DRAFT Course Outline
Biostatistics for Integrative Biology
STAT *2230
Winter 2014

Lecture:	10:00-11:20 TTh, ROZH 103
Labs:	1:30-3:20 W, SCIE 1306 (*0101) 3:30-5:20 W, SCIE 1306 (*0102) 1:30-3:20 Th, SCIE 1306 (*0103) 3:30-5:20 Th, SCIE 1306 (*0104) 11:30-1:20 Th, SCIE 1306 (*0105)

Instructor:	Prof. Christina Caruso, Department of Integrative Biology
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Office hours:	TBA

Instructor:	Prof. Julie Horrocks, Department of Mathematics & Statistics
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Office hours:	TBA

Extra Help:	Math Stats Learning Centre, 3rd Floor, McLaughlin Library Stats Tutor Available: 10:00 am-3:30 pm, Monday-Friday

TAs: TBA

Calendar description: This course introduces students to the design, completion and interpretation of research projects, including identifying categories of research questions, types of data, data gathering methods, efficient graphic and numeric methods to summarize data, standard statistical analyses involving parameter estimation and hypothesis tests and interpreting results in the context of research goals. Statistical concepts underlying practical aspects of biological research will be emphasized. Computer-intensive laboratory sessions will focus on practical data organization, visualization, statistical analysis using software, and interpretation and communication of statistical results. Department of Mathematics and Statistics and Department of Integrative Biology.

Prerequisite(s):	BIOL*1070, BIOL*1080
Restriction(s):	BIOL*2250, STAT*2040, STAT*2060, STAT*2080, STAT*2120, STAT*2250. Enrollment restricted to the BSC majors in BIOD, ECOL, MFB, WBC, WLB, ZOO

Textbook: Samuels, M.L., J. A. Witmer, and A. A. Schaffner. 2012. Statistics for the Life Sciences, Fourth Edition. New York, Prentice Hall. **Note: Although the textbook is not required, it is useful for the open-book exams**

Recommended Resource: Dalgaard, P. 2008. Introductory Statistics with R, Second Edition. New York, Springer. **PDFs of this book are available for free download through the University of Guelph library**

General objectives: Thi course is designed to give students experience and confidence in the design and analysis of data within realistic biological research contexts. Students will gain basic practical experience in collecting, displaying, summarizing, analyzing and interpreting biological data in applied research contexts using standard statistical methods.

At the end of this course students should:

- Have developed an appreciation for how basic statistical thinking is used to address biological research questions outside of this course.
- Discover that empirical research attempts to draw reliable conclusions from data that is not absolutely reliable. Effective research strategies attempt to determine the limits of uncertainty rather than eliminate uncertainty.
- Develop a basic level of applied biometric ability that allows students to navigate between research questions, data collection, choice of analytical methods and interpretation of results with respect to biological research questions.
- Have a basic understanding of optimal ways to collect data and evaluate the quality of data collected from observational and experimental studies.
- Have started to develop their own intuitions and judgment about patterns in data based on numeric and visual summaries independent of statistical analysis.
- Be aware of a common underlying approach to measuring effects and uncertainties by various standard statistical methods used in different situations.
- Be comfortable in using statistical computer software to explore and analyze data.
- Recognize and use appropriately, standard statistical language to communicate with empirical biologists and applied statisticians.
- Feel confident and interested in seeking additional formal statistical training.

Methods of Evaluation

Lab assignments 30%
In-class midterm: 30% (Feb 27, time and location TBA)
Final exam: 40% (TBA)

Assignments: The assignments are designed to give you experience in data management, experimental design, graphical methods, and statistical analysis using R, as well as reinforce concepts presented in lectures. The assignments and any required data sets will be posted on Courselink. There will be a maximum of 10 assignments in total, but you lowest assignment grade will be dropped. **Late assignments will not be accepted!!!!!**

The assignments can be completed during the scheduled labs sessions. These sessions will be run by TAs who will introduce the problems, lead discussion, and give pointers on using R. While attendance at labs is not compulsory, we strongly encourage you to attend.

Be sure to save the work you do in the lab (data files, output, word processing) and mail it to yourself before you leave. Alternatively, you can save it on a memory key.

Because of limited computers, students will work together in pairs. Discussion often leads to better understanding and so we encourage group thinking. However, we urge you to not divide up the work. You will get the best value if you work together to increase your comprehension and not to do less work. Statistical analysis, data exploration, and the learning of statistical software only comes with experience. Each student must hand in a separate complete assignment, and no part of this should be copied from another student. Academic dishonesty, such as plagiarism (including copying all or part of an assignment) and impersonation is grounds for loss of course credit and dismissal. More information on the subject of academic misconduct can be found at the following website: http://www.uoguelph.ca/undergrad_calendar/c08/c08-amisconduct.shtml

Completed assignments should be placed in the **orange drop boxes outside the Math/Stats Learning Centre, 3rd floor McLaughlin library, by 5:30 pm of the 5th day following the lab. In other words, on the following Monday (if you are registered in a Wednesday section) or on Tuesday (if you are registered in a Thursday section).**

Please write your name, student id and section number on the first page of your assignment. **Please write your name only on the back of the last page of your assignment,** and we will staple them closed (for confidentiality reasons).

