
BIOL 243

Data Management and Statistics for Biologists

Fall Term (2013-14)

From the formulation of interesting questions, through the design of experiments and statistical analysis, to final publication of results in papers and reports. Emphasis is on the foundation of statistical inference, and the application of statistical methods using statistical software.

NOTE Enrolment is limited. Priority will be given to students registered in BIOL Major (Science); BIOL, BIMA, BIPS, EBIO Specialization (Science) Plans. LEARNING HOURS 120 (36L;12T;72P)

RECOMMENDATION 12U Functions and 12 U Calculus or equivalent high school background or MATH P06/3.0 is highly recommended. EXCLUSION No more than 3.0 units from BIOL 243/3.0; CHEE 209/3.0; ECON 250/3.0; GPHY 247/3.0; KNPE 251/3.0 (formerly *PHED 251/3.0*); NURS 323/3.0; POLS 385/3.0; PSYC 202/3.0; SOCY 211/3.0; STAT 263/3.0; STAT 267/3.0; STAT 367/3.0; COMM 162/3.0. ONE-WAY EXCLUSION May not be taken with or after STAT 269/3.0.

SCHEDULE

Lectures: Monday 13:30-14:30, Wednesday 12:30-13:30, Friday 11:30-12:30. Etherington Aud.

Tuts: Various days and times in BIOSCI, refer to SOLUS for details.

Instructor	Dr. R. Montgomerie
Instructor Contact	mont@queensu.ca Phone: 613-533-6127
Office Hours	Wed 13:30-16:30
TA:	See Course on Moodle
TA Contact Information	See Course on Moodle
Office Hours	See Course on Moodle

Learning Objectives

Biology 243 focuses on the collection, management, analysis and publication of biological data. Most of the lectures and assignments deal with the practical application of statistical methods (as opposed to theory) in the collection and analysis of biological data. The lectures are designed to take the student through the normal process of scientific investigation from the formulation of hypotheses and the design of experiments to the publication of results. One major goal of the course is to foster statistical literacy so that students know the language of statistics, so that they understand statistical analyses that they read about in both the popular press and in scientific papers, and so that they can write and tell others intelligently about their own analyses. Because this is basically a 'techniques' course, the assignments are an integral component—each one is designed to give hands on experience with lecture material, from the collection and analysis of data and to the preparation of reports that interpret the statistical analyses.

Learning Hours

<i>Teaching method</i>		<i>Average hours per week</i>	<i>Number of weeks</i>	<i>Total hours</i>
In-class hours	Lecture	3	12	36
	Seminar			
	Laboratory			
	Tutorial	1	12	12
	Practicum			
	Group learning			
	Individual instruction			
Other	Online activity	1	12	12
	Off-campus activity			
	Private study	5	12	60
Total hours on task				120

Course Outline

Course introduction/Statistics in Biology—a tool to uncover processes
 Statistical literacy: understanding and writing about statistics in scientific papers and the popular press
 Overview of statistics, populations, samples and hypothesis testing
 Independence, replication and data collection
 Types of data and descriptive statistics
 Graphing
 Probability
 Sampling distributions and the Central Limit Theorem (CLT)
 CLT, confidence intervals & hypothesis testing
 Hypothesis testing-single sample (one-sample t-test)
 Hypothesis testing-two samples (two-sample t-test, paired & independent)
 Contingency tables (Chi-squared test)
 CLT, confidence intervals & hypothesis testing
 Hypothesis testing ratio of sample (F-test)
 Correlation
 Regression
 ANOVA
 Which test do I use?
 Experimental design

Tutorial Topics

Tutorials vary from year to year but this year, the topics include: Data visualization; Managing data; Hypothesis testing; Correlation and regression; One-factor ANOVA; Two-factor ANOVA; introduction to R

Textbooks/Readings

The Analysis of Biological Data by Michael Whitlock, Dolph Schluter

Grading Scheme

Component	Weight (%)	Date
Weekly quizzes	40	weekly
Weekly homework assignments	20	weekly
Independent project 1	15	midterm
Independent project 2	25	End of term

Grading Method

All components of this course will receive letter grades which, for purposes of calculating your course average, will be translated into numerical equivalents using the Faculty of Arts and Science Letter Grade Input Scheme.

The following scale will be employed for purposes of calculating your course average:

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

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

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

Academic Integrity and Queen's Code of Conduct

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 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>, on the Arts and Science website (see <http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity>), 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.

Accommodation Policy, Exam Conflicts, and Other Conflicts

Students who feel they need accommodations for disabilities or extenuating circumstances, or have a conflict between exams or other commitments should consult the Biology Department's website for details about how to proceed (<http://www.queensu.ca/biology/undergrad/integrity.html>). In general, the earlier a course coordinator is apprised of an extenuating circumstance, the more likely an accommodation can be made. Students are encouraged to be proactive in anticipating difficulties, when it is possible to do so.

Students may apply to write a make-up or deferred exam if they have an exam conflict as defined in the Academic Regulations of the Faculty (See Arts and Science Calendar Regulation 8 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>). In this case, the student should report to the Exams Office first to verify that there is a genuine exam conflict. Biology professors will not consider your situation to be a conflict unless it meets the criteria set out by the Faculty of Arts and Sciences.

Students may request a make-up or deferred exam if they have an exam conflict with off-campus travel associated with a field course (e.g BIOL-307/3.0 or 407/3.0) that is held during the fall or winter terms.

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Accommodation of Disabilities

Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Disability Services Office (DSO) and register as early as possible. For more information, including important deadlines, please visit the DSO website at: <http://www.queensu.ca/hcnds/ds/>