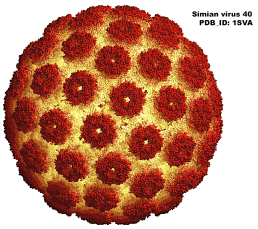
The Biology of Viruses
MMI / Biochem 575



SPRING 2015

INSTRUCTORS: **Professor Paul Friesen**
Professor Andrew Mehle

INTRODUCTION: The goal of "Biology of Viruses" (MMI/Biochem 575) is to introduce upper-level undergraduate students to the biology and biochemistry of viruses and virus infection. We will address the fundamentals of virus properties, virus multiplication, disease mechanisms, prevention and intervention of infection, and how viruses pose new threats to human and animal health through emergence and evolution. We will focus primarily on viruses that are pathogenic to animals. This course is intended to cover important concepts and themes in virology. We will discuss carefully selected examples of viruses that impact our world and everyday life. Thus, this course will not be a "bug per day" style of class.

Important prerequisite classes for this course are Biocore 301/302, Zoology 151/152, or MM&I 301. Because many biochemical and genetic principals will be used in this course, a solid background in cell biology, genetics, and general biochemistry will be necessary. A course in general biochemistry is **highly** recommended; one in immunology will be helpful.

LECTURES: Tuesdays and Thursdays, 11:00 AM – 11:50 AM
Room 1520, Microbial Sciences Building

LECTURE NOTES: A set of lecture notes will be provided each day in class. These notes will also be posted on the 575 website at Learn@UW for color printing. Although the handouts will contain the lecture material, taking careful notes during class will be essential. The lecture notes are not intended to substitute for the lecture presentation itself nor will they include every detail discussed in class. Thus, student attendance during each class is important. ***Regular attendance is required and is a prerequisite for success***.

RECOMMENDED TEXTBOOK:

Principles of Virology, 3rd Edition, 2009. S.J. Flint, L.W. Enquist, V.R. Racaniello, A.M. Skalka (eds). ASM Press. Two volumes. ISBN 978-1-55581-479-3.

This **TWO VOLUME** textbook is highly recommended, but not required. Students may wish to delay purchase of this book until which time the instructor discusses its role in class. This textbook is an excellent reference for class concepts and principles, even though it covers more detail than will be discussed in class. Figures used in lecture presentations by the instructors are often adapted from this book. It will be available for student use at the Reserves Desk at Steenbock Library and other nearby campus libraries.

EXAMS:

All examinations must be taken in this course. Make-up exams are discouraged and will be given ONLY under extraordinary circumstances. Missed exams will be allowed only if written notice of a conflict or illness is given to the instructor **24 hours prior** to the exam. There will be NO early final exams given in this course.

GRADES: A student's final grade in this upper-level course will be based on the following:

		POINTS
1.	Two in-class one-hour exams (100 points each)	200
2.	Final exam (50% comprehensive)	100
3.	Problem sets	30
	TOTAL:	330

EXAM REGRADING POLICY: Answer keys to the exams (and problem sets) will be posted on the MMI/Biochem 575 website at Learn@UW. If you have questions concerning a grade in this course, see your TA promptly. If you desire to have an exam regraded, you must return it to one of the TAs or the instructor within **one week** of taking the exam. Your graded exam must be accompanied with description of the perceived problem, which is to be written on the front page of the exam. In such cases, the entire exam will be regraded.

PROBLEM SETS: Several problem sets will be provided for each of the three sections of the course (Parts 1, 2, and 3). Printed copies will be provided in class and electronic copies will be available for downloading from the MMI/Biochem 575 website at Learn@UW. Each problem set must be completed by each individual student and returned to the instructor on the indicated due date in order to receive full credit (see Exams and Grading). Although students are encouraged to work in groups, identical group answers are NOT ACCEPTABLE. Because the problem sets are designed to facilitate student understanding of lecture information, they will be examined by the instructors but not graded. The TAs or instructors will discuss the problems in class or at discussion sessions.

TAS AND DISCUSSIONS: There are no formal discussion sessions for this upper-level course. Nonetheless, your teaching assistants (TAs) will answer questions about the lecture material and problem sets at weekly review sessions scheduled for ***Mondays, 4:00 PM in Room B105, R.M. Bock Laboratories (1525 Linden Drive)***. Your TA will also take office appointments should you desire to meet individually to discuss class material. The TAs are Ph.D. students, who are studying virology for their thesis work. They are experts willing to help you succeed in this virology course. We highly recommend that students take advantage of the knowledge and experience of the TAs.

INSTRUCTORS:

Paul Friesen Professor – Institute for Molecular Virology & Dept. of Biochemistry

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Andy Mehle Assistant Professor – Dept. of Med. Microbiology & Immunology

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TEACHING ASSISTANTS:

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GUEST INSTRUCTORS:

Kristen Bernard, Professor - Department of Pathobiological Sci.
World's expert in emerging viral diseases
kbernard@vetmed.wisc.edu, Room 4270c, Vet. Medicine Bldg.

