Writing a Biology Lab Report

A special thanks goes to Katie Jones, the author of our biology lab report samples. Without her, we wouldn't have been able to create this guide. Our gratitude also goes to Dr. Steven Karafit and Dr. Kari Naylor. They visited a Writing Center professional development meeting and graciously talked to us about their expectations for biology lab reports. Thank you!

Purpose:

The purpose of a Biology lab report is to describe and analyze a laboratory experiment that explores a scientific concept so that other scientists might be able to replicate the experiment and investigate the principles of it.

Style Guidelines:

Scientific writing is very concise and precise. The least amount of words you can use to express an idea, the better and more scientific your writing will be. Some additional guidelines to follow are:

- Margins should not be less than ½ inch.
- The font should be 12 pt.
- The paper should be written entirely in 3rd person. No personal pronouns should be used.
- If referring to anything that happened in the past, then use the past tense. For example, if you are writing about an experiment you have already performed, then refer to it in the past tense. Present tense should be used when referring to a scientific principle, such as, "Water is two parts hydrogen and one part oxygen."
- Document your sources. When incorporating information into your lab report from another source, you should always document where you found the information. The documentation style is not necessarily a specific style; you can use whichever style you are most comfortable with. If using MLA, APA or Chicago style, please refer to our style guides in our online resources for more help. Also, no quotations should be used in a laboratory report. This means that you should always be paraphrasing when presenting an idea other than your own. As defined in our MLA style guide, "paraphrasing" refers to the process of putting an author's words entirely into your own voice and style and integrating them into your work with a lead-in phrase and parenthetical note. A paraphrase, then, is not the direct

words of the author you are paraphrasing with a few words changed. It is completely your words explaining what the author said. For more information on paraphrasing, refer to our style guides

Format:

- Introduction
- Methods
- Results
- Discussion
- Conclusion

Introduction:

- **Define the topic**. The first part of a lab report should set up the topic being investigated by providing background information on it and clearly explaining exactly what you are testing.

- **Explain the significance of the topic.** How does this topic relate to the world of biology? Why is this experiment topic important? Why is this experiment important? Essentially, you should describe why your audience should pay attention to this experiment.

- **Present the hypothesis and research question.** Your hypothesis when performing the experiment should be identified in this section along with the research question(s) you are addressing. If you have more than one hypothesis, they should all be identified.

- **Define the overall goal.** Whether you have one hypothesis or many hypotheses, they should all be pointing to one overall goal. This goal should be clearly defined and explained in conjunction with your hypothesis.

- **Give an overview of the lab methods.** Explain what experimental system you will be using to test your hypothesis and why you chose that particular system. What advantages does it provide? If the system you used was provided for you in another text, explain why they chose that particular system. Then you should identify what you are measuring in the lab.

- **It should be 1 page in length.** The introduction should only be about one page total. If it exceeds this by much, you can probably eliminate some of the length by making your language more concise.

Introduction Section Example:

Prior to human development and inhabitation, Arkansas had very diverse aquatic ecosystems. However, one may assume that these diverse ecosystems were hindered by the increasing human population throughout the area. To measure the impacts of human development on the diversity of a creek, species richness and species evenness were determined for an urban creek and a rural creek. The urban creek, Tucker Creek, is a creek surrounded by human development. The developments include neighborhoods, a bike trail, and roads built within a close radius of the aquatic ecosystem that runs through the urban areas of Conway. During the time of testing, bulldozers and other equipment were in use causing even larger disturbance in the area. The rural creek, Cadron Creek, is less impacted by humans and allowed to flow freely at the testing site. There were roads built nearby, with bridges crossing the river. However, the roads were normally several hundred feet from the river with occasional boat ramps. The main human impact would occur by fishing and boat usage on the river. It was predicted that Cadron Creek would exhibit larger species diversity than Tucker Creek due to fewer disturbances. By determining species richness and species evenness by examining fish communities present in each aquatic ecosystem, one may determine the relative health of the aquatic system due to the understanding of specific requirements and degree of tolerance each species has.

