

# Syllabus



MVP Core  
CAMB 706  
Fall Semester 2022

## Course Directors and Contact Info:

**Sunny Shin**, Johnson Pavilion 201B, 215-746-8410, [sunshin@penmedicine.upenn.edu](mailto:sunshin@penmedicine.upenn.edu)

**Boris Striepen**, Hill Pavilion, 215-573-9167, [striepen@vet.upenn.edu](mailto:striepen@vet.upenn.edu)

**Jianxin You**, Johnson Pavilion 201C, 215-573-6781, [jianyou@vet.upenn.edu](mailto:jianyou@vet.upenn.edu)

## Section Directors

**Bacteriology I & II** : Sunny Shin/Jay Zhu

**Virology I** : Jianxin You/Elizabeth White

## 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	Location
MWF, 1:45-2:45	Johnson Pavilion 209

## Format

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

## Student assignments

Midterm/final exam for each semester

Journal article presentations within each subsection

Additional assignments that will vary by subsection

## Grading Criteria:

50% Exam-based (take home)

# Syllabus



40% presentation-based

10% participation-based (participation in paper 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

We ask that all members of the MVP core community – the instructors, lecturers, and students – work together to create a supportive, inclusive environment that welcomes all students, regardless of their race, ethnicity, gender identity, sexuality, religious beliefs, physical or mental health status, or socioeconomic status. Diversity, inclusion, and belonging are all core values of this course. All participants in this course deserve to and should expect to be treated with respect by other members of the community.

Our class should be a space where everyone feels welcome and safe. In order to facilitate a welcoming environment, all participants in this course are expected to :

- Exercise consideration and respect in their speech and actions.
- Attempt collaboration and consideration, including listening to opposing perspectives and authentically and respectfully raising concerns, before conflict.
- Refrain from demeaning, discriminatory, or harassing behavior and speech.

It is also important to us that everyone who participates in this class has the resources to do so. Please let us know if you need any special accommodations in the curriculum, instruction or assessments of this course to enable you to participate fully. We will make a full effort to maintain the confidentiality of any information that you share with us.

## Attendance Policy

Students are expected to attend all of the classes and paper discussions, as participation is an important aspect of the course. We understand that expected or unexpected things can happen during the semester that may prevent you from attending class. In that case, we ask that you contact us ahead of time to let us know if you are unable to attend.

## Guidelines/Expectations for Student Paper Presentations

### Students not assigned to present:

1. Read the paper well in advance of the presentation day.
2. Come prepared to present some of the figures and participate actively in the discussion with observations and answers to questions about approaches or interpretations by the authors.

### Students (2-3 selected for each paper) assigned to present:

# Syllabus



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. The assigned students will give a brief presentation of the background of the research including rationale and key previous findings upon which it is based,
  - B. The other students in the class will be asked to volunteer and present key findings in the figures.
  - C. The assigned students will be asked to give a critical review of the major findings and interpretations and the significance of the paper overall.
3. Meet with the faculty mentor for the paper immediately after your presentation for feedback.

## **Faculty Mentor:**

1. The assigned faculty member will meet with presenters prior to the presentations.
2. 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.

## **Course Directors**

### **Sunny Shin, Ph.D.**

Associate Professor of Microbiology  
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## **Bacteriology Section**

### **Sunny Shin, Ph.D.**

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### **Jay Zhu, Ph.D.**

Email: [junzhu@pennmedicine.upenn.edu](mailto:junzhu@pennmedicine.upenn.edu)

## **Virology Section**

### **Elizabeth White, Ph.D.**

Email: [eawhite@pennmedicine.upenn.edu](mailto:eawhite@pennmedicine.upenn.edu)

### **Jianxin You, Ph.D.**

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## **Parasitology Section**

# Syllabus



**Michael Povelones, Ph.D.**

Email: [mpove@vet.upenn.edu](mailto:mpove@vet.upenn.edu)

**Boris Striepen, Ph.D.**

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## ***CAMB 706 – Bacteriology Session I & II***

