First Research Write-up Reminders
ANGELL*BIO 150*Spring 2026

Remember

Learning how to write effectively in the sciences is just as important as making observations, learning facts, collecting data, mastering techniques, and proposing hypotheses. In fact, writing a complete research paper can be a challenge. There are so many little things to remember to include! By the time you are a senior in the biology department and in your upper-level courses we expect you to be able to efficiently approach this process and be able to cruise through a write up relatively easily. Writing about what you have learned is both a way to communicate your results to others and to clarify your own understanding about your results. Keep you paper simple, concise and clear to keep it memorable. Of course, you also want to persuade the reader that your findings are important. In most cases, results need an ardent and articulate advocate--you!

Overview

In order to manage this complex task, your first write-up will consist of only a subset of the typical parts of a research paper. For this assignment you will leave out a very important section-the Discussion (or in some journals it is called the Conclusion) and you will also not include an Abstract. You will, therefore, end up with….an informative **Title**, **Introduction** (with in-text citations embedded within a nice introduction), **Methods, Results, Citations** (Try to use Zotero) and AT THE VERY END your **Graphs (figures)**!

For this short write-up you will work with the maple fruit or maple samara data. We actually have **way more data** than we need so we will focus ONLY on a subset of our results-see the end of this handout-**What data should I use?.**

OTHER TIPS….Do not write it the night before, it always shows! Read and reread your paper. You should check every sentence to make sure it is written concisely. Always ask yourself if there is a quicker/shorter/clearer way of making your point. Writing Center may be useful for proofreading but sometimes are not science oriented! Feel free to use the active voice..many journals encourage this. **Above all strive to be direct and clear!**

Use of AI

Honestly, I think it would be more work to use AI to write this than to just write it yourself. This is because to write a research paper you would really need to give AI a set of pretty darn detailed instructions to get it to write in a way that we expect these to be written-which I guess you could do but I'm not sure it is worth it. Since I will mostly not be grading you on the things AI might be good at (creating nice sentences), I suggest not wasting time trying to use AI. It might just get you more confused and get in the way of your learning.

Title

You need one! It should give us a sense of what you actually did in this lab-DO NOT TITLE IT "Lab Report" (Ugh).

Introduction

Do begin generally but quickly get to the point of your research. What do we know about this system? Maybe some general info on seeds and seed dispersal. Why is this important? Put our wind dispersed maple seeds in context….but do not give us an encyclopedia entry on your topic! Some citations perhaps? Describe previous research and what those researchers found and give us some background. This serves both to introduce some background info related to your topic and to show that you as a researcher are aware of this other research. If other folks studied related topics then this area of research must be important! Remember to reword the idea from the paper you are citing, obviously do not copy and paste from the original paper (can you say plagiarism). Remember those in text (within your paragraphs) citations are most effectively and concisely placed at the end of the sentence where you describe, **in your own words**, the research (Gonzalez et al. 2022). No quotes, ever in research papers.

Finish the end of the intro by describing what we did in a general way (keep important details for Methods). Consider adding a hypothesis if you had one (though it's not required), "We/I hypothesized that samaras…. " Obviously, you don't need to have a hypothesis about every relationship you might be going to show in your figures but feel free to share one or two if you had a specific expectation. Generally, no results here (some medical journals will have a snapshot of results in intro but more often there is no mention of what you found).

Italicize species names with the Genus name capitalized and the species name lower-case (*Homo sapiens*). After the first use, it is OK to abbreviate the genus name (*H. sapiens*).

- *Acer saccharinum*=silver maple-big ones
- *Acer ginnala* =Amur maple-small ones (we did not use these in my section) Note: This is an introduced and quite invasive species!
- *Acer saccharum*=Sugar maple-ones with fat seeds at end-smaller than silver

Methods

What did we do, where did we do it and how did we do it? A knowledgeable scientist should be able to repeat your experiments after reading this section. There is often a fine balance between too much and too little information so don't tell me about the tape and markers you used or that you recorded your data (we hope so). This should not read like a recipe (who taught some of you that practice?). Do not add tons of unnecessary details. We can assume for example that you got to your study site and back to the lab, that you labeled items, that you worked with your partner etc. Standard good practices do not need to be shared!

- Summarize the procedure that we (feel free to say we-since we did it as a lab) performed in your own words using active past tense (this should make sense since you already did it!).
- Details are important-sample size-how many samaras did we drop (how many rows of data), where did we drop them? (just note that we did it inside-not important where inside)
- Precise date, time, and location may be relevant for a field study and perhaps a greenhouse study, but are **not** usually needed for a lab or indoor experiment.

