Syllabus

MVP Core

CAMB 706

Fall Semester 2019

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	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

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 (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:

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

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CAMB 706 – Bacteriology Session I & II

Course Directors: Sunny Shin & Jay Zhu

MWF, 2:30-3:30 209 Johnson

DATE	DAY	TITLE	LECTURER/ PRESENTER	EMAIL
9/6/2019	F	Intro: Course Layout Intro: Pathogen Genomes	Drs. Weitzman & Shin Dr. Bushman	weitzmanm@email.chop.edu sunshin@pennmedicine.upenn.edu bushman@pennmedicine.upenn.edu
9/9/2019	M	Intro: Concepts of Host- Pathogen Interactions	Dr. Hunter	chunter@vet.upenn.edu
9/13/2019	W	Intro: Host Immune Responses to Pathogens	Dr. Scott	pscott@vet.upenn.edu
9/13/2019	F	Bacterial Basics, Global Microbiome, Nucleic Acid Management in Prokaryotes	Dr. Bushman	bushman@pennmedicine.upenn.edu
9/16/2019	M	Antibiotic Resistance	Dr. Planet	planetp@email.chop.edu
9/18/2019	W	Student Paper Presentation	Dr. Bittinger	bittingerk@email.chop.edu
9/20/2019	F	Principles of Bacterial Pathogenesis	Dr. Brodsky	brodsky@vet.upenn.edu
9/23/2019	M	Strategies for Bacterial Adhesion and Invasion	Dr. Brodsky	brodsky@vet.upenn.edu
9/25/2019	W	Student Paper Presentation	Dr. Brodsky	ibrodsky@vet.upenn.edu
9/27/2019	F	Bacterial cell-cell interactions	Dr. Zhu	junzhu@pennmedicine.upenn.edu
9/30/2019	M	Student Paper Presentation	Dr. Zhu	junzhu@pennmedicine.upenn.edu
10/2/2019	W	Signal transduction in bacteria	Dr. Goulian	goulian@sas.upenn.edu
10/3/2019	Th	**Microbiome Symposium**		
10/4/2019	F	Signal transduction in bacteria	Dr. Goulian	goulian@sas.upenn.edu
10/7/2019	M	Student Paper Presentation	Dr. Zhu	junzhu@pennmedicine.upenn.edu
10/9/2019	W	Vertebrate microbial communities in health and disease	Dr. Levy	maayanle@pennmedicine.upenn.edu
10/11/2019	F	**CAMB Symposium**		
10/14/2019	M	Vertebrate microbial communities in health and disease	Dr. Thaiss	thaiss@pennmedicine.upenn.edu
10/16/2019	W	Student Paper Presentation	Drs. Levy & Thaiss	maayanle@pennmedicine.upenn.edu thaiss@pennmedicine.upenn.edu
10/18/2019	F	Intracellular bacteria	Dr. Shin	sunshin@pennmedicine.upenn.edu
10/21/2019	M	Intracellular bacteria	Dr. Shin	sunshin@pennmedicine.upenn.edu
10/23/2019	W	Student Paper Presentation	Dr. Shin	sunshin@pennmedicine.upenn.edu
10/25/2019	F	Gram-positive bacteria and toxins	Dr. Zackular	Joseph.Zackular@pennmedicine.upenn.edu

10/28/2019	M	Immunity to bacteria	Dr. Abt	Michael.Abt@pennmedicine.upenn.edu
10/30/2019	W	Student Paper Presentation	Drs. Abt & Zackular	Michael.Abt@pennmedicine.upenn.edu Joseph.Zackular@pennmedicine.upenn.edu
11/1/2019	F	Phage	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/4/2019	M	Student Paper Presentation	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/11/2019	M	**Bacteriology Final due**		

CAMB 706 – Virology Session I
Course Directors: Jianxin You and Matthew Weitzman
MWF, 2:30-3:30 209 Johnson

DATE	DAY	TITLE	LECTURER/ PRESENTER	EMAIL
11/11/2019	M	Viral structure and diversity	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/13/2019	W	Viral structure and diversity	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/15/2019	F	Student Paper Discussion 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).	Dr. Bushman	bushman@pennmedicine.upenn.edu
11/18/2019	M	Virus receptors	Dr. Bates	pbates@mail.med.upenn.edu
11/20/2019	W	Virus entry	Dr. Bates	pbates@pennmedicine.upenn.edu
11/22/2019	F	Student Paper Discussion	Dr. Bates	pbates@pennmedicine.upenn.edu
11/25/2019	M	Retrovirus replication	Dr. Collman	collmanr@pennmedicine.upenn.edu
11/27/2019	W	**Thanksgiving Break**		
11/29/2019	F	**Thanksgiving Break**		
12/2/2019	M	Retrovirus pathogenesis	Dr. Collman	collmanr@pennmedicine.upenn.edu
12/4/2019	W	Student Paper Discussion	Kellie Jurado	Kellie.Jurado@pennmedicine.upenn.edu
12/6/2019	F	RNA virus replication strategies	??	??
12/9/2019	M	Flu & RNA virus pathogenesis	Dr. Hensley	hensley@pennmedicine.upenn.edu
12/11/2019	W	Student Paper Discussion	Dr. Hoxie	hoxie@pennmedicine.upenn.edu
12/18/2019	W	**Virology Midterm Due**		

