**BIO 316/516 DEVELOPMENTAL BIOLOGY**

**LECTURER: Dr. Bea Holton**

**Spring 2016 – 3 credits – 2, 1.5hr lectures per week**

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**OFFICE HOURS**: M 2-4pm, Tu 10:00-11:30am or by appointment. Instructor is SAFE – trained.

**LECTURE HOURS**: 8:00-9:30am TuTh in Halsey Science 266.

**TEXT:** Gilbert, Scott F. (2013 or 2016) Developmental Biology, 10th ed.or 11th ed, Sinauer Associates, Inc., Sunderland, MA.

**DESCRIPTION:**

Developmental Biology concerns the process by which single cells (e.g. eggs, spores, or seeds) become multicellular organisms comprised of different tissue types. This course will first examine the characteristics that set germ cells apart from other cells. Second, events such as early cleavage, gastrulation, neurulation and organogenesis will be compared in diverse organisms so that similarities and differences in strategies of development can be appreciated. Third, we will examine molecular cues that cells may use in order to migrate to proper locations and differentiate into appropriate cell types. We will examine molecular mechanisms that are used to establish polarity, segmentation, and, in short, the developmental plan of embryos. Finally, we will discuss development from an evolutionary perspective. We will periodically discuss papers from the literature to understand how developmental biologists reach the conclusions that they do and to follow developments that have occurred since our text was written.

**LEARNING OUTCOMES:** 1) Students will learn the fundamentals of developmental biology as well as what we can learn about evolution from developmental biology; 2) Students will improve their ability to write clearly and concisely so that they will be able to describe complex data, results and conclusions; 3) Students will improve their ability to give oral presentations so that they will be able to present complex data, results and conclusions; 4) students will improve their critical thinking skills by analyzing figures, graphs and tables and applying the academic principles learned to the interpretation of these data.

**GRADING AND REQUIREMENTS:**

**Exams - in class, short answer/essay style**

 **Exam #1 Mar. 9**

 **Exam #2 Apr. 13**

 **Exam #3 May 9**

**Research Papers** - Short discussion and analysis of data provided by B. Holton. Please note that we will work on the first of these papers as a team in class so that all will understand how they should be done.

 **Data given to students: Feb. 16 Paper due: Mar. 2**

 **Mar. 30 Apr. 20**

I will provide students with selected data from the literature that is relevant to theories discussed in class. Students are to treat the data as their own, as though they wanted to present it to others in their field. Each paper will have 1) an Introduction that gives some background information but mostly outlines questions in the field (that will be addressed by your data) and significance of the work presented; 2) Results section that explains the data: What do the data show?, Why were certain controls done?; and 3) a Discussion section in which a REASONABLE hypothesis is formulated from the data. This sounds like a lot of writing, but, in fact, the maximum page length will be 2 type-written, single spaced pages (point size no less than 12). Most papers can be completed in much less space. The key is to think clearly, write concisely and to say exactly what you mean...no more, no less. Students may discuss the data (and interpretations of the data) among themselves, and they can ask me questions, preferably in class where all can profit from the questions and answers.

Oral presentations- Everyone will give one oral report. Presentations will be graded and worth 10% of your final grade. Undergraduates may work in pairs, graduate students must present by themselves. Undergraduates should prepare one paper from the scientific literature and discuss it thoroughly (come to me if you have questions about the paper). The presentation should take 20 minutes…no more! Graduate students should prepare two related papers. They must tie them together in a coherent fashion, show the significance of the work and clearly describe how the field advanced from one paper to the next. But, they should not take much more than 20 minutes for their presentation! Precision is everything in science!!

**Graduate students** – **Objectives**

1) Graduate students will be graded by a higher standard than undergraduates on exams, papers and presentations.

2) Graduate students are expected to be proficient in writing and speaking. At this point, they should have a good command of scientific vocabulary and use it appropriately. They should understand commonly used scientific techniques and knowledgeably discuss data gleaned from such methods. This will be demonstrated by exams, papers and presentations.

3) Data interpretation by graduate students should show insight into the larger, more general problems being addressed. This will be demonstrated by papers and by the presentation.

**Activities for graduate students**

1) Graduate students are expected to give their oral presentation alone, and the presentation should include 3-4 papers from the literature. It should also be 20min long.

2) The graduate student should also turn in a concise review of the literature surrounding the topic of their presentation. The review should be about 3-5 pages long (single-spaced) and include a list of references.