Results

- Describe just your results and each of your graphs in words (without any discussion of the ramifications of your results, but do point out trends or important features). You should highlight major patterns of each of your graphs. What do the boxplots show about how medians and the variation or spread in the data differ? Maybe there are no differences, but maybe there are interesting patterns as you look at each species. How about your scatter plots? Do you see clear relationships or not so much? Always report the direction of any difference or relationship when you are referring to scatterplots and have fitted a line. Was it a positive or negative slope? Do feel free to provide any other comments here such as comments on the range of the data (is it huge?) Or any other things that stand out. **In this write-up you will only report on the data that you are graphing!**
- Refer to all figures and tables by putting the figure reference at the end of appropriate sentences. "There were fewer galls on larger leaves (Figure 1)." We typically avoid saying things like "Figure 1 shows…." It is just a little less concise.
- DO NOT discuss why you think you saw the patterns -just note the pattern itself! (Discussions of "Why" always go in the Discussion!

Discussion/Conclusion (None needed-yay!)

Citations (Literature Cited)

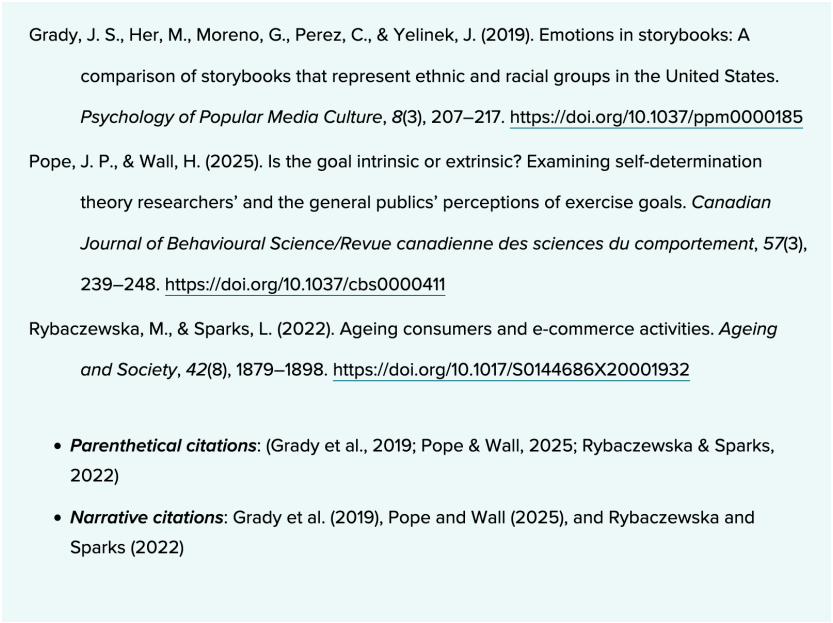
How are your Zotero skills??? Remember to insert citations into your paragraphs and Choose APA style as your citation style (as Audrey showed you in our session and as shown below). We like APA because it is super simple and very similar to one of the main biology styles. The GIGO rule applies here (Garbage in, Garbage out). Sometimes citations are not imported correctly and so you will need to change them manually, especially the **titles** and **scientific names**. Those species names need to be in **italics like this-** *Homo sapiens*. Remember you can edit your citations in Zotero itself. To get scientific names in italics you need to correct the code so that it looks like this: <i> Acer saccharinum <i> Titles of journal articles should use sentence punctuation-do you know what that means? You may need to go in and remove capitals from the titles of papers!!!!

These should be "real" primary literature sources from peer reviewed science journals-not newspapers or magazines or websites, or encyclopedias. Be sure you know how to recognize a primary literature paper. Use the library research databases that you learned about. But many of us also use Google Scholar. You can compare and contrast what you get

searching using the same search terms in multiple databases. How many citations is a “good number”? What is your “feeling”? (Honestly, I would lean towards at least 3 or 4.)

Refer to your citations in the body of your text, no quotes are ever needed. No first names should be in your “in text” citations (this means those in the body of your paper). Zotero should put the last name and year in parentheses at the end of the sentence as we did in our training (see examples below). When you insert citations into your paragraphs and there is one author it should show up as (Gonzalez 2023). When you insert citations into your paragraphs and there are two authors it should show up as (Congdon and Niculescu 2021). If there more than two authors they should show up as (Hjalten et al. 2023).

Avoid websites since they are not primary literature. In general websites can be a good way to initially explore your topic but they are not considered PRIMARY PEER REVIEWED LITERATURE! Never, ever, cite an encyclopedia in this class.



