BBSP 610/BIOS 610
Short title Biostatistics for Laboratory Scientists
Long title Introductory Statistics for Laboratory Scientists

Effective term Fall 2016 (ten weeks, two 90-min class meeting each week)
Course units/hours 2 credit hours
Grading basis (GRAD – H, P, L, F) (ADVANCED UNDERGRAD – A, B, C, D, F)
Course Component (lecture or lab) lecture

Course Description
BBSP 610/BIOS 610 introduces the basic concepts and methods of statistics with emphasis on applications in the experimental biological sciences. Emphasis is on mastery of basic statistical skills and familiarity with situations in which advanced analytical skills may be needed. The primary focus of the course is on applications in basic science research. Course objectives include learning to use statistical reasoning to formulate scientific questions in quantitative terms, learning to design and interpret graphical and tabular displays of statistical information, using basic probability models to describe trends and random variation in laboratory data, and using basic statistical models, including tests and confidence intervals, to draw inferences from data. Topics include experimental design, basic summary statistics, graphical methods for visualizing data, probability, confidence intervals, hypothesis testing, and regression.

The course introduces and employs the freely available statistical software, R, to explore and analyze data. This year, we have added Prism (licensing fee required) as a second statistical analysis/graphing program to explore and analyze data. Emphasis is placed on mastery of basic statistical analysis skills, familiarity with situations in which advanced analytic skills may be needed, the ability to critically review statistical analysis presented in relevant manuscripts, and the ability to clearly describe the results of statistical calculations when writing papers and grant applications. Students should have a basic understanding of algebra and arithmetic. No previous background in probability or statistics is required, nor is experience with statistical computing.

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Course objectives (learning outcomes):
The objectives of this course are to provide graduate students in biomedical research programs familiarity with basic experimental design and elementary statistical methods. By the end of the course, students should understand the principles of experimental design, be familiar with basic statistical methods (and how they are implemented in R and/or Prism), and know which methods are appropriate in a given circumstance.

Course Assignments
There will be short written assignments due at the end of every other week. Students will also be assigned papers to read and discuss during class.
Assessments
Grading will be based on performance on the written assignments and participation in the class discussions.

Course Format
Prior to the beginning of the class, the entire set of lecture notes and recorded lecture videos for the course will be posted online. Students should be familiar with the material presented in these lectures (either by reading the slides or watching the videos) before each class. Class will involve discussions about the assigned reading as well as selected homework problems. The instructors will also be available in class to help students with issues related to R and/or Prism.

Tentative Course Schedule

Weeks 1-2: Experimental Design
- Statistical Reasoning in the Basic Biological Sciences
- Experimental Design - Controlled Experiments
- Experimental Design - Observational Studies
- Blocking and Sampling Methods

Weeks 3-4: Basic Summary Statistics, Graphical Methods, and Introduction to R
- Introduction to R/Sampling in R
- Basic Summary Statistics (Mean, Median, etc.)
- Graphical Methods for Summarizing Data
- Outliers

Weeks 5-6: Probability, Confidence Intervals
- Probability
- Random Variables and the Normal Distribution
- Sampling Distributions and the Central Limit Theorem
- Confidence Intervals for the Mean

Weeks 7-8: Hypothesis Testing
- Hypothesis Testing
- Two-Sample T-Tests
- Confidence Intervals and Hypothesis Tests for Proportions
- Hypothesis Tests for Categorical Data

Weeks 9-10: Introduction to Regression
- Correlation
- Introduction to Regression
- Inference for Regression
- Multiple Regression
- Introduction to ANOVA
- Logistic Regression