WRITING THE TASTE LAB REPORT

Given that Bio141 is an introductory science class, I am going to assume that this lab report is likely your first introduction to scientific writing. Being able to write well is a real challenge, in part, because it is hard to explain exactly what “good” writing is. Good writing of any sort has some general characteristics, or traits, that make it good:

- it has a clear theme,
- there is background information defining the context of the theme, and
- there are illustrative examples supporting the theme and any conclusions.

Good scientific writing, however, often has another important trait.

- Scientific writing uses quantitative data and graphics to illustrate and support the paper’s theme.

Incorporating quantitative data in a paper is not easy because it requires very precise descriptions that are difficult to craft. Like anything else in life, however, you can become a better writer with practice, both by the act of writing itself and by reading examples of good writing. Assuming you are more tech-savvy than me, think of how you learned to communicate via a text message—it was by learning the tricks other people showed you in their messages rather than reading about how to text message.

The text messaging example also illustrates a fundamental truth about writing; it is a form of communication, not simply a record of stuff you have done. It is true that communication does convey information, but it does so in a form that others begin to see your interpretation of the information. In other words, they see what the information means to you within a specific context. Thus the function of a lab report is to formally convey the meaning of experimental results. It is a formal presentation of your work, and like most formal events, requires you to pay attention to the presentation. Think of it as a “black tie event” where you bring out your best clothes and polish yourself up more than usual.

Lab reports follow a fairly set format. One function of this format is to help develop the reader’s understanding of the work so they can evaluate the importance and validity of the results. In other words, a journal article or lab report should help the reader understand,

1. The existing body of knowledge (or context) within which the current experiment is being conducted; how the work is significant, why the question being asked is relevant, and the general strategy being used to answer the question.

2. The specific experimental methods and procedures used.

3. The results of those experiments and how you have been interpreted them with respect to the existing body of knowledge.

Conveniently, these points of understanding are usually organized into specific sections of a lab report that are described below. Although I go to some trouble to explain the pieces of the lab report, I will remind you that reading a lot of journal articles (you will eventually discover that journal articles are nothing more than highly developed lab reports) will help you give you practice in seeing how they are constructed. Remember, reading can help you write better.

RULES FOR THE TASTE LAB REPORT

This lab is an individual effort and the lab report you turn in (both the text and analyzed data) is expected to be your original work. This is not to say that collaboration is discouraged—in fact I highly recommend that you freely talk about your work with others. It is a fact that explaining something to someone else forces you to understand it better yourself. However, copying verbatim, paraphrasing, or simply creating a cooperatively written document simply shows that you don’t take much pride in your own professional development. I will refer you back to the Academic Dishonesty section of the course syllabus and student handbook if you need more clarification. It is also OK to seek advice on clarifying proper behavior if you encounter a situation you are unsure about.
The report itself is to be divided into five sections:

1. Introduction
2. Materials and Methods
3. Results and Discussion
4. References
5. Tables/Figures

These sections should appear in this order in your final paper. The first 3 sections of the report (Introduction – Discussion) are not to exceed a total of 4 double-spaced, typed pages (font size 12). The last two sections (References and Tables/Figures) are not included in the page count. The page limitation must be strictly adhered to; anything after the 4th page will not be read! This means that your writing will have to be clear and concise.

In order to help you write clearly and concisely, you are required to submit a rough draft of your report on [date]. The rough draft is worth 10 pts. We will give you feedback on your writing to help you improve your final draft which will be worth an additional 20 pts. It helps a lot to have your work critiqued several times by different people. In fact, what you are reading right now has gone through several revisions guided by other faculty members who have helped to improve it. So take the trouble to 1) ask someone else to read over your rough draft and offer suggestions to improve it, and 2) read someone else’s rough draft and begin to train yourself in identifying new and better ways to write. Remember, reading can help… yadda yadda yadda.

Parts of the Lab Report

Introduction: The introduction of a lab report answers two questions,

1. What the purpose or intent is of the described experiment.
2. How this particular experiment relates to previously known information.

While it is true that you could cite any number purposes for this experiment, I’d like you to find a reason more compelling than “because it gives us the opportunity to earn 30 pts towards our final grade”. Instead, you could point out how the use of statistics to analyze the class data set reveals taste perception trends in the class population, or how the results support or refute the existence of a taste chemoreceptor, or how the results support or refute the existence of specific types of taste chemoreceptors. It is best to focus on a part of this lab you found really amazing and explain what new molecular insight you have gained because of the experience. Someone once told me that anything can be interesting, you only have to decide that it is. Here is your opportunity to discover that things are more interesting than they appear.

The second question addressed by an introduction is a little less ambiguous and can be restated as “What do we already know?” This will require you to do a literature search in the library for background material about the subcellular mechanisms of taste. Your final report must contain at least three references. You may use your text and the Scientific American article as references. Wikipedia-like or “informational” internet references are not appropriate for this assignment. Electronically published journals accessed through the internet, however, are allowed. Mary Iber, our science reference librarian can help you identify appropriate resources. The main function of including background information in the introduction is that it begins to support and develop the way you interpret the experimental results. You must cite the references used in your introduction as outlined in the References section below.

