McGill University
Department of Microbiology & Immunology
Fundamental Virology, MIMM 324
Fall Term, 2024

Course Coordinators: Dr. Jacques Archambault
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Lecturers: Drs. Jacques Archambault, Dalius Briedis, Chen Liang, George Kukolj, Leo Liu, Vivian Liu, and Jose Teodoro.

Teaching Assistant: Laura Camelo Valera, laura.camelovalera@mail.mcgill.ca

Lectures: Monday / Wednesday / Friday: 10:35 AM – 11:25 AM EST
Location: Duff Ampitheatre, 3775 University Street

Evaluation Scheme: **Quizzes (15%; 5 quizzes @ 3% each):** Students will take 6 short quizzes over the term in MyCourses (~1/module), of which the student's best 5 quizzes will count towards their final grade. Generally, quizzes will test factual knowledge, concepts, theory, and may involve calculations.

Assignments (20%; 2 assignments): 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.

Final Exam (40% of course grade): During the regular exam period, students will take a final exam.
Note: Students unable to attend the midterm exam for medical reasons MUST provide a VALID medical note WITHIN 1 week of the scheduled midterm, or else will receive a grade of ZERO for the midterm. Students who provide a VALID note will be eligible for a deferred midterm exam (or a deferred grade weighting, at the Course Coordinator's discretion), the latter of which will be scheduled within 2 weeks of the originally scheduled midterm. Please provide your VALID note to the Student Affairs Coordinator: undergrad.microimm@mcgill.ca

Polling @ McGill: McGill uses a web-based polling system called TurningPoint at no cost to students and instructors. Polling in this course will be used to enhance engagement and increase interaction during lectures. During a class with polling questions, you will respond to questions from the instructor from 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 Textbooks: **Fundamentals of Molecular Virology** by **Nicholas H. Acheson** (Editor), Publisher: John Wiley & Sons, 2007 (2nd 2011).

Principles of Virology by **Vincent R. Racaniello, Glenn F. Rall, Anna Marie Skalka, S. Jane Flint and Lynn W. Enquist**
Publisher: ASM Press, 2015 (4th Edition)
These textbooks are NOT required. They cover much of the material presented in the lectures and supplement it. Students are encouraged to read the textbooks to supplement their knowledge. Students will not be expected to know details of topics that are not discussed in lectures, but will be expected to complete and learn material from assigned readings based on original primary scientific research publications.

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

Course Content and Calendar:

Date	Day	Topic	Lecturer	Location
SECTION I: INTRODUCTION TO VIROLOGY				
Aug. 28	W	1. An overview of Virology	Archambault	MNI TIMMINS
Aug. 30	F	2. The Baltimore Scheme	Archambault	SADB 2/36
Sep. 2	**M**	**Labour Day (no classes)**		
Sep. 4	W	3. Virus Structure	Archambault	**TBD**
Sep. 6	F	4. Transmission and Entry	Archambault	SADB 2/36
Sep. 9	M	5. Uncoating and Translation	Archambault	SADB M1
Sep. 11	W	6. Genome Replication and Packaging	Archambault	**TBD**
Sep. 13	F	7. Bacteriophages I	Liang	SADB 2/36
Sep. 16	M	8. Bacteriophages II	Liang	MNI TIMMINS
SECTION II: DNA VIRUSES				
Sep. 18	W	9. Polyomaviruses	Archambault	**TBD**
Sep. 20	F	10. Human Papillomaviruses I	Archambault	SADB 2/36
Sep. 23	M	11. Human Papillomaviruses II	Archambault	MNI TIMMINS
Sep. 25	W	12. Human Papillomaviruses III	Archambault	**TBD**
Sep. 27	F	13. Poxviruses	Teodoro	SADB 2/36
Sep. 30	M	14. Adenoviruses I	Teodoro	MNI TIMMINS
Oct. 2	W	15. Adenoviruses II	Teodoro	Duff THTR 1
Oct. 4	F	16. Parvovirus	Teodoro	Duff THTR 1
Oct. 7	M	17. Herpesviruses I	Briedis	Duff THTR 1
Oct. 9	W	18. Herpesviruses II	Briedis	Duff THTR 1
SECTION III: RNA VIRUSES				
Oct. 11	F	19. Orthomyxoviruses I	Briedis	Duff THTR 1
Oct. 14	**M**			
Oct. 16	**W**	**No Class – FALL BREAK**		
Oct. 18	**F**			
Oct. 21	M	20. Orthomyxoviruses II	Briedis	Duff THTR 1
Oct. 23	W	**MIDTERM EXAM** (covers up to lecuture 18)	N/A	Duff THTR 1
Oct. 25	F	21. Paramyxo- and Rhabdoviruses	Briedis	Duff THTR 1
Oct. 28	M	22. Filoviruses	Briedis	Duff THTR 1
Oct. 30	W	23. Prions and Spongiform encephalitis	Briedis	Duff THTR 1
Nov. 1	F	24. Picornaviruses	Kukolj	Duff THTR 1
Nov. 4	M	25. Alphaviruses and Flaviviruses	Kukolj	Duff THTR 1
Nov. 6	W	26. Hepatitis C virus	Kukolj	Duff THTR 1
Nov. 8	F	27. Coronaviruses I	L. Liu	Duff THTR 1
Nov. 11	M	28. Coronaviruses II	L. Liu	Duff THTR 1
SECTION IV: RETROVIRUSES AND HBV				
Nov. 13	W	29. Introduction to Retroviruses	Kukolj	Duff THTR 1
Nov. 15	F	30. Reverse Transcription and Integration	Kukolj	Duff THTR 1
Nov. 18	M	31. HIV Gene Expression	Kukolj	Duff THTR 1
Nov. 20	W	32. HIV	Kukolj	Duff THTR 1