Comment [U1]: The topic is defined.

Comment [U2]: A brief overview of the methods.

Comment [U3]: The present tense is used here because this is the current state of Tucker Creek.

Comment [U4]: The hypothesis.

Comment [U5]: This is the overall goal.

Methods:

- **Explain what steps were taken in performing the experiment.** This is the section where you describe the procedures you used in conducting the experiment.

- **Use the narrative format.** This section should not be in a list format or read like a recipe. The information should be relayed in a story type of writing.

- **Only include the important details.** Not every detail needs to be included. Only the relevant elements should be mentioned. If a scientist would need

to know a certain aspect to repeat the experiment, then it should be included. Otherwise, leave it out.

Methods Section Example:

This experiment was designed to show the effects of competition upon the survival and growth of *Brassicus napas* and *Trifolium repens* in a five week time period. Both plants are known to have moderate-rapid growth, and are easy to identify. They are relatively common and frequently used in experimentation due to inexpensive cost. To study the influence of intraspecific competition, six seeds of *Brassicus napas* were potted in each of the seven labeled plastic plant pots and six seeds of *Trifolium repens* were potted in each of the next seven labeled plastic plant pots. To study the influence of interspecific competition, four seeds per plant pot of each species were planted in seven more labeled plastic plant pots. Each pot contained un-fertilized soil. The potting steps were repeated. The second group of plant pots (containing 7 *Brassicus napas*, 7 *Trifolium repens*, and 7 mixed) were placed in an area where they would receive fertilizer treatments at regular intervals. After two weeks, each pot was thinned in order to regulate the number of plants per pot, and to regulate that each species had an equal number of individual organisms in the mixed pot. This would ensure the most precise results. After five weeks, the average numbers of individuals present in each pot was recorded and a t-test was run to determine the accuracy of the hypotheses.

Comment [U6]: The purpose behind each method is explained so that the reader can see why the author included this step in her methods section.

Comment [U7]: This experiment has already happened, so it is described in past tense.

Results:

- **Distinguish between multiple experiments.** If this report includes multiple experiments working towards the same overall goal, then each experiment should receive its own paragraph in this section. In each paragraph, explain what you did, why you did it, and what the results were.

- **Use visuals where appropriate.** A well-executed graph or table representing your results can be very effective in communicating data from your experiment. However, a figure cannot stand alone in communicating the results of an experiment. Any figures should be explained in the text of the results section. For more detailed help on constructing a figure, see http://faculty.uca.edu/skarafit/bio1/Lab 1/figures.htm.

Results Section Example:

After compiling all the results into two tables, one may see that there is a large difference in the abundance of species, or species richness, between Cadron Creek and Tucker Creek aquatic communities. There were 16 different species of fish discovered in Cadron Creek, and only 7 found in Tucker Creek (Table 1, Table 2). The species proportions, or species evenness, were also very different. There was a much higher proportion of the dominant species in Tucker Creek compared to the dominant species proportions found in Cadron Creek. The Shannon-Weiner Index of Cadron Creek fell within the normal range (1.5-3.5) at 2.434, whereas the Shannon-Weiner Index of Tucker Creek was slightly lower than the normal range at 1.4. The higher Shannon-Weiner Index value shows a higher species evenness and species richness in Cadron Creek's community structure (Figure 1).

Comment [U8]: The author explains what the reader should be seeing when looking at the accompanying tables and graphs. The data is not left to explain itself.