We will do our best to return the marked assignments in the following lab, but if not, they will be placed in a different orange box, outside the Math/Stats Learning Centre. The box will be labeled "Stat 2230 Outbox**".**

You are responsible for answering all of the questions on each assignment because these will help prepare you for the course exams. **However, only approximately half of each assignment will be graded each week**. You will not know in advance which questions will be subject to grading. Solutions for each assignment will be posted on the course website on Tuesday evening. It is up to you to check the answer sheet to evaluate your performance on the unmarked questions.

Tests: There will be one midterm and one final exam in the course. Tests will generally address the following topics: numerical and mechanical skills, your ability to critically evaluate the quality of data (e.g., data collection, experimental method) or of the experimental design and analyses, and the legitimate interpretation of results in a biological context. The midterm will be approximately 80 minutes long. Students are allowed to use their notes, copies of assignments, a calculator, and the course textbook during the midterm and final. Do not bring laptop computers, cell phones, or smartphones.

Should you need to miss a test or assignment for religious purposes, please advise the instructors within the first two weeks of classes.

E-mail communication: As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly; e-mail is the official route of communication between the University and its students.

When you cannot meet a course requirement: When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Drop date: The last date to drop one-semester courses, without academic penalty, is March 7 2014. For regulations and procedures fo dropping courses, see the Undergraduate Calendar: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Copies of out-of-class assignments: Keep paper and/or other reliable back-up copies of all out-of-class assignments; you may be asked to resubmit work at any time.

Accessibility: The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.csd.uoguelph.ca/csd/

Academic misconduct: The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Recording of materials: Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources: The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
http://www.uoguelph.ca/registrar/calendars/index.cfm?index

Information about teaching evaluations: Because this course is co-taught by the departments of Math-Stats and Integrative Biology, we encourage you to provide evaluations of the course and instructors separately to each department.

The Integrative Biology evaluation can be performed on-line through the CCS course evaluation website:
https://courseeval.uoguelph.ca/CEVAL_LOGIN.php

The Math-Stats evaluation will occur in class near the end of term. You may view an example of the MS evaluation sheet here:
http://www.mathstat.uoguelph.ca/files/TeachevaluationformF10.pdf

DEPARTMENT OF MATHEMATICS AND STATISTICS
TEACHING EVALUATION PROCESS

- Each course taught by the Mathematics and Statistics Department is evaluated in the last two weeks of the semester. The Evaluation form consists of a set of 7 questions, whose answers are entered on a provided computer sheet, and spac for comments. Note that the completed evaluation forms and any comments will not be passed on to the instructor, the Chair, and the Departmental Tenure and Promotion Committee until after all the final grades have been submitted following the final examination period.
- Your input provides important feedback to the instructor and becomes an important part of the Departmental Tenure and Promotion Committee's teaching evaluation of the instructor.
- Numerical results calculated from the 7 questions are provided to the instructor and are used by the Departmental Tenure and Promotion Committee in making faculty salary and promotion decisions.
- Comments from unsigned evaluation forms are passed only to the instructor after the final grades have been submitted following the final examination period.
- If you wish your comments to also go to the Chair and the Departmental Tenure and Promotion Committee, you must include your clearly legible handwritten

signature, with your legibly printed name and student number in the provide spaces. Note that comments that do not include a clearly legible handwritten signature are not allowed to be passed on to the Chair and the Departmental Tenure and Promotion Committee.

- These comments are made available to the Promotion and Tenure Committee only after the faculty member has had the opportunity to read and respond to the contents. Your identity will be made available to the Chair, the Department committee and the faculty member after final grades have been submitted.

TENTATIVE schedule of lectures and labs

Tuesday	Wed/Thurs lab	Thursday
January 7 Why do you need statistics? Sources of variability Sampling (Chapter 1)	No lab	January 9 Sampling (Chapter 1) Description of samples (Chapter 2)
January 14 Description of samples (Chapter 2)	Introduction to R Sampling Description of samples	January 16 Normal distribution (Chapter 4)
January 21 Normal distribution (Chapter 4) Sampling distributions (Chapter 5)	Normal distribution Sampling distributions	January 23 Confidence intervals (Chapter 6)
January 28 Confidence intervals (Chapter 6)	Confidence intervals	January 30 Experimental design I
February 4 Comparison of two independent samples (Chapter 7)	Experimental design Comparison of independent samples	February 6 Comparison of paired samples (Chapter 8)
February 11 Experimental design II	Experimental design Comparison of paired samples	February 13 One-way ANOVA (Chapter 11)
BREAK	BREAK	BREAK
February 25 Review	No lab	February 27 Midterm
March 4 Multiple comparisons (Chapter 11)	One-way ANOVA Multiple comparisons	March 6 ANOVA w/blocks (Chapter 11)
March 11 Two-way ANOVA (Chapter 11)	ANOVA w/blocks Two-way ANOVA	March 13 Linear regression and correlation (Chapter 12)
March 18 Linear regression and correlation (Chapter 12)	Linear regression and correlation	March 20 Chi-square goodness of fit (Chapter 9)
March 25 Contingency tables (Chapter 10)	Chi-square goodness of fit Contingency tables	March 27 Case studies
April 1 Case studies	Case studies	April 3 Review
Final exam: TBA		