Course Directors and Contact Info:

Matthew Weitzman, Colket 4050, 267-425-2068, weitzmanm@email.chop.edu
Sunny Shin, Johnson Pavilion 201B, 215-746-8410, sunshin@pennmedicine.upenn.edu

Section Directors

Bacteriology I & II : Sunny Shin/Jay Zhu
Virology I : Matthew Weitzman/Jianxin You

Description

The MVP Core class provides CAMB-MVP students with key fundamental knowledge of Bacteriology, Virology, and Parasitology. The course runs through the Fall and Spring for first year CAMB-MVP students. The course starts with 3 overview lectures and is then organized into three sections that cover principles of Bacteriology, Virology, and Parasitology.

Prerequisites

None

Enrollment criteria

Required for all first year CAMB-MVP students. Non CAMB-MVP students by permission of course directors.

Schedule

MWF, 2:30-3:30

Location

209 Johnson

Format

• Lecture
• Discussion - Themed lecture sets with intermittent journal article discussion groups

Student assignments

Midterm/final exam for each subsection
Journal article presentation within each subsection
Syllabus

Grading Criteria:

50% Exam based (in class or take home, varies by section leaders)
40% presentation based
10% participation based (participation in discussions, asking questions during lecture, etc.)

Course Goals

Students who complete this course successfully will have gained:

- A broad introduction to host-pathogen interactions
- A survey of bacteriology, virology and parasitology with emphasis on common and distinct themes
- Ability to analyze relevant primary articles in-depth

Guidelines/Expectations for Student Paper Presentations

Students not assigned to present:

Read the paper well in advance of the presentation day.

1. Come prepared to participate actively in the discussion with at least two questions or observations about approaches or interpretations by the authors.

Student assigned to present:

1. Meet the faculty mentor for the paper well in advance of the presentation to go over expectations and discuss the background for the paper. It is your responsibility to establish contact with the faculty member.
2. Format will be a journal club style presentation via PowerPoint and should contain the following elements:
   A. A brief presentation of the background of the research including rationale and key previous findings upon which it is based,
   B. A presentation of key findings in the most important figures (i.e. not necessarily all of them!),
   C. A critical review of the major findings and interpretations and
   D. A critique of the significance of the paper overall.
3. Meet with the faculty mentor for the paper soon after your presentation for feedback.

Faculty Mentor:

Faculty mentors are encouraged to give brief comments at the end of the presentation session about where the paper fits into the general thrust of research in their field.
Syllabus

Course Directors
Matthew Weitzman, Ph.D.
Professor of Pathology & Laboratory Med
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The Children's Hospital of Philadelphia
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Office: 267-425-2068
Email: weitzmanm@email.chop.edu

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Associate Professor of Microbiology
Perelman School of Medicine
3610 Hamilton Walk
201B Johnson Pavilion
Philadelphia, PA 19104
Office: 215-746-8410
Email: sunshin@pennmedicine.upenn.edu

Bacteriology Section
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Email: weitzmanm@email.chop.edu

Jianxin You, Ph.D.
Email: jianyou@pennmedicine.upenn.edu

Parasitology Section
Sparky Lok, Ph.D.
Email: jlok@vet.upenn.edu

Chris Hunter, Ph.D.
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Assistants
Kate Wurges
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Email: wurgesk@email.chop.edu

Laurie Zimmerman
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Email: zimml@pennmedicine.upenn.edu
CAMB 706 – Bacteriology Session I & II  
Course Directors: Sunny Shin & Jay Zhu  
MWF, 2:30-3:30  209 Johnson

