

McGill University
Department of Microbiology & Immunology
Fundamental Virology, MIMM 324
Fall Term, 2017

- Course Coordinator:** Dr. Selena M. Sagan
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- Lecturers:** Drs. Jacques Archambault, Dalius Briedis, Chen Liang, Andrew Moulant, Selena M. Sagan, and Jose Teodoro.
- Teaching Assistant(s):** Trisha Barnard, trisha.barnard@mail.mcgill.ca
Natasha Barone, Natasha.barone@mail.mcgill.ca (TEAM TA)
- Lectures:** Monday / Wednesday / Friday: 8:35 to 9:25
- Location:** Amphitheater, Lyman Duff Medical Building
3775 University Street, Montréal, QC, H3A 2B4
- Evaluation Scheme:**
- Quizzes (10% of course grade; 4 quizzes @ 2.5% each):** Students will take 5 short quizzes over the term in MyCourses (~1/module), of which the student's best 4 quizzes will count towards their final grade. Generally, quizzes will test factual knowledge, concepts, theory, and may involve calculations.
- Assignments (15% of course grade):** Students will complete the assignments described below in the course outline. Generally, assignments are designed to reinforce factual knowledge, concepts and theory.
- Midterm Exam (25% of course grade):** Students will complete an individual midterm exam that consists of multiple-choice questions.
- Final Exam (cumulative, 50% of course grade):** During the regular exam period, students take a final exam that consists of multiple-choice questions. While the exam is cumulative, it focuses primarily upon material explored during the second part of the term.
**Upon presentation of a valid doctor's note the final exam will count for 75% of the course grade if the midterm exam cannot be taken.*
- Student Response System:** As of Sep 2016, McGill is utilizing a web-based polling system called TurningPoint Cloud at no cost to students and instructors. Polling in this course will be used to enhance engagement and increase interaction during lectures. Students will respond to questions using a personal device (smartphone, tablet or laptop). Students should come to class with their devices charged and connected to the internet. Polling will be available through www.mcgill.ca/polling. For any technical problems

with polling, please contact the IT Service Desk: <http://www.mcgill.ca/it/get-started-it/need-help>. If you do not have a smartphone, tablet or laptop to use to respond to polling questions, please contact the instructor immediately in order for appropriate arrangements to be made.

Suggested Textbook: **Fundamentals of Molecular Virology** by **Nicholas H. Acheson** (Editor), Publisher: John Wiley & Sons, 2007 (2nd 2011).
**The textbook covers much of the material presented in the lectures and supplements it. Students are encouraged to read chapters assigned to more fully understand each topic. Students will not be expected to know details of topics that are not discussed in lectures.*

MyCourses: The course schedule, updates, news, and lectures can be accessed through “MyCourses” <http://www.mcgill.ca/mycourses/>

Course Description:

Viruses play a major role in infectious disease and cancer and they are important model systems for the study of gene regulation, cell biology, molecular evolution, and gene therapy. This course provides an introduction and fundamental understanding of the field of virology. The course covers viral taxonomy, basic principles of virus structure, virological assays, gene organization and expression, replication strategies, and covers bacteriophages, DNA viruses, RNA viruses, retroviruses and hepatitis B virus. The course also touches on antiviral therapy, drug resistance, viral evolution, host-virus interactions, cell transformation, and molecular mechanisms of pathogenesis.

Learning objectives:

By the end of this course, the students are expected to:

- Define a virus
- Classify viruses based on genomes/genetics
- Acquire a basic understanding of virus structure
- Learn techniques used to culture and study viruses (virological assays) and how to interpret/analyze them
- Identify key features and prototypes of each virus family covered
- Learn the strategies used by different classes of viruses for gene organization, expression, and replication
- Learn the basic principles of antiviral and vaccine development
- Acquire a basic understanding of interactions between viruses and their hosts (host-virus interactions and molecular mechanisms of pathogenesis)
- Develop an appreciation for how viruses impact human health and society

McGill Policy Statements:

1. *McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/ for more information).* (approved by Senate on 29 January 2003)

"L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest/)."

2. *In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded."* (approved by Senate on 21 January 2009 - see also the section in this document on Assignments and evaluation.)

"Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue)."

3. In the event of extraordinary circumstances beyond the University's control, the content and/or the evaluation scheme in this course is subject to change.
4. McGill has policies on sustainability, paper use, and other initiatives to promote a culture of sustainability at McGill.
5. Students with disabilities should contact the Office for Students with Disabilities (514-398-6009). These students should also contact the instructor to arrange a time to discuss their situation.
6. © Instructor generated course materials (e.g. handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form of medium without explicit permission of the instructor. Note that infringements of copyright can be subjected to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.
7. End-of-course evaluations are one of the ways that McGill works toward maintaining and improving the quality of courses and the student's learning experience. You will be notified by email when the evaluations are available on Mercury, the online course evaluation system. Please note that a minimum number of responses must be received for results to be available to students.
8. Since polling records may be used to compute a portion of course grades, **responding as someone other than yourself is considered an academic offense.** During class, possession of more than one response device or using the credentials of another student will be interpreted as intent to commit an academic offense. Please refer to McGill's policy on Academic Integrity (<http://www.mcgill.ca/deanofstudents/plagiarism>) and code of Conduct (<http://www.mcgill.ca/students/srr/honest/>).
9. Additional policies governing academic issues which affect students can be found in the McGill Charter of Students' Rights and Responsibilities: <https://www.mcgill.ca/secretariat/policies/students/handbook-student-rights-and-responsibilities-le-recueil-des-droits-et-obligations-de-letudiant>

