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Spring 2-1-2019

### BIOM 435.01: Virology

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# Syllabus

## BIOM 435: Virology

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### COURSE INFORMATION:

- CRN: 30979
- Credits: 3
- Term: Spring 2019
- Day/time: MWF; 2:00PM-2:50PM
- Building/room: Health Sciences 411

### INSTRUCTOR CONTACT INFORMATION:

#### Brent Ryckman

- Department: Biological Sciences
- Office: Interdisciplinary Science Building (ISB) 215
- Phone (Lab): 406-243-6948
- Email (preferred): brent.ryckman@mso.umt.edu
- Office hours: By appointment, or 12PM-1:50PM; WF. (If I am not in my office, check down the hall in my lab, ISB 206.)

### INSPIRATIONAL QUOTES:

#### A. Pierre Teilhard de Chardin; from “The Phenomenon of Man” (1955).

- “...the history of the living world can be summarized as the elaboration of ever more perfect eyes within a cosmos in which there is always something more to be seen.”

#### B. Kwai Chang Caine; Main character in the 1970’s TV series “Kung Fu.”

- “I seek not to know all the answers, but to understand the questions.”

### COURSE SUMMARY:

#### A. Course Description:

- A “principles-based” discussion of virology, focusing on the molecular processes and events that must be completed by all viruses for successful replication within an individual host, and spread through host populations. The molecular basis of alternative replication strategies, the interactions of viruses with host organisms, and how these interactions lead to disease will be presented with examples drawn from a representative set of the more well studied animal viruses.

#### B. Prerequisite knowledge:

- Virology can be viewed as a “secondary discipline.” That is, virologists use a variety of approaches drawn from “primary” or “first-principle” disciplines to study the biology of viruses and viral diseases. ***Thus, understanding virology requires a solid background in molecular biology, biochemistry, genetics, cell biology and immunology.*** If you are concerned about your preparedness for this course, please make an appointment with the instructor.

#### C. Textbook:

- This course will generally follow the topic organization of Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses, S.J. Flint et al., Third Edition, ASM Press 2009. This textbook is **not** available at the university bookstore, but can be obtained from any of several online retailers. Purchase of this textbook is ***optional***, but recommended (esp. if you plan to pursue relevant post-graduate studies). **Quiz/exam questions will be drawn from material covered in lectures.**

**D. Attendance:**

- Regular attendance is the number one predictor of success in this class. While it is possible to get the bare material from the lecture notes, and book chapters, it is the discussions that happen in lecture periods that lead to the deep understanding of the material that is expected on exams, and in your written assignments. To encourage attendance and participation, there will be lecture-associated assignments including, “My Question Today” and “What You Missed (see below), and occasional, unplanned assignments offered in lectures.

## **ASSIGNMENTS AND ASSESSMENT, AND GRADING:**

**A. “My Question Today” (5 submissions; 2 points each; 10 points total):**

- Education, and science in general, are really more about the development of new questions than the accumulation of “facts.” If you are actively engaged in lecture discussions, the material and ideas presented to you should elicit new “synthesis questions” in your mind. That is, new information presented to you during lectures, combined with, or placed within context of your prior knowledge base, or frame of reference, should stimulate the formation of new questions that go beyond either. You will be encouraged to voice these types of questions in lecture periods. In addition you will be expected to submit 5 such questions for credit.
- Assignment instructions.
  - Upload your assignments to the moodle link provided.
  - File formats accepted: MS WORD, PDF, Text/edit, Pages
  - Include the date and topic of the lecture to which the question refers.
  - Must be uploaded within 48 of the relevant lecture date

**B. “What you missed” (3 submissions, 3 points each; 6 points total).**

- You will write a short summary of the material of the previous lecture period as if explaining to a classmate who was absent. You will need to focus on the major virology principles, themes concepts, contexts and significance rather than the specific details of examples given.
- Assignment instructions.
  - Upload your assignments to the moodle link provided.
  - File formats accepted: MS WORD, PDF, Text/edit, Pages
  - Limit 300 words.
  - Include the date and topic of the lecture to which the summary refers.
  - Must be uploaded within 48 of the relevant lecture date

**A. Weekly quizzes (approximately 6 quizzes, 10 points each, 60 total).**

- Short quizzes that highlight the major themes of the preceding week will be given on a regular basis. Generally on Mondays. These quizzes should take less than 10 min, and will consist of multiple choice, true/false and short answer/fill-in-the-blank questions.

