BIOLOGY 132: BIOSTATISTICS

INSTRUCTOR:
Dr. Sara Lewis (Barnum 101, sara.lewis@tufts.edu) **Office Hours**: Tuesdays 1-2 pm (& by appointment)

TEACHING ASSISTANTS	**OFFICE HOURS**
Gabriel Golczer (gabriel.golczer@tufts.edu)	Fri 2.30-3.30 pm, room TBD
Kaylinnette Pinet (kaylinnette.pinet@tufts.edu)	Mon 12.30-1.30 pm, Thur room TBD
Eric Scott (eric.scott@tufts.edu)	
Charles van Rees (Charles.Van_Rees@tufts.edu)	Fri 8-9 am, Barnum 216B

CLASS MEETINGS: Class meets Tuesday & Thursday from 10.30-11.45 AM in Tisch 304: class attendance is **mandatory**, so please email Dr. Lewis *in advance* if you must miss a class. In addition, we'll hold an **optional** SPSS software recitation every Monday from 3-6 pm in the Mark Lab @ Tisch.

COURSE DESCRIPTION: In this introductory statistics course we will explore the use of statistical methodology in designing, analyzing, interpreting, and presenting biological experiments and observations. We will cover descriptive statistics, elements of experimental design, probability, hypothesis testing and statistical inference, analysis of variance, correlation, regression techniques, and non-parametric statistical methods. Throughout the course the application of statistical techniques within a biological context will be emphasized, using data from laboratory and field studies.

PREREQUISITES/CREDIT: Biology 13 & 14, plus one additional biology course. Because it covers the same material, this course cannot be taken for credit if you've already taken another intro stats course at Tufts (this includes: Psy 31, CH 31, CD 140, CEE 194, Econ 13, Soc 101, Math 21, or ES 56.

TEXTS: The required textbook is *The Analysis of Biological Data (2nd edition)* by Whitlock & Schluter, which is available at the bookstore. All course software (*SPSS* and *ConStats*) will be available in the Eaton Computer Lab. If you want to purchase your own copy of *SPSS*, IBM's *SPSS Statistics Base GradPack 24* is available for Windows or Mac for ~$45 (6 month license) or $75 (12 month license) through OnTheHub estore. We'll also be using iClickers in this course, which you can purchase at the bookstore.

GRADES: Course grades will be based on weekly problem sets (25%), two hour exams (20% each), a take-home final exam (20%), *ConStats* worksheets (5%), iClicker participation (5%), in-class group work & general class participation (5%). Details of iClicker and class participation grading are available on our course Trunk site.

PROBLEM SETS: This course has mandatory weekly problem sets that are intended to provide you with practical experience in conducting statistical analyses: problem sets are generally handed out on Thursdays and are due the following Tuesday **before class**. Problem sets are graded on a 0-10 point scale, and there is a non-negotiable late penalty of -2 points per day (or any portion thereof) late. Corrected problem sets may be turned in again at the next class meeting to be regraded (up to 7 point maximum).

ACADEMIC INTEGRITY: While we encourage collaborative learning, each student is responsible for working through and completing each assigned problem set on his/her own. Plagiarism or cheating (as well as facilitation of either activity) are unacceptable violations of Tufts Academic Integrity standards and thus will automatically result in a failing grade.

FALL 2016 SYLLABUS
BIOLOGY 132

DATE	TOPICS
Sept 6, 8	Biological variables, Data displays & Descriptive statistics
Week 1	*Problem Set 1: Descriptive Statistics & Intro to SPSS*
Sept 13, 15	Sampling & Experimental design
Week 2	*Problem Set 2 & ConStats Worksheet 1: Sampling Distributions*
Sept 20, 22	Probability rules & Probability distributions (Normal & Binomial)
Week 3	*Problem Set 3 & ConStats Worksheet 2: Probability Distributions*
Sept 27, 29	Introduction to inference; Sampling Distributions & Confidence intervals
Week 4	*Problem Set 4 & ConStats Worksheet 3: Confidence Intervals*
Oct 4, 6	HypothesisTesting on 1 & 2 sample means; Type I & II errors
Week 5	*Problem Set 5: SPSS Comparing Two Means*
Oct 11, 13	Comparing paired samples; Statistical power
Week 6	*Problem Set 6: Paired t tests*
Oct 17 (M)	*Midterm Question & Answer session*
Oct 18, 20	Mid-term exam; Test Assumptions
Week 7	*Problem Set 7: Statistical power & errors in hypothesis testing*
Oct 25, 27	Checking test assumptions; Transformations
Week 8	*Problem Set 8: SPSS Checking Assumptions & Transforming Data*
Nov 1, 3	Non-parametric alternatives: Analysis of Variance (ANOVA)
Week 9	*Problem Set 9: SPSS ANOVA I*
Nov 8, 10	Tufts FRIDAY (No class); ANOVA continued
Week 10	*Problem Set 10: SPSS ANOVA II*
Nov 15, 17	Non-parametric alternatives to ANOVA; Multiple comparisons
Week 11	*Problem Set 11: Multiple Comparisons*
Nov 22	Introduction to bivariate analysis - Correlation & regression; Thanksgiving (No class)
Week 12	*Problem Set 11b: Research Paper Commentary*
Nov 29, Dec 1	Linear regression
Week 13	*Problem Set 12: SPSS Correlation & Regression*
Dec 6, 8	Analyzing categorical data: Goodness-of-fit & Contingency tables
Dec 13 (T)	*Question & Answer Session*
Dec 16 (F)	*In-Class Exam (7-9 pm)*
Dec 19 (M)	*Take-Home Final Due (12 noon)*

Note: Problem sets are usually distributed on Thursdays of the weeks listed & are due the following Tuesday before class. Optional SPSS recitation sections will be held Mondays 3-6 pm in the Mark Lab @ Tisch.

BIOLOGY 132: BIOSTATISTICS
COURSE GOALS

We hope you'll emerge from Biology 132 with many new tools at your disposal, including being able to:

- construct and interpret graphical displays such as histograms, box plots, bar charts, stem & leaf plots, bivariate scatterplots, and mosaic charts
- calculate and interpret summary statistics for data sets
- recognize basics of experimental design, including controls, randomization, pseudoreplication, and blocking
- appreciate the logic (convoluted) of statistical inference
- construct and correctly interpret confidence intervals around point estimates
- understand the proper use and interpretation of significance levels (p values)
- recognize and understand the relevance of probability distributions such as the normal & binomial
- be able to formulate and test statistical hypotheses using 6 steps
- recognize the situations when it is appropriate to use, and be able to perform: two-sample (independent or paired) t-tests, one factor analysis of variance, simple linear regression analysis, correlation, goodness of fit tests, and r x c contingency table analysis
- know the conditions (assumptions) required for the validity of the above tests, and know which non-parametric alternatives can be used when such assumptions are not met
- know how to write a concise explanation of your statistical results
- know how to use statistical software such as SPSS to describe biological data and to test specific biological hypotheses