Immunology
UNIVERSITY OF TORONTO

Course & Instructor Information
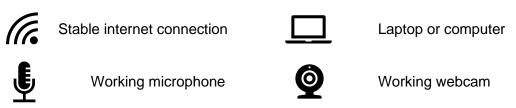
Course Instructor & Coordinator
Dr. Jasty Singh,
Assistant Professor, Teaching Stream, Department of Immunology
jastaran.singh@utoronto.ca
Office Hours: Tuesday 1-3pm via Microsoft Teams (during timetable lecture timeslot)

Required:

📶 Stable internet connection   💻 Laptop or computer

🎙️ Working microphone   📷 Working webcam

Given these unprecedented times, and the rigorous nature of this course, please review whether online learning is right for you here.

Delivery Mode:
Lectures in this course will be held **online, asynchronously**. Lecture videos will be released prior to a given week, and students will be able to self-pace their learning. Tutorials will be held **in-person** on Thursdays from 1-3pm (BA B024; 40 St. George Street). Tutorials will involve discussion and application of content from asynchronous lectures, and please note that attendance for all tutorials is **mandatory**.*

* Exceptions will be made to in-person attendance during the first two weeks of classes (Sept. 9-23; see below).

Arts & Science Calendar Course Overview ("24L"/24T)

This course will provide students with an opportunity to advance their understanding of research in Immunology in accordance with scientific methodology. Students will critically appraise scientific articles, design and analyze scientific experiments, and develop the core skills of data and statistical literacy. This course is well suited for anyone interested in discovering knowledge in Immunology, providing students with a methodology for the achievement of scientific research activities.

Prerequisites: IMM250H1, BCH210H1/BCH242Y1, BIO230H1/BIO255H1, BIO260H1/HMB265H1, STA288H1/STA220H1

****Note***: If students have not taken STA288H1 (or another comparable introductory statistics course), please note that there will be a steep learning curve for basic inferential statistics and R programming. While supplementary resources will be provided, it will be the student's own responsibility to ensure they are up to speed with course content via self-study. Extra support will be available in the course through peer collaboration, the course discussion board and instructor office hours.*

Course Learning Outcomes

- Understand research terminology and the fundamental problems of science in Immunology by searching for, reading and critically appraising primary and secondary research articles.
- Formulate hypotheses and design research studies to address fundamental gaps in the field of Immunology.
- Use *R* statistical software to generate data summaries, conduct statistical tests, and draw scientific conclusions.
- Cultivate collaborative skills through group work with peers, TAs and/or instructors.
- Learn how to effectively conduct scientific research and experimental analysis, and describe quantitative, qualitative and mixed methods approaches to research.

Required Readings

There is no required textbook for this course. All required papers/content will be posted Quercus (information below), and should be read **prior** to attending the tutorials.

Statistical Software – R Studio Cloud

R is an open source statistical package that is widely used in academia, research and industry and is quickly becoming a standard platform. It is available for download from: https://cran.r-project.org/ for use on Windows, Mac OS, and Linux (there is also a version for use on Android). RStudio provides a nice interface for R and offers some very useful functionality.

We will be using the University of Toronto JupyterHub to access the R Studio computational environment in this course. To access RStudio on JupyterHub, use your UTORid and password to login at https://jupyter.utoronto.ca/hub/login **(make sure you have RStudio selected on the login screen).** Alternatively, if you would prefer to run RStudio on your own machine, R and R Studio (both available free-of-charge) can be downloaded and installed on your own machine.

Information on how to get set up on JupyterHub, and if you wish, to download and install R and R Studio on your computer, is posted on Quercus. You will need to be familiar with R code and output and will need to generate and interpret R code/output on your IMM360 assignments.

Flow Cytometry Analysis Software – FlowJo

FlowJo™ is the leading analysis platform for single-cell flow and mass cytometry analysis. We will be using FlowJo v10 in this course – there is no charge for this in IMM360. You will receive an invitation to FlowJo at your @mail.utoronto.ca email address. After you "Accept Invitation," you will be redirected to the FlowJo Portal. Create an Account using your @mail.utoronto.ca email address. Next, download FlowJo at https://www.flowjo.com/solutions/flowjo/downloads. Once you have accepted your License Invitation, you will be able to sign in to FlowJo using your portal account credentials (https://docs.flowjo.com/portal/flowjo-portal-license-for-flowjo/).

