BIOS E-157
Viruses and Immunity: A Molecular Arms Race

Course Details:
Time: Wednesdays, 7:40-9:40 pm
Website: https://canvas.harvard.edu/courses/18077

Instructor Details:
Instructor: Jamie Schafer, Ph.D.
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Office hours by appointment.

Course Description

In order to replicate and propagate, viruses must contend with an onslaught of immune responses at both the intracellular and organismal levels. Evolutionarily, this leads to an arms race between viruses and the immune system, as each evolves mechanisms to overcome the other. This course provides an introduction to several viruses that cause human disease and the immune responses that they evade or succumb to. The course is organized in two sections: first, introduction of the immune responses most relevant for viral infection (including antibodies, T cells, natural killer cells, and intracellular nucleic acid sensors); and second, discussion of viruses famous for their impact on society and human health (including HIV, Ebola, and herpesviruses, among others). Each virus is explored in the context of its replication, mechanisms of transmission, and interaction with the immune system. We conclude with presentations led by graduate-credit students, which may extend to viruses beyond those previously examined in the course and to specialized topics, such as applications of viruses in biotechnology and therapeutics. Graduate students also participate in discussions of primary scientific literature related to lecture topics throughout the course. Because molecular virology, immunology, and interactive learning are core components of the course, students should come prepared with confident mastery of introductory cell and molecular biology, and willingness to participate in critical thinking activities that involve discussing their ideas with their peers.

Prerequisites

Introductory courses in cell biology and molecular biology are required, such as BIOS E-12 and BIOS E-16, or equivalents. Students in the course will be expected to be very comfortable with core concepts in molecular and cell biology, such as the central dogma (DNA>RNA>protein), cell signaling, endo- and exocytosis, protein trafficking, and the cytoskeleton.

Course Policies

Course meetings:

- BIOS E-157 will be taught through a combination of lectures, classroom discussions, and in-class activities. Attendance and participation at all course meetings will dramatically improve your success in the course.
- Class participation in person, in live online chat, and via course discussion boards are all encouraged. Please bring a smart phone, laptop, or tablet to class to participate in in-class activities
- A required section for graduate credit students (in person or via Canvas) will be arranged.

Assignments:

- Assignments (other than online quizzes) are due on the course website by 11:59pm on the deadline day. Late assignments will be deducted 10% for each day late.
- Online quizzes are due by 7:30pm on Wednesdays. Late quizzes will not be accepted, but the two lowest scores will be dropped.
- Graduate students will prepare a final paper (5-7 pages) and presentation (~10-15 minutes) on a topic in virology. All topics must be approved in advance; a 2-paragraph description of the paper topic and 2-3 reference citations are due on the date marked "topic due" on the course schedule. All students' final papers must cite scientific journal articles, and at least two source must be a primary article. Students will be evaluated based on their understanding of the scientific literature and clarity of their explanations.

Exams:

- Both midterm and final exams will be offered online.
- Exams will be posted for one week, but must be completed within an allotted time once begun.
- Students may consult textbook and other resources while writing the exam, thus questions will be engineered to require critical thinking and a depth of understanding beyond memorized facts.
- No late exams will be accepted and no makeup exams will be offered.

Sections:

- Required for students taking the course for graduate-level credit and will consist of discussion of primary scientific literature in virology. Meeting time will be determined after the first class pending students' and TA's schedules.

Course Goals

For all:

1. Understand the unique life cycle and survival strategy of viruses.
2. Understand how different immune defenses protect against viruses.
3. Understand the coevolution of viruses and the host immune system.

For graduate students:

4. Communicate science to a broader audience.
5. Critically evaluate primary scientific literature.

Reading Materials (on reserve at Grossman Library; available via Harvard Coop)

Required textbook: Shors, Understanding Viruses. 2nd ed. (Oct. 2011; ISBN: 978-1449648923)

- Weekly reading assignments from the textbook to be completed prior to the lecture will form the basis for weekly quizzes.
- Additional resources will be posted on the course website for selected topics.

Grading

Evaluation Method	***Undergraduate***	***Graduate***
Class Participation	15%	10%
Online Quizzes (weekly)	20%	10%
Online Assignments (2)	15%	10%
Midterm Exam	25%	20%
Final Exam	25%	20%
Final Paper and Presentation	N/A	20%
Section Participation	N/A	10%

Academic Integrity

- You are responsible for understanding Harvard Extension School policies on academic integrity (www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity) and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting the wrong draft, or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity. To support your learning about academic citation rules, please visit the Harvard Extension School Tips to Avoid Plagiarism (www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism), where you'll find links to the Harvard Guide to Using Sources and two free online 15-minute tutorials to test your knowledge of academic citation policy. The tutorials are anonymous open-learning tools.

- All work handed in must be your own, and should include citations of sources as appropriate. Please cite your references according to the guidelines of the International Committee of Medical Journal Editors (http://www.nlm.nih.gov/bsd/uniform_requirements.html)
- Students are encouraged to discuss their learning; however, each student is responsible for preparing his or her own individual homework assignments. If you have had substantive discussions with other students, please list the students who are in your study group on your submitted assignment, particularly for problem sets/response papers.

Accessibility

- The Extension School is committed to providing an accessible academic community. The Accessibility Office offers a variety of accommodations and services to students with documented disabilities. Please visit www.extension.harvard.edu/resources-policies/resources/disability-services-accessibility for more information.

Class Schedule

Week	Lecture Topic	Assessments	
		All Students	**Graduate Students**
Aug 31	Course Intro		
Sept 7	Viral Genomes + Intracellular Immunity	Quiz 1	Section 1
Sept 14	Viral Structure + Antibodies	Quiz 2	Section 2 Paper topic due
Sept 21	Viral Life Cycles + T cells	Quiz 3	Section 3
Sept 28	Natural Killer Cells and Vaccination	Quiz 4 Assignment 1 due Fri	Section 4 Paper outline due
Oct 5	HIV	Quiz 5	
Oct 12	MIDTERM EXAM (online)		
Oct 19	Polio	Quiz 6	Section 5
Oct 26	Influenza	Quiz 7	Section 6
Nov 2	Dengue (and Zika)	Quiz 8	Section 7 Paper draft due
Nov 9	Ebola	Quiz 9 Assignment 2 due Fri	Section 8
Nov 16	Herpes	Quiz 10	Final paper due
Nov 23	No class (Thanksgiving)		
Nov 30	Grad Student Presentations		Final presentation
Dec 7	Grad Student Presentations		Final presentation
Dec 14	FINAL EXAM (online)		

*Lecture schedule subject to change

*Quizzes will be posted online Friday and are due Wednesday by 7:30 pm

*Assignments 1 and 2 will be posted online Friday and are due by 11:59 pm on the following Friday