Nov. 22	F	33. HBV		Kukolj	Duff THTR 1
SECTION V: HOST-VIRUS INTERACTIONS, ANTIVIRALS AND VIRAL VACCINES					
Nov. 25	M	34. Host-Virus interactions		Liang	Duff THTR 1
Nov. 27	W	35. Antivirals		Kukolj	Duff THTR 1
Nov. 29	F	36. Viral Vaccines		Liang	Duff THTR 1
Dec. 2	M	37. Emerging Viruses		V. Liu	Duff THTR 1
Dec. 4	W	38. Oncolytic Viruses		Teodoro	Duff THTR 1

Quizzes (20%; 5 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 5 quizzes (of 6 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 (11:30 AM)	End Date (11:59 PM)	Answer Key Available
1. Viral Life cycle	1-6	Sep 16th, 2024	Sep 18th, 2024	Sep 20th, 2024
2. Bacteriophages & DNA viruses I	7-13	Oct 2nd, 2024	Oct 4th, 2024	Oct 7th, 2024
3. DNA Viruses II	14-18	Oct 21th, 2024	Oct 23th, 2024	Oct 25th, 2024
4. RNA viruses I	19-23	Nov 6th, 2024	Nov 8th, 2024	Nov 10th, 2024
5. RNA viruses II	24-28	Nov 20th, 2024	Nov 22th, 2024	Nov 25th, 2024
6. Retroviruses and HBV	29-33	Nov 27th, 2024	Nov 29th, 2024	Dec 2st, 2024

Assignments (20%)
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. **Example assignments for each part will be available on MyCourses (*see* Content tab, Course Information and Assignments).**

Part I (10% of final grade): Virus Structure, Genome and Life Cycle
Virus Sign-up (Groups tab): **Sep 13th, 2024 – midnight (those not signed up by this time will be automatically assigned to a virus)**
Due Date: **Sep 23rd, 2024 – midnight**

Students will be assigned an RNA or DNA virus that infects humans 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 figure title and 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 or in published works! You should be

constructing <u>your own</u> diagram and using this opportunity to integrate the material. To create and upload a cartoon diagram:

- Draw it on a piece of paper and upload a picture (make sure that it is clear and legible)
- 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** (Assignments tab). Limit to 2-pages of text plus a 1-page viral life cycle cartoon diagram/figure. 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 citations and references (primary source material, primary research, and/or review articles). Note that Wikipedia or blog posts (e.g. ViralZone) are **<u>not</u>** appropriate sources**, primary literature only please**. References must be in *Journal of Virology* format (**for both in-text citations <u>and</u> references**) and are not included in the 3-page limit.