Quercus Course Website

Direct Link to our Course (you will need to sign in with you UTORid and password): https://q.utoronto.ca/courses/234554

It is your responsibility to check Quercus regularly and to monitor your @mail.utoronto email inbox for messages about the course. Here, you will find important announcements, information about how to get set up with R/R Studio and FlowJo, information about assessments, help (via Discussions and office hours), your grades, etc. Several course assessments will also be posted on/submitted through Quercus and outline tutorial slides will be posted there in .pdf format by 11:59pm the night before tutorial. Alternative file formats will not be available. **Note that complete slides/lecture material used in class should <u>not</u> be posted or distributed in any form under any circumstance**.

The Discussions tool is enabled on Quercus. Direct link:
https://q.utoronto.ca/courses/234554/discussion_topics

You can ask questions there and respond to your peers' questions about weekly course content (e.g., lecture, readings, practice questions, etc.) or general course administration. If you email your instructor/TAs with a course content or general administration question, you will be directed to Quercus Discussions. This is a public (to the class) Discussion Board and an extension of our classroom learning community so please be respectful of one another. Derogatory, discriminatory, or otherwise inappropriate language or topics will be removed and dealt with at the instructors' discretion.

Evaluation Scheme & Course Assessments

Assessment	% of Grade	Due Date
Participation (Attendance/Quercus quizzes)	20% (10x2%)	Weekly
Assignment 1: Article Critique	15%	October 7
Assignment 2: Data Analysis Assignments	15% (3x5%)	October 14, 21, 28
Assignment 3: Group Presentations	15% Presentation 5% Peer Discussion	December 2 December 8
Final Test	30%	TBD

Participation (20%)

Tutorial attendance is **mandatory** and an integral part of your learning experience in this course. Students are expected not only to attend tutorial but also to read required texts and watch required lecture videos before tutorial to engage in the material during class discussions and through the discussion board on Quercus. Students will be required to complete/submit a **post-tutorial Quercus quiz** by 11:59pm on the day of the tutorial. Quercus quizzes will be graded for participation only. Students must attend tutorial <u>AND</u> complete the Quercus quiz; otherwise, they will receive a grade of 0% for that week. For the first two weeks of class (Sept. 9-23), students who are unable to attend tutorial will be able to attend online, synchronously and will still be expected to complete the post-tutorial Quercus quiz. There are *<u>no extensions nor make-ups available for missed tutorials, nor for Quercus quizzes</u>*.

Refer to the "Missed Assessment/Tutorial Policy" section below for information on how to request accommodation for a missed tutorial and what accommodations may be possible.

Assignment 1: Article Critique (15%)

You will select an article of your choice related to the field of immunology. Your critique of this article should communicate your understanding of an article's main points in the form of a brief literature review, while offering an analysis of its strengths and weaknesses. You will be responsible for generating a preliminary outline of your ideas for peer review in tutorial on **September 30**.

Based on your analysis, you will identify a unique *research question* within the field and formulate a *hypothesis* that will be used for the basis of your final oral presentation. Focus should be placed on critical analysis and concision.

<u>Due Date</u>: **October 7**, 11:59pm through Quercus

Assignment 2A-C: Data Analysis Assignments (3x5% = 15%)

You will receive different types of immunological data (flow cytometry, immunofluorescence, ELISA, RNA Seq, cell culture, etc.) and the associated publication (where applicable) during Module 2 of the course. There will be three (3) equally-weighted assignments to be completed **independently** (no collaboration permitted) and submitted through Quercus by 11:59pm on tutorial dates for those weeks (**October 14, 21, 28**). The schedule is included on the last pages of the syllabus. Assignment questions will be posted on Quercus no later than the Monday of a given assignment week. Assignments must be completed and submitted in the correct format(s) through the appropriate Quercus assignment link by the deadlines. *There are <u>no extensions nor make-ups</u> available for these assignments.* **Late assignments and assignments in other formats or submitted in different ways (e.g., over email) will <u>not</u> be accepted.**

*Tutorial 5 (Oct. 7) has an "*R practice assignment*," which is not mandatory, but will familiarize you with the expectations for all subsequent assignments. Completion of this practice assignment is *highly* recommended. Tutorials for weeks 6-8 (Oct. 14, 21, 28) will provide students with an opportunity to seek extra help for data analysis assignments from instructors and teaching assistants.

