SYLLABUS
VIROLOGY AND VIRAL PATHOGENESIS
PATH 433/ MCB433
FALL SEMESTER 2019

GENERAL INFORMATION

INSTRUCTOR:
Daniel L. Rock, PhD
Room 2830, VMBSB, Phone 244-0533; Email: dlrock@illinois.edu
Office Hours - Arrange by e-mail. The subject line for all course e-mails should read
PATH/MCB 433 – YOUR LAST NAME

CLASS TIME AND CLASSROOM:
Tuesday and Thursday 2:00-3:20 PM
Lincoln Hall 1051

COURSE DESCRIPTION:
The course emphasizes basic principles of virus structure and replication, virus-cell and
virus-host interactions that underlie the molecular biology, pathogenesis, and
transmission of viral diseases. This is a 3-credit course.

COURSE PREREQUISITE:
MCB 300 (Microbiology) or MCB 354 (Biochemical and Physical Basis of Life), or
consent of instructor

TEXTBOOK
Principles of Virology (PoV) 2015, 4th edition, by Flint et al., American Society for
Microbiology Press, Washington DC. Reading assignments are listed below in the class
schedule. Additional teaching and reading materials will be provided through the course
Illinois Compass 2g site.
_Lynn_W_Enquist_Vi

EVALUATION:

<table>
<thead>
<tr>
<th>Item</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam #1</td>
<td>125</td>
</tr>
<tr>
<td>Exam #2</td>
<td>85</td>
</tr>
<tr>
<td>Virus News Presentation</td>
<td>30</td>
</tr>
<tr>
<td>Article Presentation</td>
<td>125</td>
</tr>
<tr>
<td>Reading Journal</td>
<td>100</td>
</tr>
<tr>
<td>Virus Design Challenge</td>
<td>125</td>
</tr>
<tr>
<td>Attendance/Participation</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>650</td>
</tr>
</tbody>
</table>
A letter grade will be assigned based on the following scale (% of 650 points).

- A  93-100%
- A-  90-92%
- B+  87-89%
- B   83-86%
- B-  80-82%
- C+  77-79%
- C   70-76%
- D   60-69%
- F   59% and below

IMPORTANT DATES:

- First day of instruction: August 27 (Tue)
- Exam #1: October 3 (Thu)
- Exam #2: November 21 (Thu)
- Semester break, No classes: November 26 (Tue) and 28 (Thu)
- Last class: December 10 (Tue)

APPROXIMATE CLASS SCHEDULE

- Class 1, Aug 27 (Tue): Introduction, History, Virus Structure, Classification of Viruses
  *PoV Vol I Chapter 1*

- Class 2, Aug 29 (Thu): Virus-Cell Interaction I
  *PoV Vol I Chapter 2, 3, 4, 5, 13, 15 and Vol I Appendix*

- Class 3, Sept 3 (Tue): Virus-Cell Interaction II

- Class 4, Sept 5 (Thu): Virus-Host interactions I: Host Response to Infection
  *PoV Vol II Chapter 3 and 4*

- Class 5, Sept 10 (Tue): Example Research Article Presentation – S. Khatiwada

- Class 6, Sept 12 (Thu): *Virus News 1*; Virus-Host interactions II: Mechanisms of Viral Pathogenesis
  *PoV Vol II Chapter 2 and 5*

- Class 7, Sept 17 (Tue): *Virus News 2*; Virus-Host Interactions III: Viral Virulence and Host Range

- Class 8, Sept 19 (Thu): *Virus News 3*; Viral Genetics and Evolution of Viruses
  *PoV Vol II Chapter 10*

- Class 9, Sept 24 (Tue): *Virus News 4*; Viral Vaccines
  *PoV Vol II Chapter 8*

- Class 10, Sept 26 (Thu): *Virus News 5*; Antiviral Drugs and Chemotherapy
  *PoV Vol II Chapter 9*

- Class 11, Oct 1 (Tue): *Virus News 6*; Reverse Transcribing Viruses and Viral Oncogenesis
Class 12, Oct 3 (Thu):  Exam 1

