



Department of Biology

BIOL 4259F Research Hypothesis Testing

Fall 2025

draft 9/1/2025

1. Course Information

Prerequisites

Biology/Statistics 2244A/B and completion of at least 1.5 Biology courses at the 3000 level or above.

Essential concepts you should be knowledgeable about from Bio2244: sample, probability distribution, p-value, t-test, null vs. alternative hypothesis.

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Mode of delivery

In person. Supplementary course material will be posted on Owl Brightspace:
<https://westernu.brightspace.com/>.

For each 1 hour of lecture time, expect to spend 2 hours of out-of-class study time.

2. Instructor Information

Prof. Yolanda Morbey

TA: See Owl.

During the semester, all electronic correspondence about Bio 4259F with the instructor and TA should be done using the Discussion tool in Owl Brightspace. If using an email client, students emailing their instructors directly must use their Western (@uwo.ca) email addresses.

Office hours by appointment or during scheduled lab times.

3. Course Description/Syllabus

Statistical methods are tools that allow us to answer questions and learn about the world around us from samples of data, because we can never have complete information about a problem. As a biologist you might apply analysis of variance to learn about the effects that different diseases have on plant growth, linear regression to explore the impacts of climate change on species diversity, or logistic regression to understand the factors affecting an animal's presence on the landscape. This course aims to help students understand, conduct, and present biological research using statistics. The emphasis will be on basic theory and practical application, and will focus on the following topics: data preparation, experimental design, exploratory data analysis, general linear models, generalized linear models, and mixed models. Students will gain experience using R statistical software for effective data filtering, visualization, and analysis.

My role in this course is to guide you as you develop practical skills for the application and interpretation of statistics. The intent is not for you to learn every single statistical method. Rather, it is for you to gain confidence and skill in the use of statistics in biology.

Learning Outcomes

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

1. Understand, explain, and evaluate the assumptions of a statistical model.
2. Decide whether a specified statistical method is appropriate to analyze data from a given study.
3. Implement data management, visualization, and statistical analyses in R and R Studio and interpret the results.
4. Report the results of statistical analyses in language appropriate for a publication in biology.
5. Recognize the importance of ethical data practices and use of generative AI.

Class structure

This course will be taught *in person* and jointly with Bio 9915A. Topics will include:

- Learning R and R Studio
- Data awareness & data management
- Study design
- Intro statistics
- Linear models
- Multi-way linear models
- Model selection
- GLM
- Linear mixed models
- Time-to-event analysis

First class: September 8

First lab: September 11

Reading Week: November 3 – 9

Last class: December 8

Contingency plan

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

4. Course Materials

Required

Laptop with stable internet connection: Bring your own to lectures and labs.

Software (free):

R version 4.5.1 (June 2025) (<https://cran.r-project.org/>)

RStudio Desktop v2025.05.1 (<https://posit.co/download/rstudio-desktop/>)

*If you have an earlier version of R and RStudio on your laptop, I would recommend that you uninstall R, RStudio, and all libraries, and then install the most recent versions.

*You may also use R Studio Cloud, which is hosted online.

Books:

Beckerman, A.P., D.Z. Childs, O.L. Petchey. 2017. Getting Started with R: An Introduction for Biologists. 2nd edition. Oxford University Press, Oxford, UK. You must use this edition. Electronic access via the university library or available for purchase at the bookstore (\$75.50).

Hector, A. 2021. The New Statistics with R: An Introduction for Biologists. 2nd edition. Oxford University Press, Oxford, UK. Use of the first edition (2015) will be fine. Electronic access via the library.

Students should check Owl Brightspace (<https://westernu.brightspace.com/>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking Owl on a regular basis.

If students need assistance with the course OWL site, they can seek support on the OWL Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

Assessments

5% R markdown data report. Instructions will be posted on Owl.
Deadline: End of Week 2 (19 September), 4:30 pm.

- 25% Engagement, professionalism, and participation. The majority of this mark will come from participation in weekly quizzes (best 7 of 11 x 3% per week = 21%). For each weekly quiz, you will receive 3% if you correctly answer $\geq 80\%$ of the questions, 2.5% if you correctly answer 60-80% of the questions, and 2% if you correctly answer 50-60% of the questions. The remaining 4% will be assigned at the end of term by the instructor and TA, and is based on characteristics including, but not limited to, professionalism, integrity, attitude, independence, cooperation, improvement, and contribution during class time.
- 35% Blog project. Instructions will be posted on Owl. This assignment will be based on preparatory assignments and a final product. Preparatory assignments: 1% for first one, 2% for each thereafter x 7 = 15%. Each preparatory assignment requires 200-225 words of connected writing plus + graphical or coding elements. Final product: 1000 words of connected writing plus + graphical or coding elements = 20%. You must pass this written assignment to pass the course.
- Deadline for preparatory assignments: each Friday of Weeks 1-7 (12 September – 31 October).
Deadline for final product: 8 December, 4:30 pm.
- 35% Final Exam. In person, closed book. Date TBA. Up to 10% of the final exam will differ from the Bio 9915 exam.

Use of Generative AI Tools

Guidance for the use of generative AI tools can be found here: <https://ai.uwo.ca/Guidance/index.html>.

Generative AI tools (e.g., ChatGPT, Copilot, Gemini) may be used to support learning, but students must accept the risks and understand the ethical ramifications. Ultimately, everything submitted for grading is the students' responsibility.

Appropriate uses in this course:

- Tutor for coding
- Definitions of terms
- Brainstorming
- Grammar & spell-checking
- Translation

Inappropriate uses:

- Plagiarism
- Infringement of copyright
- Presentation of fabricated or false information

General Information about Missed Coursework

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes (NOT through their course instructors).