COURSE WEBSITE: learn@UW

The "Biology of Viruses 575" website (https://learnuw.wisc.edu/) contains a wealth of information, including the course syllabus, PPT presentations of the lectures, lecture handouts, problem sets (+/– answers), and practice exams. Additional information (optional) on different viruses is included. We **STRONGLY** encourage you to visit the website often, offer feedback, and start discussion groups if interested. The 575 website on Learn@UW is updated every class.

HONORS OPTION: Students need to make an appointment with Dr. Mehle if interested.

MATERIALS ON RESERVE: Various course-related materials will be placed on reserve at Steenbock Library (Babcock and Observatory Dr.) and the Ebling Library in the Health Sciences Learning Center (next to U.W. Hospital). These resources include the recommended textbook and other useful reading materials (see below).

OTHER USEFUL MATERIALS:

Basic Virology, 3rd Edition. 2008. E.K. Wagner, M.J. Hewlett, D.C. Bloom, D. Camerini (eds). Blackwell Publishing. ISBN 978-1-4051-4715-6.

Description: this book is an excellent reference for materials covered in class. It will also provide more details than we offer in class. Some of the figures used in lecture are adapted from this textbook. ***On reserve at Steenbock Library.***

Fundamentals of Molecular Virology, 1st Edition, 2007. N.H. Acheson, John Wiley & Sons. ISBN 0-471-35151-2.

Description: great review of virus replication and individual virus families.

Introduction to Modern Virology, 6th Edition, 2007. N. Dimmock, A. Easton, K. Leppard (eds). Blackwell Publishing.

Description: Interesting alternative to Flint's Principles of Virology.

The Biology of Viruses, 2nd Edition, Bruce Voyles (ed). McGraw-Hill (New York)

Description: particularly useful for the first portion of the course. It tends to oversimplify but is good at getting major concepts across. It has great diagrams illustrating steps in virus replication.

Fields Virology, 4th Edition, D.M. Knipe, P.M. Howley et al. (eds).

Description: goes into much more detail than class or the recommended textbook. Provides supplemental and advanced reading for interested students.

WEBSITES: There are numerous websites for virology and virus-caused diseases. Many of these sites have links to additional sites. Do some exploring. You will find material to supplement the lectures and peak your interest in special topics.

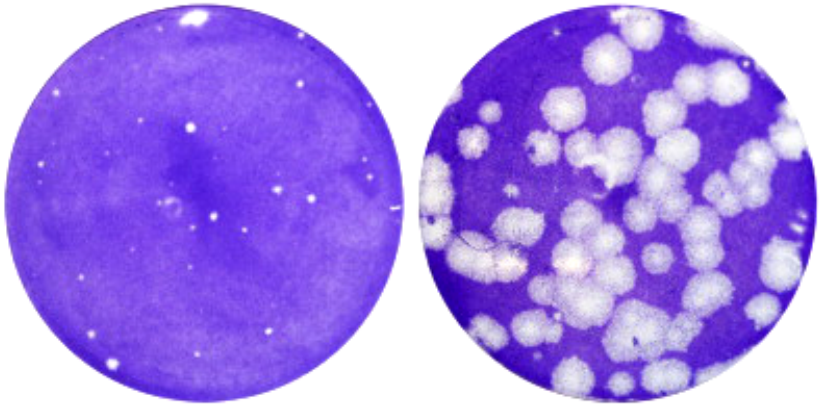
http://www.virology.net: This website, referred to as *"All the Virology on the WWW", is great as a reference for virology on the internet and includes many links to other sites. It includes tutorials and teaching links.*

http://www.virology.wisc.edu/: This website is authored by the Institute for Molecular Virology here at U.W.-Madison. Go to the link "Virus World" for great for images and movies of different viruses – it is very popular for teaching virology courses.

http://www.promedmail.org: This website is the global electronic reporting system for virus outbreaks, including emerging infectious diseases and toxins. You'll know exactly when and where H1N1 has hit hard again.

***http://www.asv.org/*:** This is the official website for the American Society for Virology, the largest group of scientists and physicians interested in general virology. The site has much useful information for students, including education pathways and careers info for those interested in virology at the professional level.

http://www.microbiologybytes.com/tutorials/Time/Machine.html: This site has an interactive time-line of history of virology. Lots of fun facts – represents an interesting twist for teaching history of viruses.

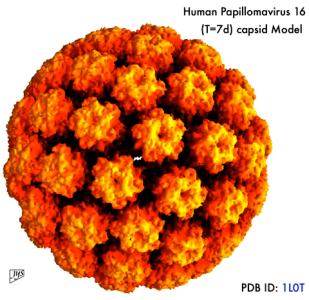


COURSE SCHEDULE:

Part 1. What are viruses and how do they multiply?

In this first part of "Biology of Viruses", we will develop the thesis that all viruses adopt a common strategy that must be followed to exist as what we define as "viruses." We will show that viruses have specific life cycles, express their genetic information (genomes) in a regulated fashion, and assemble highly evolved particles to pass on their genome to the next susceptible host. You will see that although the multiplication tactics used by particular virus families are very different they have a common theme.