<u>Due Dates</u>: **October 14, 21, 28**, 11:59pm through Quercus

Assignment 3: Group Presentation – Research Study (20%)

Students will work in groups of 4-5 and select a single research question/hypothesis from Assignment 1. Students will propose 2-3 experiments to address their research question, with careful integration of study rationale, the principles of experimental design and statistical methods. Oral presentations should be 20 minutes in length.

Groups will be responsible for uploading their group presentations to Quercus by **11:59pm** on **December 2**. There will be no extensions on the research study assignment under any circumstances. Late presentations will not be accepted. More information on the research study presentations will be posted on Quercus.

All group members are expected to contribute to the project equally and provide an outline of their involvement. Information on how individuals' contributions to the group assignment will be assessed will be provided on Quercus, but students will need to complete a peer evaluation survey to evaluate their group members' contributions. ***Failure to complete this survey will result in a 1-mark penalty on a student's individual project grade***. Every group member will earn the grade earned by their group's assignment, <u>unless</u> there is a clear and consistent message in the peer/self-evaluations that an individual's contributions were less than satisfactory. If this is the case, that individual's project grade will be less than the grade earned by the group project. The exact amount less will be determined on a case-by-case basis, based on the contributions of that particular group member.

<u>Due Date for Video Presentations & Peer Evaluation Survey</u>: **December 2**, 11:59pm through Quercus

Following submission of presentation videos on December 2nd, students will be assigned two (2) presentations each to peer review through Quercus Discussions. Participation in peer discussions will constitute 5% of your 20% grade for this assignment. Note that presenter groups are also responsible for responding to peer feedback/questions to keep the discussions going. Your peer-review discussion board post will be evaluated based on the following criteria:

	Outstanding (80-100%)	Good to Expected (60-79%)	Inadequate (40-60%)
Relevance/Content • Comments and questions directly and thoughtfully address the topic. • Contributes new ideas and demonstrates a strong understanding of course concepts (e.g. connects concepts to course modules)	Thoughtful contributions to discussions push the 'conversation' to a deeper level.	Discussion contributions keep the discussion on topic and help it to develop.	Contributions do not consistently add to the development of progression of the discussion.
Tone • Tone is respectful, friendly, professional. • Proofreads comments for clarity before posting, and uses clear, standard academic language to communicate ideas in a professional but engaging way.			

Due Date for Peer Feedback via Quercus Discussions: **December 8**, 11:59pm

Final Test (30%)

There will be a 3-hour online final test (combination of multiple-choice and written answers), to be scheduled during the Final Assessment period (December 10-21, 2021). The final will be application-based and cumulative in nature (lectures, tutorials and group presentations over the course of the semester). Information on coverage, along with some sample questions will be posted on Quercus at least one-week in advance of the exam.

Final exam conflicts and petitions for a deferred exam must be brought to the Faculty of Arts and Science. Information to follow.

Missed Assessment/Tutorial Policy

- This course follows the University of Toronto's Policies on missed tests, assignments, and tutorials and requires students to complete the Absence Declaration on ACORN if an assessment is missed due to illness. In addition to completing this absence declaration form, you must report your absence to the course coordinator, Dr. Jasty Singh (jastaran.singh@utoronto.ca) by email within one week of the assessment due date to request accommodation.
- Other reasons for missing an assessment (i.e., assignment, test) will require prior approval by your instructor. If approval is not granted in advance for non-medical reasons then 0% will be recorded for the missed assessment.
- *Note*: If you submit an assessment (i.e., assignment, test), it will be assumed that you deemed yourself fit enough to do so and your grade will stand as calculated. No accommodation will be made based on reports of medical, physical, or emotional distress *after* the fact.

- **Accommodation for a missed tutorial** - There are no make-ups for missed tutorials. If accommodation is requested for a missed tutorial as above and is granted by the instructor, the weighting for that assignment/tutorial will be shifted to your tests; otherwise 0% will be recorded for your tutorial. **Since tutorials are important to the course learning outcomes, <u>at most one</u> tutorial can be accommodated in this way.**
- There are no accommodations for individual contributions to the group presentations due to the nature of the assessment (i.e. it is a group assignment).

