BIOLOGY 174/274H, Experimental Design and Probability

Faculty: Watanabe
Requirements: complete weekly problem sets by assigned due-date, take-home final.

Course Description: Biology 174/274H is a course in experimental design and statistics. After a consideration of probability and the basic concepts of statistical inference, the course focuses on the analysis of variance (ANOVA) as a tool for coping with variability in nature and its use in designing informative experiments. The derivation and mechanics of the technique (identification of treatments, replication, nested designs, orthogonal designs with interaction, methods of comparing subsets of treatment groups after the overall analysis) are covered in detail. Strong emphasis is also placed on proper interpretation (and common mis-interpretations) of the results and their implications for the design of further studies. The course winds up with a consideration of the design of environmental impact studies as examples of the need for complex multi-faceted approaches to understanding a variable world. Two lectures per week.

Date	Topic	Reading
Week 1	Why experiment?	
	Sampling, descriptive statistics	Ch 1-3, 5.1-5.8
Week 2	Probability: many ways of counting	
	Probability distributions & confidence intervals	
Week 3	Hypothesis testing	Ch 4, 5.9-5.11
	Differences between two groups: *t*-tests	Ch 6
Week 4	Introduction to Analysis of Variance: solutions for more than 2 groups	
	Single Factor Analysis of Variance	Ch 7.1 - 7.12, 8.1 - 8.5
Week 5	After ANOVA: Planned & unplanned comparisons	Ch 8.6
	More on comparisons	
Week 6	After ANOVA: Assumptions & what to do if those assumptions don't hold	Ch 7.13 - 7.20
	Power analysis, introduction to Nested ANOVA	Ch 5.12-5.14, 8.3, 8.4
Week 7	Nested ANOVA	Ch 9
	Factorial ANOVA	Ch 10
Week 8	More on Factorial ANOVA	
	Determining Expected Mean Squares for any design: logical relationship of factors	Ch 11
Week 9	More on determining Expected Mean Squares for any design	
	Asymmetrical designs: multiple factors, but a single control	Ch 12
Week 10	Complex designs: environmental impact studies	Ch 12
	More on complex designs	

Assigned readings are from
Underwood, A.J. 1997. *Experiments in Ecology*. Cambridge Univ. Press.

There will be additional handouts that summarize the lecture material. Please do the readings prior to the lecture for which they are assigned.