

Piedmont Project Summer 2016

Co-module designer: Christina H. Lee, Oxford College of Emory University, Department of Mathematics and Computer Science

Introductory paragraph:

A personal teaching goal of mine is to help students develop their analytical mind so that they have the confidence to pursue the connections between mathematics and their intellectual curiosities and become knowledgeable global citizens. The Piedmont Project offered an opportunity to work with my colleague, Dr. Sarah Fankhauser in her Biology 120 course, An Introduction to Biological Concepts for Non-majors, to create a module that blends quantitative models on issues of sustainability, environmental awareness, and urgent societal challenges.

Our initial idea was to investigate the use of genetically-modified flood-resistant rice in South Asia and its environmental and social impacts. After the Piedmont Project, we realized the module would have a higher impact on student learning outcomes if we utilized the Oxford College's Organic Farm and explore the use of beets. By utilizing an organic farm across the street, we learned that our module would create a personal and tangible experience for the students. We also broadened our investigation to explore the cultural, social, economic, and environmental impacts of genetically modified beets.

In summary, the Piedmont Project help us to think about local resources, such as the organic farm, to use for our project as well as to think about the broader and global (ecological, economic, and social) implications of GMO crops and sustainability. The Piedmont Project also helped me to brainstorm sustainability project/word problem ideas to use in the mathematics courses that I teach. This experience has influenced me to attend The Mathematics of Planet Earth conference in September.

CONCEPTS IN BIOLOGY 120

Fall 2016

Instructor: Dr. Sarah Fankhauser
sarah.fankhauser@emory.edu
Office: Oxford Science Building, 308
Phone: 770-784-8398

Office hours: Office hours are Monday and Wednesday afternoons from 2-3pm or by appointment

Lecture Hours: T/Th 10:00-11:40pm OSB 115

Lab Hours: Th 1:40-4:40pm OSB 317



Course objectives:

The goal of this course is to introduce students to the concepts that inform our understanding of biology. We will be discussing some basic scientific concepts but more importantly we will be analyzing the methods that scientists have and still use to further our knowledge of these subjects. By the end of this class I hope that each student has a thorough understanding of the process of scientific inquiry: how scientific research is performed, evaluated and communicated. One way in which I assess your understanding of the scientific process is through writing and as such this course will have a good deal of writing.

Your role in this course:

This course requires independent investigation and analysis. You will be expected to come to class prepared to discuss the day's material with classmates. The best way to prepare is to read relevant chapters in the textbook and any additional articles from the professor.

Furthermore, this class requires A LOT of research, writing and analysis on your part. Keep up with due dates for assignments and do not wait till the last minute.

Text Book:

Day	Date	Topic	Assignment
Th	Aug 25	Introduction. How do you view science? Review group project	
Tue	Aug 30	Process of scientific inquiry, finding and evaluating information. Comparative scavenger hunt. As a class create a resource rubric	Book: 1.1-1.8 Bring in an article about Ebola
Th	Sep 1	<u>Cell biology</u> : What are the characteristics of life? Why are they important?	Book: 2
Tue	Sep 6	<u>Cell biology</u> : What makes up a cell? What are key components of prokaryotic and eukaryotic cells? Why are membranes important? (jigsaw and worksheet)	
Th	Sep 8	<u>Cell biology</u> : What are functions executed by cells and what cellular structures carry out these functions? Case study	Book: 3.2-3.4, 3.8, 18.3-18.7 Book: 3.3, 3.4, 3.6 3.7 Prepare for class debate on Tuesday
Tue	Sep 13	Class Debate: Should viruses be considered alive?	
Th	Sep 15	<u>Quiz 1</u> Group work on B2BT finding articles	Book: 3.8
Tue	Sep 20	Quiz 1 up to transport B2BT primary article analysis	Book: 3.7 DUE: Written analysis of whether you think a virus fits the definition of life. Print copy due in class
Th	Sep 22	<u>Energy cycling</u> : why do we need energy? Where do we get energy? Where do other organisms get energy? How do plant cells harvest and transform energy? Peer review of B2BT research summary	Book: 5.6-5.9, 6.10

