

BIOL5803 Virology

McCoy College of Science, Mathematics, and Engineering
Fall 2023

Contact Information

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Course Description

This course is intended to provide students with foundational knowledge in the field of virology. Viruses are obligate parasites. They are extremely diverse, and yet all viruses share a common set of strategies for survival and propagation. Viruses are infectious, and their patterns of infection can strongly shape the genetics, behavior, and survival of the populations in which they are found. Because viruses are so diverse, it is really impossible to describe all of them; thus, we will use a few viruses as models for how viruses in general do the things they do.

Textbook & Instructional Materials

There will be **no required text** for this course. However, for those wanting a book, the following are two possibilities. I will lecture from *Principles of Virology* and supplement with journal articles posted on D2L.

1. For a general text (affordable): *Principles of Virology*, 5th edition, by Flint, Racaniello, Rall, Hatzioannou, and Skalka. ASM Press. Two Volumes. About \$180 from Amazon.
2. For a specialized text if you plan on going into virology (hideously expensive): *Fields Virology*, 7th edition, 4 volumes, D.M. Knipe, PM Howley. Lippincott, Williams & Wilkins. Each of the 4 volumes is \$150 apiece, meaning the complete set is \$600. This book is considered the gold standard.

Additional Resources

There is a lot of information out there on viruses, but a few sites stand out as being particularly useful. They are:

1. [Virology](#) at Columbia with Vincent Racaniello: this is his course on viruses; complete with slides, study questions, and YouTube videos of his lectures. Since he wrote the recommended virology book, this is an excellent website for background information to supplement my lectures.
2. [Viral Zone](#): This is an encyclopedia of viruses (their structure, how they replicate, diseases, further resources).
3. “This Week in Virology” podcast: [TWiV](#), also available on iTunes. This is put out by VR Racaniello.
4. The [CDC](#) and [WHO](#) also publish a lot about viruses, including new and ongoing disease outbreaks.
5. The scientific literature is best searched for information on viruses through [PubMed](#), which gives you the option of searching FREE articles and downloading them directly to your computer.

Attendance

Students are expected to attend all meetings of the classes in which they are enrolled. This is especially true of graduate students in graduate courses that meet infrequently. If you absolutely **MUST** miss class (which would be for a significant reason), please inform me prior to the start of the class to be missed. Instructor’s records will stand as evidence of absences.

Student Handbook

Refer to: [Student Handbook-2018-19](#)

Academic Dishonesty: Cheating, collusion, and plagiarism (the act of using source material of other persons, either published or unpublished, without following the accepted techniques of crediting, or the submission for credit of work not the individual's to whom credit is given). Additional guidelines on procedures in these matters may be found through the [Dean of Students](#) office.

All forms of plagiarism are to be consciously and methodically avoided at all costs. Plagiarism is NEVER acceptable and there is no such thing as “accidental” plagiarism. Any assignment submitted in this class that is found to contain any form of plagiarism, no matter how minor an infraction, will receive a zero for a grade and you will receive no participation credit for that assignment. Plagiarism includes direct copying of the work of others without citation, paraphrasing without citation, improper or sloppy citation, citation without having actually read the source, and any or all other use of the work of others without proper vetting or reference. Do NOT use AI anything to help you write your papers. ChatGPT, GrammarlyGO and all other AI resources are considered cheating because they do NOT represent your work. Cheating results in a failing grade automatically.

Course Exam

There will be **one exam** (take-home) covering the lecture portion of the class. You will be given a set of questions to answer demonstrating that you understand how/why viruses do what they do. You will be allowed to use the scientific literature and other resources during the exam EXCEPT each other, other students, or other faculty.