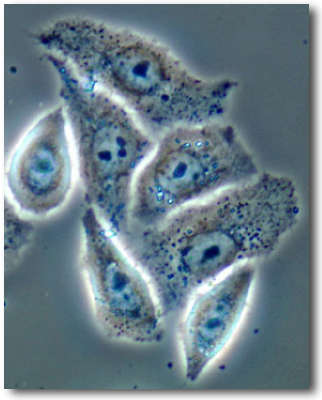
2014 Lecture #	Date	TOPIC	Instructor	Suggested Reading
1	Jan. 20 (Tues)	Introduction, Definition of a Virus	Friesen	see Lecture Notes (Learn@UW)
2	Jan. 22 (Thurs)	Genomes, Classification, Structure	Friesen	
3	Jan. 27 (Tues)	Methods in Virology	Friesen	
4	Jan. 29 (Thurs)	DNA Viruses I: Gene expression	Friesen	
5	Feb. 3 (Tues)	DNA Viruses II: Genome replication	Friesen	
6	Feb. 5 (Thurs)	Replication of Retroviruses	Friesen	
7	Feb. 10 (Tues)	Replication of RNA Viruses (+ strand)	Mehle	
8	Feb. 12 (Thurs)	Replication of RNA Viruses (– strand)	Mehle	
9	Feb. 17 (Tues)	Virus Attachment, Entry, Uncoating	Mehle	
10	Feb. 19 (Thurs)	Assembly, Maturation, Exit	Mehle	
	Feb. 24 (Tues)	Exam 1 (30% of grade)		



Part 2. Viral Pathogenesis – Anti-viral Strategies

In this section, we will examine the complexity of host-virus relationships. Viruses have effects on the host that can range from benign to lethal. We will discuss mechanisms of virus-induced disease (pathogenesis) in animals. We will study the mechanisms by which animals respond to virus attack and how some viruses escape the host's anti-viral defenses by evolving clever mechanisms, including the establishment of persistent or latent infections by some of the most "successful" viruses. Lastly, we will begin a discussion of the treatment and prevention of viral disease through the use anti-viral drugs and vaccines.

2014 Lecture #	Date	TOPIC	Instructor	Suggested Reading
11	Feb. 26 (Thurs)	Intro to Viral Pathogenesis: Multiplication in the Host	Friesen	see Lecture Notes (Learn@UW)
12	Mar. 3 (Tues)	Apoptosis and Evasion by Viruses	Friesen	
13	Mar. 5 (Thurs)	Role of Viruses in Cancer I	Friesen	
14	Mar. 10 (Tues)	Role of Viruses in Cancer II	Friesen	
15	Mar. 12 (Thurs)	Virus Persistence and Latency	Friesen	
16	Mar. 17 (Tues)	HIV & AIDS - I	Friesen	
17	Mar. 19 (Thurs)	HIV & AIDS - II	Friesen	
18	Mar. 24 (Tues)	Anti-viral Drug Strategies	Friesen	
19	Mar. 26 (Thurs)	Host Defenses to Viral Infection: Innate Immunity	Mehle	
	Mar. 31, April 2	-----SPRING BREAK-------		
20	Apr. 7 (Thurs)	Host Defenses to Viral Infection: Adaptive Immunity	Mehle	
21	Apr. 9 (Thurs)	Immune Evasion Strategies: How Viruses Fight Back	Mehle	
	Apr. 14 (Tues)	Exam 2 (30% of grade)		



Part 3. Prevention and Emerging Viral Threats

In this last section, we will discuss vaccines and their strategy to prevent infection. Importantly, we will focus the real-time health issue of emerging viruses, some old (bird and swine flu) and some new (West Nile and SARS). We will discuss their potential to threaten humankind. Finally, we will turn our attention to beneficial uses of viruses. We will discuss modern approaches in medicine that exploit viruses and their properties in vaccine production and human gene therapy as examples. The bottom line is that viruses have taught us an enormous amount about biology, disease, and human defenses against pathogens.

2014 Lecture #	Date	TOPIC	Instructor	Suggested Reading
22	Apr. 16 (Thurs)	Viral Vaccines How Viruses Fight Back	TBD	see Lecture Notes (Learn@UW)
23	Apr. 21 (Tues)	Influenza virus: Birds, swine, and humans	Mehle	
24	Apr. 23 (Thurs)	Hepatitis C Virus	Mehle	
25	Apr. 28 (Tues)	Emerging viruses: West Nile, SARS, Hantavirus	K. Bernard - Guest Professor	
26	Apr. 30 (Thurs)	Hemorrhagic Fever Viruses Ebola, Marburg, Lassa	TBD	
27	May 5 (Tues)	Prions and Disease	TBD	
28	May 7 (Thurs)	Viruses & Gene Therapy	Friesen	
May 8	**REVIEW 1**	(3:30 to 5 PM, Biochemical Sci. Bldg, Rm 1211)	Friesen, Mehle, TAs	
May 10	**REVIEW 2**	(3:30 to 5 PM, Biochemical Sci. Bldg, Rm 1211)	Friesen, Mehle, TAs	
May 11	**Final Exam**	2:45 PM - 4:45 PM (Room/Bldg. tbd)		

Nodavirus