***Course Directors: Sunny Shin & Jay Zhu***

MWF, 1:45-2:45pm Johnson Pavilion 209

DATE	DAY	TITLE	LECTURER/ PRESENTER	EMAIL
9/7/2022	W	Intro: Course Layout Intro: Pathogen Genomes	Drs. Shin, Striepen, You Dr. Bushman	sunshin@pennmedicine.upenn.edu striepen@vet.upenn.edu you@pennmedicine.upenn.edu bushman@pennmedicine.upenn.edu
9/9/2022	F	Intro: Host Immune Responses to Pathogens	Dr. Scott	pscott@vet.upenn.edu
9/12/2022	M	Intro: Concepts of Host-Pathogen Interactions	Dr. Striepen	striepen@vet.upenn.edu
9/14/2022	W	Bacterial Basics, Global Microbiome, Nucleic Acid Management in Prokaryotes	Dr. Bushman	bushman@pennmedicine.upenn.edu
9/16/2022	F	Antibiotic Resistance	Dr. Planet	planetp@email.chop.edu
9/19/2022	M	Student Paper Presentation	Dr. Bittinger	bittingerk@email.chop.edu
9/21/2022	W	Bacterial cell-cell interactions	Dr. Zhu	junzhu@pennmedicine.upenn.edu
9/23/2022	F	Student Paper Presentation	Dr. Zhu	junzhu@pennmedicine.upenn.edu
9/26/2022	M	Principles of Bacterial Pathogenesis	Dr. Brodsky	ibrodsky@vet.upenn.edu
9/28/2022	W	Strategies for Bacterial Adhesion and Invasion	Dr. Brodsky	ibrodsky@vet.upenn.edu
9/30/2022	F	Student Paper Presentation	Dr. Brodsky	ibrodsky@vet.upenn.edu
10/3/2022	M	Signal transduction in bacteria	Dr. Goulian	goulian@sas.upenn.edu
10/5/2022	W	Signal transduction in bacteria	Dr. Goulian	goulian@sas.upenn.edu
10/7/2022	F	<b>CAMB Symposium</b>		
10/10/2022	M	Student Paper Presentation	Dr. Zhu	junzhu@pennmedicine.upenn.edu
10/12/2022	W	Vertebrate microbial communities in health and disease	Dr. Levy	maayanle@pennmedicine.upenn.edu

# Syllabus



10/14/2022	F	Vertebrate microbial communities in health and disease	Dr. Thaiss	thaiss@penmedicine.upenn.edu
10/17/2022	M	Student Paper Presentation	Drs. Levy & Thaiss	maayanle@penmedicine.upenn.edu thaiss@penmedicine.upenn.edu
10/19/2022	W	Intracellular bacteria	Dr. Shin	sunshin@penmedicine.upenn.edu
10/21/2021	F	Intracellular bacteria	Dr. Shin	sunshin@penmedicine.upenn.edu
10/24/2022	M	Student Paper Presentation	Dr. Shin	sunshin@penmedicine.upenn.edu
10/26/2022	W	Gram-positive bacteria and toxins	Dr. Zackular	Joseph.Zackular@penmedicine.upenn.edu
10/28/2022	F	Immunity to bacteria	Dr. Abt	Michael.Abt@penmedicine.upenn.edu
10/31/2022	M	Student Paper Presentation	Drs. Abt & Zackular	Michael.Abt@penmedicine.upenn.edu Joseph.Zackular@penmedicine.upenn.edu
11/2/2021	W	Phage	Dr. Bushman	bushman@penmedicine.upenn.edu
11/4/2021	F	Student Paper Presentation	Dr. Bushman	bushman@penmedicine.upenn.edu
11/11/2021	F	<b>Bacteriology Final due</b>		

**CAMB 706 – Virology Session I**  
**Course Directors: Jianxin You and Elizabeth White**  
MWF, 1:45-2:45pm Johnson Pavilion 209

DATE	DAY	TITLE	LECTURER/ PRESENTER	EMAIL
11/11/2022	F	Viral structure and diversity	Dr. Bushman	<a href="mailto:bushman@penmedicine.upenn.edu">bushman@penmedicine.upenn.edu</a>
11/14/2022	M	Viral structure and diversity	Dr. Bushman	<a href="mailto:bushman@penmedicine.upenn.edu">bushman@penmedicine.upenn.edu</a>
11/16/2022	W	Student Paper Discussion	Dr. Bushman	<a href="mailto:bushman@penmedicine.upenn.edu">bushman@penmedicine.upenn.edu</a>
11/18/2022	F	Virus receptors	Dr. Bates	<a href="mailto:pbates@penmedicine.upenn.edu">pbates@penmedicine.upenn.edu</a>
11/21/2022	M	Virus entry	Dr. Bates	<a href="mailto:pbates@penmedicine.upenn.edu">pbates@penmedicine.upenn.edu</a>
11/23/2022	W	<b>Thanksgiving Break</b>		
11/25/2022	F	<b>Thanksgiving Break</b>		
11/28/2022	M	Student Paper Discussion	Dr. Bates	<a href="mailto:pbates@penmedicine.upenn.edu">pbates@penmedicine.upenn.edu</a>
11/30/2022	W	Retrovirus replication	Dr. Collman	<a href="mailto:collmanr@penmedicine.upenn.edu">collmanr@penmedicine.upenn.edu</a>
12/2/2022	F	Retrovirus pathogenesis	Dr. Collman	<a href="mailto:collmanr@penmedicine.upenn.edu">collmanr@penmedicine.upenn.edu</a>
12/5/2022	M	Student Paper Discussion	Dr. Jurado	<a href="mailto:Kellie.Jurado@penmedicine.upenn.edu">Kellie.Jurado@penmedicine.upenn.edu</a>
12/7/2022	W	Flu & RNA virus pathogenesis	Dr. Hensley	<a href="mailto:hensley@penmedicine.upenn.edu">hensley@penmedicine.upenn.edu</a>
12/9/2022	F	RNA virus replication strategies	Dr. Cherry	<a href="mailto:cherrys@penmedicine.upenn.edu">cherrys@penmedicine.upenn.edu</a>
12/12/2022	M	Student Paper Discussion	Dr. Hoxie	<a href="mailto:hoxie@penmedicine.upenn.edu">hoxie@penmedicine.upenn.edu</a>
12/19/2022	Th	<b>Virology Midterm Due</b>		

