A Guide to Writing Scientific Lab Reports

Scientific writing is essential for the dissemination of research results, and the ability to clearly convey detailed information to someone else is essential in any career. The best way to prepare for writing your lab report is to be sure you understand the experiment you are writing about. If you are not clear on the purpose or procedure of the experiment, talk to your instructor or a classmate. Start by creating an outline for the report using the sections listed below. As you are working on your report, imagine you will be giving the report to your roommate or parents – someone who was not present for the experiment. The reader should be able to understand the purpose, methods, results, and significance of the experiment just by reading the report.

Do not plagiarize! Plagiarism is using any idea, text, or information that is not your own without proper citation, thus presenting the work as if it is your own. Inappropriate use of someone else's work is plagiarism, regardless of whether or not you intend to plagiarize. Furthermore, even if you work with a partner in lab you should not both submit the exact same lab report. This is also considered plagiarism. You must write your own lab report. You are responsible for and will be held accountable for your own work. Handing in a report that is full of quoted text and citations with very little of your own writing is also not appropriate.

One strategy for preparing a report in your own words is to carefully read and take notes on the topic you're going to write about, then, without looking back at your books or notes, describe out loud the purpose of the experiment, what you did, what you observed, and what it means. Then go back and write down what you said. Where you described something that you had read elsewhere, cite the source. By explaining the report out loud without looking at notes, books, or the computer, you will be forced to put everything in your own words. Lab reports take time and revision. Don't wait until the night before it's due and expect to write a quality product!

Lab Report Format

Keep text between 10 – 12 point fonts, and use standard fonts (ex. Ariel, New Times Roman, Calibri, etc…), and single or double space is fine. There is no set report length. Just say what you need to say. Some people are skilled at writing concisely while others are less so. I'm not grading you based on length but quality of the report. Your report should include the following sections, and one section can directly follow the previous, without the need for separate pages per section. Spelling and grammar will count!

Title

The title should indicate in some detail what the report is about. Under your title include your name, your lab section, and the date. The title does not need to be on a separate page.

Abstract

The abstract contains a summary sentence or two from each of the sections below (introduction, methods, results, and conclusion) without presenting numbers or citations. Because it is a brief summary of the report, you should write this section after you've completed the other sections.

Introduction

The introduction provides background information on the topic to be covered. **In your lab report you MUST cite from the Wikibooks textbook as a bare minimum reference for your background!** For example, if the report was on how blood pressure changes with different body postures you would want to paraphrase background material on how the body regulates blood pressure. Relevant vocabulary and concepts (such as those we covered in lab or lecture) should be described. You would glean this information from a source (like the textbook). After paraphrasing that material you end the sentence with an in-text citation, giving credit to the source for that material. [See example lab report Introduction section below.] For example, take the following sentences and citation: Normally there are minor fluctuations in blood pressure throughout the day, depending on activity and changes in body posture. The brain stem detects these fluctuations and stimulates modification in blood pressure as needed if that pressure deviates from normal range (WebNet.com). *Changes in blood pressure, either above or below the normal range, stimulate corrective responses by the medulla oblongata. If blood pressure decreases or increases above normal range the medulla responds by either a sympathetic or a parasympathetic stimulation. For example, a drop in blood pressure below the set point is detected by baroreceptors within the aortic arch and carotid sinus. This information is relayed to the medulla, which*

stimulates a sympathetic increase in heart rate and vasoconstriction of systemic arterioles, and these compensatory responses will increase blood pressure[1].Make sure you *paraphrase* the information from the text by putting the information in your own words. Don't copy (word-for-word) what is written in the textbook because that is considered plagiarism. If you choose to make direct quotes that material must be within "quotation marks", and then you site your source immediately after it. For example, take the following sentence and citation: "*Input from baroreceptors can also mediate the opposite response. When blood pressure rises above an individual's normal range, the baroreceptor reflex causes a slowing down of the cardiac rate and vasodilation"*[1].

Explain the purpose of the experiment, and how it is important to physiological function. At the end of the introduction, state a clear, testable hypothesis for the experiment(s) being covered. This includes what you would expect might happen as an outcome of the experiment. For example: *I hypothesize that, based on what we know about blood pressure regulation, changing from a supine to an upright posture will cause an increase in blood pressure as a compensatory response by the body.*

Materials and Methods

Explain how you did the experiment and what materials you used. You are reporting on something that happened in the past, so write it in past tense. Explain what you did and how you did it. If the lab report is written based on class data (which is USUALLY the case) you can simply explain how the basic experiment was conducted and how many people (subjects) were involved in the data collection. You should also explain how the data was summarized and analyzed (such as in an Excel spreadsheet). What analyses were performed to compare the data sets (T-test, ANOVA)?

