Department of Biology Course Outline

SC/BIOL 2060 3.00 Statistics for Biologists
Summer 2026

This course includes mandatory in-person, on-campus activities

Course Description

Statistical problem solving for biologists. Basic theory for the analysis of parametric and nonparametric data. Includes a tutorial period for discussion and solving of statistical problems. Three lecture hours per week. Eight 1.5-hour tutorial sessions. One term. Three credits.

Course Format, Hardware and Software Requirements

Lectures and tutorials will be held in person on campus. Lecture slides will be posted on eClass prior to each lecture. Most lectures will be recorded and made available on eClass. Tests will be conducted in person during the lecture period.

Tutorials will not be recorded. Students may only attend the tutorial section in which they are registered.

A computer with internet access is required. **Microsoft Excel** (available free to all York students) and **R** and **RStudio** software (free) are required. Installation instructions will be provided. A scientific calculator (not a cell phone) is required for tests/exams.

The **final exam** will be conducted in person during the exam period, August 6-13, 2025. The exact date and time will be determined by the Registrar's Office.

Prerequisites

Prerequisites: LE/CSE 1520 3.00, or LE/CSE 1530 3.00, or LE/CSE 1540 3.00, or LE/EECS 1520 3.00, or LE/EECS 1530 3.00, or LE/EECS 1540 3.00; AND both SC/MATH 1506 3.0 and SC/MATH 1507 3.0, or SC/MATH 1014 3.00, or SC/MATH 1505 6.00, or both SC/MATH 1013 3.00 and SC/MATH 1025 3.00, or ISCI 1410 6.00, or both ISCI 1401 3.00 and 1402 3.00, or both ISCI 1401 3.00 and MATH 1025 3.00, or equivalents.

Course Credit Exclusions: AP/ECON 2500 3.00, AP/ECON 3210 3.00, AP/ECON 3480 3.00, AP/ECON 3500 3.00, AP/GEOG 2420 3.00 or SC/GEOG 2420 3.00, HH/KINE 2050 3.00, HH/KINE 3150 3.00, SC/MATH 1131 3.00, SC/MATH 2560 3.00, SC/MATH 2565 3.00, SC/MATH 2570 3.00, AP/POLS 3300 6.00, HH/PSYC 2020 6.00, HH/PSYC 2021 3.00, AP/SOCI 3030 6.00.

Course Instructor and Contact Information

Instructor: Stephen Pastore, Ph.D.

- E-Mail: spastore@yorku.ca (please include "BIOL 2060" in the subject line)
- Office Hours: By appointment (virtual or in-person)
- Office Location: Farquharson 271

Copyright Protection of Course Material

All material associated with this course is the intellectual property of the instructor and/or protected under Canadian Copyright Law. All course material, including lecture recordings, activities, tests/exams, problem sets, and assignments, are to be used for personal study purposes only. **Unauthorized distribution in any form can lead to a violation under Canadian Copyright Law and/or Academic Misconduct charges under York University Senate Policy.** Unauthorized distribution includes sharing and/or uploading of material anywhere and with anyone.

Penalties under Academic Misconduct can include failure in the course, a transcript notation and/or suspension.

Schedule

Lectures: Mondays and Wednesdays 5:30 pm – 7:00 pm in **CLH F**. Lectures may be delivered in an online format due to illness or other extenuating circumstances or emergencies.

Tutorials: Eight tutorial sessions of 1.5 hours in **BC 322**. Day and time determined by your tutorial section. During tutorials, students will work in small groups on problem sets to be handed in for grading at the end of the tutorial period.

See course eClass for complete schedule.

Evaluation

Tests (3)	30%	Lowest worth **6%**, middle worth **10%**, and highest worth **14%** (if all three tests are completed; see Missed Test Policy for more details).
Assignments (2)	20%	Worth **10%** each.
Tutorial Quizzes (8)	6%	Eight quizzes, each worth **1%**, completed at the beginning of tutorial; lowest two grades dropped (6 * 1% = 6%).
Problem Sets (6)	20%	Six problem sets, each worth **4%**, handed in at the end of the tutorial period; lowest grade dropped (5 * 4% = 20%).
Participation	4%	In-class worksheets and questions to be completed during lectures.
Final Exam	20%	Cumulative (covering the entire course). In-person during the exam period (August 6-13); exact date and time determined by the Registrar.