Class 13, Oct 8 (Tue):  *Virus News 7*; *Research Article Presentation 1*;  
Reverse Transcribing Viruses and Viral Oncogenesis

Class 14, Oct 10 (Thu):  *Virus News 8*; *Research Article Presentation 2*;  
DNA Viruses *PoV Vol I Chapter 8, 9, 10 and Vol I Appendix*

Class 15, Oct 15 (Tue):  *Virus News 9*;  *Research Article Presentation 3*; DNA Viruses

Class 16, Oct 17 (Thu):  *Virus News 10*;  *Research Article Presentation 4*; DNA Viruses

Class 17, Oct 22 (Tue):  *Virus News 11*;  *Research Article Presentation 5*; DNA Viruses

Class 18, Oct 24 (Thu):  *Virus News 12*;  *Research Article Presentation 6*; DNA Viruses

Class 19, Oct 29 (Tue):  *Virus News 13*;  *Research Article Presentation 7*; DNA Viruses

Class 20, Oct 31 (Thu):  *Virus News 14*;  *Research Article Presentation 8*;  
RNA Viruses *PoV Vol I Chapter 6, 10 and 11*

Class 21, Nov 5 (Tue):  *Virus News 15*;  *Research Article Presentation 9*; RNA Viruses

Class 22, Nov 7 (Thu):  *Virus News 16*;  *Research Article Presentation 10*; RNA Viruses

Class 23, Nov 12 (Tue)  *Virus News 17*;  *Research Article Presentation 11*; RNA Viruses

Class 24, Nov 14 (Thu):  *Virus News 18*;  *Research Article Presentation 12*; RNA Viruses

Class 25, Nov 19 (Thu):  *Virus News 19 and 20*;  *Research Article Presentation 13*

Class 26, Nov 21 (Thu):  Exam 2

**Semester Break**

Class 27, Dec 3  (Tue):  Virus Design Challenge Presentations

Class 28, Dec 5  (Thu):  Virus Design Challenge Presentations

Class 29, Dec 10 (Tue):  Virus Design Challenge Presentations
ASSIGNMENT DETAILS

**Exam Format** - Short answer or essay questions. Examples of past exams will be provided on the course Compass site.

**Virus News Presentation** - At the beginning of each class an assigned student will briefly present (~ 5 minutes) anything they have read recently related to virology that they find particularly interesting – a couple of slides or no slides, and a brief description with thoughts/opinions followed by a short group discussion.

**Research Article Presentation**

A team of two students will be assigned a research article to present to the class. **Graduate students will present individually.** Each group will: 1) **prepare a Research Discussion Handout** (see examples of Research Discussion Handouts provided on the course Compass site) that will be distributed to the class prior to the scheduled presentation. Handouts will be provided to me on or before the Sunday preceding a Tuesday presentation and on or before Tuesday preceding a Thursday presentation. I will post them on the Compass course site in the respective research article file. 2) **meet with me** at least one week before the scheduled presentation to discuss the paper and your presentation approach. Close to final presentation slides and the Research Discussion Handout should be available for review at this time. Contact me to arrange a time. 3) **present and lead a discussion of the paper.** The **presentation format and approach is totally up to the team** and may involve class involvement/participation if desired. All students in the class will have read the article prior to the presentation. Additional reading of the paper’s supplementary files and background articles likely will be needed for developing an informed quality presentation.

Some things to consider when reading and presenting a primary research article:

- Relevant background information
- Introduction - what is the current status of the field that the paper addresses?
- What is the specific question (hypothesis) being addressed in the paper?
- What are the experimental approaches used to address the question? (research techniques–and strategy. Are explanations/descriptions needed here? ) Are there underlying assumptions made in adapting these approaches?
- Research Data: What are the experimental results? **Note – not every Fig. or Table may need to be discussed in detail.**
- What are the specific conclusions made by the authors? What assumptions underlie them? Are the conclusions valid and reasonable – why or why not?
- What other experimental approaches might have been used to strengthen and/or further clarify the conclusions reached?
- What is the impact of the work on the current status of the field – how has the work changed thinking in the field? Why is it important?
“And then what?” What significant questions have been raised by the work – what needs to be done now?