Grading Scheme: Part I
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
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 met basic requirements OR not submitted

Part II (10% of final grade): The Virologists Toolbox
a) Primary virology research paper approval: **Nov 4th, 2024 – midnight**
b) Figure and figure legend: **Nov 18th, 2024 – midnight**

Using your assigned virus from ***Part I*** (above), find and **<u>READ</u>** a primary virology research article from the **past 5 years** about your virus in one of the pre-approved Journals (*Journal of Virology*, *Virology*, *PLOS Pathogens*, *Proceedings of the National Academy of Sciences, Cell, Science,* or *Nature;* other Journals accepted **<u>ONLY</u>** upon approval from the TA). Submit a *.pdf* copy **(due Nov 4th, 2024)** of your article with the **figure title highlighted** that you will use for the assignment *Part IIb* (below). Note that a **primary virology research article** is an article where the virus is the major focus and something about the virus and/or the viral life cycle is being learned and measured (i.e. the virus is not just used as an antigen).

Choose a virological method/technique that is used in one or more figures in your primary virology research article. Provide one or more panels of the figure that uses this technique (identified in ***Part IIa***), and write a Figure legend for the provided panel(s) **<u>in your own words.</u>** This should include: a

title, a description of the virological method/technique used in the figure (a **single** virological technique must be identified in **bold**), the major findings of the figure, and complete reference(s) in ***Journal of Virology*** format (**for both in-text citations <u>and</u> references**). A **virological method/technique** is defined as a technique used to measure a viral transcript, genome, protein, titer or particle (**i.e. it must measure something about the virus itself**). If several panels of a figure are provided, each panel <u>must</u> be described. Note that you should be describing the specific virological method/technique used in your paper (carefully read the ***Materials & Methods*** section of your paper, but do <u>NOT</u> regurgitate the methods). Limited to 1-page, including the Figure and Figure legend. 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 citations and references (primary source material, primary research, and/or review articles). References must be in ***Journal of Virology*** format (**for both in-text citations <u>and</u> references**) and <u>are not</u> included in the 1-page limit. Submit the assignment in ***.pdf* format** (Assignments tab).

Grading Scheme: Assignment Part II
    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 <u>own</u> work and not simply copy/paste the work of others. McGill's policy on plagiarism and academic integrity apply. In addition, for **Part II, those assigned to the same virus <u>must</u> use a distinct primary research article (first come, first serve).*

Research Tools and Resources:
The following search engines may be helpful with your assignment research:
1. Pubmed: https://www.ncbi.nlm.nih/gov/pubmed
2. Web of Science/Web of Knowledge – to get there: McGill Library webpage ⛓ Databases A-Z ⛓ select 'Web of Science' (you may need to log in if you are accessing it off campus) https://apps.webofknowledge.com/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=8DaBmAhdFZXfG7Luw8L&preferencesSaved
3. Scopus: This is the search engine that was used in MIMM214. It includes all the resources indexed in Pubmed, along with additional databases https://www.scopus.com

Reference Management Software:
I recommend that you use the reference management software **Endnote** to organize your citations and references. This is freely available from McGill University to all students at this link: http://libraryguides.mcgill.ca/citation/endnote. All of your citations and your bibliographies <u>must</u> be prepared using the ***Journal of Virology*** format as indicated in the assignment instructions (above).

The McGill library offers regular workshops on using Endnote which can be accessed at the above link. You can also make an appointment with the MIMM Liason Librarian, Andrea Miller-Nesbitt (andrea.miller-nesbitt@mcgill.ca, 514-398-1663) for any library-related questions.

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/)](www.mcgill.ca/students/srr/honest/)."

2. **Work submitted for assessment is expected to be your own. The use of technologies such as ChatGPT are prohibited and will be considered a violation of the Code of Student Conduct.**

3. **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)."

4. 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.

5. McGill has policies on sustainability, paper use, and other initiatives to promote a culture of sustainability at McGill.

6. 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.

7. © 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.

8. 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.

9. 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)](http://www.mcgill.ca/deanofstudents/plagiarism) and code of Conduct (http://www.mcgill.ca/students/srr/honest).

10. 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-responsibilitiesle-recueil-des-droits-et-obligations-de-letudiant