<table>
<thead>
<tr>
<th>DATE</th>
<th>DAY</th>
<th>TITLE</th>
<th>LECTURER/PRESENTER</th>
<th>EMAIL</th>
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</thead>
<tbody>
<tr>
<td>9/6/2019</td>
<td>F</td>
<td>Intro: Course Layout</td>
<td>Drs. Weitzman &amp; Shin</td>
<td><a href="mailto:weitzmanm@email.chop.edu">weitzmanm@email.chop.edu</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intro: Pathogen Genomes</td>
<td>Dr. Bushman</td>
<td><a href="mailto:sunshin@pennmedicine.upenn.edu">sunshin@pennmedicine.upenn.edu</a></td>
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<td></td>
<td><a href="mailto:bushman@pennmedicine.upenn.edu">bushman@pennmedicine.upenn.edu</a></td>
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<tr>
<td>9/9/2019</td>
<td>M</td>
<td>Intro: Concepts of Host-Pathogen Interactions</td>
<td>Dr. Hunter</td>
<td><a href="mailto:chunter@vet.upenn.edu">chunter@vet.upenn.edu</a></td>
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<tr>
<td>9/11/2019</td>
<td>W</td>
<td>Intro: Host Immune Responses to Pathogens</td>
<td>Dr. Scott</td>
<td><a href="mailto:pscott@vet.upenn.edu">pscott@vet.upenn.edu</a></td>
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<tr>
<td>9/13/2019</td>
<td>F</td>
<td>Bacterial Basics, Global Microbiome, Nucleic Acid Management in Prokaryotes</td>
<td>Dr. Bushman</td>
<td><a href="mailto:bushman@pennmedicine.upenn.edu">bushman@pennmedicine.upenn.edu</a></td>
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<tr>
<td>9/16/2019</td>
<td>M</td>
<td>Antibiotic Resistance</td>
<td>Dr. Planet</td>
<td><a href="mailto:planetp@email.chop.edu">planetp@email.chop.edu</a></td>
</tr>
<tr>
<td>9/18/2019</td>
<td>W</td>
<td>Student Paper Presentation</td>
<td>Dr. Bittinger</td>
<td><a href="mailto:bittingerk@email.chop.edu">bittingerk@email.chop.edu</a></td>
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<tr>
<td>9/20/2019</td>
<td>F</td>
<td>Principles of Bacterial Pathogenesis</td>
<td>Dr. Brodsky</td>
<td><a href="mailto:brodsky@vet.upenn.edu">brodsky@vet.upenn.edu</a></td>
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<tr>
<td>9/23/2019</td>
<td>M</td>
<td>Strategies for Bacterial Adhesion and Invasion</td>
<td>Dr. Brodsky</td>
<td><a href="mailto:brodsky@vet.upenn.edu">brodsky@vet.upenn.edu</a></td>
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<td>9/25/2019</td>
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<td>Student Paper Presentation</td>
<td>Dr. Brodsky</td>
<td><a href="mailto:ibrodsky@vet.upenn.edu">ibrodsky@vet.upenn.edu</a></td>
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<td>9/27/2019</td>
<td>F</td>
<td>Bacterial cell-cell interactions</td>
<td>Dr. Zhu</td>
<td><a href="mailto:junzhu@pennmedicine.upenn.edu">junzhu@pennmedicine.upenn.edu</a></td>
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<td>Dr. Zhu</td>
<td><a href="mailto:junzhu@pennmedicine.upenn.edu">junzhu@pennmedicine.upenn.edu</a></td>
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<td>10/2/2019</td>
<td>W</td>
<td>Signal transduction in bacteria</td>
<td>Dr. Goulian</td>
<td><a href="mailto:goulian@sas.upenn.edu">goulian@sas.upenn.edu</a></td>
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<td><strong>Microbiome Symposium</strong></td>
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<td>10/4/2019</td>
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<td>Signal transduction in bacteria</td>
<td>Dr. Goulian</td>
<td><a href="mailto:goulian@sas.upenn.edu">goulian@sas.upenn.edu</a></td>
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<tr>
<td>10/7/2019</td>
<td>M</td>
<td>Student Paper Presentation</td>
<td>Dr. Zhu</td>
<td><a href="mailto:junzhu@pennmedicine.upenn.edu">junzhu@pennmedicine.upenn.edu</a></td>
</tr>
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<td>10/9/2019</td>
<td>W</td>
<td>Vertebrate microbial communities in health and disease</td>
<td>Dr. Levy</td>
<td><a href="mailto:maayanle@pennmedicine.upenn.edu">maayanle@pennmedicine.upenn.edu</a></td>
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<td><strong>CAMB Symposium</strong></td>
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<td>10/14/2019</td>
<td>M</td>
<td>Vertebrate microbial communities in health and disease</td>
<td>Dr. Thaiss</td>
<td><a href="mailto:thaiss@pennmedicine.upenn.edu">thaiss@pennmedicine.upenn.edu</a></td>
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<td>Student Paper Presentation</td>
<td>Drs. Levy &amp; Thaiss</td>
<td><a href="mailto:maayanle@pennmedicine.upenn.edu">maayanle@pennmedicine.upenn.edu</a></td>
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<td><a href="mailto:thaiss@pennmedicine.upenn.edu">thaiss@pennmedicine.upenn.edu</a></td>
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<td>10/18/2019</td>
<td>F</td>
<td>Intracellular bacteria</td>
<td>Dr. Shin</td>
<td><a href="mailto:sunshin@pennmedicine.upenn.edu">sunshin@pennmedicine.upenn.edu</a></td>
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<td>10/21/2019</td>
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<td>Intracellular bacteria</td>
<td>Dr. Shin</td>
<td><a href="mailto:sunshin@pennmedicine.upenn.edu">sunshin@pennmedicine.upenn.edu</a></td>
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<td><a href="mailto:sunshin@pennmedicine.upenn.edu">sunshin@pennmedicine.upenn.edu</a></td>
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<td>10/25/2019</td>
<td>F</td>
<td>Gram-positive bacteria and toxins</td>
<td>Dr. Zackular</td>
<td><a href="mailto:Joseph.Zackular@pennmedicine.upenn.edu">Joseph.Zackular@pennmedicine.upenn.edu</a></td>
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# Syllabus