**B. Exams (300 points total)**

- 3 Exams (2 mid-term plus the final exam). Mid-term exams will have a both “take home” and in-class components.
- Take-home exams will be a set of essay questions that you will upload to a Moodle link. Questions will require that you extrapolate and apply what you have learned in class. You may consult any resources you wish, and you may discuss the questions with classmates. However, you must write your own answers; plagiarism of any nature (copy/pasting from the internet or other sources, or nearly identical answers as a classmate, etc.) will result in a “0” for that question.
- In-class exams will be a combination of multiple choice, true/false, and short answer/essay questions.

- Both in-class and take-home exams will be based on material covered in lecture/discussions. However, exams will be designed to assess your understanding of principles and fundamentals of virology, and your ability to apply and extrapolate the material, rather than the ability to recall “facts” about specific viruses. When studying, focus on understanding the principles that the specific examples are intended to address or illustrate.
- Final exam will be of the in-class format only
- Exam schedule (Tentative; subject to change):
  - **Exam 1** **February 15-20**
  - **Exam 2** **March 18-20**
  - **Final exam** **Monday, April 29; 3:20PM-5:20PM.**

#### **D. Writing Assignments:**

**1) Primary literature critical review (30 points).** Near spring break, (target date **March 22**) we will have a practical discussion on the use of PubMed and other internet sources to find primary research articles, and how to critically read such articles. At the end of this session, you will be given subject keywords and author information, and you will obtain the article from the internet. Then read the article, and come to class ready for an in-class discussion. Following the in-class discussion, you will write YOUR OWN short, (1 page) critical review of the article. Grading for this assignment will be as follows:

5 pts for correctly obtaining the article (respond to a Moodle uplink by **March 31**)

5 pts for participation in the in-class discussion **April 1**

20 pts for the written summary – **due April 13<sup>rd</sup> 11:59pm** (upload to moodle link)

#### ***General considerations for critical reading, and written review of primary research articles:***

The written critique is the essence of “peer-review” system in science. Manuscripts submitted to a journal are sent to independent “peer” scientists who provide written feedback (both positive and negative) to the journal editors to inform publication decisions. Reviewer opinions are shared with the authors who can then respond as they see fit. The thing to remember is that *a priori*, all opinions are of equal merit. The validity or strength of an opinion comes from arguments in favor and against, based on logic, evidence or data. Thus, there are no “right and wrong” opinions *per se*. Nor is there a specific format for how to write a review. **NOTE HOWEVER, a critical review is NOT simply a “summary.”** It is necessary to provide a summary for context of the critical arguments you will make. But a “critical review” also includes your own opinions about the work.

The purpose of this assignment is to help you develop your own critical/creative thinking skills. This means that you will need to consider the significance and believability of the work presented, as well as any new ideas the paper raises in your mind. Since everyone has a different background, the nature of analysis, and the questions asked with respect to any given paper can differ greatly. In many ways, it is like viewing art. Two people can notice very different aspects of the same painting or sculpture. Below is a short list of things to consider for any research paper (not exhaustive, nor in any specific order of importance):

1. What are the questions and hypotheses addressed for the paper as a whole and for each figure?
2. What is the rationale behind these questions? (why did the authors think of to do the experiments?)
3. Are the questions interesting in the broader sense? (does this really “matter” or is it just exploring a “phenomena?”)
4. What approaches (i.e., types of experiments) were used?
5. Are the approaches reasonable? (i.e. are they direct, and logical?)
6. Are the data clear, or ambiguous in terms of the questions?
7. What do the authors conclude from the presented results?
8. Are the conclusions supported by the data? (highly dependent on point 6 above)
9. If supported, what are the broader significances of the conclusions?
10. What new questions are raised in YOUR mind as a result of these conclusions?