Formal accommodations for absences will apply only to missed requirements during the period of absence. **Due dates will be extended by the number of days absent using this formula:**

New due date = last day of absence + # days absent prior to original due date

Example:

Original due date = Nov 10, 11:55 pm

Absence = Nov 8, 12:00 am – Nov 12, 11:59 pm

Last date of absence = Nov 12

days absent prior to original due date = Nov 10 - Nov 8 + 1 = 3 days

New due date = Nov 12 + 3 = Nov 15, 11:55 pm

Upon return from an absence, all remaining due dates will remain in effect.

“Students must familiarize themselves with the University Policy on Academic Consideration – Undergraduate Students in First Entry Programs, posted on the Academic Calendar:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar’s webpage: https://registrar.uwo.ca/academics/academic_considerations/

All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request without supporting documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Examination scheduled during official examination period (Defined by policy)
- Blog final product

When a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above or those in the Coursework with

Assessment Flexibility section below, the request cannot be recalled and reapplied. This privilege is forfeited.”

Evaluation Scheme for Missed Assessments

R Markdown data report – the deadline is subject to a 5 day grace period when late penalties will not be deducted. After this grace period, accumulated deductions (1% per day up to a maximum of 5% of course grade) will be applied.

Weekly quizzes – up to three can be missed. No makeups.

Blog projects – deadlines for preparatory assignments are subject to a 2 day grace period when late penalties will not be deducted. After this grace period, accumulated deductions (1% per day to a maximum of 2% of course grade) will be applied. If formal Academic Accommodation is received from an academic counsellor, this must cover the entire 2 day grace period + any subsequent time. No grace period will apply to the final product, as the due date is already as late as they can be in the semester.

Essential Learning Requirements

Students must earn a passing grade on the blog final product. The consequence of not meeting this requirement is a grade of 45%.

Absences from Final Examinations

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

☒ Written assignments will be submitted to Turnitin (statement in policies below)

☒ Students will have 1 submission to Turnitin

☒ Rubrics will be used to evaluate assessments and will be posted with the instructions

☒ After an assessment is returned, students should wait 24 hours to digest feedback before contacting their evaluator

Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

6. Additional Statements

6.1 Religious Accommodation

When conflicts arise with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the Academic Advising office of their Faculty of Registration.

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays – <https://www.edi.uwo.ca>.

6.2 Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

6.3 General Academic Policies

The website for Registrar Services is <https://www.registrar.uwo.ca/>.

Use of @uwo.ca email: In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

Requests for Relief (formally known as "appeals")

Grades are earned and, in the interest of fairness, additional points will not be granted because you need a certain GPA or because you expected better performance from yourself. Grades will be rounded to the nearest 0.1 then to the nearest integer (79.45% will become 80%; 79.44% will become 79%).

Policy on Request for Relief from Academic Decision:

https://uwo.ca/univsec//pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):

https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

6.4 Scholastic Offences

Any accusation of academic misconduct will be made on a case-by-case basis and will be based on all evidence that can be gathered (including incriminating activity on non-sanctioned apps). **All cases of academic misconduct will be reported to the Associate Chair Undergraduate, Department of Biology.** The penalty for an academic offence will be determined on a case-by-case basis. Academic offences come with the maximum penalty of failing the course and a permanent record in your transcript.

Policy on Scholastic Offences:

https://uwo.ca/univsec//pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):

https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

For further information on academic integrity, complete the Academic Integrity Tutorial:

<https://westernu.brightspace.com/d2l/le/discovery/view/course/124464>

Examples of scholastic offences include:

- copying answers or project ideas from current or past students for credit
- plagiarism of any text or project ideas (plagiarism-checking software will be used to check for unusual coincidences in answers).
- submission of your work for credit in multiple classes
- sharing exam questions via any means and at any time

Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the possession of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, and wireless earbuds or headphones.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at your desk, on your person, or within reach during an assessment will be treated as a *scholastic offence*, even if the device is not in use.

Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is your responsibility to review and comply with these expectations.

Use of Generative AI Tools

The acceptable use of generative AI is explained above.

Plagiarism Checking

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

6.5 Support Services

Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, requests for relief, exam conflicts, and many other academic-related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at:

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. If you have any questions regarding accommodations, you may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

Learning-skills counsellors at Learning Development and Success (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual

support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.

7. EDI statement

The pronouns used by:

- Yolanda Morbey: she/her
- TA: See Owl.

8. Land Acknowledgment

We acknowledge that Western University is located on the traditional lands of the Anishinaabek, Haudenosaunee, Lūnaapéewak and Attawandaron peoples, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum. This land continues to be home to diverse Indigenous peoples (e.g. First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors of our society.

More information about Indigenous Services (<https://indigenous.uwo.ca/>) and this Land Acknowledgement (<https://communications.uwo.ca/comms/land-acknowledgement/>) are available.

9. Professionalism & Privacy:

Western students are expected to follow the [Student Code of Conduct](#). Additionally, the following expectations and professional conduct apply to this course:

- ☒ Students are expected to follow online etiquette expectations
- ☒ All course materials created by the instructor(s) are copyrighted and cannot be sold/shared
- ☒ Recordings are not permitted (audio or video) without explicit permission
- ☒ Permitted recordings are not to be distributed
- ☒ Students may be expected to take an academic integrity pledge before some assessments

In emails to the instructor and TA, please put “Bio 4259” in the subject line and use your uwo.ca account. To ensure a speedy response, be considerate and professional in your e-mails; harassment will not be tolerated. Begin your email with a salutation (“Dear Yolanda”) and end with your name. Remember that emails are permanent records of your interactions with your instructors.