Course Directors and Contact Info:
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Michael Betts, 402C Johnson Pavilion, 215-573-2772, betts@upenn.edu

Section Directors
Virology II: Matthew Weitzman/Jianxin You
Parasitology I & II: Sparky Lok/ Chris Hunter

Description
The MVP Core class, to be held in the Fall and Spring for first year CAMB-MVP students, will provide CAMB-MVP with key fundamental knowledge of Bacteriology, Virology, and Parasitology. The course will be organized into three sections after 3 overview lectures as described in the syllabus

Prerequisites
None

Enrollment criteria
Required for all first year CAMB-MVP students. Non CAMB-MVP students by permission of course director.

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
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

**Virology II Section**

**Matthew Weitzman, Ph.D.**  
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**CAMB 706 – Virology Section II**

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

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**CAMB 706 – Parasitology I & II Section**

**Course Directors:** Sparkly Lok & Chris Hunter

**February 12-April 27: Parasitology (2:30-3:30 pm, MWF, 209 Johnson Pav.)**

**Section I Protozoan infections**

- **2/12** - *Introduction to protozoa* (Beiting). A survey of the major protozoan infections of humans including a brief description of the parasite life cycles and a brief discussion of the clinical diseases seen during these infections

- **2/14** -- *Biology and pathogenesis of Plasmodium* (Striepen). This lecture will cover the life cycle *Plasmodium* parasites and pathology of human malaria. We will also discuss biochemical and cell biological similarities and differences with other apicomplexa (*Babesia, Cryptosporidium, Toxoplasma,* etc.), and implications for therapeutic development
• 2/16 – Biology and pathogenesis of Toxoplasma (Hunter). The basic principles of the life cycle of this organism will be covered and the critical role that cell mediated immunity plays in the control of this infection and the evasion strategies utilized by Toxoplasma.

• 2/19 -- Disease manifestations in leishmaniasis (Novais). This series will cover the complex biology of Leishmania species and the spectral nature of the disease.

• 2/21 – Student Paper Presentation 1: Bolton, Cribas “tag team” - Dr. Hunter

• 2/23 -- Student Paper Presentation 2: Gesualdi, Wu “tag team” - Dr. Novais

• 2/26 – Immunity to Leishmania (Scott). Studies on Leishmania have provided fundamental insights into how the immune system functions to control infection. This lecture will cover some of the contributions of this model system.

• 2/28 -- Pathogenesis of African Trypanosomiasis (Hunter). An overview of the pathogenesis of African trypanosomiasis will be presented, focusing on several mechanisms used by the parasite to evade host defenses in the bloodstream.

• 3/2 – Pathobiology of Cryptosporidium sp. (Striepen) Basics of Cryptosporidium biology and status as a leading cause of diarrheal disease (“Think intestinal malaria.”). Challenges to genetic study of Cryptosporidium and development of modern molecular tools.

• 3/5 -- Immunity to Plasmodium (Burns). This lecture will cover general and unique features of immunity to infection with malaria parasites. Immune evasion mechanisms, including the role of sequestration in parasite survival will be discussed as will the challenges of malaria vaccine development and the different strategies for achieving this goal.

• 3/7 – Student Paper Presentation 3: Gonzalez – Dr. Hunter.

Section II Helminth infections

• 3/9 -- Introduction to helminths (Lok). Overview of systematics, developmental and structural biologies of parasitic trematodes, cestodes and nematodes; brief notes on major disease systems involved and final comments on impact of parasitic helminths on global disease burden.

• 3/12 -- Th2 responses during helminth infection: balancing host protection, immunopathology and control of coincident infections. (Herbert).

• 3/14 -- Innate immunity to helminth parasites: Role and interaction of granulocytes leading to
direct killing of parasites and regulation of the innate immune responses. (Herbert).

- **3/16** -- Helminth biology with a focus on *Schistosoma* (Beiting). This lecture will stress four aspects of schistosome biology and pathogenicity: (1) the life cycle, (2) molecular composition, structure and development of the tegument with notes on role of tegumental molecules in host-parasite interactions, (3) molecular genetics and the genome with emphasis on new functional genomic tools for schistosomes, and (4) the pathogenesis of schistosomiasis with emphasis on granuloma formation.