Distribution of points for undergraduates - Research papers will be worth 40% of your grade, in-class exams will be 50% and oral presentations will represent 10%. The research paper by graduate students will be worth

Distribution of points for graduate students – Research papers will be worth 40%, exams 40%, oral presentation 10% and research paper 10%.

GRADING undergraduate students: 93-100% = A, 90-92 = A-, 87-89 = B+, 83-86 = B, 80-82 = B-, 77-79 = C+, 73-76 = C, 70-72 = C-, 67-69 = D+, 63-66 = D, 60-62 = D-, below 60% = F.

graduate students: 94-100% = A, 90-93 = A-, 88-89 = B+, 84-87 = B, 80-83 = B-, 78-79 = C+, 73-77 = C. Any grade less than a C (72 or below) will be considered Failing.

Grades will only be “curved”, if necessary. Cheating in any form (including plagiarism, excessive paraphrasing, documented or not) will NOT be tolerated. Students caught cheating will receive an F in the course and will be reported to the Dean of Students.

LIST OF LECTURE AND DISCUSSION TOPICS (black = 10th ed; blue = 11th ed)

1. Fertilization - sperm and eggs; how they find each other; the process of egg activation - Ch. 4, 7
2. Axis specification in *Drosophila* – Ch. 6, 9
3. Sea urchin and tunicate development – Ch. 7, 10
4. Early development in amphibians and a bit about fish – Ch. 8, 11
5. Early development in avians (a bit) and mammals – Ch. 9, 12
6. Stem cells – Part 3, Ch 5
7. Development of the nervous system – parts of Ch. 10 and11; parts of 13-15
8. Mesoderm and endoderm - parts of Ch. 12 and 13; 17, 18, 20
9. Development and health and disease – parts of Ch. 18, 24
10. Developmental mechanisms of evolutionary change – Ch. 20, 26

We can discuss other current topics such as regeneration, aging, environmental regulation of development, sex determination, and so on. Flip through the chapters; TELL ME WHAT INTERESTS YOU!!

## WRITING ASSIGNMENTS:

### General Instructions

**Papers must be no longer than 2pg, single-spaced or 4pg, double-spaced (point size = 12). Unless stated otherwise, they must be placed in the dropbox in D2L.**

I will provide you with selected data from the literature that are relevant to theories discussed in class. You are to treat the data as though they were your own and as though you wanted to present the data to others in your field as a publishable research paper. Consequently, you must (1) capture the interest of the reader by developing some background and explaining the significance of the hypothesis tested in your paper; (2), explain clearly the results so that the reader understands their meaning and draws the same conclusions as you as the paper is read, and, (3), discuss the meaning of your results. Perhaps propose a model. **Remember, you are writing this paper for someone who understands basic techniques and principles in science BUT has not studied this particular topic. So, the reader might understand a technique like SDS-PAGE or immunohistology but may NOT understand how those techniques will help you test your specific hypothesis….explain your rationale for what you do!** Each paper will have the following sections. LABEL each section:

 - **Introduction** - gives some background information but mostly outlines questions in the field (that will be addressed by your data) and the significance of the work presented, i.e. what makes the study important. A rationale statement is often useful. You don’t have to make the hypothesis’ importance relevant to humans or medical problems. This section is generally short…..a few sentences….because you usually need a lot of space to describe the results.

 - **Results** - explains the data. Explain a bit about the techniques used and the rationale for doing specific experiments. Why were certain controls or experiments done? Describe the results in the graphs/figures/tables AND, as part of your explanation, **give data from the figures/graphs/tables** to back up what you say. Two people can look at the same figure and see different things so you have to tell the reader what YOU see. What do the data show? Give incontrovertible conclusions.

 - **Discussion** section in which a reasonable new hypothesis or model is formulated from the data.

Remember, the maximum page length is **two** pages single-spaced (or **four** pages, double-spaced), point size = 12. The key is to think clearly, write concisely and say exactly what you mean…no more, no less.

You may discuss the data (and interpretations of the data) among yourselves. You can also ask me questions, preferably in class where all can profit from the questions and answers, however, you must write your own paper!

**DO NOT TRY TO FIND THE DATA/ANSWERS ONLINE!!! The object of this assignment is to get YOU to practice analyzing data and using YOUR knowledge to interpret the data. The assignment is NOT to see whether you can summarize someone else’s published results….I already know that you can do this.**