

Course title: Evolution of Infectious Diseases

Lecture delivered live via Zoom **Tuesday & Thursday 8 - 9:20 am**

<https://ucsd.zoom.us/j/94144948396>

Meeting ID: 941 4494 8396

Lecture recordings available through Canvas on **Tuesday & Thursday at ~10 am**

Professor

Justin Meyer

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Instructional Assistants (IAs)

| IA | E-mail |
|-------------------------|--|
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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

40 Percent: Weekly homework assignments (9 total, grade is based on highest 7)

40 Percent: Weekly exams (8 total, grade is based on highest 6)

20 Percent: Final exam

Lectures

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. Lectures will be delivered live via Zoom (941 4494 8396) and recordings of them will be archived in the 'Media' tab on Canvas.

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

The **Zoom** app will be used for sections and office hours. It can be found at <https://zoom.us/>, students should use their UCSD e-mail addresses to sign up.

Students who need laptops can receive one here: <https://eforms.ucsd.edu/view.php?id=490887>

Weekly homework assignments

Weekly homework assignments will be posted on the Canvas website on Friday nights and they will be due the following Tuesday by midnight. **Students that enroll late are responsible for all assignments.** Homework will be submitted through Canvas. Each student should make sure they receive electronic confirmation that the file was uploaded properly. **If no confirmation is received within 10 minutes, or if any problem is encountered during submission, then the document should be e-mailed to their IA immediately.** The first assignment will be due **4/13/21**, and then weekly thereafter. Instructional Assistants will guide students through sample problems in section that will help students answer homework problems. **Late assignments are not accepted.**

Students will receive 70% credit for completing 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 70% is the reward for attempting the problem.

We will drop the two homework assignments with the lowest scores.

Weekly exams

Students must complete weekly online exams. Exams will begin in the third week and continue through the duration of the course. Exams will be available every Thursday from 12 am to 11:59 pm Pacific Time. The total time allotted to complete the exam is 1 hour, although most exams will take much less time to complete. We will drop the two weekly exams with the lowest scores. The first exam is scheduled on **4/15/21**.

Final exam

The final will be similar to the weekly exams, except 1) it will be worth double the points, 2) the material will be taken from the entire course, 3) students will be allotted more time to complete it, 4) all students must take the final, 5) there will be a 48-hour window to take it (Wed. 12 am – Thursday

11:59 pm Pacific Time). The majority of the material tested in the final will be covered in the final review lecture.

Academic integrity

Note, we routinely check Chegg and other sites for 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 has to miss section, they can find the problems and the answers on Canvas.

| Section ID | Time | IA | Zoom ID | Password |
|------------|---------------------|------------------|---------------|----------|
| A01 | 8:00 AM - 8:50 AM | Sahana Kuthyar | 970 8404 8486 | na |
| A02 | 9:00 AM - 9:50 AM | Sahana Kuthyar | 970 8404 8486 | na |
| A03 | 10:00 AM - 10:50 AM | Dalia Saklaway | 955 8822 7233 | na |
| A04 | 11:00 AM - 11:50 AM | Alex Weitzel | 979 9837 1906 | 342048 |
| A05 | 12:00 PM - 12:50 PM | Lauren Quezada | 919 7108 6095 | na |
| A06 | 1:00 PM - 1:50 PM | Lauren Quezada | 919 7108 6095 | na |
| A07 | 2:00 PM - 2:50 PM | Elijah Horwitz | 971 3981 5580 | na |
| A08 | 3:00 PM - 3:50 PM | Steven Luu | 714 591 8930 | na |
| A09 | 4:00 PM - 4:50 PM | Alyssa Kobayashi | 949 2608 5772 | na |
| A10 | 5:00 PM - 5:50 PM | Yichi Zhang | 342 332 1776 | na |
| A11 | 6:00 PM - 6:50 PM | Brianna Pecknold | 957 9477 8678 | na |
| A12 | 10:00 AM - 10:50 AM | Alex Weitzel | 979 9837 1906 | 342048 |
| A13 | 3:00 PM - 3:50 PM | Victoria Ly | 997 8033 3187 | na |

Office hours

Instructors will help students with any content; however, the timing of the section is ideal to discuss the homework submitted the day before.

| Time | IA | Zoom ID | Password |
|-------|------------------|---------------|----------|
| 10-11 | Alex Weitzel | 979 9837 1906 | 342048 |
| 11-12 | Brianna Pecknold | 987 1539 2527 | na |
| 12-1 | Sahana Kuthyar | 961 6894 5511 | na |
| 1-2 | Steven Luu | 714 591 8930 | na |
| 2-3 | Victoria Ly | 964 2984 1833 | na |
| 3-4 | Justin Meyer | 954 6143 0890 | na |
| 4-5 | Elijah Horwitz | 923 9290 1906 | na |
| 5-6 | Alyssa Kobayashi | 949 2608 5772 | na |
| 6-7 | Dalia Saklaway | 794 273 1165 | na |
| 7-8 | Lauren Quezada | 919 7108 6095 | na |
| 8-9 | Yichi Zhang | 342 332 1776 | na |

Schedule broken into 10 modules:

Introduction to the course and ongoing pandemic

March 30: Introduction to the course and the problem of evolving diseases

April 1: The biology of coronaviruses

Fundamentals of evolution (random processes)

April 6: Introduction to the creation of genetic variation: mutation, genetic recombination, and horizontal gene transfer

April 8: Introduction to neutral genetic drift

Fundamentals of evolution (natural selection)

April 13: Introduction to natural selection (broad concepts)

April 15: Introduction to natural selection (population genetics)

Antibiotic resistance

April 20: Evolution of antibiotic resistance

April 22: Strategies to combat antibiotic resistance

Phylogenetics

April 27: Genome sequencing and the elucidation of evolutionary relationships

April 29: Flu evolution

Elucidating past evolution by sequencing today's genomes

May 4: Molecular clocks and detecting patterns of natural selection in genomes

May 6: HIV evolution

Tracking pathogen evolution and spread using genomics

May 11: Rapid pathogen evolution during the course of infections

May 13: Pathogen spread in hospitals

Evolution of infectivity and virulence

May 18: Predicting epidemic spread and viral evolution: SIR models

May 20: SARS-CoV-2 evolution

Origins of 'new' diseases

May 25: Host shifts

May 27: Debate over natural or lab origins of SARS-CoV-2

Human coevolution and course conclusion

June 1: Human coevolution with viruses

June 3: Full course review

The following table provides a quick guide to how the course is structured. Students learn new material in lectures on Tuesday and Thursday, they review the material in section on Friday, complete a

homework assignment that is due on the following Tuesday, and then they are given a chance to ask instructors about the material during Wednesday office hours before taking an online exam on Thursday. Each module runs for two weeks, which means that modules overlap. As students turn in homework on Tuesday and take a quiz on Thursday, new lectures for the next module will be posted on those same days.

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|--------|--------|--------|-----------------------|--|---------------------------------|-------------------------------------|-------------------|
| Week A | | | Lecture: New material | | Lecture: New material | Section: Review of lecture material | Homework assigned |
| Week B | | | Homework due | Office hours: Last chance to learn Weak A material | 24-hours to take an online exam | | |

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 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 submit letters of recommendation for students in the top 10% of the course. I chose this cut off because many universities request that I rank the student and a ranking lower than top 10% can hurt applications. Students requesting letters also have to agree that I can share their letter grade, course score, and percentile. I receive many requests each year, so I am unable to customize the content of the letter beyond adding a few bullet points woven into the text. The letter I send emphasizes why BIEB152 students who earn a high score will excel in any future endeavor.