- **3/19** – Student Paper Presentation 4: Griesman - Dr. Harb

- **3/21** – Student Paper Presentation 5: Gu – Dr. Striepen

  Parasitology Midterm Exam: Take-home distributed; due March 26.

- **3/23** -- Student Paper Presentation 6: Hatterscheide – Dr. Herbert

Section III Host Behavior/Parasite Ecology & Evolution / Arthropod associated parasite transmission / Genome-scale studies of parasites

- **3/26** – Quantitative ecology of parasites growing within hosts and transmitting between hosts (Graham)

- **3/28** -- Evolution of virulence in parasites (Brisson) General theory on parasites with regard to ecology and evolution with a discussion of life-history strategies (when is it better to be virulent or asymptomatic).

- **3/30** – Student Paper Presentation 7: Marquis – Dr. Beiting

- **4/2** – Student Paper Presentation 8: Matsuda – Dr. Lok

- **4/4** -- Parasite genomics (Harb). This session will focus on the use of the Eukaryotic Pathogens databases. This lecture will cover some parasite biology while at the same time considering how in silico experiments are done on these parasites, including high throughput methods and database incorporation.

- **4/6** -- Student Paper Presentation 9: Brisson - Montoya

- **4/9** – Introduction to Vector Biology (Lok). Overview of systematics, evolutionary and structural biology of arthropod vectors, with a breakdown of taxa involved in transmission of parasitic disease agents and an outline of general types of vector/parasite interaction.
• **4/11** -- Molecular Interactions of Parasites and Vectors (Povelones). Discussion of current papers on receptor/ligand interactions mediating parasite migration and proliferation in vectors and vector defensive responses limiting parasite growth; genetic manipulation of vector/parasite interactions with an eye to novel control methods.

• **4/13** -- *Plasmodium* infections of wild-living primates and their zoonotic potential (Hahn). Ecology, population genetics and evolutionary biology of *Plasmodium* spp. in primates, with discussion of their relative importance in the origins of human malaria and in present-day zoonotic infection.

• **4/16** -- Student Paper Presentation 10: Pearuoi – Dr. Povelones

• **4/18** -- Student Paper Presentation 11: Strelau – Dr. Lok
  
  Parasitology Final Exam Take home distributed at end of class; due April 25.
Section I. Protozoan infections

2/12/18  Introduction to protozoa (Beiting)
A survey of the major protozoan infections of humans including a brief description of the parasite life cycles and a brief discussion of the clinical diseases seen during these infections.

2/14/18  Biology and pathogenesis of Toxoplasma (Hunter)
The basic principles of the life cycle of this organism will be covered and the critical role that cell mediated immunity plays in the control of this infection and the evasion strategies utilized by Toxoplasma.

2/16/18  Student Paper Presentation

2/19/18  Pathogenesis of African Trypanosomiasis (Hunter)
An overview of the pathogenesis of African trypanosomiasis will be presented, focusing on several mechanisms used by the parasite to evade host defenses in the bloodstream.

2/21/18  Disease manifestations in leishmaniasis (Novais)
This series will cover the complex biology of Leishmania species and the spectral nature of the disease.

2/23/18  Student Paper Presentation

2/26/18  Immunity to Leishmania (Scott)
Studies on Leishmania have provided fundamental insights into how the immune system functions to control infection. This lecture will cover some of the contributions of this model system.

2/28/18  Biology and pathogenesis of Plasmodium (Roos)
This lecture will cover the life cycle Plasmodium parasites and pathology of human malaria. We will also discuss biochemical and cell biological similarities and differences with other apicomplexan (Babesia, Cryptosporidium, Toxoplasma, etc.), and implications for therapeutic development.

