Foundations: Cellular Biology
BIO 141
Term 3 -2020

Class Meeting Times-M-F 9:00-11:00 am & 12:30-3:00 pm
Russell Science Center 219 & 221 (lab)

Instructors:

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Office Hours

I am usually in my office at 8:00 AM until about 6:00 PM and you are free to stop by my office at any time. I can also arrange to meet with you in the evenings and/or on weekends. If you are having problems with the material covered in class, please see me as soon as possible.

Course Description

In designing this course I thought about two questions. First, I considered courses I took as an undergraduate that really inspired my interest in science and second, I considered why I became a scientist. I quickly concluded that it was **NOT** the introductory biology courses that I took as an undergraduate. The introductory sequence seemed dry, memorization driven and void of any hands-on creative scientific experimentation. However, I do remember an upper-level course I took in animal physiology in which the professor designed the course around his research interest and allowed us to become involved in his research. The professor's research dealt with how krill (a small crustacean that is a source of food for whales) managed to live in the oxygen minimum layer in the ocean. Not only was this the class that inspired my interest in science, but it was also the course that led to my decision to become a scientist. This professor's enthusiasm for his research was relentless and infectious.

I have tried to designed a BIO 141 course that I hope will show you why I became a scientist and why I love what I do. I have removed some (not all) of the traditional content from the BIO 141 course I have taught in the past and instead, designed a course that will get you involved in the coral biological research I conduct in my lab. The content that I removed from BIO 141 will be covered in BIO 205 (Cell and Molecular Biology) so you do not have to worry about missing any important content. Notice I said that I removed "some" of the traditional content. In order to really understand the research I conduct, there is some content (especially related to DNA) that we must cover. My goal is to show you why science is exciting early in your college career. At the end of the course when you complete evaluations, you can let me know whether I have achieved my goal.

Lab

The lab component of the course is designed around a few research questions in coral biology that my lab and other labs around the world are actively investigating. However, in order for you to participate in the research project, you must first become familiar with some basic molecular techniques that DNA researchers routinely use in their labs.

Human DNA Fingerprint Lab

Genetic uniqueness is a fact of life. From generation to generation, characteristics are inherited, combined, and assorted among individuals through a common denominator, the chemical deoxyribonucleic acid or DNA. Differences in DNA sequence between individuals are detected by using a technique called DNA fingerprinting. This technique has wide-ranging applications. I have two labs designed to illustrate some of the uses of DNA fingerprinting. The first lab is a crime scene involving a chewed shoe and four dogs. In the second lab, you will explore your ability to taste phenylthiocarbamide (PTC) by examining your own DNA fingerprint.

Coral Reef Biology

I work with a group of corals called fire coral (*Millepora*). You will be working with coral DNA samples that students have collected from our research trips to Belize and The Bahamas You will be characterizing these coral samples by amplifying and sequencing their ribosomal DNA (rDNA) and determining what specific symbionts live within these coral samples (also determined by examining DNA). The experiments will be explained in class. Explanations and protocols of the experiments can be found in your lab manual.

Course Goals

- Students will develop skills in critical reading of original scientific literature.
- Students will learn to participate actively in their own education by developing and conducting a research project designed around coral reef biology.
- Students will design experiments and generate and interpret their own data.
- Students will understand the relationship between their experiments and concepts covered in class.
- Students will understand the role of subcellular biology in defining biological processes.
- Students will come to understand how their level of understanding of a biological process increases by using a historical approach to science.
- Students will appreciate that recent advances in biology are due to our ever increasing depth of understanding of basic biological processes.
- Students will understand the language of subcellular biology and effectively communicate principles in both written and oral forms.
- Students will solve a variety of problems using creative thinking skills and analytical skills in the lab.

This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, communication, and vocation.

Textbook

There is no required textbook for this class. The **recommended** chapter reading assignments are from Freeman's Biological Science editions 2nd-7th published by Pearson. I have left my copies of the textbook in the classroom for your use. If you are interested in looking at other introductory biology textbooks, please ask me. I have numerous introductory textbooks in my office that I can loan to students. **Please be sure to return my textbooks at the end of the term**.