Introductions

9/5/18 Course Layout & Intro: Pathogen Genomes

9/7/18 Intro: Concepts of Host-Pathogen Interactions

9/10/18 Intro: Host Immune Responses to Pathogens

Bacteriology I

9/12/18 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

9/14/18 Antibiotic Resistance (Planet)

9/17/18 Principles of Bacterial Pathogenesis (Brodsky)

9/19/18 Discussion (Abt & Bittinger)

9/21/18 Strategies for Bacterial Adhesion and Invasion (Schifferli)

- Function of fimbrial adhesins
- Structure and biogenesis of Gram -/+ bacterial fimbriae
- Non-fimbrial adhesins: OMPs & T5SS
- Examples of adhesin-expressing host surface colonizers
- EPEC delivers a receptor to host cells for its adhesin

9/24/18 Strategies for Bacterial Adhesion and Invasion (Schifferli)

- Bacterial tools for the zipper and trigger mechanisms of host cell invasion
- Salmonella, its T3SS & effectors & its OMPs/invasins for host cell uptake
- Yersinia sp. that use an invasin for host-cell uptake
- Listeria monocytogenes, a cell & cell-to-cell invader

9/26/18 Presentation (Schifferli)

9/28/18 Bacterial cell-cell interactions (Zhu)

10/1/18 Presentation (Zhu)

10/3/17 Signal transduction in bacteria (Goulian)

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

10/5/18 CAMB Symposium

Bacteriology II

10/8/18 Signal Transduction in Bacteria (Goulian)

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

10/10/18 Presentation (Zhu)

10/12/18 Vertebrate microbial communities in health and disease (Grice)

- Overview of the human microbiome, techniques, & practicalities
- What is the human microbiome?
- How do we study the microbiome?
- 16S rRNA gene sequencing
- Metrics and bioinformatics
- Controls
- Metagenomic shotgun sequencing
- Beyond bacteria: Eukaryotic and viral members of the microbiome

10/15/18 Vertebrate microbial communities in health and disease (Grice)

- Microbiome roles in health and disease
- The NIH Human Microbiome Project
- The microbiota of different body sites and functional roles in health and disease
- Gastrointestinal tract
- Skin
- Vagina
- Oral Cavity
- Microbiome-based therapeutics: probiotics, prebiotics, and transplantation

10/17/18 Presentation (Grice)

10/19/18 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

10/22/18 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

10/24/18 Presentation (Shin)

10/26/18 Clinical Microbiology (Graf)

- Principles of Clinical/Diagnostic Microbiology
- Structure of the Clinical Laboratory
- Regulatory aspects of Clinical Lab Medicine
- Methods to culture organisms from various anatomical sites
- Methods to identify organisms to species level
- Methods for determining antibiotic resistance in clinical isolates
- Recent advances in diagnostic microbiology
- Sequencing and MALDI-TOF Mass Spectrometry
- Case studies: Practical examples of diagnostic dilemmas and the role of the laboratory in diagnosis

10/29/18 Clinical Lab Tour (Graf)

10/31/18 Phage (Bushman)

- Phage history
- Global Virome
- Phage Phylogeny
- Clinical Consequences
- Phage T4
- Phage lambda
- Phage therapy

11/5/18 Presentation (Bushman)

11/8/18 Penn-CHOP Microbiome Symposium

11/12/18 Bacteriology Final Due

Virology I

11/12/18 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

11/14/18 Viral structure and diversity (Bushman)

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

11/16/18 Paper Discussion

11/19/18 Virus receptors (Bates)

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

11/21/18 Thanksgiving Break

11/23/18 Thanksgiving Break

11/26/18 Virus entry (Bates)

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

11/28/18 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

11/30/18 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 zooinosis

12/3/18 Paper Discussion

12/5/18 Paper Discussion

12/7/18 RNA virus replication strategies (Weiss)

- Groups of RNA viruses-positive and negative strand viruses-compare virions and genomes
- Viral structural proteins-Virus life cycle
- RNA transcription and replication strategies
- Protein expression, polyprotein processing, frame shifting
- Expression and function of viral accessory proteins
- Recombination and reassortment
- Reverse genetics

12/10/18 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)

12/12/18 Paper Discussion

12/19/18 Midterm Due