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<tr>
<td>10/28/2019</td>
<td>M</td>
<td>Immunity to bacteria</td>
<td>Dr. Abt</td>
<td><a href="mailto:Michael.Abt@pennmedicine.upenn.edu">Michael.Abt@pennmedicine.upenn.edu</a></td>
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<td>10/30/2019</td>
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<td>Student Paper Presentation</td>
<td>Drs. Abt &amp; Zackular</td>
<td><a href="mailto:Michael.Abt@pennmedicine.upenn.edu">Michael.Abt@pennmedicine.upenn.edu</a> <a href="mailto:Joseph.Zackular@pennmedicine.upenn.edu">Joseph.Zackular@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/1/2019</td>
<td>F</td>
<td>Phage</td>
<td>Dr. Bushman</td>
<td><a href="mailto:bushman@pennmedicine.upenn.edu">bushman@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/4/2019</td>
<td>M</td>
<td>Student Paper Presentation</td>
<td>Dr. Bushman</td>
<td><a href="mailto:bushman@pennmedicine.upenn.edu">bushman@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/11/2019</td>
<td>M</td>
<td>Bacteriology Final due</td>
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# CAMB 706 – Virology Session I

**Course Directors:** Jianxin You and Matthew Weitzman

**MWF, 2:30-3:30**  
209 Johnson

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<tbody>
<tr>
<td>11/11/2019</td>
<td>M</td>
<td>Viral structure and diversity</td>
<td>Dr. Bushman</td>
<td><a href="mailto:bushman@pennmedicine.upenn.edu">bushman@pennmedicine.upenn.edu</a></td>
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<td>11/15/2019</td>
<td>F</td>
<td>Student Paper Discussion</td>
<td>Dr. Bushman</td>
<td><a href="mailto:bushman@pennmedicine.upenn.edu">bushman@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/18/2019</td>
<td>M</td>
<td>Virus receptors</td>
<td>Dr. Bates</td>
<td><a href="mailto:pbates@pennmedicine.upenn.edu">pbates@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/20/2019</td>
<td>W</td>
<td>Virus entry</td>
<td>Dr. Bates</td>
<td><a href="mailto:pbates@pennmedicine.upenn.edu">pbates@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/22/2019</td>
<td>F</td>
<td>Student Paper Discussion</td>
<td>Dr. Bates</td>
<td><a href="mailto:pbates@pennmedicine.upenn.edu">pbates@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/25/2019</td>
<td>M</td>
<td>Retrovirus replication</td>
<td>Dr. Collman</td>
<td><a href="mailto:collmanr@pennmedicine.upenn.edu">collmanr@pennmedicine.upenn.edu</a></td>
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<tr>
<td>11/27/2019</td>
<td>W</td>
<td>Thanksgiving Break</td>
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<td>11/29/2019</td>
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<tr>
<td>12/2/2019</td>
<td>M</td>
<td>Retrovirus pathogenesis</td>
<td>Dr. Collman</td>
<td><a href="mailto:collmanr@pennmedicine.upenn.edu">collmanr@pennmedicine.upenn.edu</a></td>