Course Content and Calendar:

Date	Day	Topic	Lecturer	Location
SECTION I: INTRODUCTION TO VIROLOGY				
Sep. 6	W	1. An Overview of Virology	Sagan	Duff Amph.
Sep. 8	F	2. The Baltimore Scheme	Sagan	Duff Amph.
Sep. 11	M	3. Virus Structure	Sagan	Duff Amph.
Sep. 13	W	4. Attachment & Entry	Sagan	Duff Amph.
Sep. 15	F	5. mRNA Synthesis & Genome Replication	Sagan	Duff Amph.
Sep. 18	M	6. Translation & Packaging	Sagan	Duff Amph.
Sep. 20	W	7. Bacteriophages I	Liang	Duff Amph.
Sep. 22	F	8. Bacteriophages II	Liang	Duff Amph.
SECTION II: DNA VIRUSES				
Sep. 25	M	9. Poxviruses	Teodoro	Duff Amph.
Sep. 27	W	10. Adenoviruses I	Teodoro	Duff Amph.
Sep. 29	F	11. Adenoviruses II	Teodoro	Duff Amph.
Oct. 2	M	12. Parvoviruses	Teodoro	Duff Amph.
Oct. 4	W	13. Polyomaviruses	Teodoro	Duff Amph.
Oct. 6	F	14. Human Papillomaviruses I	Archambault	Duff Amph.
Oct. 9	M	Thanksgiving – NO LECTURE		
Oct. 11	W	15. Human Papillomaviruses II	Archambault	Duff Amph.
Oct. 13	F	16. Human Papillomaviruses III	Archambault	Duff Amph.
Oct. 16	M	17. Herpesviruses I	Briedis	Duff Amph.
Oct. 18	W	18. Herpesviruses II	Briedis	Duff Amph.
SECTION III: RNA VIRUSES				
Oct. 20	F	19. Orthomyxoviruses I	Briedis	Duff Amph.
Oct. 23	M	20. Orthomyxoviruses II	Briedis	Duff Amph.
Oct. 25	W	MIDTERM EXAMINATION (Lectures 1-18)	Sagan	MNI
Oct. 27	F	21. Paramyxo- and Rhabdoviruses	Briedis	Duff Amph.
Oct. 30	M	22. Coronaviruses	Sagan	Duff Amph.
Nov. 1	W	23. Filoviruses	Briedis	Duff Amph.
Nov. 3	F	24. Prions and Spongiform encephalitis	Briedis	Duff Amph.
Nov. 6	M	25. Picornaviruses and Alphaviruses	Sagan	Duff Amph.
Nov. 8	W	26. Alphaviruses and Flaviviruses	Sagan	Duff Amph.
Nov. 10	F	27. Hepatitis C virus I	Sagan	Duff Amph.
Nov. 13	M	28. Hepatitis C virus II	Sagan	Duff Amph.
Nov. 15	W	29. Emerging Viruses	Sagan	Duff Amph.
SECTION IV: RETROVIRUSES AND HBV				
Nov. 17	F	30. Introduction to Retroviruses	Mouland	Duff Amph.
Nov. 20	M	31. Reverse Transcription and Integration	Mouland	Duff Amph.
Nov. 22	W	32. HIV Gene Expression	Mouland	Duff Amph.
Nov. 24	F	33. HIV	Mouland	Duff Amph.
Nov. 27	M	34. HBV	Liang	Duff Amph.
SECTION V: ANTIVIRALS, VACCINES AND HOST-VIRUS INTERACTIONS				
Nov. 29	W	35. Antivirals	Liang	Duff Amph.
Dec. 1	F	36. Viral Vaccines	Liang	Duff Amph.
Dec. 4	M	37. Host-Virus interactions	Liang	Duff Amph.
Dec. 6	W	38. Review	TA	Duff Amph.

Quizzes (10%; 4 quizzes @ 2.5% each):

Short, low-stakes quizzes will be periodically administered during the course of the semester. They will provide feedback on the student's understanding of the course material and provide experience in responding to questions that are similar to those on the midterm and final exams. Only student's top 4 quizzes (5 total) will count towards their final grade. All answer keys to quizzes will be posted on MyCourses within 1 week of the quiz.

