

Course & Instructor Information

STA288H1 – Statistics and Scientific Inquiry in the Life Sciences

Lecture Section	Lectures & Tutorials/Labs
LEC0101	Tuesdays 11am -1pm ET in WB 116 Thursdays 11am-1pm ET in BR 200 <i>*Note: Different classrooms on Tuesday/Thursday</i>

* Refer to the schedule on the last pages of this syllabus and Quercus for detailed information about when lectures, labs or tutorials will be taking place. All times are in Eastern Time (ET).

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All course content or course administration questions must be posted to Quercus Discussions or brought to office hours. These types of inquiries will not be addressed over email. Any messages of a more personal nature (e.g., to report a missed lab assignment due to illness) should be emailed to both instructors. Be sure to include the course number (i.e., STA288 and your UTORid in your email subject line) and send to both instructors' utoronto emails listed above OR through the Quercus Inbox. You can expect a response within about 48 hours (Monday-Friday).

Technical Requirements:



Stable internet connection



Laptop or computer



Working microphone
(Group Work)



Working webcam
(Group Work)

Delivery Mode:

Lectures, labs and tutorials in this course will be held **in-person** (Tuesdays/Thursdays, 11-1pm ET). Tutorials will involve discussion and application of content from lectures and attendance for all tutorials is **mandatory**. Note that all scheduled meetings and deadlines are in Eastern Time (ET).

Calendar Description

Introduction to statistics and its connection to all stages of the scientific inquiry process. Issues around data collection, analysis and interpretation are emphasized to inform study design and critical assessment of published research. Statistical software is used to conduct descriptive and inferential statistics to address basic life sciences research questions.

Prerequisite: BIO230H1/BIO255H1

Exclusion: STA220H1, PSY201H1, GGR270H1, ECO220Y1, ECO227Y1, SOC202H1, EEB225H1, HMB325H1, STA238H1, STA248H1, STA261H1, PCL376H1, STA215H5, STA220H5, STAB22H3

Course Learning Outcomes

Upon successful completion of this course you will be able to:

- See the relevance of statistical issues in all stages of the life sciences research process.
- Select appropriate statistical methods to address basic life sciences research problems.
- Use statistical software to explore data and create numerical and graphical summaries that address life sciences research problems.
- Use statistical software to conduct appropriate statistical inference procedures (e.g., compute p-values, effect sizes, confidence intervals) to address a life sciences research problem.
- Draw scientific conclusions from graphical and numerical summaries of life sciences data and results of inferential procedures (e.g., p-values, effect sizes, confidence intervals).
- Identify strengths and weaknesses in study designs and analyses in published life sciences research.
- Design studies to address basic life sciences research problems.
- Recognize when standard statistical procedures are not appropriate and know to seek statistical expertise early in the research process.

Textbook

Introductory Statistics for the Life and Biomedical Sciences (1st edition) – Julie Vu and David Harrington.

We recommend this **free**, open-source textbook to help support your learning in this course. This textbook can be accessed at <https://www.openintro.org/book/biostat/>.

Statistical Software - R

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 STA288 lab assignments and project.

Quercus Course Site

Direct link to our course (you will need to sign in with your UTORid and password):

<https://q.utoronto.ca/courses/296762>

It is your responsibility to check Quercus regularly and to monitor your utoronto email inbox for messages about the course. Important announcements, information about how to get set up with JupyterHub and R/RStudio, information about assessments, help (via Discussions and office hours), your grades, etc. will be on Quercus and most course assessments will need to be submitted through this site. Outline lecture slides will also be posted there in .pdf format, 1 slide per page only, by 11:59pm ET the night before lecture. Alternative file formats will not be available. *Note that complete slides/lecture material used in class will not be posted or distributed in any form under any circumstances.*

The Discussions tool is enabled on Quercus. Direct link: https://q.utoronto.ca/courses/296762/discussion_topics
Please post questions there and respond to your peers' questions about course content (e.g., lecture, readings, practice questions, etc.) or general course administration. To make a posting, click on the *+Discussion* button on the top right of the page. Be sure to use an informative subject line to make our Discussions easy to follow and use. Quercus Discussions will be monitored on a regular basis. If you email your instructors 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.