Projects Required

- 1. Virology Book Club Report/Discussion (Book Report):** you will find a popular book about viruses, read it, and analyze it. An example could be something like *The Hot Zone*, by Richard Preston, which is about Ebola. The book may be fiction or non-fiction. You will analyze the book for the following elements and write about what you find:
 - a. Summary: as with any book report, you first present a paragraph or two summarizing the book.
 - b. Purpose: what was the intent of the author in writing the book?
 - c. Tone: is the story of the virus “jazzed” up to make it exciting? Frightening? Or is it written in a factual manner that intends to inform rather than terrorize.
 - d. Science: did the author do their homework and present the science of the virus – its life cycle, epidemiology, etc. and was the science presented correctly?
 - e. References: does the author draw on the science literature to write the story, or is it historical, journalistic? Are there any references at all? Flip through the references and try to locate some of them—how easy would it be for someone to double-check the contents of the book?
 - f. Author: who is the author and were they an appropriate author for the book that was written?
 - g. Assessment: is it a good book (a “good read”) and is it a good book for presenting a complex subject to the general public that does not have your education?
 - h. **Book Club Discussion:** We will take one day towards the end of the course to talk about our books in class. This will be an informal round-table discussion (no formal presentation is required).
- 2. Virus Project (Review Paper):** you will select an individual virus to study this semester and write a mini-review of the current state of knowledge about that virus. **You will specifically choose one of the primary papers you consult for your review paper to present to the class.** Your virus project paper must discuss a **minimum of 10 primary research articles** on your chosen virus (note: you can choose any virus you want, but only one student will be allowed per virus. The virus you choose does not have to be the virus you do your book report on.).
- 3. Major Presentation:** you will present **one of your primary journal articles** from your project paper to the class (1 of the 10 minimum papers). This paper must be on the virus itself or its parts (it cannot be a paper primarily on cell biology, immunology, epidemiology, medical case reports, etc.). You will be

required to email a copy of the paper to everyone in the class so that we may all read the paper prior to your presentation of it.

Late Work

No late work will be accepted. This is a non-negotiable policy. If I actually give you a deadline, I really do need your work at that time.

Problems with the Mechanics of Writing

You will be asked to write two (2) major papers in this course. If you require help with the basic mechanics of writing, you will need to work with the Writing Center. I will help you some, but I will not edit student work at the sentence level, pre-read your writing before you turn it in, help you organize it, or anything of the sort, so if you need that type of help you need to go to the Writing Center or work with another student/friend. Grammar, punctuation, spelling, logic are all graded parts of all assignments.

Desire-to-Learn (D2L)

Extensive use of the MSU D2L program is a part of this course. Each student is expected to be familiar with this program as it provides a primary source of communication regarding assignments, examination materials, and general course information. You can log into [D2L](#) through the MSU Homepage. If you experience difficulties, please contact the technicians listed for the program as I am not a technician.

Grading

Grades in the course will be broken down as follows. Straight percentages will be used to determine the overall grade in the course.

Table 1: Points allocated to each assignment

Assignments	Percentage
Exam	25%
Book Report	25%
Virus Project Review Paper	25%
Virus Project Presentation	25%

Instructor Class Policies

Please give your attention to the class and not your phones while class is in session. You may use a tablet or computer to take notes on, but please turn off the sound so we do not listen to your alarms and alerts.

Services for Students with Disabilities: for details, please go to [Disability Support Services](#).

College Policies: See the MSU student portal

Course Schedule

We will do everything possible to adhere to this schedule, but weather and other events may force changes. You are responsible for going to D2L and downloading and reading all materials listed in the schedule. It is suggested that where multiple papers are listed, you read them in the order presented.