Important Dates

Test 1:	June 1, 2026
Test 2:	June 29, 2026
Test 3:	July 22, 2026
Assignment 1:	June 26, 2026
Assignment 2:	July 31, 2026
Final Exam:	Exam Period; August 6-13, 2026 (date and time TBD)
Tutorials (8 in total):	Weeks indicated on the course schedule. Day and time determined by tutorial section.

Last date to drop course without receiving a withdrawal note on your transcript: **Monday, July 6, 2026.**
Note: For additional important dates such as holidays, refer to the "Important Dates" section of the Registrar's Website at https://registrar.yorku.ca/enrol/dates.

Resources

Textbook: M.C. Whitlock and D. Schluter, 2020. The Analysis of Biological Data, 3rd edition. W.H. Freeman & Co., New York.

- We will largely follow the text from the beginning up to and including at least chapter 17. See below for explicit details of which chapters and sections.
- If you have a copy of the 2nd edition of this book, it may suffice, but it is your responsibility to ensure that all the material in the 3rd edition that we cover, is indeed covered in the 2nd edition.

Website: The course will be managed through eClass. Please log in at https://eclass.yorku.ca.

Course Content

PLANNED TOPICS (exact material covered may vary with notice given)

1) INTRODUCTION TO STATISTICS (Chapter 1)

- What is statistics?
- Populations and samples
- Random sampling
- Types of data – categorical versus numeric
- Explanatory vs. response variables
- Frequency and probability distributions

2) DISPLAYING DATA (Chapter 2)

- Plotting frequency distributions 4
- Bar graphs, histograms
- Contingency tables
- Scatterplots for two variables

3) DESCRIBING DATA (Chapter 3)

- Sample mean and sample median
- Variance and standard deviation
- Quartiles and box plots
- Cumulative frequency distribution
- Proportions

4) ESTIMATION WITH UNCERTAINTY (Chapter 4)

- Estimating a population parameter
- Sampling distribution of the estimates
- Mean
- Standard error
- Confidence intervals

5) PROBABILITY (Chapter 5, Sections 5.1 through 5.9 up to "sampling without replacement")

- Probability of events
- Mutually exclusive events
- Probability distributions
- Addition and multiplication rules
- Independent events
- Probability trees
- Conditional probability
- Pseudoreplication (Interleaf 2)

6) HYPOTHESIS TESTING (Chapters 6 and 7)

- Null (H_0) vs. alternative (H_A) hypotheses
- One vs. two-sided tests
- Examples
- Handedness and Chlorophyll
- P-value
- Type I and Type II errors
- Analysing proportions and hypothesis tests using the Binomial distribution
- **Omit the material on calculating confidence intervals for proportions (pages 190-91, 3rd ed.; pages 189-191, 2nd ed.)**

7) GOODNESS-OF-FIT AND CONTINGENCY TESTS (Chapters 8 and 9)

- χ^2 goodness-of-fit tests
- Assumptions
- Fitting data to probability distributions
- Relative risk, odds ratios
- Contingency tests, Fisher's Exact test

8) THE NORMAL DISTRIBUTION (Chapter 10, Sections 10.1-10.6)

- The standard normal distribution and probabilities
- Normal distribution of sample means
- Central limit theorem
- **Omit Section 10.7 on normal approximation for the binomial distribution**

9) STUDENT'S T-TEST (Chapters 11 and 12)

- The t-distribution
- Confidence intervals
- One- and two-sample t-tests
- Assumptions
- Paired t-test
- F-test of equal variances
- **Omit Section 11.5 on confidence limits for variance and standard deviation**

10) VIOLATIONS OF ASSUMPTIONS, TRANSFORMATIONS, NON-PARAMETRIC TESTS (Chapter 13)

