BIEB 152 W23

***** New flipped class format, lectures provided via videos and class is used for discussion *****

Course title: Evolution of Infectious Diseases

Lectures provided via video, discussion delivered in person Galbraith Hall 242**, Tuesday & Thursday 8 am - 9:20 am**

Professor

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**Please add 'BIEB 152' to the subject line of e-mails*

Graduate Student Teaching Assistant (TAs)

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Short Course Description

Doctors who treat infectious diseases are faced with a uniquely difficult problem since the pathogens they treat often evolve, rendering today's therapies useless tomorrow. The need to consider evolution has often been overlooked when developing treatments, however, with the spread of antibiotic resistance it is now of great concern. Future medical treatments will have to include comprehensive strategies that go beyond treating disease, but also counteract the evolutionary potential of pathogens. To this end, the Evolution of Infectious Disease Course will provide a thorough review of concepts and methods in evolutionary biology, with a focus on subjects that can be used to manage disease. This course will offer a thorough review of infectious disease evolution, practice with using the newest analytical techniques to track pathogen evolution, and discussions on the latest reports of disease evolution: from breakthroughs in slowing antibiotic resistance, to the emergence of new strains of zoonotic viruses like SARS-CoV-2.

Course Goals

- Build a fundamental understanding of concepts and methods in evolutionary biology
- Provide background on disease evolution research and future directions in the field
- Develop analytical skills to evaluate DNA sequences and other data to study the evolution of infectious diseases

Grading

36 Percent: Weekly homework assignments (7 total, grade is based on highest 6)
24 Percent: Midterm
40 Percent: Final exam
*No extra credit

Lectures
Videos of each lecture will be provided every Thursday for the following week's content. Students are expected to watch them before class. In class we will discuss the lecture material, review several problems, discuss news on the pandemic and other infectious diseases, and the professor will answer any questions students have on the material. The in-class sessions will be recorded and uploaded to Canvas; however, students are encouraged to attend these sessions to ask questions and to participate.

Lectures for this course are critical because there is no textbook. The topics we discuss, like Covid-19, are too new to be covered in textbooks. Because of this, it is critical that students listen (and re-listen) to the lectures.

The **Canvas website** will be used to distribute information and files, collect homework, take exams, and to communicate.

Weekly homework assignments
Weekly homework assignments will be posted on the Canvas website on Thursdays after class, and they will be due the following Tuesday before class. **Students that enroll late are responsible for all assignments.** Homework will be submitted through Canvas. Each student should make sure that they receive electronic confirmation that the file was uploaded properly. **If no confirmation is received within 10 minutes, or if any problems are encountered during submission, then the document should be e-mailed to your grader immediately (Table of grader assignments follow)**. There will be 7 homework assignments in total. **Late assignments are not accepted**. If you have questions about homework grading, please email your assigned grader first and then the professor.

Student last name range	Grader name	Grader email
A-Di	Munguia Figueroa, Michelle	mmunguiafigueroa@ucsd.edu
Do-Ji	Al Khadoka, Mirna	malkhadoka@ucsd.edu
Jo-Nad	Duffy, Henrik Mattsson	hduffy@ucsd.edu
Nam-Sea	Hsu, Jonathan	johsu@ucsd.edu
Sed-Z	Tiwari, Arukshita	a2tiwari@ucsd.edu

Students must show their work in completing problems. Students will receive 75% credit for attempting each homework problem, the remaining credit will be awarded if the answer is correct. Students will not receive partial credit for wrong answers; the initial 75% is the reward for attempting the problem.

We will drop one of seven homework assignments. We do not drop any additional homework assignments unless a student provides a medical excuse that spans more than a single week in which homework was due. These excuses should be submitted to the professor.

You may work together in small groups (4 or less), but never share answers with students who have not aided in solving the problems with you. Also never share answers online.

Exams (midterm and final)
The midterm will cover material from the first 5.5 weeks of the course. The final is cumulative. There are no makeup midterms. If a student misses the midterm, then their final exam will be worth 64% of

their final grade. The final exam is cumulative. Both exams will be **in person**. Students will be allowed to bring in one sheet of notes to the exams. This must be hand written.

