

MOLECULAR VIROLOGY

MICR*4330

Winter 2011

DEPARTMENT OF MOLECULAR AND CELLULAR BIOLOGY

Tentative Course Outline Jan 10, 2011

COURSE OBJECTIVES

This course will provide students with an in-depth understanding of viruses at the molecular level. The course will focus on the diverse strategies that viruses use in their replication cycle as well as the interaction of viruses with the cell. Examples of major viral families will be given to illustrate the extremely varied, intricate and complex interplay between viruses and their host cells, including various cellular responses (e.g. apoptosis) to prevent virus infection and the counteracting viral responses to them. The laboratory component of this course will give the students hands-on experience in the virology field, and familiarize them with basic virology and cell biology laboratory techniques.

COURSE PERSONNEL and ANCILLARY MATERIALS

INSTRUCTORS: Dr. Peter Krell (Coordinator) SCIE 4252, ext. 53368, pkrell@uoguelph.ca
Dr. Ray Lu SCIE 3443, ext. 56247, rlu@uoguelph.ca

LAB DEMONSTRATOR: Debra Flett, SCIE 3504, ext. 52533, dflett@uoguelph.ca

LAB TEACHING ASSISTANTS: Yang Liu, SCIE 4442 (office) 4260 (lab) ext 53264
Alexandra Elliot SCIE 4254 (office) 4260 (lab) ext 53264

TEXTBOOK: There is no designated textbook for this course. The main recommended reference is Flint, Principles of Virology 3rd edition (2008). You may find Fields' Virology 5th Edition (2007) and Basic Virology 3rd Edition by Edward K. Wagner (2008) helpful. These textbooks are available on a 2 hour reserve in the library. The library also has an online version of the Encyclopedia of Virology at <http://www.sciencedirect.com/science/referenceworks/9780123744104>

COURSE WEB PAGE: There is a D2L Courselink set up for this course. You can access this courselink from <https://courselink.uoguelph.ca/shared/login/login.html>. Your username is your Central Login ID and your password is your uoguelph email password.

COURSE FORMAT

LECTURES: Tuesday and Thursday in SCIE 2315, 1:00 to 2:20 pm are slotted. Note lectures are normally 50 mins in length from 1:00 to 1:50 with a total of 24 lecture slots. The additional 30 mins/lecture will be for laboratory related material, provide extra time near the end of the semester for presentations and to finish lectures earlier. The student is responsible for all material covered during lectures, and to follow announcements regarding assignments and exams.

LABORATORY: Wednesday and Thursday 2:30 – 5:20 pm in Science Complex 4111. The Lab Manual is available through the Department of Molecular and Cellular Biology.

TENTATIVE LECTURE SCHEDULE (not in this order and lecture numbers approximate)

1. Overview of virus structure and replication cycle (1 lecture)
 - Virus morphologies and composition
 - Stages of replication
 - Attachment
 - receptor mediated endocytosis
 - membrane fusion
 - other
 - Penetration
 - Uncoating
 - Biosynthetic phase (mRNA, protein, genome replication)
 - Assembly - Morphogenesis
 - Release
 - Maturation

2. Various strategies for virus replication (10 lectures).
 - Attachment/Penetration/Uncoating
 - Genome expression: transcription
 - dsDNA viruses
 - ssDNA viruses
 - ssRNA viruses (+ve and -ve strand)
 - dsRNA viruses
 - Genome expression: processing mRNAs
 - 5' capping, 3' polyadenylation
 - splicing
 - post transcriptional sequence changes
 - Genome expression: translation
 - Translational regulation
 - Cis factors in viral mRNA (IRES, pseudoknots and frameshifts)
 - Posttranslational modifications
 - Genome replication
 - Viral DNA (ds and ssDNA) replication
 - Viral RNA (-ve, +ve and dsRNA) replication
 - Virion assembly, release and maturation:
 - Naked virions
 - Enveloped virions

IN-CLASS MIDTERM: Feb. 15, 2011, (covering material in lectures up to and including Feb 11).

3. Stages of pathogenesis *in vivo* (i.e. in a host organism) (2 lectures)
 - Entry
 - Incubation period and spread within the host
 - Multiplication
 - Immune response
 - Spread to other hosts
 - Outcome of the infection to the host

4. Patterns of viral infection (1 lecture)
 - Dynamics of host-cell interaction
 - Acute infection
 - Persistent infection
 - Latent infection
 - Others
 - Abortive infection, transforming infections, etc
5. Molecular basis of viral host cell interactions (4 lectures)
 - Cell and host specificity
 - Cellular defences to virus infection (e.g. toll-like receptors, apoptosis)
 - Host defences to virus infection (e.g. humoral and cellular immunity)
 - Viral defences against host defences (e.g. inhibitors of apoptosis; decoys of and binding proteins to host defence proteins, RNA silencing)

COURSE EVALUATION

Midterm Exam (20%): Feb. 15, 2011, (in class)

The midterm exam will cover the material up to and including Feb 11.

Final Exam (35%): April 21, 7:00 to 9:00 pm (CONFIRM details with Registrar's Office)

The final exam is comprehensive and covers all lecture material.

*** Students will get the best combination of:**

20% midterm exam plus 35% final exam weighing a total of 55%

OR

0% midterm exam plus 55% final exam.