Computing Labs & Tutorials

There will be three (3) 2-hour computing labs and three (3) mandatory 2-hour tutorials during the term as well as a Lab 0 to introduce you to the RStudio computing environment through JupyterHub:

Labs – The purpose of these computing labs is to provide you with hands-on experience using the statistical software (R and R Studio) to summarize data and to run statistical procedures and to extract meaning from data. There will be interactive videos that you will need to work through before attempting the lab questions. The purpose of these video modules is to introduce the R code and review the methods relevant to that particular lab. **Lab 0 will be held in class on Thursday, January 19th.** We will work through the exercises introducing you to the RStudio environment and the workflow of the labs and lab assignments during this class. Your first lab assignment will also be due through Quercus that day for a completion grade (1%). Although not mandatory, attendance at the other three lab sessions is strongly recommended because you will have access to support from an instructor and TAs as you work through the assignment problems. We will not be available to help with lab assignments outside of lab Q&A session. This said, if you are comfortable with independently working through the lab questions without this support, you may work on the assignment questions on your own. Lab assignment questions will be posted by the Monday of lab weeks. You are strongly recommended to attempt the Labs 1-3 assignments early in the week to ensure you have access to the support you need on Thursday of that week during the lab Q&A session. Regardless of whether or not you attend the lab Q&A session, you must submit the lab assignment through Quercus by 11:59pm on the day of the lab. The lab schedule is included on the last pages of this syllabus. More information about the labs and the lab assignments will be posted on Quercus.

Tutorials – The purpose of tutorials is to reinforce concepts from class and to support your progress with the course project. During these tutorials, we will revisit the more challenging concepts discussed in previous classes and you will have an opportunity to work with your group members on your course project with support from an instructor and TAs. These tutorials are important to your learning and your group's project progress so attendance is mandatory. Attendance will be tracked and you will need to submit a post-tutorial

reflection survey by 11:59pm the day of your tutorial in order to earn the 2% attendance/participation grade for that tutorial. The tutorial schedule is included on the last pages of this syllabus.

NOTE: There are no make-ups for missed labs/tutorials.

Questions & Additional help

Have a course-related question? Need extra help with the material? Here are some options:

- **Have a question about STA288 course material, R, or general administration of the course?**
 - Review the questions already posted on the Quercus Discussions and if your question hasn't already been addressed, post it there with an informative subject line.
 - Visit the instructors' office hours. Note that the TAs will not be available by email or for extra help outside lab/tutorials or any office hours they hold.
- **Need to reach the instructors about a private or personal matter (e.g., illness, grades)?** Email the instructors at their utoronto.ca email addresses OR through the Quercus Inbox – do not post this on Quercus Discussions! ***E-mail should only be used for emergencies or personal matters and should include the course (STA288), and your UTORid or student number.*** If you email a question to the instructors about course material or course administration, then you will be asked to post your question on Quercus Discussions – these types of questions will not be answered by email.

Grading Scheme & Assessment Information

Your course grade will be calculated using the following grading scheme:

Assessment	% of Grade
In-class participation	6%
Attendance/participation in tutorials (includes attendance + post-tutorial reflection survey due 11:59PM on tutorial day)	6% (2% for each)
Completion of Lab 0 Assignment	1%
Lab assignments (due 11:59 PM on lab day)	24% (3x8% each)
Course project – research proposal	6%
Peer review of research proposals	1%
Completion of Survey on Statistical Practice	1%
Course project – research report	20%
Test 1	15%
Test 2	20%

No special rounding rules or individual grade adjustments (e.g. to meet GPA cut-offs, minimal requirements for programs, etc.) will be used to calculate course grades. No special reweighting of assessments or extra work will be accepted to account for perceived poor performance, nor to account for any assessment(s) that have been missed without accommodation. There are no exceptions to these policies.

In-class participation

Poll Everywhere will be used to promote engagement during classes and provide feedback on your understanding as well as to provide you with credit on your lecture participation. More information will be shared in lecture.

The proportion of questions you answer (starting the 3rd week of classes) will determine the fraction of the available participation grade (6%) that you earn, as shown in the table on the right. There will be around 3 questions per class. However, some classes will have more or fewer questions. Your participation grade only requires that you try; you do not have to get the questions correct to earn this part of your course grade.