Grady, J. S., Her, M., Moreno, G., Perez, C., & Yelinek, J. (2019). Emotions in storybooks: A comparison of storybooks that represent ethnic and racial groups in the United States. *Psychology of Popular Media Culture*, *8*(3), 207–217. https://doi.org/10.1037/ppm0000185

Pope, J. P., & Wall, H. (2025). Is the goal intrinsic or extrinsic? Examining self-determination theory researchers’ and the general publics’ perceptions of exercise goals. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, *57*(3), 239–248. https://doi.org/10.1037/cbs0000411

Rybaczewska, M., & Sparks, L. (2022). Ageing consumers and e-commerce activities. *Ageing and Society*, *42*(8), 1879–1898. https://doi.org/10.1017/S0144686X20001932

- ***Parenthetical citations***: (Grady et al., 2019; Pope & Wall, 2025; Rybaczewska & Sparks, 2022)
- ***Narrative citations***: Grady et al. (2019), Pope and Wall (2025), and Rybaczewska and Sparks (2022)

https://apastyle.apa.org/style-grammar-guidelines/references/examples/journal-article-references

Figures (Graphs)
Remember figure legends or “titles” or “captions” should go below the figure. While in lab we may practice adding a figure legend in after you paste your graph into your google doc. The format for that figure legend is very specific! It needs to have “Sentence punctuation”! Generally, we do not put a title above our figures/graphs. For example, you might write something like this under your graph: Fig. 1. Wing loading and distance samaras drifted in two different maple species. Remember to add a period at the end! Do spend time making your graphs look good.

FYI: Table legends do go above the Table (but you likely do not need a table for this paper). Do not repeat the same data in both a table and a graph if you use a table in the future.

- A graph is preferable to a table and never simply list your raw data. Sometimes journals will have an appendix with raw data if data are meant to be shared with others.
- Label the axes or columns and define all treatments and include units. When you have two words labeling an axis the second word is very typically lower case.
- Write informative Figure legends so that it is not necessary to refer back to the report to understand the Figure. Hint-**Do not write “vs” in your figure legend**. Figures should stand alone.

We generally put the Independent variable on the x axis..in this case the independent variables are sort of the variables we “started with” or that were “given to us" by the samara. So these would be…Mass and Wing loading! The

other variables are the variables we measured like Distance and Time. Since these will "depend" on the independent variables they are referred to as dependent variables.

What data should I use?

When you stepped through and ran the code we shared in lab in the R (the Rmd file), you compared the Amur and Silver subsets of data. Since that is what the Rmd file instructions came with, you will NOT use those analyses for your write-up. Instead, you may choose to compare either Amur Maple Samaras with Sugar Maple Samaras OR Sugar Maple Samaras with Silver Maple Samaras. So… your research write up will focus on one or the other-not both!

You might remind yourself of all our variable names. Remember the Species column is basically a categorical variable (you wrote in there either Amur Maple, Silver Maple or Sugar Maple). If you look over the other column names, you will notice that they are continuous variables. In those columns you put a measurement (Distance, Time, Mass and then you calculated Area and Loading and SeedPercent).

Given that you calculated Loading and SeedPercent you might remind yourself what these variables tell you? FYI: Wing loading is calculated as the mass (g) divided by the area of the wing or in our case the estimated area of the entire fruit (length x width) so units would be g/mm^2. You might try researching this calculation. It is handy because it combines several of our variables into a single relevant measure.

Remember that there are two figure types you all made in R: boxplots (which demonstrate the spread of a single continuous variable like area or distance- against a categorical variable like species), and point plots or scatter plots (which compare two different continuous variables-again with two lines representing two species).

- Your **first graph** will be a box plot of Distance comparing the two species you chose to compare.
- Your **second graph** will be a point plot or scatter plot with trend lines. Choose any two continuous variables to compare in your two selected species. The data for both species should be on the same graph, just like we did for the Amur Maple and Silver Maple comparison. Remember, a scatter plot shows you the relationship between two continuous variables (think height and weight of people-if height goes up do you expect weight to also increase?).
- Your **third graph** will also be a point plot or scatter plot with trend lines. Choose a separate set of continuous variables to compare and once again you will have both of your species on a single graph.

Remember: Look over later "chunks" in the Rmd file (highlighted in gray boxes) that show you how to **change your labels to add units**…I'm going to have you NOT INCLUDE A TITLE ABOVE YOUR GRAPH, because you should add a really awesome Figure legend and paste it below your graph in your Google doc!