Improving Your Lab Report

Improving your Title
A good title efficiently tells the reader what the report is about. It may include such information as the subject of the experiment (what it is about), the key research variables, the kind of research methodology used, and the overall findings of the experiment. To make your titles better, follow these guidelines:

- If your title is too long (takes up more than a line), reduce it by taking out non-essential words and phrases.
- If your title doesn't have enough information, make a list of the key words related to the experiment (scientific concept of the experiment, important variables, procedure, overall finding) and use the list to come up with ideas for further information.
- If your title is a complete sentence (with a subject and a predicate), rewrite it so that it is not a full statement but a phrase describing the experiment.

Improving your Introduction

- ***successfully establishes the scientific concept of the lab***

To establish the scientific concept for the lab you need to do two things:

1. state what the lab is about, that is, what scientific concept (theory, principle, procedure, etc.) you are supposed to be learning about by doing the lab. You should do this briefly, in a sentence or two. If you are having trouble writing the opening sentence of the report, you can try something like: "This laboratory experiment focuses on X…"; "This lab is designed to help students learn about, observe, or investigate, X…." Or begin with a definition of the scientific concept: "X is a theory that…."

2. give the necessary background for the scientific concept by telling what you know about it (the main references you can use are the lab manual, the textbook, lecture notes, and other sources recommended by the lab manual or lab instructor; in more advanced labs you may also be expected to cite the findings of previous scientific studies related to the lab). In relatively simple labs you can do this in a paragraph following the initial statement of the scientific concept of the lab. But in more complex labs, the background may require more paragraphs.

- ***effectively presents the objectives and purpose of the lab***

In a paragraph, or more if you need it, write out the objectives of the lab in paragraph form and then describe the purpose of the lab: what it is that accomplishing the objectives will help you learn about the scientific concept of the lab.

1. The objective(s) are what it is you are supposed to accomplish in the experimental procedure itself. The objective(s), therefore, is usually presented in terms of a specific verb that describes what you are supposed to be doing in the lab, such as to measure, to analyze, to determine, to test etc. Often, the objective(s) for the lab is given in the lab manual. If you are having trouble phrasing the sentence about objectives, try something like: "The main objectives of this lab were to…"; "In this lab we were to…."

2. The purpose of the lab is different in significant ways from its objective(s). Purpose provides the wider view; it answers the why question, why you are doing the lab in the first place. Instead of focusing just on the specific actions of the experimental procedure, purpose looks at the experimental procedure within the context of what you are supposed to be learning.

If you are having trouble starting the sentence about the purpose of the lab, try saying something like this: "The objectives of this lab enabled me to learn about X by…"; "Performing these objectives helped me to understand X by…." To improve this part of the introduction, go back to what you have written about the scientific concept and look for a link between it and the activities you are expected to perform in the lab: what specifically about the scientific concept were these activities designed to teach you?

- ***states hypothesis and provides logical reasoning for it***

A good statement of the hypothesis summarizes in a sentence or two what outcomes you anticipate for the experimental procedure. Typically the outcomes will be presented in terms of the relationship between dependent and independent variables. If you are having trouble starting the paragraph on the hypothesis, try a sentence opener like this: "The hypothesis for this lab was…"; "My hypothesis was…"; "We predicted that…"; I hypothesized that…."

Providing logical reasoning for the hypothesis means explaining the reasoning that you used to make your hypothesis. Usually this reasoning is based on what you know about the scientific concept of the lab and how that knowledge led you to the hypothesis. In science, you reason from what you know to what you don't know. In a couple of sentences (more for complex labs) describe the logic that you used to reason from what you know about the scientific concept to your educated guess of the outcomes of the experimental procedure. If you need to make the logic of your hypothesis clearer, use words that indicate an explanation: because, since, due to the fact that, as a result, therefore, consequently, etc.

Often you can present the hypothesis and the supporting reasoning in one paragraph. In more complex labs, especially those with multiple procedures and therefore multiple hypotheses, you may need more paragraphs, perhaps one for each hypothesis.

Improving your Conclusion (this is sometimes referred to as a discussion section)

- ***opens with effective statement of support of hypothesis***

The Conclusion should start with a sentence or two in which you make a judgment as to whether your original hypothesis (from the Introduction) was supported, supported with qualifications, or not supported by the findings. To improve the opening of your Introduction, make sure your judgment is stated clearly, so that the reader can understand it. There are, generally speaking, three possible conclusions you could draw:

- the data support the hypothesis;
- the data do not support the hypothesis; or
- the data generally support the hypothesis but with qualifiers (tell what they are).

If you had trouble composing this sentence, try being straightforward about it, for example, "The hypothesis that X solution would increase in viscosity when solutions Y and Z were added was supported by the data."

