# BIO 106: Biostatistics
# Fall 2018 Tentative Syllabus
# M/Th 1:25-2:40 Th 2:40-4:05

**Instructor:** Kate Mathis (KMathis@clarku.edu)

**TA:** Gen Morinaga (GMorinaga@clarku.edu)

**Room:** Biology 124

**Office Hours:** Thursday 12:00-1:00pm or by appointment, in Biology 234

**Texts:** (*Optional*) Whitlock and Schluter, 2015. *The analysis of biological data, 2nd Ed.* Roberts & Co.

## I. Course description and philosophy:

**Course description:** An introduction to mathematical and statistical methods that are most useful to biologists, this course provides skills that are useful in organizing and summarizing data, graphic methods of data presentation, and testing hypotheses based on experimental results. Key mathematical methods for describing biological phenomena are included, along with basic techniques for identifying differences among groups and relationships among variables. This course may be used by biology majors to fulfill part of their mathematics requirement. Alternatively, it may be counted among the required 10 biology courses for the major.

**My philosophy:** Biostatistics shouldn't be intimidating or difficult, it should be a fun way for us to better understand the biological world. My goal is to provide you with the practical tools to analyze real biological data in a meaningful way. The course will involve hands-on tutorials and problem sets that will give each student practice analyzing and visualizing data. Three projects will give students the opportunity to choose data that is important to them for analysis. In the real world biological data isn't ever analyzed in a vacuum, and in this course students are encouraged to work together, and there are no quizzes or tests.

## II. Assignments and grading

**1. Grading overview:** You will be able to earn a total of 1000 points, which will come from the following activities:

| Activity | Points possible | Percentage of total points |
|---|---|---|
| Problem Sets + Homework | 200 | 20% |
| Lab assignments | 400 | 40% |
| Small Projects (2) | 200 | 20% (10% each) |
| Final Project | 200 | 20% |

***Final Grade:***
A = 90 - 100% = 900 – 1000 points
B = 80 - 89% = 800 – 899 points
C = 70 - 79% = 700 – 799 points
D = 60 - 69% = 600 – 699 points
F = Below 60% = 000 – 599 points

**2. Homework + Problem Sets:** Over the course of the semester there will be two homework assignments and six problem sets. Problem sets will involve analyzing and visualizing data using techniques learned in class. Problem sets and Homework assignments are due at the beginning of class, and can be either printed out or emailed.

**3. Labs:** Weekly labs will be tutorials designed to guide students through data analysis in R. Each weeks lab assignments will be turned in at the end of the lab or at the beginning of class on the following Monday. Students are encouraged to help one another during lab, however each student must turn in their own individual lab assignment with unique answers.

**4. Small Projects:**. There will be two small projects over the course of the semester. The first project will be an individual project where students will summarize and visualize data of their choice. For the second project students will break up into groups of 2-4 where students will summarize, visualize and analyze data of their choice. Results from both projects will be turned in as a written report and presented to the class.

**5. Final Project:** These projects will involve students asking a question or questions, collecting their own data, testing several hypotheses, writing a mini-manuscript, and presenting their results to the class. Details will be discussed in class.

**6. Attendance and participation:** You are expected to arrive to class on time and actively participate each class period. Complete attendance is mandatory during all student presentations; otherwise presentation points will be forfeited. If for whatever reason you need to miss a class, please email me beforehand.


# III. Policies

**What you will need:**

1) **You will need access to a computer**. If you do not have one, you can arrange to check out one of the department laptops in Lasry (they must be kept within the building).

2) The computer you use in lab should have wireless access to the web.

3) Specialized statistical software:

We will be using R statistical software in this course, and the interface utility RStudio. Both are free and can be downloaded from the internet. If you cannot handle the installation yourself, we will help you to install this software onto your computer during one of the early lab sessions. You should also have a spreadsheet program, Excel, or the freeware equivalent (must be able to save a file in Excel format)

**Make-up and Late Work Policy**: In general, make-ups and late work are not accepted. Likewise, assignments are due at the beginning of class unless otherwise noted, and no make-ups or late work are accepted unless otherwise stated (see grading rubrics). However, most work may be turned in early when you know you have to miss a class. I suggest emailing your work to me early enough to receive a confirmation email from me.

**Rebuttal System**: If you think you were graded unfairly (or erroneously) on an assignment, please turn in a written explanation (rebuttal) with your graded assignment to me within one week of getting your graded assignment back from me. I will write a response and return it to you. We can set up an appointment if you disagree with my response.

**Classroom Etiquette:** I expect you to treat other students with courtesy and respect at all times. This includes treating your fellow students' viewpoints with respect, refraining from talking or causing distractions during a lecture or while another student is talking, and doing your share in all group activities.

**Time/Workload:** It is expected that you will spend 180 hours working on this course. Only 55 hours of this time will be spent in class and lab, therefor the majority of the work you will be doing will be when we are not together.  This will involve spending additional time working on projects, problem sets and homework assignments as well as reviewing the material learned in class.