Cadron Creek	Hwy 285 Access		19-Apr-11	Column1	Column2	Column3
Common Name	**Scientific Name**	**rank**	**Total Abundance**	**proportion of species**	**ln(pi)**	**pi x ln(pi)**
Steelcolor Shiner	*Cyprinella lutrensis*	*1*	22	0.23	-1.473	-0.338
Brook Silverside	*Labidesthes sicculus*	*2*	12	0.13	-2.079	-0.260
Bigeye Shiner	*Notropis boops*	*3*	10	0.10	-2.262	-0.236
Orangethroat Darter	*Etheostoma spectabile*	*4*	9	0.09	-2.367	-0.222
Fantail Darter	*Etheostoma flabellare*	*5*	8	0.08	-2.485	-0.207
Wedgespot shiner	*Notropis greenei*	*6*	7	0.07	-2.618	-0.191
Redfin Shiner	*Lythrurus umbratilis*	*7*	6	0.06	-2.773	-0.173
Slender Madtom	*Noturus exilis*	*8*	5	0.05	-2.955	-0.154
Longear Sunfish	*Lepomis megalotis*	*9*	3	0.03	-3.466	-0.108
Channel Darter	*Percina copelandi*	*10*	3	0.03	-3.466	-0.108
Dusky Darter	*Percina sciera*	*11*	3	0.03	-3.507	-0.105
Greenside darter	*Etheostoma blennioides*	*12*	3	0.03	-3.466	-0.108
Central Stoneroller	*Campostoma anomalum*	*13*	2	0.02	-3.871	-0.081
Speckled darter	*Etheostoma stigmaeum*	*14*	1	0.01	-4.564	-0.048
Bluntnose Minnow	*Pimephales notatus*	*15*	1	0.01	-4.564	-0.048
Spotted bass	*Micropterus punctulatus*	*16*	1	0.01	-4.564	-0.048
					H'=-∑pi x ln(pi)	2.434

Table 1. Calculating species diversity for the fish community of Cadron Creek in the Spring 2011. Sixteen species were discovered using the two methods of seining: seine haul and kick sets. The proportion of the species declined as the rank of the species decreased. The Shannon-Weiner Index was calculated using the sum of column 3 (p_i x ln(p_i)). The results were based on n=3.

Tucker Creek	Tuesday	Column1	12-Apr-11	Column2	Column3	Column4
Common Name	**Scientific Name**	**rank**	**Total Abundance**	**proportion (pi)**	**ln(pi)**	**pi x ln(pi)**
Red shiner	*Notropis lutrensis*	*1*	53	0.54	-0.625	-0.335
Western Mosquitofish	*Gambusia affinis*	*2*	14	0.14	-1.956	-0.277
Brook silverside	*Labidesthes sicculus*	*3*	13	0.13	-2.030	-0.267
(red tailed minnows)	*(unknown)*	*4.00*	8	0.08	-2.516	-0.203
Blackspotted Topminnow	*Fundulus olivaceus*	*5*	7	0.07	-2.649	-0.187
Largemouth bass	*Micropterus salmoides*	*6*	3	0.03	-3.497	-0.106
Longear Sunfish	*Lepomis megalotis*	*7*	1	0.01	-4.595	-0.046
					H'=-∑pi x ln(pi)	1.421

Table 2. Calculating species diversity for the fish community of Tucker Creek in Spring 2011. Seven species were discovered using seining. The proportion of the species declined as the rank of the species decreased. The Shannon-Weiner Index was calculated using the sum of column 4. The results were based on n=3.

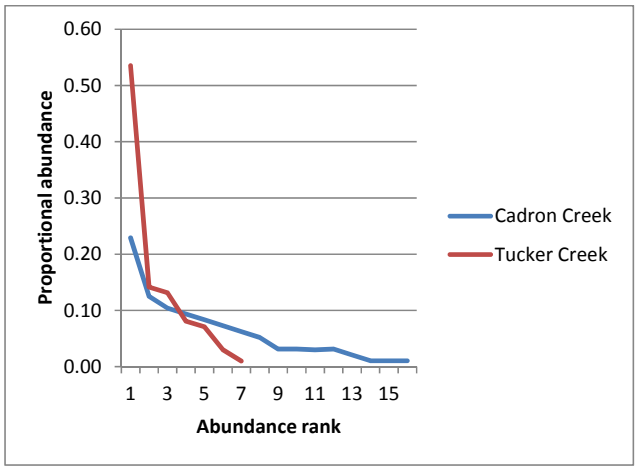

Figure 1. Comparing the species diversity of the fish communities in Cadron and Tucker Creeks. Tucker Creek had relatively few species with high proportions of the dominant species. Whereas Cadron Creek

had multiple species, with smaller species proportions. The higher the abundance rank, the larger the species richness; the larger the area under the curve, the greater the species evenness. Cadron Creek shows a significant increase in species richness and species evenness when compared to Tucker Creek.

