Dec 4	Secondary sex determination	17: 539-543
Dec 7	Aging	18: 585-591; 1^0 lit
Dec 9	Topic: student choice (from chapters 18-23)	TBA
Dec 11	Topic: student choice (from chapters 18-23)	TBA
Dec 14	Wrap Up and Review	
Dec 18	***Final Exam*** **(1:30-3:30)**	

EXPECTATIONS AND EVALUATION

GRADING	
Exams	35%
Final Project	15%
In class performance	10%
Lab Performance	40%

A little over **1/3** of your grade will be based on your performance on **exams** covering lecture material in the course. The exams will consist of multi-part questions for which you will write half-page to full page (or longer) responses. They are designed to test your ability to synthesize information, critically analyze data, and design controlled experiments. The first two exams will have an in-class component and a take-home component whereas the final exam will take place during the 2 hour scheduled slot of finals week. Scott Gilbert's *Developmental Biology* is an excellent textbook and I will expect you to keep up with the reading material that accompanies the lecture. Both my lectures and the textbook emphasize experimental evidence and you will get to know something about the researchers as well as their work and how each has contributed to the knowledge base of this fast-growing field. There is much more in Gilbert's textbook than we will be able to cover in class. In terms of exams, you will only be responsible for topics covered in class; however, I encourage you to read up on other topics presented in the book that we may not cover but that may be of interest to you. Furthermore, there are several websites that are relevant to developmental biology; I will be supplementing the lecture and text with at least two of these: Scott Gilbert's website supporting the textbook (http://8e.devbio.com/)

and the virtual embryo (http://www.ucalgary.ca/UofC/eduweb/virtualembryo/). Again, there is a whole world of information available through these websites that you may want to further explore on your own.

In addition to readings from the textbook, we will read and discuss papers from the primary literature (1^0 lit). It can sometimes be a struggle for undergraduate students to read and understand some of these technically dense papers, but there is really no substitute for becoming familiar with some of the original studies that have contributed significantly to the field. Reading more of the primary literature also gives you a much better feel for the kinds of questions that are asked, the experimental approaches used to address those questions, and the ways in which those studies are then reported. Reading these published studies will greatly aid you in writing up the results of your own laboratory experiments as well as responding on exams and writing your final project. Your "**in class performance** " grade (**10%** of final grade) will be based on your preparedness for and participation in discussions of these assigned papers. In addition you may be asked to prepare a 5-10 minute short presentation on a relevant topic to the day's discussion, or do some in-class problem-solving or experimental design. Furthermore, you will also be involved in reviewing the written work of your peers and providing critical feedback. All of these assignments will contribute to this component of your final grade.

Your **final project** will account for **15%** of your final grade. You have **3 options** to choose from in completing your final project: a written **grant proposal**, a **literature review**, or a **policy report**. Your final project is due the Wednesday *before* Thanksgiving and should be uploaded to Moodle. Rough drafts of your final project will be due midway through the semester with time to incorporate feedback from me and your peers prior to submitting your final version.

Option A, grant proposal: Your job will be to design a series of experiments, including proper controls, that address a novel question in developmental biology. You will do the background research, generate the question, and design the experiments. You will have a lot of freedom in this endeavor, but the question(s) being pursued must be *novel*. Grant proposals that are written over a couple days and with little thought do not get funded. Thus, to aid you in writing a solid proposal, you will need to choose an experimental topic early in the semester, and then work on writing your proposal over the remaining course of the semester. The final proposal will be limited to a *maximum* of 6 single-spaced pages, not including references. Details for writing proposals, as well as how they will be scored, are posted on Moodle. Those of you who are seriously considering going on to graduate school to pursue a PhD in experimental biology should choose this option.

Option B, literature review: Instead of writing a grant proposal, you may opt instead to write a comprehensive review of a topic relevant to developmental biology (e.g. role of miRNAs in animal or plant development, human congenital heart defects). The final paper should consist of a *minimum* of 10 single-spaced pages, not including references, which should consist of a *minimum* of 20 *primary* research or medical studies.

Option C, policy report: For those of you who would rather do something more policy driven or "applied" you may want to choose this option. The policy report will be directed toward exploring the socio-ethical issues surrounding **egg donation for research purposes** and generating policies that if adopted would set guidelines for egg donors,

researchers, and any other relevant stakeholders. The report will be focused on this one issue but you may want to mention for comparative purposes current policies governing embryo donation for research purposes and/or policies directed toward egg donation for reproductive purposes. This option entails that you review any publications on the topic, research current federal and state (MN but also other states, particularly CA and MA) policies, find out about policies in other countries (must include U.K., Israel, S. Korea, Japan, Singapore), research current practices in part by interviewing investigators who utilize egg donors to acquire human eggs to carry out stem cell research or other related types of investigations, gather opinions from other sources (e.g. generate a survey, interview bioethicists, interview egg donor(s) if possible), and finally lay out recommended guidelines providing a rationale for each recommendation. As more than one person is likely to choose this option, you may work with other students from the class to collect data/information and I encourage you to discuss possible regulatory actions and guidelines, but you must *write* at least six pages of the final report. Details of various sections that should be included in your report are posted separately on Moodle. The final report should consist of a *minimum* of 12 single-spaced pages, not including references. Interview transcripts, surveys, and other original sources of information or raw data should be attached as appendices to the report.

The final **40%** will come from your efforts in the **lab** section of the course (see separate Lab syllabus).

PLEASE NOTE: The only acceptable excuses for missing an exam are severe personal illness, a family emergency, or other event of similar nature. If you cannot take an exam on the assigned day because of participation in a sporting event or other official Macalester activity, you must notify me ahead of time (i.e., BEFORE the day of the exam) so that we can schedule an appropriate time for you to take the exam. If you need special accommodation for note-taking or test-taking, e.g. due to ESL or a learning disability, please feel free to discuss your situation with me. I will do my best to accommodate your needs and help you achieve your full potential in my course.

Back to **Course Pages**