**2) Term paper. (100 points). (note: if you are retaking this course, your previous term paper will not be accepted. You must choose a new topic.)**

- a) Due last week of semester. April 26
- b) Submit to Moodle upload link. (Word file or PDF)

c) **2000 – 3000 words.**

d) Must use a minimum of 5 independent references. **At least 2 must be “primary” research papers similar in nature to the one we use for the primary literature assignment.** (i.e., not a review article, general media/internet source, or textbook).

Use an “endnote” format for internal citations. That is, following a sentence for which you wish to cite a publication, use a number in parentheses “(1)”. This number must correspond to a reference list at the end of your document using the format shown here:

**1. Author1 Last name, first initials, Author2 Last name, first initials, etc. Publication Year. Article title. Journal. Vol:page numbers.**

Contrary to popular belief, science is more about questions than it is about facts and answers. Discovery of new “facts” invariably raises new, deeper question in the minds of creative scientists. During the semester, we will discuss what is currently believed about several viruses and viral processes. It is the instructor’s hope that, most, if not all of these discussions will raise many new questions in your mind.

For this term paper, you will explore a virology-related question(s) of your choice. This assignment is intended to build off the critical and creative thinking skills developed in the Primary Research Literature Assignment (see above). You will need to do extensive research of external sources. Internet sources such as “Wikipedia” are reasonable places to begin, but do NOT rely on them. Primary research literature sources will be necessary. This paper will be graded mostly on the degree to which you have expressed new, creative thoughts. This is not simply a “book report” where you summarize ideas presented in the sources that you cite. You need to bring together others’ ideas and then synthesize them through you own unique creativity into a set of “new” ideas. It is very difficult, but like most things, you can get better with practice.

**E. Seminar attendance/reviews (maybe 10-20 points):** There may be one or two outside speaker seminars related to virology during the semester. It may happen that, in lieu of class, you will be asked to attend the seminar and then write a short summary/analysis for credit. Details will be given if necessary.

**F. Learning Outcomes:** After this course you should be able to (in no order of importance):

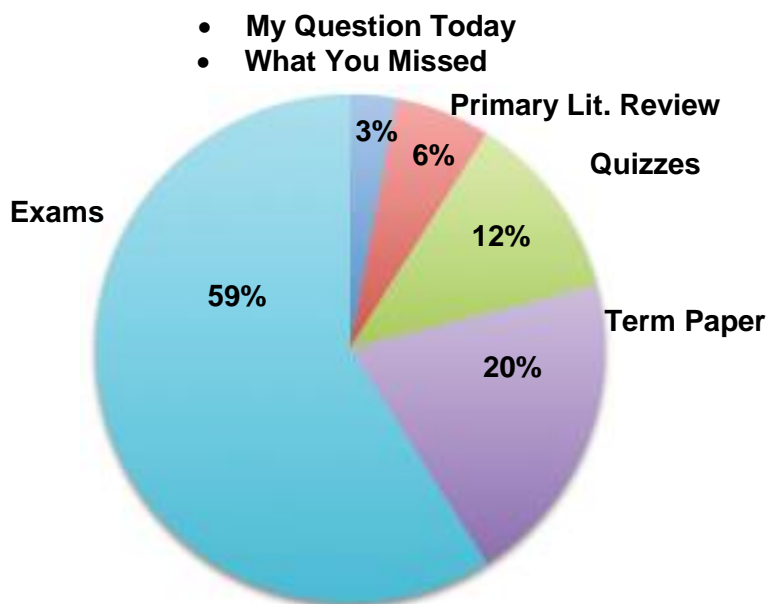
1. Fill in the blank-labels on a diagram of the Baltimore virus classification scheme.
2. Cite at least two examples of molecular biology “principles” that were discovered by studying viruses.
3. Distinguish the terms “susceptible”, “resistant” and “permissive” with respect to potential host cells.
4. Explain the term “cytopathic effects” in the context of viral replication.
5. List at least two distinct ways of quantifying viruses as physical entities, and two distinct ways of measuring viruses as replicating entities.
6. Calculate multiplicity of infection using given information/data.
7. Identify the, eclipse, latent/lag, exponential and plateau phases of a viral replication curve
8. Match the terms icosahedral, helical, naked and enveloped to diagrams of representative viral particles.
9. Distinguish the terms “affinity” and “avidity” with respect to viral receptor interactions.
10. Explain the fundamental differences in entry mechanisms between enveloped and naked viruses.
11. Identify what types of *purified* viral genomic nucleic acids are infectious when delivered into cells by transfection methods.
12. Explain why RNA viruses are generally more prone to mutations than DNA viruses
13. Distinguish reassortment from recombination as mechanisms of RNA virus evolution.
14. Explain at least one mechanism by which RNA viruses switch from mRNA production to genome replication.
15. Compare and contrast the autoregulatory and temporal cascade mechanisms of DNA virus gene expression regulation.
16. Explain the relationship between alternative RNA splicing mechanisms of HIV and nuclear export of viral RNA molecules.
17. Explain at least one mechanism of how viruses inhibit or suppress host gene expression.
18. Explain at least one mechanism by which viruses expand their genetic coding capacity at the level of mRNA translation.