Notice that you can miss up to 10% of the questions for any reason and still earn full credit for class participation.

Due to this flexibility, there is no accommodation for missed in-class participation for any reason (e.g., legitimately missed lectures, technical problems, forgetting to submit questions, etc.).

% Questions answered	Class Participation Mark (/6%)
0%	0%
$0 \leq \% \text{ answered} < 20$	1%
$20 \leq \% \text{ answered} < 40$	2%
$40 \leq \% \text{ answered} < 60$	3%
$60 \leq \% \text{ answered} < 80$	4%
$80 \leq \% \text{ answered} < 90$	5%
$90 \leq \% \text{ answered} \leq 100$	6%

Tutorial Attendance/Participation

There will be three (3) mandatory tutorials during the semester (schedule on the last pages of the syllabus). To earn the 2% toward each tutorial, you must be present in tutorial, and complete/submit a post-tutorial reflection survey through Quercus by 11:59PM ET on tutorial day. Attendance will be tracked each tutorial, and late surveys will **not** be accepted.

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

Lab Assignments

The three (3) equally weighted lab assignments should be completed **independently** (i.e., you must answer the questions and write/run R code **on your own**; no sharing of answers permitted) and submitted through Quercus by 11:59PM ET on lab days. The schedule is included on the last pages of the syllabus. Assignment questions will be posted on Quercus no later than the Monday of your lab week. Assignments must be completed and submitted in the correct format(s) through the appropriate Quercus assignment by the deadlines. Late assignments and assignments in other formats or submitted in different ways (e.g., over email) will **not** be accepted so be sure to complete your assignment early so you can be sure to submit it on time. Although attendance/participation in the lab Q&A sessions is not necessary to earn credit for your lab assignment, you will have support from your instructor and TAs during lab. This lab assignment support will not be available at other times.

Refer to the "Missed Assessments" section below for information on how to request accommodation for a missed lab assignment and what accommodations may be possible.

Course project

Understanding biological research involves studying not only data, but the published biological context, and considering important statistical issues related to design and analyses. Therefore, in STA288 you will have the opportunity to engage in collaborative research with a group of 4-5 people in the course (groups will be formed on Quercus).

Group project proposal – In the research proposal, you and your group will identify a life science/biology related research question based on a review of the literature, and describe how a study could be designed, and how data would be collected, analyzed and interpreted. All group members are expected to contribute to the proposal **equally** and provide an outline their involvement in this proposal.

The group research proposal assignment will be comprised of three parts:

- (1) Groups will submit their proposals for peer review via Peer Scholar (due **11:59PM ET Feb. 16**).
- (2) Following submission of the research proposals to Peer Scholar, each student will be assigned two (2) proposals each to peer review through Peer Scholar. All reviews must be completed by **11:59PM ET Mar. 2**. The quality of your peer feedback will be assessed and is **worth 1% of your final grade**. A grading rubric will be posted on Quercus.
- (3) Groups will be able to incorporate this feedback upon submission of the final research project proposals, which are due through Quercus **11:59PM ET Mar. 9**.

Group project report - Your group will conduct the study outlined in your research proposal, addressing any feedback received on your final research project proposal, by studying a virtual population. You will be given access to The Islands (<https://islands.smp.uq.edu.au/login.php>) – an online environment that has been created by the University of Queensland that allows students to collect data from a virtual population. Within your group, the final group project will expand on the initial research proposal, and you will conduct the study (being sure to incorporate the feedback provided on your proposal), and present your design, analysis and research findings in a written group assignment **due through Quercus 11:59PM ET Apr 13**. All group members are expected to contribute to the project equally and provide an outline of their involvement in the project. Information on how individuals' contributions to the group project will be assessed will be provided on Quercus.

Due to the nature of this assessment, there will be **no extensions** on the research proposal or project under any circumstances. Late proposals/projects will not be accepted and there are no accommodations available for individuals' missed contributions to their group's project. More information on the research proposal and project will be posted on Quercus.

