BIOL 860 Syllabus - Fall 2025
Introduction to Management and Statistical Analysis of Biological Data

Course Information

Start and end date: September 3rd 2025 - November 28th 2025

Lectures: Wednesday 1:30pm - 3:00pm BIOSCI 3110
Tutorials: Friday 1:30pm - 3:00pm BIOSCI 3110

Course overview

This course is for new graduate students who are at early stages of planning their research projects and collecting data. Topics will include experimental design, matching hypotheses with appropriate statistical analyses, parameter estimation, and graphing. Statistical analyses will be based on a foundation using normal error distribution. Students will be introduced to R, a Language and Environment for Statistical Computing.

Instructors: María José Gómez Quijano and Aly Van Natto

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*These are shared office spaces, please be mindful of other students working there and/or send an email if you need to meet with either of us.

Course materials and technology requirements

We want to ensure all course materials are open access and available for free to every student. However, we recognize that this course has a technology requirement, if you need any support or accessibility accommodations regarding these requirements please reach out to the course instructors within the first two weeks of the course.

1. OnQ site: for all in class materials and submissions
2. Laptop with desktop or HPC Frontenac cluster version of : a) R (https://www.r-project.org/)
   b) R studio (https://posit.co/download/rstudio-desktop/).
3. R Crash Course for Biologists by Robert I. Colautti (https://colauttilab.github.io/RCrashCourse/)
4. R Stats for Biologists by Robert I. Colautti

(Link TBD - will be provided by instructors)

5. Any other lectures or materials will be provided by instructors.

Course objectives

By the end of the course students should be able to:

1. Learn to properly collect, clean, wrangle, and visualize large datasets
2. Develop and test experimental hypotheses applying statistical inference
3. Develop transferable analytical skills that can be applied to a wide range of biological research contexts

Course timeline

Week	Lecture Topics	Tutorial Topics	Deliverables
1	Introduction to BIOL 860 and statistical thinking	Work on Assignment 1 and course survey	Assignment 1
2	Introduction to R studio, R markdown, data integrity and data collection	Final project introduction and data collection activity	Team Chart
3	Introduction to the tidyverse and data wrangling	Work on Assignment 2	Assignment 2
4	Introduction to statistical inference and experimental design	Special lecture: Science communication and collaboration	Final Project proposal
5	Introduction to sample distributions and central moments	Work on Assignment 3	Assignment 3
6	Introduction to data visualizations, accessibility and publication quality visuals.	Work on Assignment 4 TBD: Research data management workshop	Assignment 4
7	**Reading Week**	**Reading Week**	**Reading Week**
8	Introduction to data transformations and estimations	Work on Assignment 5	Assignment 5
9	Introduction to hypothesis testing and t-test	Special lecture: The history of frequentist statistics	Reflection
10	Introduction to simple linear regression	Grad student guest lecture	NA

11	Advanced linear models	Work on Assignment 6	Assignment 6
12	Introduction to model selection	Final project presentations	Presentation and code

***** Weekly schedule is subject to changes and modifications based on course needs, any changes to this timeline will be communicated with students in class and in OnQ**.**

Grading Scheme

1. Assignments x 6 : 36% (6% x 6)
2. Project Proposal : 15%
3. Final project : 34% (17% presentation , 17% reproducible code)
4. Other deliverables : 5%
5. Class participation : 10%

Student and instructor expectations

We will discuss this in the first class. We would like this to be a collaborative agreement between you and ourselves.

Land Acknowledgement

Let us acknowledge that Queen's University occupies unceded traditional Anishinaabe and Haudenosaunee territory. To acknowledge this traditional territory is to recognize its longer history, one predating the establishment of the earliest European colonies. It is also to acknowledge this territory's significance for the Indigenous Peoples who lived, and continue to live, upon it and whose practices and spiritualities are tied to the land and continue to develop in relationship to the territory and its other inhabitants today. Indigenous communities in Kingston/Katarokwi continue to reflect the area's Anishinaabe and Haudenosaunee roots. There is also a significant Métis community and First Peoples from other Nations across Turtle Island present here today. We also acknowledge that topics covered in this class are the product of colonial and oppressive practices, as a teaching team we recognize the harm that these had and continue to have on indigenous and underrepresented communities and are committed to properly educating students on these issues.

To read more about the history of the land, see the Queen's Encyclopedia and to learn more about land acknowledgements, see the Office of Indigenous Initiatives.

IEDIAA Statement

Queen's University recognizes that the values of equity and diversity are vital to and in harmony with its educational mission and standards of excellence. It acknowledges that direct, indirect, and systemic discrimination exists within our institutional structures, policies, and practices and in our community. These take many forms and work to differentially advantage and disadvantage persons across social

identities such as race, ethnicity, disability, gender identity, sexual orientation, faith, and socioeconomic status, among other examples.

In this class we hope for a collective agreement to create an inclusive environment where all students and instructors feel valued, supported and respected. As a teaching team we are also committed to provide an accessible learning space for all, including an universal learning design and anti-oppressive pedagogical practices that will hopefully provide students with positive and enriching learning opportunities.

Academic considerations and accommodations

This course uses a Universal Design for Learning philosophy, adding flexibility in deadlines and grading for students who need accommodations. If there are extenuating circumstances throughout the semester, please contact the course instructors.
Any additional accommodations should be handled through Queen's Student Accessibility Services (QSAS): https://www.queensu.ca/studentwellness/accessibility-services

Academic Integrity

Queen's students, faculty, administrators and staff all have responsibilities for upholding the fundamental values of academic integrity; honesty, trust, fairness, respect, responsibility and courage. These values are central to the building, nurturing, and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and conduct conform to the principles of academic integrity. Information is available in the Arts and Science Calendar (see Academic Regulation 1), on the Arts and Science website (see website), and at Biology's website (http://www.queensu.ca/biology/undergrad/integrity.html) and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulations on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Statement on Plagiarism

Plagiarism is a form of cheating and includes copying code written by students. There is no 'right answer' for the assignments in this class – there are often many potential coding solutions. You will also develop your own coding style, which will make it obvious when code has been copied. In this course we encourage collaboration, team work, and learning how to use the resources available to you. We understand that right now there are many tools that can help you learn new skills and troubleshoot

code. However, we expect you to think critically about how you are using tools like AI, how it might affect your learning and how you can use it to uplift your learning and not hinder it.

It is completely fine to ask others to help you troubleshoot an error message or help you figure out why your code isn't working properly. We encourage you to work with others, but expect your work to be a reflection of your own thinking. As a bonus, you will learn to code better and you will learn valuable skills that will transcend this class.

Copyright

Grading Scales

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale.

Arts & Science Letter Grade Input Scheme

Assignment mark	Numerical value for calculation of final mark
A+	93
A	87
A-	82
B+	78
B	75
B-	72
C+	68
C	65
C-	62
D+	58
D	55
D-	52
F48 (F+)	48
F24 (F)	24
F0 (0)	0

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale.