***** Attendance in person is encouraged *****

Course title: Evolution of Infectious Diseases

Lecture delivered in person CENTR 101**, Tuesday & Thursday 2 pm - 3:20 pm**

Lecture recordings available in the Canvas Media Gallery

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

Instructional Assistants (IAs)

Emily Armbruster	earmbrus@ucsd.edu
Deborah Chen	dsc001@ucsd.edu
Chase Morgan	c1morgan@ucsd.edu
Elizabeth Stuart	estuart@ucsd.edu

one more IA forthcoming

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
35 Percent: Weekly homework assignments (8 total, grade is based on highest 7)
25 Percent: Midterm
40 Percent: Final exam

Extra credit earned by attending sections (0.5% percentage boost on your final grade, if you attend all 9, you will receive a 4.5% boost, e.g., attendance can boost some Bs to A-).

Lectures
Lectures will be in-person and podcasts will be available on Canvas in the media gallery.

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 Friday nights, and they will be due the following Thursday by midnight. **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 their IA immediately**. There will be 8 homework assignments in total. Instructional Assistants will guide students through sample problems in section that will help students answer homework problems. **Late assignments are not accepted**.

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 eight homework assignments. We do not drop any additional homework assignments unless a student provides a medical excuse that spans more than a single week. 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 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 65% of their final grade. The final exam is cumulative. Both exams will be administered in person.

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

Sections
Sections are used to help prepare students for their upcoming homework. In section, your IA will go over a problem set that is highly similar to the next homework. If a student must miss section, they can

find the problems and the answers on Canvas. Students may attend other sections unless we encounter a problem with certain sections having too many students. Attendance is not mandatory, but role will be recorded by the IAs and students will be awarded with a 0.5% boost to their final class percentage for each section attended. There will be 9 sections (no section on the first week) and so students can receive a 4.5% boost for just showing up.

Section	Day	Time	Location	IA	IA e-mail
A01	M	11:00 AM - 11:50 AM	WLH 2209	Deborah Chen	dsc001@ucsd.edu
A02	T	8:00 PM - 8:50 PM	HSS 1305	Emily Armbruster	earmbrus@ucsd.edu
A03	W	8:00 AM - 8:50 AM	HSS 2150	TBD	
A04	W	8:00 PM - 8:50 PM	HSS 1305	Emily Armbruster	earmbrus@ucsd.edu
A05	Th	8:00 PM - 8:50 PM	CENTR 203	Chase Morgan	c1morgan@ucsd.edu
A06	Th	9:00 PM - 9:50 PM	CENTR 203	Chase Morgan	c1morgan@ucsd.edu
A07	F	7:00 PM - 7:50 PM	CENTR 203	Elizabeth Stuart	estuart@ucsd.edu
A08	F	8:00 PM - 8:50 PM	CENTR 203	Elizabeth Stuart	estuart@ucsd.edu

These assignments are tentative

Office hours
Instructors will help students with any content; however, they will not help with answering homework questions that have not been submitted yet.

Teacher	E-mail	Day	Time	Location
Emily Armbruster	earmbrus@ucsd.edu			
Deborah Chen	dsc001@ucsd.edu			
Justin Meyer	jrmeyer@ucsd.edu			
Chase Morgan	c1morgan@ucsd.edu			
Elizabeth Stuart	estuart@ucsd.edu			

Still being worked out

INTRODUCTION
Jan 10: Introduction to the course and the problem of evolving diseases
Jan 12: Brief introduction to the biology of pathogens: viruses, bacteria, and eukaryotes

STOCHASTIC PROCESSES
Jan 17: Introduction to the creation of genetic variation: mutation, genetic recombination, and horizontal gene transfer
Jan 19: Introduction to neutral genetic drift

NATURAL SELECTION
Jan 24: Introduction to natural selection
Jan 26: Adaptation of SARS-CoV-2 and other pathogens

ANTIBIOTIC RESISTANCE
Jan 31: Evolution of antibiotic resistance
Feb 2: Strategies to combat antibiotic resistance

TRACKING PATHOGEN SPREAD USING PARSIMONY AND PHYLOGENETICS
Feb 7: Genome sequencing and pathogen spread
Feb 9: Phylogenetics: Elucidation of evolutionary relationships

ELICIDATING PROCESS FROM PATTERN
Feb 14: Molecular clocks
Feb 16: Detecting natural selection in sequences (dN/dS ratio)

WITHIN PATIENT AND EPIDEMIC EVOLUTION
Feb 21: Rapid pathogen evolution during infections
Feb 23: **Midterm** (in class)

HUMAN ADAPTATION TO DISEASES AND THE CASE OF FLU
Feb 28: Human genetic variation and coevolution with pathogens
Feb 30: Influenza evolution

VIRULENCE EVOLUTION AND THE CASE OF HIV
March 4: Predicting evolution of virulence
March 6: HIV evolution

HOST SHIFTS
March 11: Host shifts
March 13: Full Course review

Final Exam, Thursday 3/23/23, 3 pm – 6 pm

Course structure:
Students will have three opportunities to learn the course material before exams: lecture, then section, and then through answering homework problems. Each week we will introduce new material, then the following week students will answer questions in section related to the previous week's lectures. Homework will then be assigned to be turned in the following week. This means that each course module will be stretched across 3 weeks and that modules will overlap.

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
All exam material will be taken from the section/homework problems and lectures.

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 so that the average is a B or higher. 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%.