Syllabus

MVP Core
CAMB 706
Fall Semester 2020

Course Directors and Contact Info:

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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	Location
MWF, 2:30-3:30	Virtual (BlueJeans)

https://bluejeans.com/165361280

Want to dial in from a phone?

Dial one of the following numbers:

- +1.408.419.1715 (United States(San Jose))
- +1.408.915.6290 (United States(San Jose))

SEE ALL NUMBERS

Enter the meeting ID and passcode followed by #

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

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 (modified for virtual presentation)

Students not assigned to present:

1. Read the paper well in advance of the presentation day.
2. Email to the assigned faculty member a specific question about the science presented in the paper that can become part of the discussion
3. Come prepared to 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:

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 (ie. 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:

1. The assigned faculty member will meet with presenters remotely prior to the presnetations.
2. Faculty members will collect emailed questions from non-presenting students and moderate the discussion on the day of presentation to ensure involvement of students in answering.
3. 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

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CAMB 706 – Bacteriology Session I & II

Course Directors: Sunny Shin & Jay Zhu

MWF, 2:30-3:30 Virtual (BlueJeans)

DATE	DAY	TITLE	LECTURER/ PRESENTER	EMAIL
9/9/2020	W	Intro: Course Layout Intro: Pathogen Genomes	Drs. Weitzman & Shin Dr. Bushman	weitzmanm@email.chop.edu sunshin@pennmedicine.upenn.edu bushman@pennmedicine.upenn.edu
9/11/2020	F	Intro: Concepts of Host- Pathogen Interactions	Dr. Striepen	striepen@vet.upenn.edu
9/14/2020	M	Intro: Host Immune Responses to Pathogens	Dr. Scott	pscott@vet.upenn.edu
9/16/2020	W	Bacterial Basics, Global Microbiome, Nucleic Acid Management in Prokaryotes	Dr. Bushman	bushman@pennmedicine.upenn.edu
9/18/2020	F	Antibiotic Resistance	Dr. Planet	planetp@email.chop.edu
9/21/2020	M	Student Paper Presentation	Dr. Bittinger	bittingerk@email.chop.edu
9/23/2020	W	Principles of Bacterial Pathogenesis	Dr. Brodsky	ibrodsky@vet.upenn.edu
9/25/2020	F	Strategies for Bacterial Adhesion and Invasion	Dr. Brodsky	ibrodsky@vet.upenn.edu
9/28/2020	M	Student Paper Presentation	Dr. Brodsky	ibrodsky@vet.upenn.edu
9/30/2020	W	Bacterial cell-cell interactions	Dr. Zhu	junzhu@pennmedicine.upenn.edu
10/2/2020	F	**CAMB Symposium**		
10/5/2020	M	Student Paper Presentation	Dr. Zhu	junzhu@pennmedicine.upenn.edu
10/7/2020	W	Signal transduction in bacteria	Dr. Goulian	goulian@sas.upenn.edu
10/9/2020	F	Signal transduction in bacteria	Dr. Goulian	goulian@sas.upenn.edu
10/12/2020	M	Student Paper Presentation	Dr. Zhu	junzhu@pennmedicine.upenn.edu
10/14/2020	W	Vertebrate microbial communities in health and disease	Dr. Levy	maayanle@pennmedicine.upenn.edu
10/16/2020	F	Vertebrate microbial communities in health and disease	Dr. Thaiss	thaiss@pennmedicine.upenn.edu
10/19/2020	M	Student Paper Presentation	Drs. Levy & Thaiss	maayanle@pennmedicine.upenn.edu thaiss@pennmedicine.upenn.edu
10/21/2020	W	Intracellular bacteria	Dr. Shin	sunshin@pennmedicine.upenn.edu
10/23/2020	F	Intracellular bacteria	Dr. Shin	sunshin@pennmedicine.upenn.edu
10/26/2020	M	Student Paper Presentation	Dr. Shin	sunshin@pennmedicine.upenn.edu
10/28/2020	W	Gram-positive bacteria and toxins	Dr. Zackular	Joseph.Zackular@pennmedicine.upenn.edu
10/30/2020	F	Immunity to bacteria	Dr. Abt	Michael.Abt@pennmedicine.upenn.edu

11/2/2020	M	Student Paper Presentation	Drs. Abt & Zackular	Michael.Abt@pennmedicine.upenn.edu Joseph.Zackular@pennmedicine.upenn.edu
11/4/2019	W	Phage	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/6/2019	F	Student Paper Presentation	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/13/2019	F	**Bacteriology Final due**		

CAMB 706 – Virology Session I
Course Directors: Jianxin You and Matthew Weitzman
MWF, 2:30-3:30 BlueJeans

