# BI 171 Lab #2

## Part 1. Pre-Lab Assignment: EXCEL Tutorial- Descriptive Statistics

**Descriptive statistics** are defined as statistics that quantitatively describe a set of data from a study. As Biologists, you will be expected to know how to both run and interpret Descriptive statistics analyses on a variety of data sets. The **goal** of this pre-lab assignment is to introduce you to the field of Descriptive statistics and to provide you with the tools you need to perform Descriptive statistics analyses.

Posted on our Moodle page is the link to a **YouTube video** that describes how to perform a Descriptive Statistics Analysis using EXCEL's Data Analysis ToolPack. You should watch this short video before performing the exercise below. The pre-lab quiz assignment on Moodle will include questions from this video tutorial.

After having watched the Descriptive Statistics video, open the EXCEL file titled '*Mouse mass data'* that is posted on this week's MOODLE page. The data set includes body mass measurements from adult females of two species of North American mice (deer mice-*Peromyscus maniculatus* and white-footed mice–*Peromyscus leucopus*). This practice data set will allow you to calculate Descriptive Statistics for each species of mouse. First, use **EXCEL** to calculate Descriptive Statistics for the deer mice. You can calculate mean, median, standard deviation, standard error and the confidence level using the ***Data Analysis*** option in EXCEL.

**If you are using a Mac, the *Data Analysis* package is likely not available and, therefore, you will need to go to the Carroll College virtual desktop (virtualdesktop.carroll.edu) and use the version of EXCEL available there.**

1. Select the *Data* tab, then *Data Analysis*, then *Descriptive Statistics* and then *OK*.
2. Select the red arrow button next to the *Input Range*.
3. Highlight the input data you want to analyze (e.g. all the deer mouse data in column B) and select *Enter*.
4. Select the open circle next to the Output Range and then click on the red arrow button. Click on a cell within the current worksheet where you want your data table to appear.
5. Select *Summary Statistics* and *95% confidence*, and then *OK*.

The calculations will appear on a table within the worksheet and will have the following information regarding your Input data: Mean, Standard Error, Median, Mode, Standard Deviation, Sample Variance, Kurtosis, Skewness, Range, Minimum, Maximum, Sum, Count, Confidence Level (95.0%). For our purposes, we will focus on the following descriptive statistics:

- The **Mean** is the arithmetic average of the data and serves as the most common measure of central tendency.
- The **Standard Deviation** gives you an indication of the variability of the data and is often reported because it is in the same measurement units as the mean (e.g. deer mouse mass = 18.22 ± 1.32 g)
- The **Range** is also an indication of the variability of the data and represents the difference between the minimum and maximum sample values. A data set's range is typically reported as the minimum and the maximum sample values with a dash between them (e.g. deer mouse mass ranged between 16.31 – 20.84 g).
- The **Standard Error** is in the same units as the mean and gives you a measure of the precision of the mean (e.g. deer mouse mass = 18.22 ± 0.26 g). With normally distributed data, we can assume the true mean is within 0.26 g of 18.22 g.
- **Confidence Intervals** give us a further measure of confidence about the mean. To get the confidence interval, you need to take the confidence level reported by EXCEL and subtract the level from the mean to get the lower confidence limit and then add it to the mean to get the upper confidence limit.

For example, with a mean deer mouse mass of 18.22 g and a confidence level of 0.54, the confidence interval would be 17.68 – 18.76. Because the level of confidence we selected was 95% we can say that we are 95% confident that the true mean mass for deer mice is between 17.68 and 18.76.

After having completed the Descriptive statistics analysis on the deer mice data set, **repeat the analysis** for the white-footed mouse data. Once you have these two data sets analyzed, **complete the Pre-lab assignment** on MOODLE by the indicated due date.

## Part 2. Discovery Lab: Making a bar graph

An important part of science is sharing your findings with the rest of the world. An effective way to convey data is by creating figures that summarize the findings in a concise and comprehensive manner. One type of figure that is commonly used in scientific communication is the **bar graph**.

In lab today, your instructor will show you how to make a simple bar graph using EXCEL. Once you have the basics down, your lab group should practice making a graph using the *mouse mass data* from the pre-lab assignment.

**You will be constructing bar graphs throughout the semester and will be expected to use the formatting presented in lab today. Use the following figure checklist to ensure your figure is complete:**

a. Make certain that the figure is at least 8.5 cm wide.
b. Use Calibri or Arial font in at least 12 pt for all text.
c. Italicize any species names that were used.
d. Include a figure legend (title) at the bottom of the figure.
e. Omit unnecessary boxes, borders or horizontal lines in the figure
f. Rotate the y-axis label to be parallel to the y-axis.
g. Add error bars using the Custom Error Bars option and either your Standard Deviation or Standard Error values (the link to a video tutorial describing how to add Custom Error Bars to a bar graph is posted on this week's Moodle page)

## Part 3. Inquiry Lab: Termite data analysis

**Introduction:**

You have been provided with the materials you requested for the termite study you designed last week. Work with your partners to complete the following.

**Procedure:**

1. Amend your experimental design
    a. Based on the feedback you received from your initial experimental design, you may want to consider modifying your experiment(s).
        i. Questions for consideration:
            1. Are you going to be able to logistically implement your experiment?
            2. Do you need a greater/lesser number of treatment levels?
            3. Do you need a greater/lesser number of replicates?
            4. Have you clearly defined how you will quantitatively measure your dependent variable?
    b. Check with your instructor or TA to be certain that your have a viable experimental design.
2. Implement your experiment.

## Part 4: Post-Lab Assignment: Termite report

1. With your research partners, use WORD to write a short (1-2 page) results section that includes the following content:

a. The **authors** of the report and **title** of your experiment.
b. Perform a ***Descriptive Statistics*** **analysis** on your data in the same manner as the pre-lab assignment. **Paste** the tables for each treatment into the WORD document.
c. A **paragraph** that compares the mean and standard deviation of the control versus treatment(s). Did the termites prefer following a particular ink line more than others?
d. Construct a bar graph of your data that plots the **mean** value of your dependent variable for each treatment ± the **standard error**. Use the checklist from the Discovery portion of the lab to be sure that you have included everything indicated. **Paste** the bar graph into the WORD document.
e. In a short paragraph, report the **results of the confidence intervals** for each group. Do the intervals overlap? If so, you may conclude that the groups are not statistically different regardless of what the means and standard deviations suggest. If not, then you can conclude the opposite… the groups are significantly different.
f. In a **final paragraph** discuss what you think your results mean. For example: What are reasonable conclusions you can make about the data? What are future experiments you might perform? In the future, how could you extend or improve the experiment you just completed? For a typical scientist, the results of this lab should have raised one BIG question – WHY would termites follow ink trails? Obviously their nest mates aren't using tiny ink pens to trace their paths. Somehow, an ink trail imitates something that termites depend on to follow each other. What might that be? In answering this question, think about the lifestyle of termites for a minute. Where do they usually live? What kinds of signals or cues could they use in such an environment to find and communicate with one another?

2. After typing your report, designate one person from your group to immediately (before leaving lab) submit your report in the form of a WORD file to MOODLE, in the designated assignment titled **Post-lab Assignment 2**. Your summary will be evaluated on the following criteria: completeness, correctly formatted figures with figure titles, correct reporting and interpretation of means and standard deviation, correctly reported and interpreted confidence intervals, and basic writing skills (spelling, grammar, sentence structure, etc.).