Discussion:

- **This section carries the most weight.** Most professors pay the closest attention to this section because this is where students interpret what they have discovered.

- **Reiterate the results.** Remind the reader of what you found in the results section of the lab report. If more than one experiment was conducted, separate the individual experiments into individual paragraphs just as they were in the results portion. Rather than saying the same information over again though, discuss the results in the context of the overall goal of the experiment, which was identified in the introduction of the report.

- **Interpret the results.** The reader needs to know what the results of the experiments mean. Why is the data like it is? Why is this data important to know? Answering these questions will take raw data and make it meaningful for the reader.

- **Discuss potential modifications for the experiment.** If a person wanted to replicate this experiment, what might they change about it to create further progress in this topic area? This is not about correcting mistakes made in conducting the experiment. What should be discussed here is how to modify the methods of the experiment to push scientific knowledge in this topic forward.

Discussion Section Example:

The purpose of this experiment is to observe the effects of intraspecific and interspecific competition on two different plant species, and to observe how fertilizer effects competition in the plant species. It is predicted that the *Brassicus napas* will be more negatively impacted than *Trifolium repens* by intraspecific competition, because *Brassicus napas* must compete for nitrogen resources. *Trifolium repens* has the ability to fix the nitrogen it requires to survive and grow. For this

Comment [U9]: In this paragraph she reiterates the information from the introduction.

same reason, it is also expected that the *Trifolium repens* will outcompete *Brassicus napas* when grown together. It is also expected that there will be less intraspecific competition within the fertilized group, because more nitrogen will be available.

The results do not support the hypotheses (p-value>α; α=0.05). The results show no significant difference between the average biomass of each species when grown on its own without fertilizer. After performing the t-tests for the experiment done without fertilizer, the results refute the hypothesis that *Brassicus napas* would be more negatively affected by intraspecific competition, and the hypothesis that stated *Trifolium repens* will outcompete *Brassicus napas*. This is very significant. Even with the ability to fix nitrogen, *Trifolium repens* did not grow faster or survive longer than *Brassicus napas.* This may have to do with the plant maturation. *Brassicus napas* is recorded to being a rapid growing plant, whereas *Trifolium repens* is recorded to growing at a more moderate speed[1,3]. If *Brassicus napas* was able to grow enough, it would outcompete *Trifolium repens* for available space in the small planting pots.

The results did not show any significant difference between the average biomass of *Trifolium repens* when it was grown on its own using fertilizer. This was determined by a two-point t-test (α=0.05) between *Trifolium repens* grown on its own and *Trifolium repens* grown in the presence of *Brassicus napas*. The p-value was much greater than α, thus refuting the hypothesis that *Trifolium repens* would be effected by interspecific competition. A two-point t-test (α=0.05) between *Brassicus napas* grown on its own and *Brassicus napas* grown in the presence of *Trifolium repens* did support the hypothesis that less interspecific and intraspecific competition would occur in *Brassicus napas* in the presence of fertilizer. The decline in both types of competition may be accounted for by the introduction of nitrogen into the soil. The plant no longer competes for the limited supply of nitrogen, and is able to grow much more quickly than when no fertilizer was added. *Trifolium repens* was not affected, because its growth was not limited by nitrogen availability. Further experimentation should be performed to determine *Trifolium repens*' limiting growth factor, whether it is space availability, nutrient availability, or any number of other factors.

