# Statistical Methods in Plant Biology (pbio 3150/5150)

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| **Lecture** | Tue./Thu. 01:30–02:50 pm in Porter #104 |
| **Laboratory** | To be decided ... |
| **Office Hours** | Tue./Thu. TBD in Porter #409 |
| | by appointment (Mon./Wed./Fri.) @ The Ridges |
| **Contact Information** | Room #115, Building #21, The Ridges; 7-1949; `ruhil@ohio.edu` |
| **Teaching Assistant** | Ryan Dorkoski; Porter Hall #419; `rd023411@ohio.edu` |
| **Teaching Assistant's Office Hours** | Fri. 01:00–03:00 pm in Porter #409 |

### Course Objectives

The goal of this course is to introduce upper-level students in the natural sciences to the quantitative skills and technological tools necessary to evaluate the literature and be able to carry out original research in the discipline. Lectures will focus on the quantitative skills associated with proper experimental design, statistical analysis, data interpretation, and presentation of results. Numerous worked examples and problem sets will be used to demonstrate and enhance your understanding of important biostatistical procedures. Laboratories will emphasize micro-computer technology and software applications likely to be encountered in the biological sciences. The goal is to provide an overview of common software applications and technological solutions to standard research problems in biology.

*Note*: The first few weeks of class establish the foundation for all that follows. Each week we will build upon material covered in preceding weeks so be warned: Both the pace of the class and the complexity of the material increases rapidly. If, at any point, you feel you are getting lost and need some help, don't hesitate ... contact Ryan or I right away. The longer you wait, the more difficult will it be to catch-up. When you email with a question or to schedule a time to meet you must email both Ryan and I.

### Required Text

Whitlock, M. C. and D. Schluter. 2015. *The Analysis of Biological Data (Second Edition)*. Roberts & Co., Greenwood Village, CO.

### Laboratory

We will use R for all analysis and graphics. It is free, powerful, and growing exponentially in its capabilities. Along with R, RStudio provides an excellent graphical user interface (and much more). There will be regular lab meetings for each week. These lab meetings are not mandatory but many students have found them to be useful. By the way, the website for the textbook has R code for the book.

**Grade Requirements**

Your course grade will be determined on the basis of the following components:

| Course # | Problem Sets | Exam I | Exam II | Exam III |
|---|---|---|---|---|
| PBIO 3150 | 25% | 25% | 25% | 25% |
| PBIO 5150 | 25% | 25% | 25% | 25% |

**Exams** are largely quantitative (i.e., worked problem solving), with most of the material coming directly from the textbook. The rationale for this is to: (1) encourage you to work through the problems in the text (both exercises & examples) as we go through each chapter, (2) confirm that you have reached a correct solution, and (3) to limit the scope of material you will encounter on the exams. (Note that I reserve the right to make minor alterations to the data.) Occasionally short answer and/or short essay questions may appear on the exam. Exams for 3150 and 5150 will be open-book, taken in class, and may have a take-home portion.

There will be approximately 6–8 **problem sets** worth 25% of your grade. Graduate students may have extra problems to solve. Problem sets must be completed using the R programming language and with RStudio, and submitted as MS Word documents knitted with a RMarkdown file in RStudio (you will be shown how to do this). Bookmark the course website for lecture handouts and example R scripts.

While you are working on an assignment, I give you the opportunity to ask questions, send drafts, etc. via email. I respond as quickly as I can but there is a strict no exceptions rule that you should be aware of (see below):

- Assignment due Tuesday @ 01:30 PM – questions and draft versions of your assignment accepted no later than Sunday @ 01:30 PM
- Assignment due Thursday @ 01:30 PM – questions and draft versions of your assignment accepted no later than Tuesday @ 01:30 PM

*Note*: All *assignments must be submitted via* Blackboard. Assignments submitted late *without my prior approval and not governed by University policy on "legitimate absences"* will remain ungraded, earning an F by default. Further, while you are allowed to put your heads together for homework assignments you are bound by the Student Conduct policies in force at Ohio University.

Your final course grade will be determined on the basis of the following distribution:

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|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 94-100 | A- | 90-93 | B+ | 86-89 | B | 82-85 | B- | 78-81 | C+ | 74-77 |
| C | 70-73 | C- | 66-69 | D+ | 62-65 | D | 58-61 | D- | 53-57 | F | 0-52 |

**Special Accommodations:**

> Ohio University students with disabilities are assured equal access and full participation in the university's programs and services. As such if you have special needs please let me know on the first day of class so that we can make suitable arrangements for you to participate fully in this course.

**Course Policy:**

Attendance is expected for all scheduled class meetings except in cases of "legitimate absences" as defined by the University (illness, death in the family, religious observances, jury duty, or University-sponsored activity). Absences that fall outside this purview do not qualify for make-up exams or homework assignments. The penalty for academic misconduct is a grade of F on any evaluated assignment affected by the misconduct.

**Multiple Final Examinations - Resolution Adopted by Faculty Senate March 12, 2012**

Students may not be required to sit for more than three final examinations in one day. Should a student be scheduled for more than three examinations in one day, the student may seek relief from the instructor with the examination scheduled latest in the day. This process must be initiated and completed by the beginning of the 13th week of the semester. The instructor will provide an examination for the student at a mutually agreed upon time during the examination period.

**Course Calendar (dates & topics may change as needed)**

| Date(s) | Topic | Reading(s) |
|---|---|---|
| January 12 & 14 | Introduction to PBIO 3150/5150 & Statistics | W&S : Ch. 1 |
| January 19 & 21 | Displaying & Describing Data | W&S : Chs. 2 & 3 |
| January 26 & 28 | Estimating with Uncertainty; Probability | W&S : Chs. 4 & 5 |
| February 2 & 4 | Hypothesis Testing; Proportions & Frequencies | W&S : Chs. 6 & 7 |
| February 9 | Review for Exam 1 | W&S : Chs. 1 – 7 |
| February 11 | **Exam 1** | W&S : Chs. 1 – 7 |
| February 16 & 18 | Fitting Probability Models; Contigency Analysis | W&S : Chs. 8 & 9 |
| February 23 & 25 | The Normal Distribution; Inferential Statistics | W&S : Chs. 10 – 11 |
| March 1 – 5 | **Spring Break** . . . | Classes not in session |
| March 8 & 10 | Comparing Means; Violations of Assumptions | W&S : Chs. 12 – 13 |
| March 15 & 17 | Experimental Design; ANOVA | W&S : Chs. 14 – 15 |
| March 22 | Review for Exam 2 | W&S : Chs. 10 – 15 |
| March 24 | **Exam 2** | W&S : Chs. 10 – 15 |
| March 29 & 31 | Correlation; Regression Analysis | W&S : Chs. 16 – 17 |
| April 5 & 7 | Multiple Explanatory Variables | W&S : Chs. 18 |
| April 12, 14, & 19 | Computer Intensive Methods; Likelihood | W&S : Chs. 19 – 20 |
| April 21 | Review for Exam 3 | W&S : Chs. 16 – 20 |
| April 26 | **Exam 3** at 12:20 p.m. | W&S : Chs. 16 – 20 |