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<td>12/4/2019</td>
<td>W</td>
<td>Student Paper Discussion</td>
<td>Dr. Jurado</td>
<td><a href="mailto:Kellie.Jurado@pennmedicine.upenn.edu">Kellie.Jurado@pennmedicine.upenn.edu</a></td>
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<tr>
<td>12/6/2019</td>
<td>F</td>
<td>Flu &amp; RNA virus pathogenesis</td>
<td>Dr. Hensley</td>
<td><a href="mailto:hensley@pennmedicine.upenn.edu">hensley@pennmedicine.upenn.edu</a></td>
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<tr>
<td>12/9/2019</td>
<td>M</td>
<td>RNA virus replication strategies</td>
<td>Dr. Cherry</td>
<td><a href="mailto:cherrys@pennmedicine.upenn.edu">cherrys@pennmedicine.upenn.edu</a></td>
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<tr>
<td>12/11/2019</td>
<td>W</td>
<td>Student Paper Discussion</td>
<td>Dr. Hoxie</td>
<td><a href="mailto:hoxie@pennmedicine.upenn.edu">hoxie@pennmedicine.upenn.edu</a></td>
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<tr>
<td>12/18/2019</td>
<td>W</td>
<td>Virology Midterm Due</td>
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Syllabus

Introductions

9/6/19  Course Layout & Intro: Pathogen Genomes (Bushman)

9/9/19  Intro: Concepts of Host-Pathogen Interactions (Hunter)

9/11/19  Intro: Host Immune Responses to Pathogens (Scott)

Bacteriology I

9/13/19  Bacterial Basics, Global Microbiome, Nucleic Acid Management in Prokaryotes (Bushman)

- Principles of pathogenesis
- Pathogen genomes
- Effects of host-microbe competition on host genomes
- Studying microbial genomes by whole genome synthesis

9/16/19  Antibiotic Resistance (Planet)

9/18/19  Paper Discussion (Bittinger)

9/20/19  Principles of Bacterial Pathogenesis (Brodsky)

9/23/19  Strategies for Bacterial Adhesion and Invasion (Brodsky)

9/25/19  Paper Discussion (Brosky)

9/27/19  Bacterial cell-cell interactions (Zhu)

9/30/19  Paper Discussion (Zhu)

10/2/19  Signal transduction in bacteria (Goulian)

- Definition and diversity of two-component systems
- Basic Reactions
- Histidine Kinases
- Response regulators
- Specificity and Cross-talk

10/3/19  Microbiome Symposium

10/4/19  Signal Transduction in Bacteria (Goulian)

- Two canonical examples of two-component signaling:
  - porin regulation
  - chemotaxis
Syllabus

10/7/19  

**Paper Discussion (Zhu)**

### Bacteriology II

10/9/19  

**Vertebrate microbial communities in health and disease (Levy)**

10/11/19  

**CAMB Symposium**

10/11/19  

**Bacteriology Midterm Due**

10/14/19  

**Vertebrate microbial communities in health and disease (Thais)**

10/16/19  

**Paper Discussion (Levy and Thais)**

10/18/19  

**Intracellular bacteria (Shin)**

- General strategies used by intracellular pathogens
- Escape from the phagosome- Listeria, Shigella
- Arrest normal phagosome maturation- Salmonella, Mycobacteria
- Unique ER-derived compartment- Legionella
- Acidic lysosomal compartment- Coxiella