Completion of Survey on Statistical Practice

A reflection survey will be administered in this course. You will earn 1% toward your STA288 grade for *completing the survey once in its entirety* during its availability period. No preparation is needed for this survey. You will not earn grades based on the correctness of the answers, but all questions must be attempted during the availability period to earn the 1% credit. The survey will be open between March 1 and March 17, 2023. Please watch Quercus Announcements for more information.

Term Tests

There will be two (2) in-person term tests (combination of multiple choice and written answers) scheduled throughout the term:

Term Test 1: Thurs. Feb. 9

Term Test 2: Thurs. Mar. 23

Term tests will be written during class time on these dates (**11:10AM-1PM ET**) and you will have exactly **1 hour and 50 mins** to complete the tests. You must bring your student identification to the term tests.

Information on term test coverage and room locations, along with some sample questions will be posted on Quercus in advance. Students may find a non-programmable calculator to be useful for the term tests. Any basic calculator will be sufficient (no special functions are necessary). Calculators on phones or other devices equipped to communicate with the outside world (for example, through the internet or cellular or satellite phone networks) will not be permitted during the term tests.

Refer to the “Missed Assessments” section below for information on how to request accommodation for a missed test and what accommodations may be possible.

Marking Concerns with Assessments

Any requests to have an assessment regraded must be made in writing **within one week** of the date the marks were posted on Quercus. Instructors will release a Regrade Request Form for you to fill out. To be considered, your form must clearly identify the question you have concerns about, contain a detailed justification for your concern and make specific references to your answer and to the relevant course material. *Keep in mind that it is possible for your assessment grade to go down if the regraded mark is lower than your original assessment grade.*

Accommodations for Missed Assessments

- 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 **both** instructors by email within one week of the assessment due date to request accommodation.
- Other reasons for missing a lab assignment/tutorial/test will require prior approval by your instructors. If approval is not granted in advance for non-medical reasons then 0% will be recorded for the missed assignment/test.
- **Note:** If you submit an assessment (e.g., lab 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 lab assignment or tutorial** - There are no make-ups for missed lab assignments or tutorials. If accommodation is requested for a missed assignment or tutorial as above and is granted by the instructors, the weighting for that assignment/tutorial will be shifted to your tests; otherwise 0% will be recorded for your missed lab assignment/tutorial. **Since these activities/assessments are important to the course learning outcomes, at most one lab assignment and one tutorial can be accommodated in this way. 0% will be recorded for any additional missed lab assignments or tutorials, and you must complete at least one lab assignment and at least one tutorial in order to pass the course.**
- **Accommodation for missed term tests** – An alternative assessment will be arranged at the instructors’ discretion, if accommodation is granted for a missed term test. Note that this alternative assessment may have a different format (e.g., oral assessment) and may be scheduled in April after classes end.
- There are no accommodations for missed lecture participation or individual contributions to the group project proposal or reports.

Academic integrity

You are responsible for reviewing and understanding the content of the University of Toronto’s Code of Behaviour on Academic Matters at <http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>.

Academic offenses will be taken very seriously and dealt with accordingly. For all of the assessments in this course, submitting another student’s answer(s) as your own, or providing your own answer(s) to another student for him/her

to submit as his/her own is considered as an academic offense and will be reported as such. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact any of the instructors in the course.

Note: 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>).

Intellectual Property Statement

Course material (i.e. lecture slides, recordings, assignments, test questions and other supplementary course material available on Quercus) is the intellectual property of your instructors and is 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 **not** permitted under any circumstances and is considered an infringement of intellectual property rights.

Accessibility Needs

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodation, please feel free to contact Accessibility Services at (416) 978 8060; <http://accessibility.utoronto.ca>

How to Succeed in this Course

- Read this course syllabus in its entirety and understand the course policies.
- Attend and participate in class regularly and take notes (obtain notes from a classmate for any missed classes).
- Do and submit lab assignments on time and take advantage of the support available to you during labs.
- Attend and participate in tutorials and complete/submit the post-tutorial reflections.
- Regularly review class notes, read the textbook and complete the recommended assigned exercises.
- If you find that you are having trouble with concepts, please seek help as early as possible on Quercus Discussions or in office hours.
- Do not try to memorize the biological pathways – these are useful reminders and may help set the concepts for problems as well as help you remember related topics (i.e. provide context) on assessments, but will not be tested separately – this is a statistics and scientific design course.
- Practice, practice, practice! Work through at least some of the recommended textbook exercises each week to make sure you understand the basic concepts. You need to study and do practice problems frequently (not just in the week before the exam) to keep up in the course.
- Take advantage of the help available & ask questions (lectures, labs, tutorials, office hours, Quercus Discussions).

