1 Course Details

1.1 Calendar Description

This course will focus on molecular aspects of virus replication cycles and the diverse strategies used for replication of select RNA and DNA viruses. Virus-host interactions including tumour virology and host antiviral responses such as interferon and apoptosis will be discussed. Viral anti-host-defence responses as well as recent advances in molecular virology and evolution will be also be covered.

Pre-Requisites: MICR*3330, (MICR*2430 is recommended)

1.2 Course Description

The overarching objectives of this course are to provide students opportunities to gain a deeper appreciation of viruses and virus-host interactions at the molecular and cellular level and to develop research and communication skills that are essential for further studies in virology. These objectives will be achieved through lectures, laboratory exercises and a student group research project involving a mini-review, quasi-peer review and in-class presentations.

Building upon the introductory course, The World of Viruses (MICR*3330), this advanced course will start by discussion of the various strategies used by different groups of viruses for transcription, translation and post-translational processing, genome replication as well as interactions with their host. To gain a deeper and more comprehensive understanding of these processes, we will use two RNA virus families (Coronaviridae and Closteroviridae) for in-depth analyses. These two viral families are exceptional in several ways: 1) they contain the largest RNA genomes discovered to date; 2) members of both families are the causal
agents of major diseases in humans, livestock animals and plant crops; and 3) studies of both viral families have unraveled and will continue to reveal novel mechanisms for transcription, translation, post-translational processing, as well as the biogenesis of viral replication complexes (VRCs). In addition, students will be provided the opportunity to learn key concepts and experimental strategies in contemporary virology such as high-throughput sequencing, viromes, transcriptomics, phylogenetics and evolution virology.

A major emphasis of this advanced virology course is on student-centred learning and skill development in scientific inquiry through a group research project. Each student group is to produce a mini-review article on a chosen topic. The draft mini-review will then be subjected to a peer review process similar to solicit feedback and suggestions from other student groups for the purpose of further improvement. Furthermore, each student group will lead a journal club style in-class discussion where they critique on one of the research papers related to their mini-review.

The laboratory component will provide students opportunities for experiential learning with some key experimental systems and methodologies that are commonly used in virology research. These include the inoculation of embryonated chicken eggs to grow viruses, hemagglutination and hemagglutination inhibition assays, launching infection of a model RNA virus (potato virus X) in the experimental plant *Nicotiana benthamiana* through wildtype and GFP-tagged infectious cDNA clones, followed by a series of experiments including the observation of symptom development, monitoring viral movement through GFP, RNA isolation, RT-PCR, gene cloning, DNA sequencing, multiple sequence alignment and the construction of phylogenetic trees. All these methods will be highly useful in research on the molecular biology of viruses.

### 1.3 Timetable

**Lectures:**
Mondays and Wednesdays, 12:30 - 1:20 PM.

**Labs:**
Thursdays and Fridays, 2:30 - 5:20 pm

### 1.4 Final Exam

**Time:** TBA

**Location:** TBA
(Cumulative, covers all lectures, guest lectures and students' presentations, and lab components)

2 Instructional Support

2.1 Instructional Support Team

Instructor: Baozhong Meng Baozhong Meng
Email: bmeng@uoguelph.ca
Telephone: 519-824-4120 Ext 53876
Office: SSC 4205
Office Hours: Wednesdays 4:00 – 5:00 pm

Lab Co-ordinator: Mehdi Shabanian
Email: shabania@uoguelph.ca
Telephone: +1-519-824-4120

2.2 Teaching Assistants

Teaching Assistant (GTA): TBA TBA
Office Hours: TBA

Teaching Assistant (GTA): TBA TBA
Office Hours: TBA

3 Learning Resources

3.1 Additional Resources

Information on Textbooks and Resources (Notes)

Students are not required to purchase a textbook though it would be a good idea to purchase a copy of the most recent text Principles of Virology by Flint et al. Lecture materials will be derived from various sources including textbooks, review articles and primary research papers. Principles of Virology (4th edition by Flint et al., 2015, ASM Press) and Fields Virology (6th edition by Knipe and Howley, Wolters Kluwer/Lippincott Williams and Wilkins, 2013) are two of the most useful references in virology and will be available on reserve in the library.

In addition, materials pertaining to lectures, labs, assigned reading materials, as well as
announcements will be posted on CourseLink.


# 4 Learning Outcomes

## 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. 1). A deeper understanding and appreciation of the various strategies different groups of viruses use to express their genomes.

2). An appreciation of the intricate interactions between a virus and its host at the molecular and cellular levels.

3). Experimental approaches and methodologies that are commonly used in virology research.

4). Host defense mechanisms including cell-based antiviral responses and the adaptive immune response against viral infections.

5). Evolution biology, phylogenetics, metagenomics and high-throughput sequencing for the discovery of novel viruses.

6). Enhanced skills in active learning, teamwork, and scientific inquiry through critical reading of the published literature.

7). Skills in scientific communication through students group project (minireviews, in-class presentation and peer review).


# 5 Teaching and Learning Activities

## 5.1 Lecture
Topics: SCHEDULE OF LECTURES (Tentative, subject to change)

PART 1: Overview of viruses; common experimental systems and methods used in virology research.