- ***backs up statement with reference to appropriate findings***

After stating the judgment about the hypothesis, you should provide specific numerical evidence from the data in the Results to back up the judgment. The first key to improving this part of the conclusion is finding specific evidence reported in the Results that you can use to back up your judgment about your hypothesis. The second key is to describe the evidence in such a way that the reader can clearly see that there is sufficient evidence that supports your judgment about the hypothesis. Be specific. Point out specific evidence from the Results and show how that evidence contributed to your judgment about the hypothesis.

- ***provides sufficient and logical explanation for statement of hypothesis***

You should return to the scientific concept of the lab (described in the Introduction) and use that concept as a basis for explaining your judgment of the hypothesis. Your understanding of the scientific concept may have changed by doing the lab.

Problems with the sufficiency of the explanation refer to the reader's judgment that you didn't include enough details in your explanation, that there wasn't enough of an explanation to satisfy the reader that you fully understood why the relationship between the results and hypothesis was what it was. You need to

provide greater depth in your explanation. Do some brainstorming. Look again at the explanation you placed at the end of the Introduction. Jot down more details about the explanation and use those jottings to help you expand that part of the Discussion.

Problems with the logic of the explanation refer to the reader's judgment that your explanation of the support or lack of support of the hypothesis did not adhere to sound scientific reasoning. Look at the reasoning you used in the explanation. It should follow one of four basic arguments:

1. If the results fully support your hypothesis and your reasoning was basically sound, then elaborate on your reasoning by showing how the science behind the experiment provides an explanation for the results.

2. If the results fully support your hypothesis but your reasoning was not completely sound, then explain why the initial reasoning was not correct and provide the better reasoning.

3. If the results generally support the hypothesis but with qualifications, then describe those qualifications and use your reasoning as a basis for discussing why the qualifications are necessary.

4. If the results do not support your hypothesis, then explain why not; consider (1) problems with your understanding of the lab's scientific concept; (2) problems with your reasoning, and/or (3) problems with the laboratory procedure itself (if there are problems of reliability with the lab data or if you made any changes in the lab procedure, discuss these in detail, showing specifically how they could have affected the results and how the errors could have been eliminated). This is where you should be discussing possible sources of error.

You can also improve the logic of your explanation by using words that make your argument clear, such as *because*, *since*, *due to the fact that*, *as a result*, *therefore*, *consequently*, etc.

- **_sufficiently addresses other issues pertinent to lab_**

A low rating in this area means that the instructor thinks that there are other interesting issues you could have discussed about your findings. Other issues that may be appropriate to address are (1) any problems that occurred or sources of error in your lab procedure that may account for any unexpected results; (2) how your findings compare to the findings of other students in the lab and an explanation for any differences (check with the lab instructor first to make sure this is permissible); (3) suggestions for improving the lab.

Improving the Presentation of your Report

- **_report is written in scientific style: clear and to the point_**

Style in this case refers to your choice of words and sentence structure. The style of science writing strives to be clear and to the point. You should avoid using grand thesaurus words and long, artfully convoluted sentences.

As to choice of words, science writing uses words that its audience (other scientists in the field) will readily understand. To outsiders, the scientific vocabulary of this language looks like a lot of jargon. But the point is that scientific words that are obscure to outsiders are usually not obscure to the insiders that comprise the scientific audience. Your writing should sound like scientific writing. This means that you should go ahead and use proper scientific terminology, but you should also choose plain, everyday words for non-scientific terminology.

Your sentences should be clear and readable for your educated audience. Avoid excessively long and meandering sentences. But don't use a lot of very short sentences, either. Vary your sentence length. If you have difficulties with making your sentences readable, read over them aloud, noting the sentences that seem to be too long or are hard to read. Rewrite those sentences so that they flow more easily.

Also, avoid using quotations. Scientists very rarely quote from source materials; they do so only when a particular wording is important to the point they are trying to make. Using direct quotations is appropriate to English papers, but not to lab reports.

- ***grammar and spelling are correct***

Grammar errors. It's important that you understand that the source of grammar problems is not, for most of us, a matter of not knowing the rules of grammar. So don't worry about that. The source of most grammatical errors is simply not seeing them in your own writing. We usually read our own writing for the meaning that the words convey and not for the words themselves.

Correcting grammar problems, then, is usually a matter of learning to read our writing differently. Read your lab report at least twice specifically looking for errors in grammar. You should focus on the words and sentences themselves. You don't need any special knowledge for detecting and correcting most grammar problems. If you do read for error, you will probably be able to spot problems and correct them without having to look anything up in a handbook.

Spelling errors. First, run the spell-checker on your computer. That should take care of almost all of your spelling problems. Sometimes, however, there are words that the spell-checker does not catch because they are words that are actually spelled correctly but are used for the wrong meaning, like using "to" for "too" and "that" for "than." You should be able to spot these misuses of words by reading over the report looking for error, as described under "grammar errors" immediately above.

Resources
Adapted from the LabWrite Program at NC State University…
http://labwrite.ncsu.edu/lc/lc-improvinglaprep.htm