DATE	DAY	TITLE	LECTURER/ PRESENTER	EMAIL
11/13/2020	F	Viral structure and diversity	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/16/2020	M	Viral structure and diversity	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/18/2020	W	Student Paper Discussion	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/20/2020	F	Virus receptors	Dr. Bates	pbates@pennmedicine.upenn.edu
11/23/2020	M	Virus entry	Dr. Bates	pbates@pennmedicine.upenn.edu
11/25/2020	W	**Thanksgiving Break**		
11/27/2020	F	**Thanksgiving Break**		
11/30/2020	M	Student Paper Discussion	Dr. Bates	pbates@pennmedicine.upenn.edu
12/2/2020	W	Retrovirus replication	Dr. Collman	collmanr@pennmedicine.upenn.edu
12/4/2020	F	Retrovirus pathogenesis	Dr. Collman	collmanr@pennmedicine.upenn.edu
12/7/2020	M	Student Paper Discussion	Dr. Jurado	Kellie.Jurado@pennmedicine.upenn.edu
12/9/2020	W	Flu & RNA virus pathogenesis	Dr. Hensley	hensley@pennmedicine.upenn.edu
12/11/2020	F	RNA virus replication strategies	Dr. Cherry	cherrys@pennmedicine.upenn.edu
12/14/2020	M	Student Paper Discussion	Dr. Hoxie	hoxie@pennmedicine.upenn.edu
12/21/2020	M	**Virology Midterm Due**		

Introductions

9/9/20 Course Layout & Intro: Pathogen Genomes (Bushman)

- Principles of pathogenesis
- Microbial and host genomes
- Effects of host-microbe competition on the genomes of each

9/11/20 Intro: Concepts of Host-Pathogen Interactions (Streipen)

9/14/20 Intro: Host Immune Responses to Pathogens (Scott)

Bacteriology I

9/16/20 Bacterial Basics, Nucleic Acid Management in Prokaryotes (Bushman)

- Bacterial phylogeny
- Bacteria nucleic acid management

9/18/20 Antibiotic Resistance (Planet)

9/21/20 Paper Discussion (Bittinger)

9/23/20 Principles of Bacterial Pathogenesis (Brodsky)

9/25/20 Strategies for Bacterial Adhesion and Invasion (Brodsky)

9/28/20 Paper Discussion (Brodsky)

9/30/20 Bacterial cell-cell interactions (Zhu)

10/2/20 CAMB Symposium

10/5/20 Paper Discussion (Zhu)

10/7/20 Signal transduction in bacteria (Goulian)

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

10/9/20 Signal Transduction in Bacteria (Goulian)

- Two canonical examples of two-component signaling:

- porin regulation
- chemotaxis

10/12/20 Paper Discussion (Zhu)

Bacteriology II

10/14/20 Vertebrate microbial communities in health and disease (Levy)

10/16/19 Bacteriology Midterm Due

10/16/20 Vertebrate microbial communities in health and disease (Thaiss)

10/19/20 Paper Discussion (Levy and Thaiss)

10/21/20 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

10/23/20 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

10/26/20 Paper Discussion (Shin)

10/28/20 Gram positive bacteria and toxins (Zackular)

10/30/20 Immunity to bacteria (Abt)

11/2/20 Paper Discussion (Abt and Zackular)

11/4/20 Phage (Bushman)

- Phage history
- Global Virome
- Phage Phylogeny

- Clinical Consequences
- Phage T4
- Phage lambda
- Phage therapy

11/6/20 Paper Discussion (Bushman)

- Crick et al., Nature 1961. General Nature of the Genetic Code for Proteins

11/13/20 Bacteriology Final Due

Virology I

11/13/20 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

11/16/20 Viral structure and diversity (Bushman)

- Introduction: viral diversity
- The human virome
- Metagenomics and virus hunting

11/18/20 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).

11/20/20 Virus receptors (Bates)

- What is a virus particle?
- General problems in virus replication
- Virus attachment
- Internalization and fusion strategies

11/23/20 Virus entry (Bates)

- Metastable virion entry
- Stepwise dis-assembly
- Signaling in viral entry
- Viral receptor identification and analysis

11/25/20 Thanksgiving Break

11/27/20 Thanksgiving Break

11/30/20 Paper Discussion (Bates)

12/2/20 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
    - Intrinsic host defense
    - HIV auxiliary genes

12/4/20 Retrovirus pathogenesis (Collman)

- Introduction
    - Overview
    - Endogenous retroviruses
- Oncoretroviral Pathogenesis
    - Non-acute transforming viruses: Insertional oncogenesis
    - Acute transforming viruse: 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

12/7/20 Paper Discussion (Jurado)

12/9/20 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)

12/11/20 RNA virus replication strategies (Cherry)

12/14/20 Paper Discussion (Hoxie)

12/21/20 Virology Midterm Due