Results

The results section needs a written portion, in addition to any data tables and figures. In this written portion you should report any summary data (such as class averages of data sets for different conditions) and then, if the data was statistically analyzed, report the "P-values" and then report any significant differences found among the experimental groups (which groups were the same versus different) . You DO NOT explain your data in the results section! You simply report averages and differences among groups, and P-values, and refer to your tables and figures. You will explain your data results in the discussion section.

Discussion

The discussion section should include the interpretation of your results. You do not need to repeat the numbers stated in the results section but need to explain the physiological basis for the differences you observed. If something changed WHY did the change occur? What is the physiological basis for what you observed in the data? It is important in this section to tie together what your experimental results mean within the broader context of the physiology of the topic you were examining. To end the discussion you can also mention possible sources of experimental error here. Sometimes things go wrong. That's okay. You can explain that here as well.

Literature Cited

Provide the full citation for all in-text citations provided earlier in the report. Below I've given you several examples of how you would provide a literature citation properly. In general, for a Human Physiology lab report you MUST at least use the course textbook as one of your references within the report. Additionally, you can use scientific journal articles. Textbooks and journal articles are the preferred and most accurate sources for any biological report. If appropriate you can use a science-based web page or article (ex. Medline, WebMD, etc…). In general, "Joe Blow's web page just doesn't cut it for a college lab report citation. Also, **DO NOT use the lab handout as a literature source UNLESS that handout has a citation within it giving the source of its background material.** In general, our lab handouts have no citations.

<u>Citing our course textbook</u>:

1. Wikibooks Contributors, Human Physiology 2006. (http://en.wikibooks.org/wiki/Human_Physiology) Pg. _____

<u>Citing a journal article:</u>

1. Olufsen, M.S., J.T. Ottesen, and H.T. Tran (2005). Blood pressure and blood flow variation during postural change from sitting to standing: model development and validation. *Journal of Applied Physiology* Vol. 99 No. 4, 1523-1537.

Citing a textbook:
1. Fox, S.I. (2016) Human Physiology 13e. McGraw-Hill Co. (Pgs 8-10).

Citing a web source:
1. WebNet.com (http://www.medicinenet.com/script/main/art.asp?articlekey=17237)

Sample Lab Report

Osmosis Across an Egg Membrane Based on Tonicity of External Environment

"Student Q", Department of Biology, Francis Marion University, Florence SC.

Abstract

In this study we examined the effects of hypertonic and hypotonic solutions on osmosis through egg cell membranes. We measured the original volume of decalcified eggs, and then soaked the eggs in high fructose corn syrup (a hypertonic solution) and water (a hypotonic solution) for two hours, or 30 minutes, respectively, and measured changes in egg volume. We found that eggs soaked in corn syrup shrunk in volume and eggs soaked in tap water increased in volume.

Introduction

Osmosis is a form of passive transport of water across a cell membrane. Water passes through cell membranes based on the concept of tonicity, or the concentration of solutes, dissolved in water, found on both the inside of the cells or the cell cytoplasm, and on the outside of the cells or the extracellular space[1]. If the exterior of a cell contains a higher concentration of dissolved solutes compared to the inside of the cell, then the solution on the exterior of the cell is considered hypertonic to the inside of the cell, which is considered hypotonic. For a cell placed in a hypertonic solution, water will cross the cell membrane, by osmosis, to enter the extracellular space. Thus, the cell loses water and can shrink or crenate, leading to cell death. If the inside of the cell is hypertonic compared to the exterior, then water will enter the cell membrane by osmosis, and the cell could swell or possibly burst, leading to cell death. Therefore, tonicity of the solution a cell is surrounded by has a powerful effect on that cell due to the osmosis of water across the cell membrane. In order for cells to remain unchanged by the exit or entry of water across their membrane, they must be surrounded by a solution that is isotonic, or is of equal concentration of solutes as is found inside the cell[2]. The purpose of our experiment is to examine changes in a cell (a chicken egg cell) in response to exposure to hypertonic and hypotonic solutions. We hypothesize that eggs soaked in a hypertonic solution will shrink, and eggs soaked in a hypotonic solution will swell due to osmosis.

