

BIO. 372/572 Medical and Environmental Applications of Cell Biology and Genetics (3 cr)

LECTURER: Drs. Lisa Dorn and Bea Holton

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OFFICE HOURS:

LD: Posted on the announcements page of D2L

BH: TBA

LECTURE HOURS: 11:30am-12:30pm MWF in Halsey Science HS237.

*Both instructors are S.A.F.E. trained.

TEXT: Various texts on reserve in Halsey Resource Center

OBJECTIVES:

Do you ever wonder if 60 minutes is giving you an accurate description of the latest findings in Alzheimer's research, the genetics of obesity and other health concerns? What is all the hullabaloo over pollutants, climate change or endangered species? How can new molecular and cellular techniques inform these "tree-hugger" topics?

In this course, we will discuss the principles and techniques of cell biology and genetics that apply to a variety of medical issues as well as other societal topics. For example, the molecular basis of drug addiction, cancer, aging and long term memory might be discussed but also the application of molecular techniques to species conservation, evolution and environmental influences on humans and other species. This course is theme-based, meaning that we will cover 8 topics of current interest where you will first learn about general processes such as receptor/ligand interactions, signal transduction, cytoskeleton (and control of its distribution), gene regulation, epigenetics, cell cycle and protein translocation that apply to current topics (see above).

Throughout this course, we will read and discuss original papers from the scientific literature so that students will become familiar with the methods and the logic that scientists use to test their hypotheses but also the popular press so that students can view such reports with a critical eye.

By the end of this course, students should have

- 1) improved writing and presentation skills
- 2) acquired an advanced understanding of topics in cell biology, genetics and biotechniques
- 3) developed their ability to read original research papers
- 4) grasped the idea of how academic research allows understanding of medical issues, evolution, conservation and other current societal concerns

GRADE ELEMENTS:

1. **Attendance/Tardiness:** You will be working and presenting in groups and so it's not fair to the rest of the group if they exert significant effort on your project when you are not there. Likewise, if you are consistently late you cannot effectively contribute to discussions, understand presenters in order to evaluate them and will cause disruption/resentment in your group (we read and take seriously peer assessments). Therefore, we will treat late arrivals beyond 5 min's as absences. We will allow 2 missed class periods without punishment, *except* for days when your group is presenting, when you may not be absent, ever. You can miss 1 class period when another group is presenting. ***After that, for every class period you miss, your FINAL LETTER GRADE will be reduced by 1/2 a grade (e.g.***

A to A-, A- to a B+ etc.). Exceptions are possible of course, for example, if you have contracted a communicable disease please STAY HOME! PLEASE let us know as soon as you can when circumstances keep you home.

2. **Presentations/Discussions:** The class will be divided into groups of about 4 people. Each group will choose **two topics** to present to the rest of the class. You may choose a paper from the primary literature to present. Lists of papers can be found on d2l.
 - a. Holton and Dorn will provide background information relevant to each topic to help you understand the papers you will be presenting. These lectures will be given just prior to a new unit (i.e. group of two topics).
 - b. You will have 2 class periods devoted to preparation **but you are expected to work outside of class as well.**
 - c. We expect each person in the group to contribute equally to these presentations. That means that one person should NOT present the “hard” concepts and the other person the “easy” concepts.
 - d. We expect appropriate time devoted to experimental **techniques** as well as the **results and implications** of those results (i.e. why are these findings new, important and interesting).
3. **Quizzes:** Holton and Dorn will administer **6 challenging quizzes**, one per unit. The quizzes will be given the day after that topic’s presentations are finished.
4. **Papers:** You will write 2, one-page papers that describe and interpret a couple of figures from one of the 10 papers that we will discuss. Lisa and Bea will choose those figures and post them on D2L. There will be figures from several of the papers. **You will choose one set of figures, and they must not be from the paper that your group presented.**
5. **Peer grading and Assessment:** Members of a group will have the opportunity to grade one another (on a scale of 1 to 100). Similarly, you are expected to hand in comments on each group’s presentation on the day of their presentation. If you fail to hand in an assessment you will be marked as absent.
6. **Graduate Student Assignment:** A 5 page single-spaced paper reviewing, in more detail, one of the topics presented in class or a topic of the student’s choice. References must be included. The paper topic must be approved by Dorn and/or Holton *before Spring Break* and cannot be related to the student’s thesis.