PART 2: Diverse strategies used by different groups of viruses for genome replication and expression

-Transcription and processing of viral mRNAs

-Translation and post-translational modifications of viral proteins

-Strategies for genome replication

PART 3: Molecular and cellular basis of virus-host cell interactions

-Cell biology aspects of virus-host interactions

-RNA silencing as an ancient defense mechanism against RNA viruses

-Viral suppressors that counteract RNA silencing

-Host defense against viral infections: innate immune responses (TLRs, interferons, apoptosis, natural killer cells, etc.)

-Viral counter-defense mechanisms (inhibition of apoptosis, mimicry of cellular proteins involved in antigen presentation and recognition, etc.)
PART 4: Current research on select families of viruses

PART 5: Metagenomics, phylogenetics, emerging viruses and virus evolution

PART 6: Virology research at Guelph (Guest lectures)

5.2 Seminar

Topics: Student Group Research Project (mini-review, peer review and in-class presentations)

MINI REVIEW BY STUDENT GROUPS:

To engage students in self-motivated and active learning, and to enhance the skills of students in critical thinking, data analysis and understanding of scientific publications, organization and presentation of scientific communication, and teamwork, students are required to complete a group term paper and in-class presentation project. Students will form groups and choose a topic related to lectures, and compose a mini-review on the chosen topic. Draft of mini-review will be subject to peer review by other student groups through PEAR. Specific requirements on the content, format, and page limits will be provided later on.

IN-CLASS PRESENTATIONS BY STUDENT GROUPS:

In addition to the mini-review, each group will give an in-class presentation on one of the primary research articles chosen by the group for their mini review. The presentation will be 20 minutes for each group, followed by 5 min for Q and A. The in-class presentation must be in the Powerpoint format and include: 1) the title of your presentation and the names of the students in your group; 2) an introduction to background information necessary for the audience to understand and follow your presentation; 3) hypothesis and objectives of the chosen paper; 4) experimental approach and key methodologies used; 5) results; and 6) conclusions and future directions you would like to suggest.
PEER REVIEW BY OTHER STUDENTS GROUPS:

To familiarize students with the process of publishing in biological sciences, draft term papers will undergo a similar peer review process as used in scientific publication by peer students who are required to provide detailed and constructive comments and suggested changes that would improve the quality of the draft papers. Students are encouraged to take full advantage of the feedbacks from the review and revise your paper before final submission. These activities will be highly beneficial to students, as these activities would prepare you for skills in scientific research and communication.

Deadline for submission of draft of mini review for peer-review:

Friday, March 11, 2021 at 5 pm.

Deadline for submission of final paper:

Friday, March 25, 2021 at 5 pm.

5.3 Lab

Topics: Laboratory Exercises:

Lab activities are designed to have students learn several important experimental systems and an array of methodologies commonly used in contemporary research in virology. These include the following:

i) Inoculation of embryonated chicken eggs to grow viruses.

ii) Hemagglutination, hemagglutination inhibition.

iii) Experiments related to potato virus X. Inoculation of the experimental model plant *Nicotiana benthamiana* with wildtype and gfp-tagged infectious cDNA clones of a model RNA virus, Potato virus X, through agrobacterium-infiltration, observation of disease symptoms, monitoring disease progression and viral trafficking via green fluorescence observation, RNA isolation, RT-PCR, gene cloning, and DNA sequencing.
iv) Students will also have the opportunities to retrieve viral sequences from GenBank, conduct multiple sequence alignment and to construct phylogenetic trees.

6 Assessments

6.1 Marking Schemes & Distributions

<table>
<thead>
<tr>
<th>Components of Assessment</th>
<th>Weighting</th>
<th>Due date for submission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term paper:</td>
<td>20%</td>
<td>March 11 (draft); March 25 at 5 pm (Final)</td>
</tr>
<tr>
<td>In-class presentation</td>
<td>7.5%</td>
<td></td>
</tr>
<tr>
<td>Peer review:</td>
<td>2.5%</td>
<td>March 18, at 5 pm</td>
</tr>
<tr>
<td>Laboratory:</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Midterm exam:</td>
<td>15%</td>
<td>February 16 (in class)</td>
</tr>
<tr>
<td>Final exam (TBA):</td>
<td>30%</td>
<td>TBA</td>
</tr>
</tbody>
</table>

Total: 100%

7 Course Statements

7.1 COURSE POLICIES
Due to the requirement for students’ active participation in lectures, in-class presentations and lab exercises, it is mandatory for students to attend all lectures and labs. Under special circumstances that are beyond control, for example, severe illness, if a student has to miss a class, the student must inform the instructor for the lecture to be missed or the lab coordinator for the lab at least one day prior to the lecture or the lab.

Given the complexity and the high-cost nature of laboratory exercises, we will be unable to schedule for make-up labs. Students who miss a lab session without proper documentation for illness or other compassionate reasons will receive a grade of zero for that particular lab.

If you miss the midterm, with proper documentation and at the discretion of the instructor, the weight may be transferred to the final exam.

8 Department of Molecular and Cellular Biology

Statements

8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. B.Sc. Academic Advising or Program Counsellors

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. http://www.learningcommons.uoguelph.ca/
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-
8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. [https://www.uoguelph.ca/counselling/]
- Student Health Services is located on campus and is available to provide medical attention. [https://www.uoguelph.ca/studenthealthservices/clinic]
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. [http://www.selfregulationskills.ca/]

8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) [http://www.e-laws.gov.on.ca/index.html]. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar. ([https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml))

8.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement
When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-regregchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be
noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.