Statement on Academic Integrity

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your own honest efforts. Plagiarism—representing someone else's work as your own or submitting work that you have previously submitted for marks in another class or program—is a serious offence that can result in sanctions. Speak to your course instructor for advice on anything that you find unclear. To learn more about how to cite and use source material appropriately and for other writing support, see the U of T writing support website at http://www.writing.utoronto.ca. Consult the Code of Behaviour on Academic Matters for a complete outline of the University's policy and expectations. For more information, please see http://www.artsci.utoronto.ca/osai and http://academicintegrity.utoronto.ca.

Students will be required to submit their course assignments to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their assignments to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

Accessibility Needs

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, please feel free to approach the course instructor, as well as register with Accessibility Services (AS) at the beginning of the academic year by visiting http://accessibility.utoronto.ca.

Intellectual Property Statement

This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely after each session. Note that all course materials are the intellectual property of the course instructor, and they are made available to you for your personal use in this course. Sharing, posting, selling or using this material outside of your personal use in this course is **<u>not</u>** permitted under any circumstances and is considered an infringement of intellectual property rights. According to intellectual property laws, not asking permission constitutes stealing.

Questions & Additional Course Help

All course content or course administration questions <u>must</u> be posted to the online Discussion Board on Quercus or brought to office hours. Any messages of a more personal nature (e.g., medical documentation for a missed class/assignment) should be emailed to the instructor. You can expect a response within 48 hours (Monday-Friday) to a discussion board posting or to an email. To email your instructor, click on the inbox section of your Quercus page, click on the feather (i.e. quill) icon on the top right of the page to compose your message, select "Teachers" within IMM360H1 as the recipients and use an informative subject line.

Course Schedule

The tentative schedule for course topics is shown on the following pages. Some adjustments may be made to weekly topics as the course progresses.

	Lecture Topic (Asynchronous)	Date	Tutorial Topic (Synchronous)
Module 1 – Engaging with Research			
Sept. 6-12	**Introduction to Scientific Inquiry & Research** • What is scientific inquiry? • Establishing rationale for your study	Sept. 9	Components of a research question & hypothesis Work with datasets and brainstorm research importance
Sept. 13-19	**Finding, Reading & Analyzing Scientific Publications** • Use of research databases for problem solving	Sept. 16	Critical Appraisal – what to look for: deconstructing papers
Sept. 20-26	**Minding the Gap – Finding a Niche for Study** • Developing a research hypothesis	Sept. 23	Characteristics of good research topics and how to create one *Overview of Article Critique Assignment 1*
Sept. 27-Oct.3	**Scientific Communication** • Abstracts, papers, grants • "Pitches"	Sept. 30	Peer review of Article Critique Assignment outlines – identifying strengths/weaknesses in scientific communication
Module 2 – Working with Immunological Data			
Oct. 4-10	**Introduction to Quantitative, Qualitative and Mixed-Methods Research** • Introduction to types of variables • Quantitative vs. qualitative variables	Oct. 7	***Article Critique Assignment 1 Due*** Variable identification exercise Review of *R and "R Practice Assignment" (in tutorial)*
Oct. 11-17	**Common Techniques in Immunology & Demo of Software** • Flow cytometry, ELISA, QPCR, etc. • FlowJo analysis	Oct. 14	Data summaries in R. ***Assignment 2A due at 11:59pm***
Oct. 18-24	**Analysis and Interpretation of Immunological Data** • "Statistics Workshop"	Oct. 21	Working with immunological data in R. ***Assignment 2B due at 11:59pm***
Oct. 25-31	• Descriptive & inferential procedures • Bridging statistics with immunology	Oct. 28	Working with immunological data in R. ***Assignment 2C due at 11:59pm***
Module 3 – Designing a Research Study			
Nov. 1-7	**Study Design** • Types of studies • Sampling vs. study design	Nov. 4	Case studies of various experimental designs & impact on findings
Nov. 8-14	**READING WEEK – NO CLASSES**		
Nov. 15-21	**Drawing Scientific Conclusions & Impact** • Driving research forward • Funding opportunities	Nov. 18	Group work on Presentations
Nov. 22-28	**Good Lab Practice** • Project planning and management • Organizing your lab notes	Nov. 25	Review & Group work on presentations
Nov. 29-Dec. 5	**Watch Final Presentations & Provide Feedback**	Dec. 2	Review problems ***Group presentations due at 11:59pm, Discussion due Dec. 8 at 11:59pm***