Daily Slides for Class

Slides used in lecture and lab are posted in Moodle (BIO 141). **Either bring your computer or a copy of the slides to class each day**.

Major Assignments/Exams: Descriptions & Deadlines

Self Quizzes

There are **two** self-quizzes that cover reading assignments that will help you select a topic for your research proposal. Due dates for the self-quizzes are indicated in the syllabus. You need to read the papers and ask and answer **five different questions** based on your understanding of the assigned paper. These self-quizzes are worth **20 points each** for a total of **40 points**. For each question and answer, you can earn 2 points for the question and 2 points for the answer. Points earned for the questions will be awarded based on the quality and complexity of the question. Straight memorization questions like "What is bleaching" will not earn any credit. However, the question "What are the processes involved in coral bleaching?" will earn credit. Answers will be awarded credit based on the quality and correctness of your answer. The self-quizzes must be submitted (typed) at 9:00 am on the due date.

Homework

There are **six** homework assignments that must be completed (typed) and submitted **before the start of morning class** on the date indicated in the syllabus. The homework assignments assess your understanding of the material we are covering in class and assess your ability to interpret results and draw conclusions from our experiments.

Exams:

Exams last approximately 2 hours and are a set of short answer questions requiring a paragraph or two of writing to answer. Exams will cover material in both the lecture and lab. If you understand the material and convey that understanding in a clear and concise manner, you will score well on the exams. You will be asked to synthesize and apply biological concepts to new problems. Copies of old exams are found on my Web page (http://people.cornellcollege.edu/ctepper/141.html) or Moodle.

Research Proposal-Oral Presentation:

A complete description of the requirements for the research proposal and oral presentation can be found on my Web page (http://people.cornellcollege.edu/ctepper/141.html) or Moodle.

Written Research Proposal

A complete description of the requirements for the written research proposal can be found on my Web page (http://people.cornellcollege.edu/ctepper/141.html) or Moodle.

Course Grading

Self-Quiz #1	W	10/23	20 pts
Self-Quiz #2	F	10/25	20 pts
Homework #1	M	10/28	25 pts.
Exam 1 (lectures & labs)	Th	10/31	100 pts.
Pre-proposal Group Presentations	M	11/4	50 pts.
Homework #2	T	11/5	20 pts
Homework #3	W	11/6	25 pts
Homework #4	Th	11/7	25 pts
Homework #5	F	11/8	25 pts
Homework #6	T	11/11	15 pts.
Group Research Proposal Paper	T	11/12	50 pts.
Exam 2 (lectures & labs)	W	11/13	100 pts
TOTAL			**475 pts.**

90-100%	A
85-89%	A-
80-84%	B+
75-79%	B
70-74%	B-
65-69%	C+
60-64%	C
55-59%	C-
<55	< C-

Course-Specific Support

Review Sessions:
Informal review sessions are scheduled the evening before each exam. These review sessions are for you to ask questions concerning the material covered in class. In order to take advantage of these sessions, come prepared with questions.

Course Policies and Information for Students

Attendance:
Students are expected to attend all lectures and labs. If you have a legitimate reason for missing class or a deadline, send me an e-mail **before class begins**. For each unexcused absence (no notification before morning or afternoon class begins), 10 points will be deducted from your final grade.

Drop Policy:
You may drop the course at any time in the first three days**.** <u>In order to drop the class on the fifteenth day you must have attended all classes, completed all assignments, and based on my analysis of your work, put the appropriate effort into learning the material</u>.

DISABILITIES AND ACCOMODATIONS POLICY: Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Office of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml.

ACADEMIC HONESTY POLICY: Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgment of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Catalogue, under the heading "Academic Honesty."