**Academic Dishonesty:** Any effort to circumvent the evaluation procedures of the course to improve the grade for yourself or other students (aka "cheating") is considered academic dishonesty.  This includes, but is not limited to, misrepresentation of the cause for an absence during a class or laboratory, submitting the work of another (partially or entirely) as one's own, altering a problem set or lab answer to be submitted for regrading. You are encouraged to report academic dishonesty and anonymity will be protected if requested. If we believe that academic dishonesty has occurred and we have supporting evidence, we will report the case to the College Board immediately after informing the student that we are doing do, and why.  Please read Clark's academic dishonesty policy at CUWeb (http://www2.clarku.edu/offices/aac/integrity.cfm).  If you are uncertain about these guidelines, please consult with us.

**Student/Accessibility:** Students with learning differences or in need of accommodations of any sort should consult with Student Accessibility Services, accessibilityservices@clarku.edu or (508)-798-4368.

**Safe Learning Environment:** As an instructor, I am responsible with creating a safe learning environment in our classroom.  I am required to share information regarding sexual misconduct or information about a crime that may have occurred at Clark. The only exceptions to this reporting responsibility are designated "Confidential" sources, including the professional staff in Clark's Center for Counseling and Personal Growth and the medical providers at the Health Center, as well as Prof. Cordova (jvs.confidential@clarku.edu), Prof. Palm Reed (kpr.confidential@clarku.edu), and Prof. Stewart (als.confidential@clarku.edu).

# Tentative Schedule

| Week | Day | Date | Lectures | Labs | Assignments due[*] | Readings |
|---|---|---|---|---|---|---|
| 1 | M | 8/27 | Introduction, Course Plan | - | | |
| | Th | 8/30 | Experimental Design | Lab 1: Install R, Rstudio | Example of a hypothesis | Chapter 14 |
| 2 | M | 9/03 | Labor Day – No Class | | | |
| | Th | 9/06 | Biologically Important Functions | Lab 2: Functions | Examples of Biological Equations | Chapter 1 |
| 3 | M | 9/10 | Displaying Data | - | | Chapter 2 |
| | Th | 9/13 | | Lab 3: Graphics | Problem Set 1 | |
| 4 | M | 9/17 | Describing data | - | Good, bad, Ugly graphics | Chapter 3 |
| | Th | 9/20 | | Lab 4: Summarize Data | | |
| 5 | M | 9/24 | Estimation + Probability + Hypothesis Testing | - | | Chapter 4-6 |
| | Th | 9/27 | | Presentation 1 | Small Project 1 | |
| 6 | M | 10/01 | Tests involving proportions | - | | Chapter 7-8 |
| | Th | 10/04 | | Lab 5: Goodness of Fit | Problem Set 2 | |
| 7 | M | 10/08 | Fall Break – No Class | | | |
| | Th | 10/11 | Contingency Tests + T-test | Lab 6: Normal Distributions and T-tests | | Chapter 9+11 |

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[*] Unless otherwise stated, assignments are due at the beginning of class. Assignment deadlines are very unlikely to change and will never be earlier than listed on the schedule.

| Week | Day | Date | Lectures | Labs | Assignments due[*] | Readings |
|---|---|---|---|---|---|---|
| 8 | M | 10/15 | Comparing two means and means of more than two groups | - | | **Chapter 12 + 15** |
| | Th | 10/18 | | Lab 7: ANOVA | Problem Set 3 | |
| 9 | M | 10/22 | Correlation | - | | Chapter 16 |
| | Th | 10/25 | | Presentation 2 | Small Project 2 | |
| 10 | M | 10/29 | Regression | - | | Chapter 17 |
| | Th | 11/01 | | Lab 8: Correlation + Regression | Final Project Proposal | |
| 11 | M | 11/05 | Nonparametric statistics | - | | Chapter 13 |
| | Th | 11/08 | | Lab 9: Non-parametric tests | Problem Set 4 | |
| 12 | M | 11/12 | Two-way ANOVA, ANCOVA | - | | Chapter 18 |
| | Th | 11/15 | | Lab 10: Two-way ANOVA, ANCOVA | | |
| 13 | M | 11/19 | Multiple Regression | - | Problem Set 5 | Chapter 19 |
| | Th | 11/22 | Thanksgiving – No Class | | | |
| 14 | M | 11/26 | Resampling and Bootstrapping | - | | Chapter 19.2 |
| | Th | 11/29 | | Lab 11: Multiple Regression | | Chapter 20 |
| 15 | M | 12/03 | Final Presentations | | | |

| Week | Day | Date | Lectures | Labs | Assignments due[*] | Readings |
|------|-----|------|----------|------|--------------------|----------|
|      | Th  | 12/06 |         | Meta-analysis Activity | Problem Set 6 |        |
| 16   | M   | 12/10 | Final Presentations |  |  |        |
|      | Th  | 12/13 |         |      |                    |          |