- Detecting deviations from normality (we will not perform the Shapiro-Wilk test by hand)
- Transforming data to meet normality assumption
- Non-parametric alternatives to t-tests

11) ANALYSIS OF VARIANCE (Chapter 15)

- Single factor ANOVA
- *Section 15.2, Nonparametric alternatives: you don't need to know details, but you should know of their existence and when to use them*
- Planned versus unplanned comparisons
- Fixed versus random effects

12) CORRELATION AND REGRESSION (Chapters 16 and 17)

- **Omit the material on confidence intervals in Section 16.1**
- Correlation coefficient
- Assumptions and error
- Spearman's rank correlation
- **Omit the material on confidence intervals in Section 17.1**
- Linear regression
- Estimation of least squares line
- Hypothesis test of slope
- **Omit the material on confidence in predictions in Section 17.2**
- Testing hypotheses (ignore ANOVA approach)
- **Omit the material on ANOVA approach in Section 17.3**
- **Omit the material on regression towards the mean in Section 17.4**
- Assumptions, transformations

Experiential Education and E-Learning

This course uses **Microsoft Excel** (with the data analysis add-in), the statistical computing environment **R** (https://www.r-project.org/), and **RStudio** (https://rstudio.com/products/rstudio/download/).

Course Policies

Tests and Exams

- Assessments will be "open book"; you may consult the course textbook (printouts or hardcopy) and your own printed (paper) notes during tests and the exam.
- A scientific calculator is required.
- Electronic devices (other than a scientific calculator) are prohibited.
- Tests are strictly individual exercises. Communication of any kind with any person other than the course director during a test is prohibited and will be treated as academic misconduct.

Missed Test Policy

- There are no makeup tests.
- If you miss **one** test, 10% of the total test grade (30%) will be replaced by the final exam grade. The remaining tests will be worth 8% and 12% each, weighted in your favour. *Note: No documentation is required to transfer the weight of the missed test to the final exam; the transfer will be automatic.*
- If you miss **two** tests, the grade for the second missed test will normally be **zero** unless there are exceptional mitigating circumstances. If that is the case, e-mail spastore@yorku.ca within 48 hours of the second missed test (ideally before, but as soon as you are able to do so) and attach any supporting documentation you wish to provide. In this case, 20% of the total test grade (30%) will be replaced by the final exam grade. The remaining test will be worth 10%.

Missed Exam Policy

- If you miss the final examination please complete and submit a Deferred Standing Agreement (DSA) form available from the Registrar's website to spastore@yorku.ca together with a letter outlining the reason for missing the exam and any supporting documentation you wish to provide, within **one week** of the missed exam.
- If you are approved to write a deferred exam, an in-person final exam will be arranged on campus as soon as possible.

Tutorials

- **Students may only attend the tutorial section in which they are registered.** Please ensure you are registered in a section that does not conflict with your other courses.
- **There are no makeup tutorial sessions.** The lowest tutorial grade will be dropped allowing you to miss a tutorial session without penalty.

Late Assignment Submissions

- Late assignment submissions will receive a deduction of 5% per calendar day.

E-Mail Etiquette

- **Subject line:** please begin with "BIOL 2060" followed by a brief, but reasonably detailed, indication of the subject of your e-mail (e.g., "BIOL 2060: question about lecture 3", etc.).
- **Body:** please remember to include your name and student number at the end of every e-mail.
- **Response time:** please allow two working days to receive a response.

Use of Generative AI (e.g., ChatGPT)

Use of Generative AI (e.g., ChatGPT) for some of the assessments in this course, the use of GenAI tools is permitted, but only at the preliminary stages. The use of these tools should aim to expand your understanding of course material and deepen your learning instead of serving as a replacement for your efforts. All written assignment answers must be in your own words and include proper citations. Assessment guidelines for each individual assessment will provide information on whether students can use these tools, how these tools may be used, and how to be transparent about their use. For more information about academic integrity expectations at York, please refer to the Senate Policy on Academic Conduct and University Policy on Academic Integrity.