According to Snaydon in his research on the effect of competition on the growth of *Trifolium repens*, competition may have little influence on shoot growth due to a short period of growth. However, if allowed to grow longer, on may see that more competitive ability of the populations of *Trifolium repens* may lead to larger leaf size and long petiole lengths. Competition does have a significant impact on roots in Snaydon's experiment. The roots are noted to compete for Phosphorus found in the soil. This increases the root competition. This increased

Comment [U10]: She recommends further research based off of the research done in this experiment. This furthers scientific knowledge in this area and should always be addressed in the discussion section.

Comment [U11]: Even though her research didn't support her hypothesis, she refers the readers to other scientists whose findings did support her hypothesis.

competition may influence the length of the root system, the ability to extract nutrients through the roots, and prevent the plant from fully maturing in low nutrient concentrations[5].

Comment [U12]: She uses Chicago style to correctly cite the outside sources she used.

Snaydon's findings support the results of the experiment done described by this paper. There was an overall increase in biomass of *Trifolium repens* with the addition of nutrients. However, there was no significant difference between interspecific competition and intraspecific competition recorded. It did not outcompete *Brassicus napas* when grown together, because it was limited by nutrients found in the soil as well. For further testing, one may measure the average biomass of undergrowth for each plant and compare it to see if competition affected the root system.

A second experiment was performed by Andersen to examine the competitive effects of a two-component intercrop. There are potential benefits and detriments when plants are grown side by side. The results of this study concluded that *Brassicus napas* has an early competitive advantage that allows it to grow well among all intercrops as early as two weeks after growth was first observed. Andersen also suggests that this rapid growth may utilize most the nitrogen in the soil and suppress any other species grown alongside *Brassicus napas*[6]. This experiment supports the results described previously in this paper. *Brassicus napas* outcompeted *Trifolium repens* when fertilizer was added. Nitrogen was no longer a limiting factor and *Brassicus napas* suppressed the growth of *Trifolium repens*.

[5] Snaydon, R. W. (1971). An analysis of competition between plants of Trifolium repens l. populations collected from contrasting soils. *Journal of Applied Ecology*, 8(3), 687. Retrieved from EBSCO*host*.

[6] Anderson, M., Hauggaard-Nielsen, H., Weiner, J., & Jensen, E. (2007). Competitive dynamics in two- and three-component intercrops. *Journal of Applied Ecology*, 44(3), 545-551. doi:10.1111/j.1365-2664.2007.01289.x

Conclusion:

- **This section is not always required.** Some professors feel as if the discussion section also functions as a conclusion. However, many do still expect a conclusion section after the discussion. The conclusion pulls the discussion section into the context of the introduction.

- **Restate the results and discussion.** Briefly reiterate the ideas from the results and discussion sections in the context of the overall purpose of the experiment that was identified in the introduction. Do the ideas from the results and discussion support the hypothesis? What can you conclude about the topic being investigated from this experiment?

Conclusion Section Example:

As mentioned earlier, this experiment has led to many other researchable questions. Further testing should be done in order to determine the effects of competition upon the average biomass of root systems of *Trifolium repens* and *Brassicus napas* to determine if the *Trifolium repens* undergrowth was also suppressed by the rapid growing *Brassicus napas.* The hypothesis for this experiment would state that the rapid growing *Brassicus napas* would outcompete *Trifolium repens* and that the root system of *Trifolium repens* would be much smaller in the presence of another species. A second experiment may be performed to determine the limiting factor of *Trifolium repens*, whether it is nutrients or space availability. The hypothesis for this experiment would state that space and nutrients were both limiting factors in the growth of *Trifolium repens*. This would explain how *Brassicus napas* so successfully outcompeted *Trifolium repens* in the current experiment. Even though many of the results did not support the hypotheses, one may conclude that intraspecific and interspecific competition did occur in each experiment.

Comment [U13]: She refers them to earlier sections of her report.

Comment [U14]: She explicitly states that her hypothesis was not supported and then makes a conclusions based on her research and earlier research mentioned in the discussion section.