Tue	Sep 27	<u>Energy cycling</u> : how do cells accomplish energy production? What happens if this production is disrupted? Case study	Book: 5.4, 5.5, 6.6-6.9
Th	Sep 29	<u>Central dogma</u> : Secret of Life	
Tue	Oct 4	<i>Exam 1</i>	
Th	Oct 6	<u>Central dogma</u> : What is our genetic material? What are important features of it? What makes up genes and how are genes important?	Book: 7, 8.2 Prior to class: read and do activity in parts 1 and 2 of assigned case study
Tue	Oct 11*	Fall Break	
Th	Oct 13	<u>Central dogma</u> : What is the process of DNA→ Protein? How can expression of different proteins be modulated and why is this modulation important?	Book: 8.1-8.10 DUE: questions about Secret of Life
Tue	Oct 18	<u>Cell Division and inheritance</u> : how do organisms grow? How are genes passed on to offspring?	Book: 9.1-9.5, 11.2-11.5, 11.7-11.9
Th	Oct 20	<u>Cell Division and inheritance</u> : Mendelian genetics: how can we predict inheritance patterns? Quiz 2	Book: 9.5-9.6, 10, 11.1, 11.6
Tue	Oct 25	<u>Mutations and Cancer</u> : All cancer is genetic but not all cancer is inherited: How can mutations be acquired? How do mutations lead to cancer? How can cancer be inherited? Case study	
Th	Oct 27	<u>Evolution and changes in genes</u> : how do beneficial genes become fixated in a population? How do populations evolve overtime?	
Tue	Nov 1	What is genetic modification? What are the impacts on farmers, people, ecosystems? Guest speakers: Dr. Keith Turner from Monsanto and Daniel Parson Oxford Organic Farm	Book: 8.1-8.6
Th	Nov 3	Exam 2	

Tue	Nov 8	<u>Microbiology</u> : what are important features of bacteria? Why are bacteria important to us? How can and do we use bacteria to our advantage?	
Th	Nov 10	<u>Microbiology and evolution</u> : How do bacteria become resistant to antibiotics? How do these resistance mechanisms spread in a population?	Book: 31
Tue	Nov 15	<u>Body systems</u> : Focus on the immune system. What are essential parts of the immune system? How do our actions affect immune development? How do vaccines affect our immune system? Case study	18.3, 18.6, 14.8
Th	Nov 17	<u>Science and society</u> : What is the controversy that surrounds vaccines today? What is the science behind this? How can we make our own conclusions based on the science?	Book: 14 <i>Read Wakefield et al. study and interpret results</i>
Tue	Nov 22	Work on B2BT	
Th	Nov 24	Thanksgiving	
Tue	Nov 29	Case study: what is the disease agent? How do clinicians, researchers, epidemiologists work together to identify a disease agent?	
Th	Dec 1	B2BT Presentations!	
Tue December 6: Last day and Final Exam Review			
FINAL EXAM: Tuesday, May 3rd 2pm			

Group project: Bench to breakfast table (B2BT)

"Bench-to-Breakfast Table" presentation

We learn most of what we know about scientific research on biology from the popular press. What happens to a scientific idea as it travels from the lab bench to your morning newspaper? How is scientific information "translated" by the press for the general public? Is press coverage of such research accurate, objective, and complete?

In assigned groups you will follow these steps to complete this assignment:

- A. Choose a **well-publicized** scientific news story about a topic of your choosing, but has some connection to this course, and try to find several different news articles about the story. If you are unsure if your choice is appropriate, discuss it with me. Here are some potential broad topics to help you in deciding: climate change, GMOs, diet fads, cancer, vaccination policies, antibiotic usage and resistance.