3/2/18  Student Paper Presentation:

3/5/18  Immunity to Plasmodium (Burns)
This lecture will cover general and unique features of immunity to infection with malaria parasites. Immune evasion mechanisms, including the role of sequestration in parasite survival will be discussed as will the challenges of malaria vaccine development and the different strategies for achieving this goal.

Section II. Helminth infections

3/7/18  Introduction to helminths (Lok)
Overview of systematics, developmental and structural biologies of parasitic trematodes, cestodes and nematodes; brief notes on major disease systems involved and final comments on impact of parasitic helminths on global disease burden.

3/9/18  Student Paper Presentation

3/11/18  Th2 responses during helminth infection: balancing host protection, immunopathology and control of coincident infections. (Herbert).

3/14/18  Innate immunity to helminth parasites: Role and interaction of granulocytes leading to direct killing of parasites and regulation of the innate immune responses. (Herbert).

3/16/18  Helminth biology with a focus on Schistosoma (Beiting)
This lecture will stress four aspects of schistosome biology and pathogenicity: (1) the life cycle, (2) molecular composition, structure and development of the tegument with notes on role of tegumental molecules in host-parasite interactions, (3) molecular genetics and the genome with emphasis on new functional genomic tools for schistosomes, and (4) the pathogenesis of schistosomiasis with emphasis on granuloma formation.

3/19/18  Parasitology Midterm Exam: Take-home distributed; due 3/30/18

Section III. Host Behavior/Parasite Ecology & Evolution / Arthropod associated parasite transmission / Genome-scale studies of parasites

3/21/18  Parasite modulation of host behavior (Greenberg)
Parasites can alter host behavior, apparently to their advantage, but distinguishing between adaptive manipulation versus pathology can sometimes be tricky. We will examine some of the best-studied cases of apparent manipulation, with an eye towards understanding underlying molecular and physiological mechanisms.

3/23/18  Ecology of Parasites (Levy)
Covers the Ross-Macdonald model in the context of T. cruzi ecology and control.

3/26/18  Evolution of virulence in parasites (Brisson)
General theory on parasites with regard to ecology and evolution with a discussion of life-history strategies (when is it better to be virulent or asymptomatic).

3/28/18  Student Paper Presentation

3/30/18  Helminth drug targets and drug discovery (Greenberg)
In the absence of vaccines, chemotherapy represents the major strategy for treating and controlling helminth infections. However, lack of drug options and emergence of parasite drug resistance are huge problems, and new drugs are urgently needed. We will explore current anthelmintic drug targets, and prospects for development of new targets and new drugs. One obvious strategy for developing selective anthelmintics would be to target parasite-specific proteins and pathways. Surprisingly, however, most current anthelmintic drugs actually interact
with proteins that are very highly conserved between mammals and helminths. We will explore those drugs and targets, as well as strategies for development of new therapeutics.

4/2/18  **Parasite Genomics (Harb)**
This session will focus on the use of the Eukaryotic Pathogens databases. This lecture will cover some parasite biology while at the same time considering how in silico experiments are done on these parasites, including high throughput methods and database incorporation.

4/4/18  **Student Paper Presentation**

4/6/18  **Introduction to Vector Biology (Lok)**
Overview of systematics, evolutionary and structural biology of arthropod vectors, with a breakdown of taxa involved in transmission of parasitic disease agents and an outline of general types of vector/parasite interaction.

4/9/18  **Molecular Interactions of Parasites and Vectors (Povelones).**
Discussion of current papers on receptor/ligand interactions mediating parasite migration and proliferation in vectors and vector defensive responses limiting parasite growth; genetic manipulation of vector/parasite interactions with an eye to novel control methods.

4/11/18  **Plasmodium infections of wild-living primates and their zoonotic potential (Hahn)**
Ecology, population genetics and evolutionary biology of Plasmodium spp. In primates, with discussion of their relative importance in the origins of human malaria and in present-day

4/13/18  **Student Paper Presentation**

4/16/18  **Re-cap Protozoa (Hunter)**

4/18/18  **Re-cap Helminths/Arthropods (Lok)**
Parasitology Final Exam distributed at end of class. Take home; due April 25.