

Biology 4401: Experimental Design & Statistical Methods  
Fall 2013 (formerly ST: BIOL 4805)

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Course description: This course is designed to provide an introduction to the basic methods for designing experiments, analyzing data, and drawing inferences. Mathematical concepts and theory underlying statistical methods commonly applied in the biological sciences will be covered, including fundamentals of discrete and continuous distributions, random and fixed variables, hypothesis testing, regression and analysis of variance techniques. Parametric and non-parametric approaches for data analysis are included. The computer program MINITAB provides the analytical tool for putting statistical theory into practice using a variety of data sets. In addition, students are required to examine critically the application and use of statistical analysis in the scientific literature.

Textbook: “*Introductory Statistics*,” by Prem S. Mann (8<sup>th</sup> Ed.), J. Wiley & Sons  
(*Note to students: earlier editions are satisfactory*)

Grading:	Homework assignments	30%
	Midterm Exams (3 @10% each)	30%
	Final Exam	20%
	Student Critique on Applied Statistics	10%
	In-class work (group problems)	10%

Homework assignments are to be completed and submitted prior to posted deadlines! Any assignments submitted after the deadline will be assessed a 25% penalty, and no homework will be accepted after graded assignments have been returned.

Midterm exams will be based on lecture material. Formula sheets and calculators are **not** allowed unless specifically indicated by the instructor. Statistical tables required for answering questions will be provided.

The final exam is a comprehensive take-home exam.

Instructions for preparing the Critique paper (**due Nov. 22**) will be posted to the course web site (T-Square).

### SYLLABUS

DATE	TOPIC	TEXT CHAPTERS
Aug 20	Introduction to course	
Aug 22	Descriptive Statistics	1-3
Aug 27	Intro to Probability Distributions	4-5
Aug 29	Binomial & Poisson Distributions	4-5
Sep 3	Density Functions & Intro to Normal Distribution	6
Sep 5	The Normal (Gaussian) Distribution	6

DATE	TOPIC	TEXT CHAPTERS
Sep 10	The Standard Normal (z) Distribution	7
Sep 12	Sampling Distributions	7
Sep 17	Probability Statements: What do They Really Mean?	-
Sep 19	<b>MIDTERM EXAM 1</b>	<b>1-7</b>
Sep 24	Applications of sampling distributions	8
Sep 26	Central Limit Theorem	8
Oct 1	Hypothesis Testing	9
Oct 3	Type I & Type II Errors & Power	-
Oct 8	One-sample tests of hypotheses	9
Oct 10	Sign test and Ranked Sign test	15*
Oct 15	<b>Fall Break, No Classes</b>	
Oct 17	Two sample tests of hypotheses	10
Oct 22	<b>MIDTERM EXAM 2</b>	<b>8, 9, 15</b>
Oct 24	Two sample tests	10
Oct 29	Wilcoxon signed-rank test & rank sum test	15
Oct 31	Goodness of fit and Chi Square tests	11
<b>Nov 1</b>	<b>Deadline for Critique Paper Approval</b>	
Nov 5	Tests for multiple samples (ANOVA)	12
Nov 7	Analysis of variance	12, 15
Nov 12	Mean separation techniques in ANOVA	12
Nov 14	Introduction to linear regression	13
Nov 19	Linear regression	
Nov 21	Linear regression with non-parametric applications	13, 15
<b>Nov 22</b>	<b>Critique Paper Due</b>	
Nov 26	<b>MIDTERM EXAM 3</b>	10, 11, 12, 13, 15
Nov 28	<b>Thanksgiving Break, No classes</b>	
Dec 3	Multiple Regression: Adding variables to a linear model	14*
Dec 5	Two-way ANOVA and ANCOVA models	-
	<b>Take-Home Final Released to Class</b>	
Dec 11	<b>Final Exam (Take Home) Due @ 5:00 pm</b> (hard copy ONLY)	<b>ALL</b>

\*Note: Chapters 14 & 15 are not included in the textbook but are available as a free download from the publisher