

Name _____

Directions

Before completing this assignment, please read the lab manual pages vii-xi, watch the overview video, and read this awesome paper on piranha behavior: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1626212/pdf/rsbl20040267.pdf>. Then answer the questions throughout the worksheet to explore the content and apply it.

This assignment has three goals.

- I. To help you develop an essential skill for scientists: **writing a clear, testable, predictive hypothesis**. This is an important skill, no matter your major, because it will develop your ability to write clearly and concisely.
 - II. To give you **practice with the terminology used in experimental design**. Use of this terminology is necessary for success in future lab experiments!
 - III. Help you become familiar with **interpreting and analyzing scientific literature**, skills that will be increasingly important as you start writing about the work that you do in the laboratory..
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- I. **Hypotheses are tentative explanations for observations and are essential for designing experiments that are testable.** For example, if you observed that the internet wasn't working, you might have a hypothesis that you are logged off of UCA's network. You might then predict that logging back in will fix the problem. You could then write a predictive research hypothesis that combines your hypothesis, your experimental design, and your prediction:

If I cannot connect to the internet because I am logged off of the network and I log back onto the network, then I will be able to reconnect to the internet. Predictive hypotheses are written in an **"If... and... then"** format.

If... *is followed by a tentative explanation for your observation:* **If** I cannot connect to the internet because I am logged off of the network...

and...: *is followed by your experimental procedure:* ...**and** I log back onto the network...

then... *is followed by your prediction:* ... **then** I will be able to reconnect to the internet.

To solidify your understanding, you can start by identifying the parts of a hypothesis and then apply it to a new scenario. **Pretend you make the following observation and hypothesis.**

Observation: After a prairie fire, grass often comes back thicker and taller than before the fire.

Predictive Hypothesis: If fire replenishes nutrients in the soil and a farmer burns the prairie, then the grass will grow back significantly taller the next year compared to the current year.

1. Identify the following parts by: A. **Circling (or if completing digitally, highlighting in yellow)** the hypothesis; B. **Drawing a box (or highlighting in green)** around the methods; C. **Underlining (or highlighting in blue)** the prediction for the predictive hypothesis above. (1 pt)
2. Now **practice writing your own** hypothesis, prediction, and predictive hypothesis for the following examples. (1 pt)

Observation: Beet root cells placed in 20% ethanol solutions seem to suffer from cell membrane damage, causing betacyanin (the red pigment in beets) to leak out.

Hypothesis: Ethanol damages the membranes of beet root cells.

Method of Investigation:

Prediction:

Predictive Hypothesis:

If-

And-

Then-

- II. Let's continue this exploration and build on what you have learned. Write a hypothesis, prediction, and predictive hypothesis for the following observations. Then, add to your analysis by identifying the different variables and control(s).

Observation: Bean plants that are given fertilizer grow taller than plants that do not receive fertilizer

Hypothesis:

Method of Investigation:

Prediction:

Predictive Hypothesis:

3. If you were going to design an experiment for #3 above, what would the **dependent** and **independent variables** be? **How did you know?** (1 pt)

Dependent:

Independent:

4. What would your **control condition** be? Why do you need a control for this experiment? (1 pt)

III. Having the **ability to read and write scientific papers will empower you** to explore what others have discovered about topics you are interested in and tell others about your research as well. Typically, these papers are organized in similar formats to make them easier to process and for the reader to find the parts that matter most to them at that time. **Most papers will start with an abstract, then present an introduction, methods, results, conclusions/discussion, and a reference section to cite literature used to support statements.**

To explore this format, let's use an exciting piece of scientific literature about Piranhas.

Hop into the **paper by clicking the URL**. Read it from the beginning and work your way through to the citations at the end. Do not get discouraged if you are confused by any of the terms; underline or highlight confusing jargon as things you need to look up to better understand. **Note: You do not need to understand the statistical analyses in this paper at this time.**

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1626212/pdf/rsbl20040267.pdf>

Now work your way through the following questions about each section.

In the Introduction

5. What Hypothesis do the researchers propose to test in this paper? Rewrite it as an “if...and...then” hypothesis. Did the researchers make more than one prediction? If so, be sure to include these in the hypothesis or hypotheses. (2 pt)

6. What are three words in the introduction that you had to look up? Explaining their meaning in your own words. (1 pt)

New word #1:

New word #2:

New word #3:

In the Methods

7. When and where was the experiment conducted? (1 pt)

8. What was the control for the simulated attack experiments? (1 pt)

In the Results

9. Based on Figure 2 in the article, do the results support the hypothesis that larger groups provide better protection from predators? Explain your reasoning using the data. (1 pt)

In the Discussion

10. According to the authors, what is the main reason for piranhas forming large groups? (1 pt)

11. What are two limitations of this study that the authors mention or that you can identify? How might future research address these limitations? (1 pt)

In the References

12. What is the difference between paraphrasing and direct quoting? How many times do the authors of this paper **directly quote** other sources? (1 pt)

13. If you were to cite the piranha paper in a paper that you wrote, how would your citation look in the literature cited section of your paper (see lab manual Appendix D for information)? (1 pt)

14. Add an in-text citation for this paper to the sentence below, similar to how you would do this in your own writing. (1 pt)

While piranha are often thought of as fierce predators, they may actually swim in groups in order to avoid being eaten themselves ().