Academic integrity
Note, we routinely check Chegg and other sites for course material, please do not share the course material.
http://academicintegrity.ucsd.edu/excel-integrity/define-cheating/index.html

Section (2-2:50 Tuesdays)
There's just one mega section run online by TA Michelle Munguia Figueroa. This will be hosted via Zoom (https://ucsd.zoom.us/j/92219220899). Michelle will review homework turned in that morning. The Zoom sessions will be recorded and shared on Canvas. The first section will be held on the first day homework is due, October 10th.

Office hours
Office hours upon request. Each lecture is an open-ended discussion where you can ask questions, so one-on-one meetings should not be necessary except for sensitive subjects.

Sept 28: Introduction to the course and the problem of evolving diseases

Oct 3: Introduction to the creation of genetic variation: mutation, genetic recombination, and horizontal gene transfer
Oct 5: Introduction to neutral genetic drift
*HW 1 assigned, due on Tuesday (Oct. 10th by 8am)

Oct 10: Natural selection on mutations
Oct 12: Natural selection on phenotypes
*HW 2 assigned, due on Tuesday (Oct. 17th by 8am)

Oct 17: Evolution of antibiotic resistance
Oct 19: Strategies to combat antibiotic resistance
*HW 3 assigned, due on Tuesday (Oct. 24th by 8am)

Oct 24: Genome sequencing and pathogen spread
Oct 26: Phylogenetics: elucidation of evolutionary relationships
*HW 4 assigned, due on Tuesday (Oct. 31st by 8am)

Oct 31: Molecular clocks
Nov 2: Detecting natural selection in sequences (dN/dS ratio)
*HW 5 assigned, due on Tuesday (Nov. 7th by 8am)

Nov 7: Rapid pathogen evolution during infections
Nov 9: Predicting epidemic dynamics and the evolution of virulence
*HW 6 assigned, due on Tuesday (Nov. 14th by 8am)

Nov 14: Midterm review (no video, this is just in-class, bring your questions)
Nov 16: **Midterm** in class

Nov 21: HIV Evolution
Nov 23: **Thanksgiving** (no class and no homework)

Nov 28: Host shifts
Nov 30: Influenza evolution
*HW 7 assigned, due on Tuesday (Dec. 5th by 8am)

Dec 5: SARS-CoV-2 evolution
Dec 7: Full course review (video and in-class discussion, bring questions)

Final Exam, 12/12/2023

Course structure:
Students will have four opportunities to learn the course material before exams: video lectures, in-class discussion, answering homework problems, and then through homework discussion during online sections. The following diagram describes the course flow:

Videos will be released on Thursdays on the following week's content. Students should watch the videos before class. Tuesday and Thursdays will be used to discuss the new material and to go over problems. Homework problems are released on Thursday, which are due the following Tuesday. Each section is dedicated to going over the homework that was just turned in.

Readings
Scientists' understanding of the evolution of infectious diseases is rapidly improving with the advent of new genome sequencing technologies. Therefore, there is not an up-to-date textbook that we can use for this course. Periodically we will provide materials online to complement lectures. Note that readings posted are meant to enhance students' education but are not essential to complete homework or to answer exam questions.

Studying for exams
Start by knowing how to solve the problems provided in lecture and for homework and then memorize the video and in-class lecture materials.

Curving?
In the past, we have not curved the final scores or the test scores. This year's format is different than previous years and if the change negatively impacts scores, then we will curve the course. Along these lines, we **do not round up** when computing the final letter grade. The grading scale we intend to use is:

A	92.5-100%
A-	90-92.5%
B+	87.5-90%
B	82.5-87.5%
B-	80-82.5%
C+	77.5-80%
C	72.5-77.5%

C-	70-72.5%
D	60-70%
F	<60%

Letter of reference policy

I am more than happy to write letters for the students in the top 5%. At the end of the term, I will email the students who qualify with an invitation and instructions. Please do not request a letter if you do not receive this message. I am sorry about this strict cutoff, but I have served on admission committees and it's important that students receive strong letters. Many applications require letter writers to rank students, and so it's important that students request letters from professors, superiors, and mentors, that can rank them in the top 5%.