Course Schedule

Week	Subject/Readings/Slide Packets (found on D2L)
Week 1 (8/30)	<p>Course Introduction Slide Show: Virology Basics 1 Forni D, Cagliani R, Clerici M, and Sironi M (2022) “Disease-causing human viruses: novelty and legacy.” <i>Trends in Microbiology</i> 30(12):1232 – 1242. Wolf YI, Kazlauskas D, Iranzo J, et al. (2018) “Origins and Evolution of the Global RNA Virome” <i>mBio</i> 9(6):e02329-18.</p>
Week 2 (9/6)	<p>The Infectious Cycle Slide Show: Virology Basics 2 Mukhopadhyaya I, Segal JP, Carding SR, Hart AL, Hold GL (2019) “The gut virome: the ‘missing link’ between gut bacteria and host immunity?” <i>Therapeutic Advances in Gastroenterology</i> 12:1 – 17.</p>
Week 3 (9/13)	<p>The Baltimore Classification Slide Show: Virology Basics 3 Baltimore D (1971) “Expression of Animal Virus Genomes” <i>Bacteriological Reviews</i> 35(3):235 – 241.</p>
Week 4 (9/20)	<p>The Structure of Viruses Slide Show: Virology Basics 4 Rossmann MG (2013) “Structure of viruses: a short history” <i>Quarterly Reviews of Biophysics</i> 46(2):133 – 180.</p>
Week 5 (9/27)	<p>Attachment and Entry of Viruses Slide Show: Virology Basics 5 Greber UF (2016) “Virus and Host Mechanics Support Membrane Penetration and Cell Entry” <i>Journal of Virology</i> 90(8):3802 – 3805. Dou D, Revol R, Ostbye H, Wang H, Daniels R (2018) “Influenza A Virus Cell Entry, Replication, Virion Assembly and Movement” <i>Frontiers in Immunology</i> 9:1581.</p>
Week 6 (10/4) Week 7 (10/11)	<p>The Replication Cycle (Flu as a Model) Slide Show: Virology Basics 6 te Velthuis AJW, Fodor E (2016) “Influenza virus RNA polymerase: insights into the mechanisms of viral RNA synthesis” <i>Nature Reviews Microbiology</i> 14:479 – 493. Dou D, Revol R, Ostbye H, Wang H, Daniels R (2018) “Influenza A Virus Cell Entry, Replication, Virion Assembly and Movement” <i>Frontiers in Immunology</i> 9:1581 (paper is from Week 5). Su S, Bi Y, Wong G, Gray GC, Gao GF, Li S (2015) “Epidemiology, Evolution, and Recent Outbreaks of Avian Influenza Virus in China” <i>Journal of Virology</i> 89(17):8671 – 8676.</p>
Week 8 (10/18) Week 9 (10/25)	<p>Epidemiology, Transmission, and Evolution of Viruses Slide Show: Virology Basics 7 de Graaf M, Fouchier RAM (2014) “Role of receptor binding specificity in influenza A virus transmission and pathogenesis” <i>The EMBO Journal</i> 33(8):823 – 841. Keynan Y, Malik S, Fowke KR (2013) “The Role of Polymorphisms in Host Immune Genes in Determining the Severity of Respiratory Illness Caused by Pandemic H1N1 Influenza” <i>Public Health Genomics</i> 16: 9 – 16. Park DJ, Dudas G, Wohl S, et al. (2015) “Ebola Virus Epidemiology, Transmission, and Evolution during Seven Months in Sierra Leone” <i>Cell</i> 161:1516 – 1526. Graham M, Winter AK, Ferrari M, Grenfell B, Moss WJ, Asman AS, Metcalf CJE, Lessler J (2019) “Measles and the canonical path to elimination” <i>Science</i> 364:584 – 587.</p>

Week	Subject/Readings/Slide Packets (found on D2L)
Week 10 (11/1)	Emerging Viruses No Slide Show Frutos R, Serra-Cobo J, Pinault L, Roig ML, Devaux CA (2021) “Emergence of Bat-Related Betacoronaviruses: Hazard and Risks” <i>Frontiers in Microbiology</i> 12:591535. Patrono LV, Vrancken B, Budt M, et al. (2022) “Archival influenza virus genomes from Europe reveal genomic variability during the 1918 pandemic” <i>Nature Communications</i> 13:2314.
Week 11 (11/8)	Vaccines No Slide Show DeStefano F and Shimabukuro TT (2019) “The MMR Vaccine and Autism” <i>Annual Review of Virology</i> 6:585 – 600. Pertwee E, Simas C, Larson HJ (2022) “An epidemic of uncertainty: rumors, conspiracy theories and vaccine hesitancy” <i>Nature Medicine</i> 28:456 – 459.
Week 12 (11/15)	VIROLOGY BOOK CLUB (Reports DUE) This is an informal round table where you will tell us about your book.
Week 13 (11/22)	THANKSGIVING NO CLASS
Week 14 (11/29)	Student Presentations (Projects DUE) 1. 2. 3. 4.
Week 15 (12/6)	Student Presentations (Projects DUE) 5. 6. 7. 8.