# Syllabus



# Syllabus



## Introductions

- 9/7/22 Course Layout & Intro: Pathogen Genomes (Bushman)
- Principles of pathogenesis
  - Microbial and host genomes
  - Effects of host-microbe competition on the genomes of each
- 9/9/22 Intro: Concepts of Host-Pathogen Interactions (Streipen)
- 9/12/22 Intro: Host Immune Responses to Pathogens (Scott)

## Bacteriology I

- 9/14/22 Bacterial Basics, Nucleic Acid Management in Prokaryotes (Bushman)
- Bacterial phylogeny
  - Bacteria nucleic acid management
- 9/16/22 Antibiotic Resistance (Planet)
- 9/19/22 Paper Discussion (Bittinger)
- 9/21/22 Bacterial cell-cell interactions (Zhu)
- 9/23/22 Paper Discussion (Zhu)
- 9/26/22 Principles of Bacterial Pathogenesis (Brodsky)
- 9/28/22 Strategies for Bacterial Adhesion and Invasion (Brodsky)
- 9/30/22 Paper Discussion (Brodsky)
- 10/3/22 Signal transduction in bacteria (Goulian)
- Definition and diversity of two-component systems
  - Basic Reactions
  - Histidine Kinases
  - Response regulators
  - Specificity and Cross-talk
- 10/5/22 Signal Transduction in Bacteria (Goulian)
- Two canonical examples of two-component signaling:
  - porin regulation
  - chemotaxis

# Syllabus



10/7/22 CAMB Symposium

10/10/22 Paper Discussion (Zhu)

## **Bacteriology II**

10/12/22 Vertebrate microbial communities in health and disease (Levy)

10/14/22 Vertebrate microbial communities in health and disease (Thaiss)

10/17/22 Paper Discussion (Levy and Thaiss)

10/19/22 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

10/21/22 Intracellular bacteria (Shin)

- Innate immune recognition
- IFN $\gamma$  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

10/24/22 Paper Discussion (Shin)

10/26/22 Gram positive bacteria and toxins (Zackular)

10/28/22 Immunity to bacteria (Abt)

10/31/22 Paper Discussion (Abt and Zackular)

11/2/22 Phage (Bushman)

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

# Syllabus



- Phage T4
- Phage lambda
- Phage therapy

11/4/22 Paper Discussion (Bushman)

11/11/22 Bacteriology Final Due

## Virology I

- 11/11/22 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
- 11/13/22 Viral structure and diversity (Bushman)
- Introduction: viral diversity
  - The human virome
  - Metagenomics and virus hunting
- 11/16/22 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).
- 11/18/22 Virus receptors (Bates)
- What is a virus particle?
  - General problems in virus replication
  - Virus attachment
  - Internalization and fusion strategies
- 11/21/22 Virus entry (Bates)
- Metastable virion entry
  - Stepwise dis-assembly
  - Signaling in viral entry
  - Viral receptor identification and analysis
- 11/23/22 Thanksgiving Break
- 11/25/22 Thanksgiving Break
- 11/28/22 Paper Discussion (Bates)
- 11/30/22 Retrovirus replication (Collman)
- Introduction
    - The retrovirus family
    - Shared and unique genetic features
  - Replication cycle
    - Entry
    - Reverse Transcription
    - Nuclear migration & Integration

# Syllabus



- Regulation of gene expression & protein expression
- Assembly & release
- Interaction with host proteins
  - Intrinsic host defense
  - HIV auxiliary genes

## 12/2/22 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

## 12/5/22 Paper Discussion (Jurado)

## 12/7/22 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)

## 12/19/22 RNA virus replication strategies (Cherry)

## 12/12/22 Paper Discussion (Hoxie)

## 12/19/22 Virology Midterm Due