10/21/19  

**Intracellular bacteria (Shin)**

- Innate immune recognition
- IFNg defense and evasion- Chlamydia
- Evasion of host cell apoptosis- Coxiella
- Pyroptosis and inflammation- Salmonella
- Autophagy- Shigella and Listeria
- Inhibition of immune signaling- many pathogens
- Endosymbiotic bacteria

10/23/19  

**Paper Discussion (Shin)**

10/25/19  

**Gram positive bacteria and toxins (Zackular)**

10/28/19  

**Immunity to bacteria (Abt)**

10/30/19  

**Paper Discussion (Abt and Zackular)**

11/1/19  

**Phage (Bushman)**

- Phage history
- Global Virome
- Phage Phylogeny
- Clinical Consequences
Syllabus

- Phage T4
- Phage lambda
- Phage therapy

11/4/19  Paper Discussion (Bushman)

11/11/19  Bacteriology Final Due
Virology I

11/11/19  **Viral structure and diversity (Bushman)**
- Methods: negative staining, cryo-EM, X-ray crystallography, NMR, mixed methods
- Genetic economy -> symmetry
- Helical symmetry
- Icosahedral symmetry
- Relationship between structure and route of transmission

11/13/19  **Viral structure and diversity (Bushman)**
- Introduction: viral diversity
- The human virome
- Metagenomics and virus hunting

11/15/19  **Paper Discussion (Bushman)**

Schooley et al., Development and Use of Personalized Bacteriophage-Based Therapeutic Cocktails To Treat a Patient with a Disseminated Resistant Acinetobacter baumannii Infection. *Antimicrob Agents Chemother.* 2017 Sep 22;61(10).

11/18/19  **Virus receptors (Bates)**
- What is a virus particle?
- General problems in virus replication
- Virus attachment
- Internalization and fusion strategies

11/20/19  **Virus entry (Bates)**
- Metastable virion entry
- Stepwise dis-assembly
- Signaling in viral entry
- Viral receptor identification and analysis

11/22/19  **Paper Discussion (Bates)**

11/25/19  **Retrovirus replication (Collman)**
- Introduction
  - The retrovirus family
  - Shared and unique genetic features
- Replication cycle
  - Entry
  - Reverse Transcription
  - Nuclear migration & Integration
  - Regulation of gene expression & protein expression
  - Assembly & release
- Interaction with host proteins
Syllabus

- Intrinsic host defense
- HIV auxiliary genes

11/27/19  Thanksgiving Break
11/29/19  Thanksgiving Break
12/2/19  Retrovirus pathogenesis (Collman)
  - Introduction
    - Overview
    - Endogenous retroviruses
  - Oncoretroviral Pathogenesis
    - Non-acute transforming viruses: Insertional oncogenesis
    - Acute transforming virus: V-Onc carrying viruses
    - Trans-activating oncoviruses
  - Lentiviruses (other than immunodeficiency viruses)
  - Immunodeficiency virus pathogenesis
    - Transmission & acute infection
    - Viral dynamics and chronic disease
    - Mechanisms of immunopathogenesis
    - Viral & host determinants of disease
    - HIV as a zoonosis

12/4/19  Paper Discussion (Jurado)
12/6/18  Flu & RNA virus pathogenesis (Hensley)
  - Introduction to influenza virus
    - Viral lifecycle
    - Pathogenesis
    - Epidemiology
  - Immune escape
    - Influenza virus antibodies
    - Antigenic shift
    - Antigenic drift
  - Evasion of anti-virals
  - Influenza virus versus other RNA viruses (measles as an example)

12/9/19  RNA virus replication strategies (Cherry)
12/11/19  Paper Discussion (Hoxie)
12/18/19  Virology Midterm Due