OUTLINE OF TOPICS*

The textbook readings will depend on the topics currently receiving attention in the popular press but likely will include:

1. **Manipulating Genes: Genetic Engineering**
 - a. GMOs: Developing and Mitigating transgene escape
 - b. Gene Therapy
 - c. Zinc Finger Nucleases
2. **Molecular Evidence of Evolution**
 - a. Evolution of Predators
 - b. Evolution of Dogs
 - c. Evolution of Human specific traits
 - d. Evolution of miRNA

3. **Cancer Treatments and Causes**
 - a. Epigenetics
 - b. Cures
4. **Molecular Ecology**
 - a. Butterfly migrants
 - b. Butterflies and mimicry
 - c. Conservation of Migratory Salmon
 - d. Climate and Species Distributions
 - e. Transcriptomics and species interactions
 - f. Coral Reef Genomes & Environments
5. **Neural Science of Memory and Addiction**
 - a. Long term potentiation
 - b. Disease: FMRP and Cancer
 - c. Epigenetic control of Fear Memory
 - d.
6. **Aging**
 - a. Lysozomal Activity
 - b. Telomeres
 - c. Starvation diets
 - d. Reserwatrol
 - e. mtDNA
 - f. Exercise and aging
7. **Stem Cell Research**
 - a. Current methods
 - b. Adult vs. embryonic
 - c. Applications?

***This is an advanced class that covers current, interesting topics. If you have topics that YOU would like to see covered, please give them to us and we will try to work them in.**

UNDERGRADUATE REQUIREMENTS

GRADING:

Group participation (peer graded) 10%
 Quality of Presentation (Holton/Dorn grades) 40%
 Quizzes (6 Holton/Dorn grades) 20%
 Papers (2 Holton/Dorn grades) 30%

GRADING SCALE:.

A = 93-100%, A- = 90-92
 B+ = 87-89, B = 83-86, B- = 80-82,
 C+ = 77-79, C = 73-76, C- = 70-72,
 D+ = 67 - 69, D = 63-66, D- = 60-62
 F (Failure) < 60

GRADUATE REQUIREMENTS

OBJECTIVES:

In comparison to the undergraduates, the graduate students will be expected to demonstrate:

- A greater depth of knowledge. This will be assessed through presentations, quizzes and papers.

- Greater ability or effort to synthesize information. This will be assessed through presentations and papers.
- More sophisticated communication, both oral and written. This will be assessed through presentations and papers.
- Greater skills proficiency (e.g. mastery of power point, understanding and interpreting data presented to them, etc.). This will be assessed through presentations and papers.
- A leadership role (e.g. modeling intellectual curiosity, directing literature research). This will be assessed through discussion with group members, through their assessment of each other and by watching the dynamics of the group.

ADDITIONAL GRADUATE STUDENT ACTIVITY

A 5 page single-spaced paper is required that will review in more detail one of the topics they presented or a topic of their choice, including references. The paper topic must be approved by Dorn and/or Holton *before Spring Break* and cannot be related to their thesis topic.

GRADING:

Group participation (peer graded); **if poor participation, letter grade will be reduced by ½**; this is a stricter standard than that for undergraduates

Quality of Presentation (Holton/Dorn grades) 35%

Quizzes (6 Holton/Dorn grades) 20%

Papers (2 Holton/Dorn grades) 30%

Final Paper 15%

GRADING SCALE:

A = 94-100%, A- = 90-93

B+ = 88-89, B = 84-87, B- = 80-83,

C+ = 77-79, C = 74-76, F <73

NOTE: ANY GRADE BELOW A 'C' IS CONSIDERED FAILING

EXPECTATIONS FOR ORAL PRESENTATIONS:

1. On the day of the presentation each person must have their own powerpoint. Each slide must have a number and the name of the person presenting.
2. On the due date a single **power point presentation MUST be placed in the dropbox**. You can have separate files and combine them when you submit.
3. Each person should present equal amounts of material (i.e. time)
4. Each presentation should take **no more than 45 minutes** leaving 15 minutes for questions either during the presentation or after. **TIME YOUR INDIVIDUAL PRESENTATION!!!!**
5. Clarity, accuracy and precision of oral and slide text will be evaluated
6. Complexity of the topic will be considered. A lower score will be assigned to students consistently avoiding the difficult parts of the topic.
7. Pace of presentation (not too fast, not too slow). Judiciously pare down the information to fit the time slot.
8. Quality of the slides: the # of slides with only words or poor illustrations will reduce your score. Your score will *really* go down if your slide contains phrases that don't make a lot of sense (dwell on *teaching* your audience) or are incorrect!
9. Ability to answer questions (researching in between methods presentation and results presentation is a plus) (OK to say I don't know). You *must* know what you are talking about!! Don't try to fake it.