A note of caution: Avoid the temptation to ramble. Focus on conveying the meaning for a single point in your report; don’t try to do it all. Remember that you are dealing with a page limit that is very strict.

Don’t overlook the value of a title in helping to frame the introduction to your report. Titles should clearly describe the content of the experiment and paper; they immediately give you a hint of what is being addressed and are most often are one-line descriptions for the experiment or study. Some simple examples are: Detection of Alcohol Dehydrogenase Activity in Yeast Extracts; Development of a Colorimetric Assay for NO\textsubscript{3}/NO\textsubscript{2}; Comparative Study of Booger Mass from North American College Student Populations. Notice that these titles tell you exactly what you can expect to encounter if you read the corresponding paper.
Here is a section of a student’s lab report introduction. This student uses a citation of previous research to develop supporting structure/definitions that help the reader understand what she is talking about. She then goes on to clearly state that her intent is to develop a bioassay to test feeding choices by termites.

All termites communicate using chemical signals called pheromones. They use pheromones to tell each other where to find food, what to eat, to distinguish members of their own colony from others, and many other things. … Hydroquinone is a pheromone that was first isolated from the Australian termite species Mastotermes darwiniensis, and identified as the phagostimulating pheromone in termite saliva1. Researchers were able to use bioassay techniques to show that hydroquinone and not one of the other chemicals present in the saliva (glucose, arbutin, or inositol) was the phagostimulant. They have also discovered that all termite species produce hydroquinone and use it as a phagostimulating pheromone1. The termites used this pheromone to tell each other what they should eat… The purpose of this project was to develop a food choice bioassay to measure the effect of the termite pheromone hydroquinone on worker termites.

Materials and Methods: Materials and Methods sections are written in a style that is very economical and terse. They are not cookbook recipes written step-by-step. Instead they are summary descriptions of the procedures used to complete the lab. The greatest challenge is to decide what information should or should not be included. The general rule of thumb is to include enough detail so someone of your ability could repeat exactly what you did. This requires that you distinguish between “general” and “specific” knowledge. For this lab, specific knowledge includes details such as the taste perception scale used for ranking tastes or the statistical tests used to analyze the data. These are specific pieces of information necessary if someone who hasn’t done this experiment before was going to try it. General knowledge would include how to make the tea, or how to taste something. While it might be obvious to you after doing the experiment, you will need to explain that taste was evaluated before and after treatment, and how the treatment was done (i.e. swishing the tea and then rinsing the mouth). A good test for a well written Materials and Methods section is to ask someone who has not done the experiment to read it and explain what you did in the lab.

A few comments on the writing style for this section. Because this section is a description of procedures you performed at an earlier date, it is written in the past tense. This is also the case when referring to previously established results (i.e. citing someone else’s work) in the introduction or the discussion sections of a paper. The Materials and Methods sections do not contain personal references (i.e. no pronouns like I, me, we, etc.). The experiments were obviously performed by a person, yet there is never any mention of “I did this, then we did that.” Sometimes it is reasonable to include personal references in the Discussion sections, especially if you are putting forth your personal interpretations of results, but leave these out of the Materials and Methods.

Below is part of a materials and methods section from a student paper. She had an obvious problem with the verb tense but was very good about including details (i.e. specific knowledge) that allow someone else to repeat the experiment. There is one example of general knowledge that someone familiar with culturing bacteria would be familiar with and not need further explanation. Can you identify it?

Cells are grown overnight at 30°C in tryptic soy broth. The broth is transferred to centrifuge tubes and then centrifuged for about 20 minutes at 10,000 rpm to pellet the cells, and the supernatant is poured off. The cells are completely suspended in a 4:1 mixture of methanol to toluene. A very small amount of acetyl chloride is used as the catalyst for the reaction, with methanol providing the methyl group. After this mixture is heated in a boiling water bath for approximately one hour, a few mL of a 6% sodium carbonate solution are added to neutralize everything. Then a few mL of toluene are added to extract the fatty acids. The mixture can be centrifuged again to separate the layers. The top toluene layer contains the fatty acids, which can be run on the GC-MS.

Results and Discussion: Results and Discussion sections serve two purposes. First, they describe the results observed in an experiment, and second, they interpret these results within the context of the background information relevant to the experiment. For this particular lab, you will need to interpret the experimental data in light of what you already know about the subcellular mechanism of taste. Is there a reasonable explanation that logically accounts for the observed results or are the results so screwy that you have to form a new (a likely controversial) explanation? Ultimately, you are trying to convince the reader that your data makes sense, even when the experimental design is
viewed critically. Are your screwy results are due to experimental flaws or is your technique so sound that you actually have discovered something new?