B. Find at least **2** primary research articles regarding the news story you have chosen. Sources for finding primary research articles:

- <http://www.ncbi.nlm.nih.gov/pubmed>

- <https://scholar.google.com/>

- <http://www.biomedcentral.com/>

C. The presentation should include the following:

- A summary of the research and results as described below:

The summary should answer the following questions:

- What is the big picture question that the authors have?
- What hypothesis was the author(s) trying to test?
- What methods were used to test the hypothesis?
- What results were obtained?
- How did the author(s) interpret these results?
- Critical consideration of the mass media reporting of the research described in the scientific source. What aspect of the research was emphasized? Was anything important omitted? Were the results accepted uncritically? Were conflicting opinions discussed? How did different popular articles differ from each other?
- The group's thoughts on the validity of the reporting and whether you think the news articles accurately and ethically communicate the scientific findings.

Structure: Professional powerpoint presentation that is 10 minutes long with 5 minutes for questions. Sources must be cited appropriately.

LAB SCHEDULE

Week #	Date	Topic	Assignments
1	Aug 30	Examination of Oxford campus diversity Part I	
2	Sept 6	Examination of Oxford campus diversity Part 2	Record sheet and Methods due

3	Sept 13	Microscopy and the cell: Prokaryote vs. eukaryote differentiation	Discussion Due
4	Sept 20	Transport across cell membrane	
5	Sept 27	UV sensitive yeast part 1 (proposal and literature search)	Results of transport lab due Proposal of yeast investigation due by 12pm day after lab
6	Oct 4th	UV sensitive yeast Part 2	
7	Oct 18th	UV sensitive yeast Part 3	Yeast Introduction Draft Due
8	Oct 25th	Inheritance and bioinformatics (computer lab)	Yeast lab results draft write-up due by 5pm Worksheet
9	Nov 1	GMO Part 1 Discussion of final research paper	Worksheet
10	Nov 8	PCR discussion and GMO Part 2 Case study with Dr. Lee	Final yeast research paper due by 5pm
11	Nov 15	GMO Part 3 *Collect data for Diversity of Oxford's campus part 3	PCR and results worksheets due
12	Nov 22 nd	Analyze Diversity of Oxford's campus change over time. Work on class presentation	
13	Nov 29th	Diversity of Oxford's campus group presentation	Presentation and critique

The instructor reserves the right to modify this syllabus or the lab syllabus as she deems it necessary.

Additional Course Information / Class Policies:

Honor Code: All examinations and work for credit in this course, including draft assignments, come under the regulations of the Honor Code. Your signature on your examination or paper attests to your upholding the Honor Code in your work. Honesty and ethical behavior are imperatives in any career. Therefore, academic dishonesty will not be tolerated. See http://oxford.emory.edu/audiences/current_students/Academic/academicsuccess/student-honor-

[code/](#) for descriptions of what constitutes academic dishonesty. Anyone caught violating this policy will be reported to the Honor Council, as detailed in the honor code. If you have any questions about what constitutes your own work, definitely ask!

Absences: The policy on absences is outlined in a separate handout. Unexcused absences or a failure to follow the procedures outlined in that handout will result in a reduction of your grade. Additionally, frequent tardiness is exceptionally rude and will result in a decreased grade. Missed exams: In general, missed exams may not be made up. However, if you know that you have a conflict ahead of time, please inform me at least a week before the scheduled exam time. Situations will be evaluated on a case by case basis.

Cell Phones: They must be turned off if brought into class or lab. Cell phones must be turned off and left at the front of class in your book-bag during exams.

Computers or tablets: These may only be used for scholarly research at designated times during class.

Evaluation

200 points 2 lecture exams

30 points quizzes

50 points research paper(two scaled)

~80 points laboratory worksheets

180 points final exam

70 points independent project

25 points diversity presentation

20 points debate write-up

100 points case studies (approximately 5 randomly chosen case studies will be graded)

730 points total (*approximate, instructor reserves the right to modify assignments)

Final grade determination: *Your final grade in the course is determined by the percentage of total points that you earn at the end of the course.*

(Plus and minus grades are given on the final grade)

A: 90 - 100%; B: 80 – 89%; C: 70 – 79%; D: 60 – 69%; F <60%