Grade Re-Appraisal Procedures

Grade re-appraisal requests **must be** submitted within **one week** of receiving a grade. You must indicate the reason for the request (e.g., the total was miscounted). If you think your work was marked incorrectly **you must include a rationale** for regrading based on **academic merit** (i.e., an explanation as to why marks were deducted unfairly). Note that re-marking can result in the mark being raised, confirmed, or lowered and the grade from a re-appraisal is final.

Please note that in order to maintain academic integrity and fairness to all students in the course, final grades are **NOT negotiable** and will not be "bumped up" to a higher-grade bracket. Individual 'extra credit' assignments are not available during or after the course.

Religious Observance Days

Should the dates for a test pose a conflict with a religious observance day for your particular religion, you must notify the instructor at least 3 weeks before the date of the test. In the event of a religious observance conflict with the final exam, students must complete an Examination Accommodation Agreement Form and submit it to the instructor **at least 3 weeks before the date of the exam.**

Advice for Successful Course Outcomes

1) Acquire a copy (or e-copy) of the textbook and use it. You are responsible for all chapters in the textbook indicated and all material in those chapters unless certain pages/sections are explicitly excluded by the instructor.

2) Keep up with lectures and readings and attend lectures whenever possible. While lecture recordings allow some flexibility when needed it can be easy to will fall behind if you do not keep up with the course material. The recordings are not indented as a substitute for attending lectures. Note that announcements are made at the beginning of lectures and may not be communicated elsewhere.

3) Some lectures will have in-class activities (worksheets/questions) that need to be completed and submitted during class time. These make up 5% of your final grade. You need to be present in-class to submit these for grading.

4) Attend the tutorials and complete the problem sets. Not only do these make up 20% of your final grade but they will also prepare you to successfully complete the tests, exam, and assignments.

5) Complete as many problems/questions as you can. Practice using your calculator.

6) Use the statistical program and software taught during the course. It will be an important tool in this course, and, more importantly, you will use it extensively in future years in your other undergraduate courses.

Students who feel that there are extenuating circumstances that may interfere with their ability to successfully complete the course requirements are encouraged to discuss the matter with the Course Director as soon as possible.

Community Guidelines

The following values are fundamental to academic integrity and are adapted from the International Center for Academic Integrity*. In our course, we will seek to behave with these values in mind.

As students, we will…	As a teaching team, we will…
• Honestly demonstrate our knowledge and abilities on assignments and exams • Communicate openly without using deception, including citing appropriate sources	• Provide honest feedback on your demonstration of knowledge and abilities on assignments and exams • Communicate openly and honestly about the expectations and standards of the course via the syllabus, and with respect to assignments and exams
• Complete assignments on time and in full preparation for class • Show up to class on time, and be mentally/physically present • Participate fully and contribute to team learning and activities	• Provide timely feedback on your assignments and exams • Show up to class on time, and be mentally/physically present • Create relevant assessments and class activities
• Speak openly with one another, while respecting diverse viewpoints and perspectives • Provide sufficient space for others to voice their ideas	• Respect your perspectives even while we challenge you to think more deeply and critically • Help facilitate respectful exchange of ideas
• Contribute fully and equally to collaborative work, so that we are not freeloading off others • Not seek unfair advantage over fellow students in the course	• Create fair assignments and exams, and grade them in a fair, and timely manner • Treat all students equitably
• Not engage in personal affairs while on class time • Be open and transparent about what we are doing in class • Not distribute course materials to others without authorization	• Be available to all students when we say we will be • Follow through on our promises • Not modify the expectations or standards without communicating with everyone in the course
• Say or do something when we see actions that undermine any of the above values • Accept a lower or failing grade or other consequences of upholding and protecting the above values	• Say or do something when we see actions that undermine any of the above values • Accept the consequences (e.g., lower teaching evaluations) of upholding and protecting the above values

*This class statement of values is adapted from Tricia Bertram Gallant, Ph.D.