10. Evidence of understanding beyond the scope of the research paper
11. Following good practices of presenting figures (we will provide advice)

What we are looking for

WRITING ASSIGNMENTS: General Instructions

We will provide students with selected data from the literature that we have discussed in class. Students are to treat the data as though they were their own and as though they wanted to present them to others in their field. Consequently, you must first capture the interest of the reader by explaining the significance of the hypothesis tested in your paper; second, explain clearly the results so that the reader understands their meaning and draws the same conclusions as you and, finally, discuss how your results expand upon knowledge published to date. Each paper will have:

- **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. A rationale statement is often useful.

- **Results** section that explains the data. What do the data show? (To answer this question, you may also have to explain a bit about the techniques used and the rationale for doing specific experiments.) Why were certain controls done?

- **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 **two** typewritten, single-spaced page (font no less than 12). The key is to think clearly, write concisely and say exactly what you mean...no more, no less.

Students may discuss the data (and interpretations of the data) among themselves. However, they can ask us questions, preferably in class where all can profit from the questions and answers.

Lec #	Day	Date	Schedule of Events	Assignments Due Everybody	Assignments Due Presenters
1	M	3-Feb	Introduction to the Course: Organize the groups, assign papers, describe expectations for presentations.		
2	W	5-Feb	Explore topics, Questions for Dorn/Holton, Assign tasks to members of group		
3	F	7-Feb	Intro to unit1: Background material from <i>Dorn or Holton</i>		
4	M	10-Feb	Develop Outline of Presentations, Work on slides		
5	W	12-Feb	Preparation Day		
6	F	14-Feb	Article #1 Presentation and Discussion	Read Article#1	

7	M	17-Feb	Article #1 Presentation and Discussion		Submit Power Point
8	W	19-Feb	Article #2 Presentation and Discussion	Read Article#2	
9	F	21-Feb	Article #2 Presentation and Discussion		Submit Power Point
10	M	24-Feb	<i>Quiz and Miscellaneous Day</i>	Quiz on Unit1	
11	W	26-Feb	Intro to Unit2: Background material from Dorn or Holton		
12	F	28-Feb	<i>Preparation Day</i>		
13	M	3-Mar	Article #3 Presentation and Discussion	Read Article#3	
14	W	5-Mar	Article #3 Presentation and Discussion		Submit Power Point
15	F	7-Mar	Article #4 Presentation and Discussion	Read Article#4	
16	M	10-Mar	Article #4 Presentation and Discussion		Submit Power Point
17	W	12-Mar	<i>Quiz and Miscellaneous Day</i>	Quiz on Unit2	
18	F	14-Mar	Intro to unit3: Background material from Dorn or Holton		
19	M	17-Mar	Preparation Day	Assign Writing #1	
20	W	19-Mar	Article #5 Presentation and Discussion	Read Article#5	
21	F	21-Mar	Article #5 Presentation and Discussion		Submit Power Point
	M	24-Mar	SPRING BREAK		
	W	26-Mar	SPRING BREAK		
	F	28-Mar	SPRING BREAK		
22	M	31-Mar	<i>Quiz and Miscellaneous Day</i>	Quiz on Unit3	
23	W	2-Apr	Explore topics again, Questions for Dorn/Holton, Assign research tasks to members of group		
24	F	4-Apr	Intro to unit 4: Background material from Dorn or Holton		
25	M	7-Apr	Preparation Day	Writng Assignment #1	
26	W	9-Apr	Article #6 Presentation and Discussion	Read Article#6	

27	F	11-Apr	Article #6 Presentation and Discussion		Submit Power Point
29	M	14-Apr	Article #7 Presentation and Discussion	Read Article#7	
30	W	16-Apr	Article #7 Presentation and Discussion		Submit Power Point
31	F	18-Apr	<i>Quiz and Miscellaneous Day</i>	Quiz on Unit4	
32	M	21-Apr	Intro to unit 5: lecture material from text <i>Dorn or Holton</i>		
33	W	23-Apr	Preparation Day		
34	F	25-Apr	Article #8 Presentation and Discussion	Read Article#8	
35	M	28-Apr	Article #8 Presentation and Discussion		Submit Power Point
36	W	30-Apr	Article #9 Presentation and Discussion	Read Article#9	
37	F	2-May	Article #9 Presentation and Discussion	Assign Writing #2	Submit Power Point
38	M	5-May	<i>Quiz and Miscellaneous Day</i>	Quiz on Unit5	
39	W	7-May	Intro to unit 6: lecture material from text <i>Dorn or Holton if necessary</i>		
40	F	9-May	Preparation Day		
41	M	12-May	Article #10 Presentation and Discussion	Read Article#10	
42	W	14-May	Article #10 Presentation and Discussion		Submit Power Point
43	F	16-May	<i>Quiz and Miscellaneous Day</i>	Quiz on Unit6 "Writing Assignment #2	