BIO 141 - Schedule of Topics, Readings, and Assignments

Date	Time	Topics & Assignment Due Dates	Readings
10/21 M	AM	Introduction to the Course. Why become a Scientist?	Reading #1 - Status & Trends Caribbean Coral Reefs
	PM	Coral Reefs	
10/22 T	AM	DNA & DNA Replication	Ch 4
	PM	DNA Replication Introduction Dog Crime Lab	Ch 15 Lab Manual pp7-9
10/23 W	AM	**Self-Quiz #1 DUE-Status & Trends Caribbean Coral Reefs** The Case of the Chewed Shoes (lab-pour gels) DNA Replication Introduction-Human DNA Fingerprint Lab	Reading #2 Shifting Baselines Lab Manual p8 Ch 15 Lab Manual pp10-14
	PM	The Case of the Chewed Shoes(lab-load gels) Introduction-Human DNA Fingerprint Lab	Lab Manual pp 8 & 9 Lab Manual pp10-14
10/24 Th	AM	Protein Structure Human DNA Fingerprint (lab-isolate DNA)	Ch 3 Lab Manual pp14-15
	PM	Enzymes Human DNA Fingerprint (lab-PCR)	Ch 8.3 Lab Manual pp15-16
10/25 F	AM	**Self-Quiz #2 DUE-Shifting Baselines…** Enzymes Cell Structure & Function Human DNA Fingerprint (lab-enzyme digestion)	 Ch 7 Lab Manual p 16
	PM	Cell Structure & Function	Ch 7
10/28 M	AM	**Homework Assignment #1 Due-8:45 am** **Practice Exam Question-8:45 am** Introduction to Fire Coral Human DNA Fingerprint (lab-agarose gels)	Lab Manual p18 Tepper et al. 2012 Lab Manual pp 16-17
	PM	Human DNA Fingerprint (lab-run & view agarose gels) Introduction to Fire Coral Cell Structure & Function	Lab Manual p 17 Ch 7
10/29 T	AM	**Practice Exam Question-8:45 am** Cell Structure & Function Fire Coral-PCR amplification I (lab)	 Lab Manual p19
	PM	Transcription	Ch 16 & 17

10/30 W	AM	**Practice Exam Question-8:45 am** Transcription & Translation Fire Coral –agarose gels (lab)	 Ch 16 & 17 Lab Manual p19
	PM	Fire Coral-Agarose Gels (lab) Translation	Lab Manual pp 19-20 Ch 17
10/31 Th	AM	**Exam 1**	
	PM	Fire Coral-PCR Amplification II (lab)	Lab Manual p19
11/1 F	AM	Cnidarians & Protists Fire Coral –Agarose Gels (lab)	Cnidarian e-handout Lab Manual p19
	PM	Fire Coral –Agarose Gels (lab) Cnidarians & Protists	Lab Manual p19
11/4 M	AM	Fire Coral Sequence Data Explanation **Student Pre-Proposal Presentations**	Tepper et al. 2012
	PM	**Student Pre-Proposal Presentations**	
11/5 T	AM	**Homework Assignment #2 Due-9:00 am** DNA Sequencing Explanation	Lab Manual p21 Lab Manual pp22-24
	PM	PCR Sequencing-Fire Coral DNA (lab)	
11/6 W	AM	**Homework Assignment #3 Due-8:45 am** **Practice Exam Question-8:45 am** Fire Coral & *Symbiodinium* qPCR Explanation	Lab Manual p25 Samayoa et al. 2017 Valasek & Repa 2005
	PM	Load & Run Sequencing Gel (lab) qPCR Explanation	Lab Manual pp22-24
11/7 Th	AM	**Practice Exam Question-8:45 am** Making Sense of Sequencing Data (worksheet & data)	
	PM	Making Sense of Sequencing Data (worksheet & data) Symbiosis & Bleaching	
11/8 F	AM	**Homework Assignment #4 Due-8:45 am** **Practice Exam Question-8:45 am** qPCR-Fire Coral/*Symbiodinium* (lab) Symbiosis & Bleaching	Lab Manual p31
	PM	Making Sense of qPCR data	
11/11 M		**Homework Assignment #5 Due** Group Meetings-Proposal & qPCR data	Lab Manual p32
11/12 T		Group Meetings-Proposal & qPCR data **Homework Assignment #6 Due** **Written Research Proposal Due**	 Lab Manual p36
11/13 W		**Exam 2**	