University Policies

Academic Honesty and Integrity

Academic misconduct undermines the values of honesty, trust, respect, fairness, and responsibility that we expect in this class and is a fundamental and important value of York University. York University provides supports such as academic integrity workshops to ensure that all students understand the norms and standards of academic integrity that we expect you to uphold.

York students are required to maintain the highest standards of academic honesty and they are subject to the Senate Policy on Academic Conduct. The Policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards. Please review and familiarize yourself with the policy.

There is also an academic integrity website with comprehensive information about academic honesty and how to find resources at York to help improve your research and writing skills, and cope with university life. Students are expected to review the materials on the Academic Integrity website:

Examples of actions that do not adhere to York's Academic Integrity Policy include:

- Plagiarism (passing off someone else's work as your own)
- Accessing unauthorized sites for assignments or tests
- Unauthorized collaboration on assignment and exams
- Uploading work to third party repository sites (e.g., Course Hero, One Class, etc.)
- Scanning, sharing, uploading, or publishing exams, tests, or scholarly work

For more information on what academic integrity is and why it is important, see: https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/.

Information on the process of investigations into breaches of academic honesty: https://spark.library.yorku.ca/academic-integrity-breach-of-policy-on-academic-honesty/.

Academic Standards: Third Party Repository Sites

Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third party repository sites (e.g. Course Hero, One Class, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be willfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, students are urged not to upload their work to these sites. Whenever a student submits work obtained through Course Hero or One Class, the **submitting student will be charged with plagiarism and the uploading student will be charged with aiding and abetting.**

Note also that exams, tests, and other assignments are the copyrighted works of the professor assigning them, whether copyright is overtly claimed or not (i.e. whether the © is used or not). Scanning these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites.

Accessibility

York University is committed to principles of respect, inclusion and equality of all persons with accessibility needs across campus. The University provides services for students with accessibility needs (including physical, medical, learning, and psychiatric needs) needing accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University.

Students in need of these services are asked to register with accessibility services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs. Please note that registering with accessibility services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs.

Additional information is available at the following websites:

Counselling & Development Services – https://counselling.students.yorku.ca
Counselling & Disability Services at Glendon – https://www.glendon.yorku.ca/counselling/
York Accessibility Hub – https://accessibilityhub.info.yorku.ca

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community and making accommodations for observances of special significance to adherents. Should any of the dates specified in this syllabus for an in-class test or examination pose such a conflict for you, contact the Course Director within the first three weeks of class. Similarly, should an assignment to be completed in a lab, practicum placement, workshop, etc., scheduled later in the term pose such a conflict, contact the Course Director immediately. To arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete and submit an accommodation request form **at least 3 weeks before the exam period begins**: https://secure.students.yorku.ca/pdf/religious-accommodation-agreement-finalexaminations.pdf

Student and Instructor Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at http://secretariat-policies.info.yorku.ca/policies/disruptive-andor-harassing-behaviour-inacademic-situations-senate-policy/.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University.

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here: https://calendars.students.yorku.ca/policies-and-regulations.

Assistance for Students (Academic and Well-Being)

Academic Advising: https://www.yorku.ca/science/academic-advising/. Departments also offer program-specific advising. Check with your Department's Undergraduate Office.

Centre for Human Rights, Equity, and Inclusion: https://rights.info.yorku.ca

Centre for Indigenous Students Services: https://aboriginal.info.yorku.ca/

Food Access, Funding, & Supports/Resources: https://students.yorku.ca/food

Good2Talk 24-hour Ontario Student Helpline: 1-866-925-5454 /Text: GOOD2TALKON to 686868

Keep.meSAFE: https://myssp.app/keepmesafe/ca/home

Learning Commons (general academic learning supports including library research, time management, study skills, career planning, etc.): https://learningcommons.yorku.ca/

Peer Tutoring: https://www.yorku.ca/colleges/bethune/get-help/peer-tutoring/

Sexual Violence Response and Support: https://thecentre.yorku.ca

Student Counselling, Health, and Well-being: https://counselling.students.yorku.ca/