19. Explain the term “concatamer” as it relates to viral DNA replication.
20. Describe three priming mechanisms for viral DNA replication.
21. Explain the concept of “self-assembly” of viral particles.
22. Compare and contrast cell-to-cell viral spread and cell-free viral spread.
23. Match a list of general events in viral pathogenesis with a list of viral, host and environmental factors that influence the event.
24. Distinguish intrinsic host defenses, innate immunity and adaptive immunity.
25. Distinguish acute and persistent infections using given data.
26. Explain at least one mechanism of viral immune evasion.
27. Explain why DNA viruses often affect the regulation of the cell cycle, and how this relates to the development of cancer.
28. Obtain primary research articles from internet sources such as PubMed
29. Critically evaluate the strengths and weaknesses of primary research articles.

#### **G. Grading (approximate; subject to change):**

	Semester total per assessment tool	Percent of final grade
My Question Today	10	2
What You Missed	6	1
Primary literature review	30	6
Quizzes	60	12
Term paper	100	20
Exams	300	59
Semester Total	506	100

Final grade	Final Score	Percentage
A	469 - 506	93-100
A-	454 - 468	90-92
B+	439 - 453	87-89
B	417 - 438	83-86
B-	403 - 416	80-82
C+	388 - 402	77-79
C	367 - 387	73-76
C-	352 - 366	70-72
D+	337 - 351	67-69
D	317 - 336	63-66
D-	302 - 316	60-62
F	< 301	< 60



## **Disability Services**

The University of Montana assures equal access to instruction by supporting collaboration between students with disabilities, instructors, and Disability Services for Students. If you have a disability that requires an accommodation, contact either of us at the beginning of the semester so that proper accommodations can be provided. Please contact Disability Services for Students if you have questions, or call Disability Services for Students (DSS) for voice/text at 406.243.2243. You may also fax the Lommasson Center 154 for more information at 406.243.5330.

## Topics covered as time permits

	<u>Flint chapters</u>
1. General perspectives on viruses	V.1, Ch.1-3
2. Methods of studying viruses	V.1, Ch.1-3
3. Virus structure	V.1, Ch. 4
4. Initiation of infection	V.1, Ch. 5
5. Gene expression/genome replication	V.1 Ch. 6-11
6. Assembly, egress and spread	V.1, Ch. 13
7. Pathogenesis	V.2, Ch 1, 2
8. Host defenses/viral immune evasion	V.2, Ch 3,4,5
9. Viruses and cancer	V.2, Ch. 7