Quiz	Lectures Covered	Start Date (9 AM)	End Date (10 PM)	Answer Key Available
1. Introduction to Virology	1-6	Sep. 25	Sep. 27	Sep. 29
2. DNA viruses	7-13	Oct. 10	Oct. 12	Oct. 13
3. HPV	14-16	Oct. 16	Oct. 18	Oct. 20
4. RNA viruses	19-26	Nov. 13	Nov. 15	Nov. 17
5. HCV and Retroviruses	27-33	Nov. 27	Nov. 29	Dec. 1

Assignments (15%)

The purpose of these assignments is to help you to process and integrate the knowledge learned in class to prepare you for quizzes, the midterm and final exams. These assessments will help you to organize course material and are intended as a study tool.

You must sign up for a virus of interest which will be the topic for all of the assignments on MyCourses. To do so, go to the **Groups** tab (navigation bar) and select a virus of interest by the date indicated below. **If you do not choose a virus by this date, one will automatically be assigned to you.**

Assignment	Topic	Due date	Rubric	% of Assignment Grade
Sign-up	Virus of Interest	Sep 19 th , 2017	-	-
Assignment #1	Virus Structure, Genome & Life Cycle	Sep 25 th , 2017	/15	45%
Assignment #2	Primary Research Article Submission	Nov 15 th , 2017	/1	5%
Assignment #3	The Virologist's Toolbox	Dec 1 st , 2017	/9	50%

Assignment #1: Virus Structure, Genome & Life Cycle

Virus of Interest Sign-up: **Sep 19th, 2017**

Due Date: **Sep 25th, 2017 – 10 PM**

Students will be assigned an RNA or DNA virus that infects humans (preferred) or animals. Using the format indicated, provide information on the classification, genome, structure and the disease characteristics of the assigned virus. Follow the format closely. You may omit items that are not applicable. On a separate page, draw a cartoon diagram of the life cycle for your virus (1-page). What is the order of events in the life cycle? Where do these events occur? Which factors are involved, and what actions do they have? Provide a detailed figure legend that includes a brief description of the viral life cycle. Include viral receptor(s), entry mechanism, uncoating, gene expression, genome replication, assembly, and release.

The cartoon diagram should look like the types of figures you find in a textbook or review articles. They should **not** be a copy of the figures in the textbook! You should be constructing your own using this opportunity to integrate the material.

To create and upload a cartoon diagram:

- Draw it on a piece of paper and upload a scan (McGill uPrint printers will scan to email) or take a picture (make sure that it is clear)
- Use software (Powerpoint, Adobe Illustrator, other graphic software, etc.) to create an electronic cartoon diagram

Assignments will be submitted in MyCourses as a single document in *.pdf* format. Limit to 2-pages of text **including** the figure legend plus a 1-page viral life cycle cartoon diagram/figure. References not included in the 2-page limit. Use 12-point font, Times New Roman, 1-inch margins all around, Name (upper right corner), McGill ID (upper left corner), and page numbers (bottom center). Include references (primary source material, primary research, and/or review articles). Note that Wikipedia is **not** an appropriate source.

Grading Scheme:

Viral classification, genome and structure

Virus classification (/1)

Genome (/2)

Virion Structure and composition (/2)

Disease Characteristics (/1)

Distinctive Characteristics (/3)

Formatting and references (/1)

Cartoon Diagram and Figure Legend (/5)

Cartoon diagram and Figure legend: Did this figure meet the following criteria (Figure and Figure legend include a depiction and description of the viral life cycle, including viral receptor(s), entry mechanism, uncoating, gene expression, genome replication, assembly, and release).

5/5 – Strongly Agree (Exceeds expectations)

4/5 – Agree (Superior)

3/5 – Meets expectations (Acceptable)

2/5 – Disagree (Some criteria missing)

1/5 – Strongly Disagree (Key elements missing)

0/5 – Does not meet basic requirements OR not submitted

Assignments #2 and #3: The Virologist's Toolbox

Primary Research Article Submission: **Nov 15th, 2017 – 5 PM**

Due Date: **Dec 1st, 2017 – 10 PM**

Using your assigned virus from *Assignment #1* (above), find and read a primary **virology** research article about your virus from the last 5 years (*J Virol, Virology, J Gen Virol, PLoS Pathogens, PNAS, Cell, Science, or Nature*; other Journals accepted **only** upon approval from the TA). Find a figure (or panel(s) of a figure) in which a virological method/technique is used. Provide the figure (or panel(s) of the figure) and write a Figure legend **in your own words** (including a description of the virological method/technique, the major findings of the figure, and provide a complete reference in *Journal of Virology* format. Limit to 1-page - including Figure and Figure legend, single-spaced, Times New Roman, 12-point, 1-inch margins all around, page numbers. Submit both your primary research article (**Nov 15th, 2017**) and your assignment (**Dec 1st, 2017**) in *.pdf* format.

Grading Scheme:

Identification of a primary virology research article (/1)

Figure (or panel(s) of the figure) provided and clear (/1)

Virological technique correctly identified (/1)

Description of virological technique (/3)

Description of major finding(s) of the Figure (/3)

Formatting and Reference(s) (/1)

**Although some students may be assigned the same virus, you are expected to hand in your own work and not simply copy/paste the work of others. McGill's policy on plagiarism and academic integrity apply. In addition, for Assignments #2 and 3, those assigned to the same virus must use a distinct primary research article (first come, first serve).*