Presentation (20%; 5% for written critique and 15% for symposium presentation): The class will organize and run a University of Guelph Virology Symposium near the end of the semester based on their presentation assignment. Students will work in groups of 3 of their choosing. The students will decide the overall topic (the instructor has veto power). A list of recent (e.g. 2008 to 2011) scientific articles will be chosen by the students, with specific ones assigned (by choice and/or random draw) to each group. Each group is expected to critically read the assigned article(s), as well as other relevant reviews and publications on the topic. The students within each group are expected to collaborate with each other on the assignment and will share the same grade. The symposium will include oral presentations by each group and will be based on the article(s) they have chosen. Each group will write a "critique" to summarize the salient data in the assigned paper and discuss the strengths, weakness, possible future research and the author's conclusions in light of related publications. This critique will be sent for a "friendly review" to one other group prior to submission.

Five marks will come from the critique and 15 marks will be from the Symposium including organization and participation of each student in the discussions during all presentations.

Lab (25%): Students will work in groups of 3 with each sharing equally in the work.

2% phage plaquing, isolation analysis protocol (based on original literature)

10% bacteriophage isolation/analysis lab report (one report per pair)

8% individual reports of lab results (3% for avian viruses labs, 5% for insect virus labs)

5% individual performance in the laboratory.

Overall Grade Assessment (the best of two combinations of marks)

	A	OR	B
Midterm Exam	20%		0%
Symposium Presentation	20%		20%
Lab	25%		25%
Final Exam	35%		55%
Total	100%		100%

The final grade will be based on the best combination (A or B) for the Grade Assessment above.

Absence, Exam Deferral and Academic Misconduct: Students who are absent from class during the term will be expected to make up for classes missed through their own discussion with fellow students and independent reading. **No deferrals will be given for the midterm exam, regardless of the reasons (voluntary, medical, compassionate or others).** If a student misses the scheduled midterm exam, their final exam will automatically count for 55% of the final grade. Please refer to the University of Guelph Undergraduate Calendar: Section VIII entitled Undergraduate Degree Regulations and Procedures at the link provided below for information on the University policies and procedures for examination, academic misconduct and deferred final examinations. **Pay specific attention to the definition of “Academic Misconduct” and the penalties that can be accrued as described in that section.**

http://www.uoguelph.ca/undergrad_calendar/c08/index.shtml

The grading guidelines used in this course are those adopted by the University in the Undergraduate Calendar under VIII. Undergraduate Degree Regulations and Procedures, Grades, Grading Procedures, namely

- **80 - 100 (A) Excellent.** An outstanding performance in which the student demonstrates a superior grasp of the subject matter, and an ability to go beyond the given material in a critical and constructive manner. The student demonstrates a high degree of creative and/or logical thinking, a superior ability to organize, to analyze, and to integrate ideas, and a thorough familiarity with the appropriate literature and techniques.
- **70 - 79 (B) Good.** A more than adequate performance in which the student demonstrates a thorough grasp of the subject matter, and an ability to organize and examine the material in a critical and constructive manner. The student demonstrates a good understanding of the relevant issues and a familiarity with the appropriate literature and techniques.
- **60 - 69 (C) Acceptable.** An adequate performance in which the student demonstrates a generally adequate grasp of the subject matter and a moderate ability to examine the material in a critical and constructive manner. The student displays an adequate understanding of the relevant issues, and a general familiarity with the appropriate literature and techniques.
- **50 - 59 (D) Minimally Acceptable.** A barely adequate performance in which the student demonstrates a familiarity with the subject matter, but whose attempts to examine the material in a critical and constructive manner are only partially successful. The student displays some understanding of the relevant issues, and some familiarity with the appropriate literature and techniques.
- **0 - 49 (F) Fail.** An inadequate performance.

MICR 4330 LAB SCHEDULE Winter 2011

WEEK	EXPERIMENT	RESULT REPORT DUE DATE	BACTERIOPHAGE PROJECT (Suggested Schedule)
1 (Jan 12,13)	Introduction and Working with Bacteriophage	Jan 19, 20 (Protocol 2 marks)	Introduction to Project Written Research Protocol
2 (Jan 19,20)			Start project, isolate and titre phage
3 (Jan 26,27)			High titer phage stocks
4 (Feb 2,3)			Phage DNA isolations
5 (Feb 9,10)	Embryonated Eggs as Viral Hosts	Mar 2, 3 (3 marks)	Phage DNA cloning
6 (Feb 16,17)	Viral Hemagglutination		Plasmid isolation & purification
(Feb 23,24)	BREAK WEEK		
7 (Mar 2,3)	Insect Cell Culture and Cytopathic Effect of Insect Nucleopolyhedroviruses	Mar 16, 17 (5 marks)	Plasmid sent for sequencing
8 (Mar 9,10)	Titration of AcMNPV		
9 (Mar 16,17)			Computer search and interpretation
10 (Mar 23,24)			
11 (Mar 31,31)			Written Report Due (10 marks)
12 (Apr 6,7)			

For the Bacteriophage project you will produce your own **written protocol (2 marks)** for plaquing, virus isolation and growth of high titre stocks, purification, extraction of viral DNA, restriction enzyme analyses and cloning of restriction enzyme digest fractions. This should be in the form of a lab protocol but with reference to the literature. This is due week two of your lab date (Jan 19/20).

Laboratory Grades:

Phage research protocol	2 marks
Reports of Results	8 marks
Bacteriophage isolation/characterization report	10 marks
<u>Performance/Participation in Laboratory</u>	<u>5 marks</u>
Total Laboratory Marks	25 marks

Note you will be working mostly in groups of three, though for some laboratories, as directed by the laboratory instructors, you might be working in larger groups.

For the independent phage project, you are expected to work in groups of three.