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!

Format - Your report should include the following:

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.

Introduction

The introduction provides background information on the topic to be covered. For example, if the report was on changes in blood pressure with changes in body posture you would want to paraphrase background material on how the body regulates blood pressure. Relevant vocabulary and concepts (such as those we covered in the lab introduction) should be described. You would glean this information from a source (like a textbook or other source). 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 sentence and citation: Changes in blood pressure, either above or below the normal range, stimulates corrective responses by the medulla oblongata. If blood pressure decreases or increases above normal levels the medulla responds by either a sympathetic stimulation of increased heart rate or a parasympathetic decrease in heart rate, respectively (Fox, 2013). 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, including the page number for where it was found. 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” (Fox, 2013; Pg 478). 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 known 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.
General guidelines for “in-text” citations:

If there is only one author for the source just cite that author’s last name followed by the year of the publication. For example (McDiarmid, 2009). If there are only two authors, include the two authors last names followed by the year of publication. For example (McDiarmid and Pough, 2010).

If there are more than 2 authors (3 or even 11) you simply use last name of first author followed by et al. and then the publication year. For example (McDiarmid et al., 2013).

If you make a direct quote from a source you must put the quoted material within quotation marks, and then at the end of the sentence include the author(s) last name, publication year, and page in that publication. For example: “It is known that non-specific beta blocker drugs, such as propanolol, are known to target both B1 and B2 adrenergic receptors (Altig, 2012; Pg 223)

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 contributed by separate groups of students you can simply explain how a group conducted the experiment, and then explain how many replicates of that experiment were performed in the lab. You can also explain if the data was summarized in Excel (such as averages) and how it was analyzed (i.e. what kind of analyses were performed to compare the data sets).

Results

The results section will include any data tables and graphs. Results section needs a written portion also. In this written portion you should report any summary data (such as class averages of data sets) and then, if the data was statistically analyzed, report the “P-values” and then report any significant differences found among the experimental groups, and what groups were the same. You DO NOT explain your data in the results section. You simply report numbers and differences among groups, or differences between before and after conditions. You will explain your data results in the discussion section.

Discussion

The discussion section should include the interpretation of your results. 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. 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 an example of how you would provide a literature citation of the Fox Human Physiology textbook properly. You would simply fill in the correct pages that YOU used as reference for your lab report.

Citing Physiology Text:


Don’t switch verb tense throughout the report. Spell-check. Proofread. See the attached sample report for format.
Sample Lab Report

The Effect of Temperature on Metabolic Rate in Frogs

“Student Name”
August 30, 2005

Introduction

Ectotherms, or cold-blooded animals, are defined as those organisms that cannot maintain a constant internal body temperature when exposed to fluctuating environmental temperatures (Randall et al., 1997). Subsequently, the metabolic rate of ectotherms such as frogs changes with exposure to changing environmental temperature (Schmid, 1982). In frogs, metabolic rate typically declines when they are exposed to cooler environmental temperatures in the winter months and metabolic rate increases with exposure to warmer environmental temperatures during the spring and summer months. Thus, frogs are excellent models for examining the influence of environmental factors on metabolism (John-Alder et al., 1988). Metabolism is defined as the sum total of all chemical reactions that occur in the body for producing energy. Metabolic rate is defined the amount of energy expended over a give time period. The metabolic rate is usually measured indirectly by calculation from measurements of the amounts of oxygen and carbon dioxide exchanged during breathing under certain standard conditions (Randall et al., 1997). In this study, I will examine the metabolic rate of Green tree frogs exposed to varying environmental temperatures to determine the influence of temperature on metabolism in this animal.

The null hypothesis of this study was that metabolic rate of frogs would not change with environmental temperature. Conversely, the alternative hypothesis of this study was that metabolic rate of frogs would vary with environmental temperature. The prediction of this study was that frogs exposed to cooler temperatures would have lower metabolic rates while frogs exposed to warmer temperatures would have higher metabolic rates.

Materials and Methods

Fifteen adult Green tree frogs (Hyla cinerea) were collected from a pond on the Francis Marion University campus. Each frog was weighed (g) on a metric balance and placed in a small (4 X 4 in) Tupperware container having air holes in the lid. Five frogs were randomly assigned to one of three treatment groups: 16°, 22°, and 28°C. Before the frogs were exposed to experimental temperatures the oxygen (O₂) and carbon dioxide (CO₂) gas concentrations within the frog containers were measured with a gas probe and recorded at 0 and 15 min at room temperature (22°C). The gas concentrations were used to calculate the initial (control) metabolic rates of frogs using the mathematical formula from Randall et al. (1997).

For group one and two, five containers were placed in an incubator set at a constant temperature of 28° and 22 C, respectively. Group two served as a control group because it is the only group for which environmental temperature did not change for the initial and final metabolism measurements. For group three, five containers were placed in a refrigerated incubator at 16 °C. All three groups were exposed to experimental temperatures for 15 minutes. Afterward, containers were removed and the O₂ and CO₂ concentrations within the containers were measured with the gas probe. The initial and final concentrations of O₂ and CO₂ were subtracted to determine how much O₂ was consumed and how much CO₂ was exhaled by the frogs during the experiment. The difference between the initial and the final O₂ and CO₂ concentrations allowed us to calculate the metabolic rate of the frogs under experimental conditions, using the formula given in Randall et al. (1997). This experimental protocol was conducted according to procedures outlined by Lillywhite (2000).

Results

Mean metabolic rate of frogs among experimental groups was compared using an Analysis of Variance (ANOVA) and data are presented as mean ± standard deviation (Fig. 1). Metabolic rate was highest (0.35 ml O₂/g-h) for frogs exposed to 28°C, intermediate (0.55 ml O₂/g-h ) for frogs exposed to 22°C, and lowest (0.80 ml O₂/g-h )for frogs exposed to 16°C. The null hypothesis is rejected in favor of the alternative due to a highly significant statistical P value (P=0.003).
Figure 1. Mean metabolic rate in *H. cinerea* in groups exposed to 16°C, 22°C, or 28°C for 15 minutes. Letters above bars indicate significant differences as determined by ANOVA.

Discussion

The results of this study support the hypothesis that environmental temperature influences metabolic rate in *H. cinerea*. Frogs exposed to 16°C exhibited the lowest metabolic rate while frogs exposed to 22°C and 28°C exhibited higher metabolic rates. The results indicated that the energy requirements in frogs decline with cooler environmental temperatures and increase with warmer temperatures. These findings suggest that frogs in cold environments have lower activity and energy levels. Conversely, a warmer environment would increase metabolic rate in frogs and support greater activity and energy levels. As with any experimental procedure there were sources of error possible. The metabolic rates calculated might be less accurate if the containers were not air-tight and O₂ and CO₂ leaked from the environment into the containers, or vice versa. Also, if the frogs were active within the containers (e.g. they were jumping or trying to escape) their metabolic rates could have been elevated due to exercise rather than in response to environmental temperature.

Literature Cited


