Syllabus_2025

Microbiology and Infectious Disease Academy

Course Description

Microbiology and Infectious Disease Academy will give students an opportunity to understand the basic cell and molecular biology, microbiology, immunology, genetics, epidemiology and public health initiatives surrounding the study of infectious disease. Malaria, HIV/AIDS, COVID19, influenza, smallpox as well as other endemic and pandemic species, both old and new will be discussed. The central dogma of molecular biology, the basics of the structure of the cell, the life cycle of pathogens, and the mammalian immune system will be covered in enough depth to give students the tools to comprehend the different strategies for preventing, testing, treating and educating the public on infectious disease. Students will work on case studies on several pathogens important in global health using concepts learned in daily lectures. Students will listen to or participate in interviews with a variety of experts whose work intersects with infectious disease, public health or pandemic response each day of the course. Students will visit biomedical research labs and perform microbiology experiments themselves to get hands-on experience in the field. Students will be asked to lead a discussion and prepare a final public service announcement for their peers, friends and family to educate them on 'what they need to know' about responding to the next pandemic.

Classroom Information and Schedule:

MWF at 830am – report to **Levin 111**. We will start in this classroom, then move to several Levin labs downstairs until lunchtime.

MWF after lunch – report to **Fagin 116**

TR – report to **Fagin 116** at 830am and after lunch

General Daily Schedule:

MWF:

830am: Prep for journal club or PSA
930am: Micro Lab
Noon: lunch
130pm: lecture and activities

TR:

830am: Lecture
10am: activities
Noon: lunch
130pm: guest speakers, activities, and more

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Academy Director:

Ruth Elliott is a Senior Lecturer in Biology at the University of Pennsylvania and teaches biochemistry and biology to students in both Penn's pre-health post-bac program and the fully online BAAS program. Before teaching full-time starting in 2020, she did biomedical research in a lab as a research technician in the Perelman School of Medicine. At the time she worked on a family of viruses no one cared about (yet), the coronaviruses. After years of tutoring as a side gig, she decided to make teaching her full-time gig, though she still misses hands-on research at times. During the COVID19 pandemic, the high school team asked her to teach the next generation about what was happening. Humbled, she consulted with many of the experts in the field to give students a well-rounded view of infectious disease and pandemics in hopes young people see how they can contribute to (better) infectious disease outbreak responses of the future. A team of pre-health students, aspiring doctors, teach the course with her every summer and is the highlight of the year for the whole team!

Instructors:

Dina Alnabulsi

Jenna Bockman

Ana DeCesare

Max Gauthier

Learning Goals

- Students will gain a basic understanding of the genetic code of DNA and how this translates to protein sequences
- Students will be able to list the basic components and processes of a cell and how these are used to replicate pathogens
- Students will learn the definitions and concepts behind key terminology that is familiar to them from reading the news on epidemics
- Students will collaborate with other students to analyze data, look up resources, interpret information found in articles, and put together a final public service announcement and pathogen review
- Students will be exposed to a variety of careers that are all involved in the prevention and treatment of infectious diseases and outbreaks
- Students will do several lab and hands-on activities and participate in field trips that allow them to do the work of microbiology and research themselves

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Course Structure and Components

Classes will meet daily in from 8:30am-4pm in person on weekdays July 7-25. The lecture content comes largely from the field of microbiology. During class, first, students will actively participate in a lecture on the scientific principles required to understand a particular aspect of a pathogen life cycle, its pathogenesis in people and infectious disease outbreak management in populations. Following lecture, students will work in groups to do activities that encourage students to apply this knowledge to understand the information, news, data and outbreaks all around them. These activities might include field trips, discussions, debates, Q&A sessions with guest speakers and projects. Several hands-on activities like labs, research projects, games and lab visits will allow students to investigate and discover in the field of microbiology and biomedical research for themselves. Students will also listen to or participate in interviews from 'frontline workers', researchers, professors, virologists, microbiologists, or epidemiologists or public health experts involved currently or in the past pandemic response in the world and reflect on these interviews in small group discussions. A final project will have students present a review of an epidemic of a particular pathogen and lead a discussion on this with their peers as well as performing a public service announcement.

Components by Day:

Monday, July 7, Day 1: Epidemiology
Lead teacher: Professor Elliott
Lecture Topic: Epidemiology
Activity: Lab Day 1, Analyzing Epi Curves and time machine
Interview: Grayson Privette

Tuesday, July 8, Day 2: Molecular Biology
Lead Teacher: Max Gauthier
Lecture Topic: Molecular Biology and the Central Dogma
Activity: epi curves, glow germ
Interview: Drew Weissman, 2022
Visitor: Rene Najera

Wednesday, July 9 Day 3: Cells
Lead Teacher: Jenna Bockman
Lecture Topic: Prokaryotes and Eukaryotes
Activity: Lab Day 2, solving an outbreak
Interview: Drew Weissman, 2021

Thursday, July 10, Day 4: Natural Selection and Genetics
Lead Teacher: Ruth Elliott
Lecture Topic: natural selection and genetics
Activity: Pathogen of the Day
Event: Water Works Field Trip
Interview: Matthew Ferrari

Friday, July 11, Day 5: Microbiology I
Lead Teacher: Ruth Elliott
Lecture Topic: Microbiology part I
Activity: Day 3 Lab, Pathogen Life Cycles, Pathogen of the Day

Monday, July 14, Day 6: Microbiology II
Lead Teacher: Max Gauthier
Lecture Topic: Microbes Part II
Activity: Day 4 Lab, case study
Visitor: Kyle Rodino
Interview: Susan Weiss, 2021

Tuesday, July 15, Day 7: Immune System I
Lead Teacher: Ruth Elliott
Lecture Topic: Innate Immunity
Activity: Visit Sunny Shin's Lab, medical anthropology reading
Visitor: Adam Mohr
Interview: Scott Hensley

Wednesday, July 16 Day 8: Immune System II
Lead Teacher: Jenna
Lecture Topic: Adaptive Immunity
Activity: Micro Lab Day 5, scavenger hunt
Visitors: Cadwell Lab
Interview: Kristine Rose

Thursday, July 17, Day 9: Prevention
Lead Teacher: Ana
Lecture Topic: prevention and antisepsis
Activity: case study and journal club check-in
Visitor: Lori Mason
Interview: Susan Weiss, Stanley Perlman, Julian Leibowitz

Friday, July 18, Day 10: Surveillance
Lead Teacher: Ruth
Lecture topic: testing, reporting etc.
Activity: Day 6 Micro Lab, journal club prep

Monday, July 21, Day 11: Lab Day
Lead Teacher: none
Lecture topic: none
Activity: Day 7 micro lab, Visit the Weiss lab

Tuesday, July 22, Day 12: Vaccines
Lead Teacher: Ruth
Lecture topic: Vaccines
Activity: vaccine debate, journal club and PSA prep
Visitor: Paul Offit

Wednesday, July 23, Day 13: Social Determinants of Health
Lead Teacher: Ana
Lecture Topic: SDOH
Activity: Day 8 Micro lab, case studies

Thursday, July 24, Day 14: Journal Clubs
Activity: Journal Clubs
Maybe: PSA or epic trivia or case study

Friday, July 25, Day 15: Final Day
Activity: Final Day of Lab, Thank you's, Goodbyes, Award Ceremony
Maybe: PSA or epic trivia or case study