The most effective organizational structure for a Results and Discussion section is to present a specific result and then explain how it either supports or refutes your initial hypothesis. It is critical that you present results in way that helps the reader see the same relationships you did. Don’t hesitate to direct the reader’s attention to specific places on graphs or tables. It is not appropriate to simply list data, because data by itself has no meaning. It is only when the data are used to support or refute a specific point that it is meaningful. The bulk of your data should be presented in tables, graphs and/or figures with particularly important bits of information being highlighted in the written text. Don’t forget; graphics should be included at the end of the paper after the References section, not in the Results and Discussion.

Below is an example of a Results and Discussion section from a student lab report. Read it before I discuss the strengths and weaknesses of this example.

Upon collection of the data the scores for the tests of “before” and “after” showed significant difference of all of the sweet rating. In figure 2, sugar showed a significant difference in sweetness after drinking the test (p<0.01). In figure 3, Aspartame showed a significant difference in sweet taste after drinking the tea (p<0.01). In figure 1, M&Ms also showed a significant difference in sweetness after drinking the tea (p<0.01). Based on figure 4, the comparisons of “before” and “after” represented by bars, concludes that before drinking the tea all of the sweetest items tasted (sugar, aspartame, and M&Ms) were all sweeter before drinking the Gymnema herbal tea and the after results how significant difference in the ability to detect a sweet taste in the “after” portion of the histogram.

This leads to the conclusion that it is possible that the taste of the tea altered the sweet taste by binding and activating the α portion of the G proteins within the taste buds, which minimized the interpretation of the sweet stimuli. Because of the teas prolonged effect and lasting aftertaste, all of the sweet items were no longer sweet. Thus we conclude that it prevented the sweet tastant to react with the enzyme that causes the precursor to activate kinase that indirectly blocks the potassium channels in the cell. The tea’s tastant also caused a longer a receptor contact, which increased the stimulus and this depolarization involving bitter taste interpretation.

Consideration needs to be taken that there could be considerable differences in certain sensitivities within subjects being tested (Chandrashekar, J. et al., 2000). Thus olfactory stimulation of smells of foods also creates taste perception and also age of the participants (Martin, F., 2006). Some final question about the tea should have been included in the study or the tea should have been rated separately from the other items on the same tastes and scale, but compiled differently for evidence of possible bitter stimuli that could be causing the masking of the sweet tastes that were tasted after the tea.

A strength of this example is their use of declarative statements regarding the results of specific tests. For example, this author says that sugar showed a significant difference in sweetness based on data in figure 2. By directing the reader to specific data, they have started to lay out the evidence that leads to their conclusions. It is possible to make this work even stronger if they had highlighted the specific data shown in figure 2. For example, they could have written,

“The taste of sugar was significantly different in this experiment. Before being treated with the tea, sugar scored an average of 6.5 points but declined to 3 points after tea treatment (Figure 2).”

This way forces the reader to pay attention to the actual data. The way it is written, the author is assuming that the data is obvious to the reader, which most cases it is not.

Another strength of this discussion is that the subsequent paragraphs attempt to link the experimental results into what is already known about taste perception. In other words, the author is proposing a simple explanation as to why the results came out the way they did. The last part of the third paragraph also critically evaluates the experiment by suggesting that the taste of the tea may have altered perception rather than receptor binding. They then suggest a different experimental procedure that might eliminate this possibility. Also note that certain statements of fact are supported by references, an essential practice when building an argument. By citing references, you are signaling the reader that you have some basis or evidence to support your ideas and that you are not just making this stuff up.
Unfortunately, certain word choices and punctuation errors make this report hard to understand in places. Don’t overlook that fact that punctuation is a visual cue for helping us to group words in order to construct ideas. Simple errors or even misspelling words can irritate your reader. Your goal as an author is to encourage people to read your work and they are less likely to do that when you are irritating.

References: You will eventually notice that there are many ways to cite references within your writing, and professors can get into heated arguments about which style is appropriate. I believe that it doesn’t really matter and you should just pick one method and be consistent about it. One rule you must follow, however, is to include only references that are cited in the written text. Most of these citations will be in the introduction. You may reference these citations by using either 1) the author’s name and publication year enclosed in parentheses (Nowak-Thompson, 1997), or 2) a superscripted reference number like this\textsuperscript{546}.

Below are three citation formats for different types of reference materials. The idea is to provide the reader with all the information necessary to locate a source. Check and recheck the accuracy of your citations. 

Remember that internet sources are not acceptable for these papers!

For a journal article - printed

For a journal article - online

For a book

If you have questions about the reference citations, you can check with either of us or the helpful people in the library/writing center.

Tables and Figures: The results of an experiment can be depicted in a visual format using graphs or figures or as a numerical or written record of data in a table. Graphs, figures and tables should always contain a legend that adequately explains what you are depicting without reference to the text of the paper. Tables should have a brief descriptive title. Graphs are considered figures and should be designated as Fig. #. If you use more than one figure or table in your paper, number them in the order that they appear in the text of the paper. Number the figures independent of the numbering of tables. Always refer the reader to the figure or table where appropriate in the paper. Remember: figures and graphs should be simple, accurate, labeled, and clearly understood. A simple test for clarity is to give it to someone else and have them explain it to you. If they easily get the main point of the graph, then you done good, pardner.