# The Essentials of Writing a Good Lab Report for Introductory Biology Courses

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# What we will cover tonight:

- The experiment
- Parts of a report
- Where to start?
- Breakdown of content
- Major issues in content (must do's)
- Common errors that hurt your grade

### Improving your lab report:

# Improvements from first submission/draft to final product

# The Experiment

- Be Prepared! (i.e. Reread the lab before starting to write!)
  - Big Picture: What's the point?
  - Make yourself a flowchart: They really do help
  - Reread the lab questions embedded in the lab manual.
  - Keep the focus on the *big picture*...
  - Ex. What was the lab all about? Determining the effects of temperature on growth rate of stonefly larvae....t was *not* about measuring turning on the balance, labelling the tubes, etc.

# Parts of a Report

- The Title page
- The Introduction
- The Methods and Materials
- The Results
- The Discussion
- Literature Cited

# The Title Page

- This is a FEW words that describe the experiment you completed without repeating the lab title.
- Sounds impossible...but it CAN be done with a little thought.
- Weird but true: Save this step for last.
  - Good Ex: Captures main point of lab!
  - Poor Ex: "Enzymes"

Clear, concise title goes here!

Your Name

Your lab partners

Bio 107 or 108: TA names

DATE

#### The Introduction

...is usually several paragraphs long. It should tell **why** the study was undertaken; give a **brief** summary of relevant background information; and end with a statement of the specific problem we are examining (Pechenik, 1997).

\*\*When appropriate-near the end it can include hypotheses formulated prior to the experiment.\*\*

#### The Introduction

- What is our big question?
- Why are we asking it?
- How will we answer our question?

  What particular methods are we using to get at this question? Why these methods...what do they show?
- What do we expect? PREDICTIONS
- Why do we expect this? HYPOTHESES

#### The Methods and Materials

- Serves as a set of instructions for someone to be able to repeat the experiment in the future.
- Also a place to explain what you DID NOT do!
- Active (We measured seed weight....) or passive (Seed weight was measured...) voice-ASK YOUR TA!!
- START HERE!

#### Methods and Materials

- Check your lab manual!
- Usually 0.5 to 1.5 pages long
- References are absolutely necessary. You didn't design the lab so you can't take the credit.
- Concise explanation of materials and procedures...may want to include a small figure if a procedure involved a weird or complicated setup.

What's the biggest problem that we see as TAs grading these lab reports....?

Let's just say...
"Level of Detail" is an art in itself....

### Consider these two paragraphs...

On January 5, I obtained four paper cups, 400 g of potting soil, and 12 radish seeds. I labeled the cups A,B,C,and D and planted three seeds per cup, using a plastic spoon to cover each seed with about one-quarter inch of soil.

On January 5, I planted three radish seeds in each of four individually marked paper cups, covering the seeds with about one-quarter inch of potting soil.

Pechenik, 1997

I know which I would rather read...why?

# Because the essential details are there without the tedious details...

- Cups were individually marked
- Three seeds per cup
- One-quarter inch of covering
- Potting soil
- How do we determine if something is "essential"?

Ask: What factor(s) may have influence over my results?

#### The Results

- Includes text **and** figures-ask your TA if the figures are to be embedded in the text or separate at the end of the report.
- Text is a summary- *not an interpretation* -just the facts.
- ALL of the following are appropriate.
- A written description of your figures.
- The figures themselves
- Sentences like: "Feeding rate increased as temperature increased, as seen in Figure X."

# Figures...Tables and Graphs

- Focus: What is the <u>best</u> way to show the trend in my data?
- Axes: clear, concise labels, avoid excess words
- Axes labels MUST have units
- Legend: Not a repeat of both labels
- Tick mark labels
- Spread it out!
- Info per unit is horizontal in a graph
- If you can't read it, neither can I.

# What are raw data & what do I do with them?

- Anything you initially recorded.
- Include it as an appendix, never as a part of the formal report, never ever ever ever. Ever.
- A table filled in during lab is *raw* (in the appendix); those results in graphical format is a figure (in the results).
- Your initial hand-drawn standard curve is *raw* (in the appendix); a titled, labelled and neat graph is a *figure* (in the Results).

# Results: The base of the report

• Do not underestimate the weight of the Results section!

• The data, clearly presented, are the single most important part of a good report. Without good Results, you cannot write a logical Discussion (the other big part). Keep the "Big Question" in mind when organizing this section....

# Titles for Figures

Number & Title are necessary!

For example:

Figure 1: Mean number of nodules produced in each of three treatments: low light, moderate light and high light conditions

# Axes labels: for example....

- Time (min)
- pH
- Blood glucose (mg/ml)
- Temperature (°C)
- Product (mg)
- Absorbance (400 nm)

#### The Discussion

- This is your interpretation of your results.
- why, not what
- Convince the reader that you are interpreting the data fully and intelligently
- 1-2 pages…longer is not always better!

- What did you expect to find (predictions/hypotheses) and why?
- How do your results compare to what you expected?
- How might you explain any *un*expected results?
- How could you test your explanation for this?
- How could you improve this experiment if you were to repeat it?
- Citations are a must! As is a good set of background information.

(Lombard and Terry, 2004)

#### Literature Cited

- A *minimum* of the Lab Manual and Campbell. Don't overuse the web for this: in general, the web is not the best resource!
- Give credit where credit is due
- Proper format makes a good clean report: (Author, Year)--No page numbers!!

#### For example, in the body of the lab report:

The sky is red at sunset due to the refraction of light off particles of pollution (Smith and Jones, 1945).

At the end of the report in the Literature Cited section, specific format and alphabetized by author

Wilcox, M. R. and G. S. Hoffman. 1987. <u>Human</u>
<u>Anatomy and Physiology</u>. Third edition.

Benjamin/Cummings, New York, New York. pp. 435-440.

# Some extra tips just for you...

- "As" and "Ass" are both accepted by spell check programs.
- Scientific names italicized as in: *Homo sapiens*
- Proofread....swap papers with someone, make sure they can make sense of your lab report. This makes a big difference in quality (and grade).
- Be sure each sentence actually says something relevant, otherwise, get rid of it.

#### Use words not numerals when...

- Beginning a sentence: "Four ml samples were removed from each flask." rather than "4 ml samples..."
- Two in a row: "We placed five 6-seedling pots in the greenhouse." not "We placed 5 6-seedling.."
- The other option is to rewrite the sentence to avoid both these situations.

# Naked decimals...one of many pet peeves (your TA's have their own!!)

- *Always* precede a decimal with zero if the number is smaller than 1.
- This will avoid any ambiguity and eliminate any chance of a misread.
  - Use 0.57 g instead of .57 g
  - Much much clearer to read.

#### Other resources.....

- Consult your Lab Manual...there is good information in back that is very clear and well-organized. Well worth your time!
- A Short Guide to Writing About Biology Third Edition, by: Jan Pechenik is worth its weight in gold and great for many other writing applications.
  - (Check the library!)
- Your TA's are always willing to help but you have to actually **ask**.

### Most Important

- Keep the focus on what will answer the big question...what is the focus?
- Proofread, proofread, proofread
- Don't procrastinate! Lab reports take a couple solid hours to write if you want a decent grade!
- Ask for help well before the due date.
- Talk to your classmates
- Be sure you understand plagiarism! When in doubt...ask. Better to over-cite than to not cite.