Course Schedule

This is our tentative schedule for course topics. Some adjustments may be made to the topics as the course progresses, depending on the rate at which individual topics are covered, but the lab, tutorial and test schedule and all deadlines will remain the same. There will be recommended textbook problems posted on Quercus.

Week	Tentative topic schedule (See Quercus for up-to-date weekly topics and resources)	Date	Lecture/Tutorial/Lab Schedule	Important reminders & Due Dates
Jan 9-15	Introduction to the Course & Summarizing Data	Tues, Jan 10	Lecture 11am-1pm	
		Thurs, Jan 12	Lecture 11am-1pm	
Jan 16-22	Summarizing Data (continued)	Tues, Jan 17	Lecture 11am-1pm	Lab 0 Assignment due 11:59PM, Jan. 19
	Introduction to RStudio (Lab #0)	Thurs, Jan 19	Lecture, 11am-1pm	
Jan 23-29	Sampling & Study Design	Tues, Jan 24	Lecture, 11am-1pm	Post-tutorial reflection survey due 11:59PM Jan. 26
	Tutorial #1	Thurs, Jan 26	Tutorial #1 , 11am-1pm	
Jan 30- Feb 5	Study Design (continued)	Tues, Jan 31	Lecture, 11am-1pm	Lab 1 Assignment due 11:59PM Feb. 2
	Lab #1	Thurs, Feb 2	Lab #1 , 11am-1pm	
Feb 6-12	Exploring Behaviour of Statistics Across Samples	Tues, Feb 7	Lecture, 11am-1pm	
	TEST 1	Thurs, Feb 9	TEST 1 , class time	
Feb 13-19	Introduction to Statistical Modeling and Inference	Tues, Feb. 14	Lecture, 11am-1pm	Post-tutorial reflection survey due 11:59PM Feb. 16 Group project proposal due on Peer Scholar 11:59PM Feb. 16
	Tutorial #2	Thurs, Feb. 16	Tutorial #2 , 11am-1pm	
Feb 20-26	<i>READING WEEK</i>			
Feb 27- Mar 5	Inferences on Means	Tues, Feb. 28	Lecture, 11am-1pm	Lab 2 Assignment due 11:59PM Mar. 2 Deadline for peer review of Group project proposal via Peer Scholar 11:59PM Mar. 2
	Lab #2	Thurs, Mar. 2	Lab #2 , 11am-1pm	

Mar 6-12	Inferences on Means (continued)	Tues, Mar. 7	Lecture, 11am-1pm	
	Tutorial #3	Thurs, Mar. 9	Tutorial #3 , 11am-1pm	Post-tutorial reflection survey due 11:59PM Mar. 9 Revised Group Project Proposal due on Quercus 11:59PM Mar. 9
Mar 13-19	Inference on Proportions	Tues, Mar. 14	Lecture, 11am-1pm	
	One-way ANOVA	Thurs, Mar. 16	Lecture 11am-1pm	
Mar 20-26	One-way ANOVA (continued)	Tues, Mar. 21	Lecture, 11am-1pm	
	TEST 2	Thurs, Mar. 23	TEST 2 , class time	
Mar 27-Apr 2	Two-way ANOVA	Tues, Mar. 28	Lecture, 11am-1pm	
	Lab #3	Thurs, Mar. 30	Lab #3 , 11am-1pm	Lab 3 Assignment due 11:59PM Mar. 30
Apr 3-9	Wrap-Up	Tues, Apr. 4	Lecture, 11am-1pm	
	Group Project Q&A	Thurs, Apr. 6	Lecture, 11am-1pm	
Apr 11-28	<i>Final assessment period - Group project report due 11:59PM Apr. 13</i>			

* You need to attend lectures, tutorials and labs based on the schedule above. There are no make-ups for missed lab assignments, tutorials, nor lecture participation.