Research Article Reading Journal

Every student must keep a reading journal for the example article and all thirteen of the research articles we will be discussing in class. Each journal entry consists of an outline and notes for the article being discussed as well as any additional information obtained from other readings. You may choose any writing style(s) with which you feel comfortable (entries may combine outlines, reading notes and reflections – these need not be essays). A journal entry should be 1-3 typed pages per research article. (see examples of Reading Journal Entries provided on the course Compass site). Your ideas will not be graded as correct or incorrect -- rather journal entries are an opportunity to explore and demonstrate your understanding of the article and explore new ideas and concepts. The cumulative quality of the content and completeness of your entries will be evaluated.

Journal entries for given articles are due on or before the start of class on the day we are discussing the article. These should be e-mailed to me with the subject line: PATH/MCB 433 - Your Last Name - Article #

Virus Design Challenge Project

Based on your exceptional knowledge of virology, you have been selected to develop a new virus design that you feel improves upon existing designs. Use your existing knowledge of viruses, their specific interactions with cells/host and their current limitations to develop this new design that will improve viral fitness and perpetuation in nature. Your design concept should include at least four specific features which may involve, but need not be limited to, specific gene content, genome structure, genome replication, viral gene expression strategies, viral virulence/immune evasion strategies, and any other novel capabilities you wish your virus to have. Be bold in your thinking – there is no correct answer but, ideas must be consistent with the general laws of biology as we currently understand them. This assignment has three deliverables: I) a short paper (~ 4-5 pages of text - additional materials including drawings, videos etc. can be included if desired) where you provide 1) a brief overview of the life cycle of your virus noting the new design features 2) a description of each new design feature with discussion of why it constitutes an improvement both individually and collectively to your design and 3) a discussion of assumptions made and possible problems/pitfalls of the design – why might what you are proposing not be successful? II) a class presentation where you present your design concept to the class (10 minutes presentation / 5 minutes of questions). and III) A brief review of all designs presented in class addressing innovation, creativity and strengths/weaknesses etc. and your ranking of the top 4 designs. All virus design papers are due on or before Monday, December 2.

BIG prizes will be awarded for the top three ranked designs.

Class Attendance/Participation

Class attendance is required for all Research Article and Virus Design Challenge Presentations. Participation in class discussions and activities is essential to build our learning environment. This does not mean I will be evaluating you solely on the number of times you speak but, everyone should be prepared and engage in class discussions.
Research Articles:

**Example Article** - Metabotropic glutamate receptor subtype 2 is a cellular receptor for rabies virus. PLoS Pathog 14(7): e1007189. https://doi.org/10.1371/journal.ppat.1007189

**Article 1** - HSV-1 single-cell analysis reveals the activation of anti-viral and developmental programs in distinct sub-populations. Drayman et al., eLife 2019;8:e46339. DOI: https://doi.org/10.7554/eLife.46339


**Article 3** - Single-Cell Analysis of RNA Virus Infection Identifies Multiple Genetically Diverse Viral Genomes within Single Infectious Units. Combe et al., Cell Host & Microbe 18, 424–432. http://dx.doi.org/10.1016/j.chom.2015.09.009

**Article 4** - Cyclical adaptation of measles virus quasispecies to epithelial and lymphocytic cells – To V, or not to V. Donohue et al., PLoS Pathog 15(2): e1007605. https://doi.org/10.1371/journal.ppat.1007605


**Article 9** – A small-molecule fusion inhibitor of influenza virus is orally active in mice. M. J. P. van Dongen et al., Science 363, eaar6221 (2019). DOI: 10.1126/science.aar6221

**Article 10** - Genome-wide identification of interferon-sensitive mutations enables influenza vaccine design. Du et al., Science 359 (6373), 290-296. DOI: 10.1126/science.aan8806

**Article 11** - Genetically modified pigs are protected from classical swine fever virus. Xie et al., PLoS Pathog 14(12): e1007193. https://doi.org/10.1371/journal.ppat.1007193

**Article 12** - A multicellular way of life for a multipartite virus. Sicard et al., eLife 2019;8:e43599. DOI: https://doi.org/10.7554/eLife.43599