Materials and Methods

Six chicken eggs were decalcified in vinegar for two days, and then the mineral shell was carefully removed to expose the egg membrane. The length (from pole to pole) circumference and the width (around the egg middle) circumference was measured in centimeters (cm) to calculate an original egg volume. The length (L) and width (W) measurements were divided by two before being used in the calculation, shown below, to determine original egg volume, or Vo. The eggs were then soaked in high fructose corn syrup for two hours. The eggs were then removed and the syrup washed away, and the length and width of the eggs were measured again to calculate the post-syrup egg volume, of Vs. Eggs were then soaked in warm tap water for 30 minutes. Afterwards the eggs were removed and measured again to calculate the post-water volume, or Vw. Data was entered into, and summarized, using Excel. Data sets were analyzed, with paired T-tests, to compare the following: Original versus post-syrup volume, post-syrup versus post-water volume, and original versus post-water volume. Egg volume was measured as cubic centimeters (cm^3).

** To calculate egg volume use the following equation:*

$V = KV_c \times [L \times W^2]$

Where V = egg volume
KVc = volume coefficient of 0.496
L = length circumference / 2
W = width circumference / 2

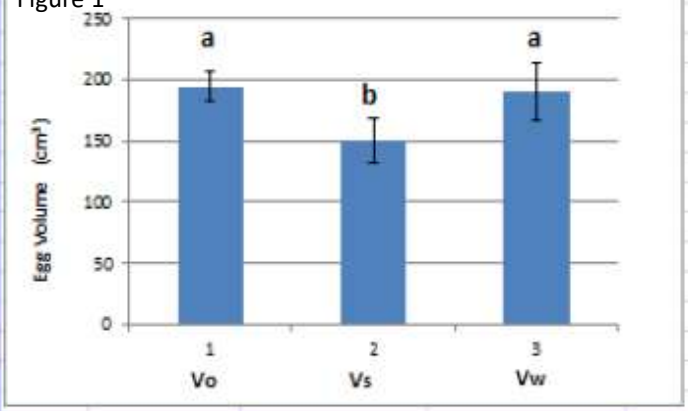
Results

The average egg volume for the original eggs was 194.7 cm_3, for the post-syrup eggs was 150 cm_3, and for the post-water eggs was 190.5 cm_3. The T-test P-values for the contrast between original versus post-syrup eggs was 0.00002, which demonstrated that eggs placed in a hypertonic corn syrup solution shrunk significantly. The T-test P-value for the contrast between the post-syrup and the post-water eggs was 0.0033, which demonstrated that eggs soaked in a hypotonic water solution swelled significantly. The T-test P-value for the contrast between the original versus the post-water eggs was 0.3359, which demonstrated that the original egg volume was not significantly different than the post-water volume, and that eggs placed water swelled back up their original size. Refer to the summary table and figure shown below.

Table 1: Tonicity and Changes in Osmosis Across an Egg Cell Membrane

Egg	Vo (original)	Vs (post-syrup)	Vw (post-water)	
A	188.4	129.5	167.6	
B	208.57	166.99	176.2	
C	208.57	175.14	208.57	
D	194.43	151.93	230.16	
E	188.4	140.4	182.3	
F	180	136	178	
AVG	194.7	150.0	190.5	
STDEV	11.7	18.1	23.9	
V0 - Vs	1-tailed, paired T-test P-valu		0.00002	Significantly diff
Vs - Vw	1-tailed, paired T-test P-valu		0.0033	Significantly diff
Vo - Vw	1-tailed, paired T-test P-valu		0.3359	not diff

Figure 1



Discussion

We discovered that eggs soaked in a hypertonic corn syrup solution shrank, while eggs soaked in a hypotonic water solution swelled. Eggs shrank in corn syrup because the exterior environment of the egg was hypertonic compared to inside the cell. Therefore, eggs in a hypertonic solution had water exit the cell membrane due to osmosis. Eggs swelled in the water because the exterior environment of the egg was hypotonic compared to inside the cell. Therefore, eggs in a hypotonic solution had water enter the cell membrane due to osmosis. As with any experiment, there are always sources of error. In this experiment, the most likely source of error is inaccuracy in measurement of the eggs.

Literature Cited

1. Tonicity. https://en.wikipedia.org/wiki/Tonicity

2. Wikibooks Contributors, Human Physiology 2006. http://en.wikibooks.org/wiki/Human_Physiology. Pg. 16