Review Paper (More Information)

Once your virus is selected, you need to choose some aspect of the virus’ life cycle to investigate. For example, you may decide to study how the virus gets into the cell. You may need to do some more research on your virus to see what is out there before deciding what specifically you want to study. Note: **START EARLY!!!** You may have to inter-library loan some articles, so you can’t wait until the last minute. I no longer hold subscriptions to the major virology journals, so I can’t get the articles for you. The [PubMed](#) database is the easiest way to review papers before getting them because you can read all abstracts for free (and then many of the papers are open access, so you can download immediately).

Once your virus and life-cycle topic are chosen, you will need to find **10** peer-reviewed **primary** journal articles **published within the last 5 years** about the topic you have chosen. You may choose to include some review papers (secondary journal articles), but these are in addition to the 10 primary articles (not in place of). The 10 articles must all focus on your specific topic (as per the example, they would all have something to do with viral entry into the host cell). You will want to include background information on the virus (where it is found, how transmitted, diseases, etc.), but this can be obtained from Viral Zone, the CDC, etc. The 10 articles must then be analyzed and synthesized into a review article on the topic (e.g., you will use primary journal articles as the source material to write a secondary review article that describes the current state of research on the topic).

The review paper must be a minimum of 10 written pages (excluding cover page, reference list, etc.) in 12 point font, double-spaced, and 1 inch margins all the way around. Students will be held to high standards of grammatical accuracy, so make sure you proofread your writing. You may include figures, but they must be clear, well footnoted as to source, have good figure legends, and be referred to in the text (figures can be inserted in the text or put on their own pages; they do not count as part of your written pages). Note: figures should be annotated to demonstrate you are not just using them for filler (for example, with notes or arrows to call attention to what you want me to see). The papers must be integrated to tell a cohesive story of the topic – you are NOT writing a paragraph summary of each paper strung together with no integration. If you write that type of paper, you will receive a failing grade.

Class Presentation (More Information)

From the 10 primary journal articles you gather for the mini-review paper, you will select **ONE paper** to present to the class. Your paper must be approved by me before presentation. We will set up an email list and you will email your paper to the class (one) 1 week before your presentation so that we can read it. We will run this like a journal club, which means that you will give no more than a 20-25 minute presentation on the paper and we will then discuss it (the audience can ask questions and/or we will talk about different aspects of the paper and what it means in context of the class). You will need to craft a **PowerPoint** presentation of your talk, which you will also turn in to me as part of your grade. You will be evaluated by me and your peers (peer review sheets will be handed out). Which paper you pick to present will ultimately be up to you (even though I want to approve it), but you will do best picking the most interesting paper of the 10 you are working with so as to convey that enthusiasm to us.

What goes into the presentation? Some sort of introduction (what the virus is, where it is found, does it cause human illness, etc.), an overview of the life cycle, where your focus is, the core of the paper (what was the research question, what was the hypothesis, what experiments were run and why, a focus on the results and what they mean), how the paper fits into the overall understanding of the life cycle, how your research fits into the context of the class, and future directions of the research (where do you think the research needs to go?). Note: you do NOT need to try and learn every technique in the paper in order to present it, but you do need to understand enough to explain the results of the paper to us. This may mean that you will need to consult other papers or encyclopedias, etc. to help you understand the techniques in general terms. You will want, therefore, to put your presentation together early and practice it at least a little so that you are comfortable talking about the results.

What does the audience do during the presentation? Listen, ask questions, and evaluate the presentation. You are expected to read the papers prior to the presentations so you can actively participate in the discussion.