**LABORATORY WORK**

**From Libbie Coleman**

***In doing all parts of a lab keep this in mind:*** Your lab write up is the way you communicate what you did and what you found out to others who are not familiar with biology or with the lab. Imagine you are explaining it to a friend who has never taken biology. To accomplish this, observations must be thorough, organized and clearly labeled. You must fully explain your answers to discussion questions. Your conclusion must be thorough and presented in a clear, logical way. You must make your claim and show how your data (observations) support that claim. You must “connect the dots” for your reader – explain how the evidence supports your ideas.

**I. IN GENERAL, BEFORE BEGINNING ANY LABORATORY INVESTIGATION:**

1. Thoroughly understand the **experimental question** - in other words, *know what you are trying to find out!*
2. *Think about what you already know about the problem* from your work in class, reading, and past experience. What do you think might happen? You will usually be required to make a formal prediction called a **hypothesis** and explain briefly why you predicted this outcome.
3. *Thoroughly understand the* ***procedure*** so you can formulate a better hypothesis and data table AND, most importantly, so you will know what you’re doing when you get into the lab.

**II. REQUIREMENTS FOR LABS**

There are two types of labs: ***FORMAL*** and ***INFORMAL***. Always assume a lab is *FORMAL* unless I specifically tell you otherwise.

1. **GENERAL REQUIREMENTS (all labs)**
   1. All lab work must be done **in ink** (exception: *sketches and graphs)* in your lab notebook.
   2. Write on **one side** of paper only.
   3. These sections must be TITLED: Hypothesis, Procedure, Observations, Discussion Questions, Conclusion.

1. **INFORMAL LABS**
   1. No conclusion
   2. ***PRELAB REQUIREMENTS\* :***
      1. Title and number of the Lab
      2. Experimental Question
      3. Procedure: a brief one or two sentence summary.
2. **FORMAL LABS**

1) **ALL** sections shown in **Part III** are required, including a conclusion.

2) ***PRELAB REQUIREMENTS\* :***

* + 1. a) Title and number of the Lab
    2. Experimental Question (purpose)
    3. Hypothesis
    4. Procedure(Do NOT copy! Make a flow chart summarizing the important steps - not every detail!)
    5. If there are PRELAB QUESTIONS, write out answers to them.
    6. Observations(Prepare any **data tables** you will need to record your observations. Use a ruler!)

***\*NOTE:* *–* Prelabs must be completed BEFORE class begins on the day of the lab**

* + - *If you have not done a prelab you may not be allowed to participate in the lab that day.*(You may do a “dry” lab -i.e. copy the data from a classmate and complete the lab report for 1/2 credit.)
    - *A formal prelab must have a complete, fully-labeled data table.*

**III. DETAILED REQUIREMENTS FOR EACH SECTION of the LAB REPORT:**

**Experimental Question (purpose)**: The question we will try to answer in the investigation. Often it is the title of the investigation. MUST be in question form. No sentence fragments! *Example: What is the effect of temperature on the rate of growth of nose hair?*

**Research and Hypothesis**: Briefly summarize what you know about this subject (usually from reading and prior experience) and predict the outcome of the investigation- in other words, what do you think will turn out to be the answer to the experimental question and briefly explain WHY you predict this. ***It is expected that you are doing the assigned reading and that it will inform your hypothesis.***  Complete sentences required. *Example: Rate of nose hair growth will increase as temperature goes up. I predict this because I’ve learned that life processes happen faster at higher temperatures.*

**Procedure:** Study the detailed procedure. Create a flow chart summarizing the main steps you will carry out in the lab. Omit details of HOW you will do each thing. This is to help you get the “big picture” of what you need to accomplish and in what order. (You will follow the detailed procedure in the supplement when you perform the lab!)

**Observations**: The data you write down as you do the investigation in class. Except for sketches (which must be in pencil) observations must bein **INK**. All data must be organized on a clearly labeled table and will include one or more of the following:

a. measurements and/or numbers (always include units)

b. written descriptions of what you observed

c. sketches or diagrams (must be LABELED!)

d. graphs and/or charts of data when appropriate

e. mathematical analysis of data (percents, ratios etc.) when appropriate

*NOTE:*When recording data **NEVER ERASE** !! What seems unimportant now may be very important later. *If you wish to change an entry draw a single neat line through it* and write the new entry beside or above it.

**Discussion Questions:** Always answer ALL discussion questions at the end of the lab. You are not required to copy the questions, but, unless the question asks for a list or graph etc., you are required to answer in complete sentences that restate the question. For full credit, you must EXPLAIN your answers

**Conclusion:** *Summarize* and *interpret (that is, explain)* your results. What do they show (or perhaps, not show) about the problem we were investigating? Pay particular attention to any **patterns** you notice! Must be in paragraph (not list) form. In your conclusion you need to:

Briefly summarize your results. Tell what happened. Look for and identify patterns.

Analyze your results - what is your claim? In other words what do you think is going on here? If there is a pattern, what might account for it?

do NOT make statements that are not supported by your data!

clearly identify the evidence from the data that supports each statement.

If you haven’t already done so in #2, directly answer the experimental question if you can - based on the results of your experiment. If the results don’t allow you to answer the experimental question, explain why not.

Discuss whether the results of your experiment support your hypothesis. (In other words, did the experiment turn out the way you predicted it would?) Explain why or why not.

Discuss specific errors if you believe any occurred that might have affected your results. What was the error? What makes you think this error occurred? How might it have affected your results? Don’t just say “I probably made some errors”!

**IV. WHILE DOING LAB WORK IN CLASS**you are always expected to:

1. Read and follow the lab procedures carefully.
2. Read and follow the instructions on the overhead and any verbal instructions given by the teacher.
3. Follow all LAB SAFETY and BEHAVIOR RULES at all times.
4. Clean up after yourself. LEAVE THE LAB STATION AS YOU FOUND IT - OR BETTER!

clean all tools and apparatus you have used.

arrange items neatly in your tray as you found them.

wipe and dry your table top if necessary.

pick up all trash and waste material in your work area (including the floor!) and dispose of it in trash can or as directed by teacher.

E. Collaborate and cooperate with group members and other classmates, BUT always do your own work (see **INTEGRITY** below).

**V. EVALUATION OF LABORATORY WORK**

1. The primary objective of ALL lab work in this class is to learn. Therefore, when we go over the lab in class after you have turned it in, *ask questions*!!! Make notes and corrections on your carbon copy during the discussion.
2. I will use the following symbols and abbreviations in grading your work:

**S.U. =** set up; something is wrong with the format or organization = O.K., correct, right

**C.S.** = complete sentence or complete statement required = wrong

**INC.** = Incomplete. Usually in conclusion or questions. **CONC.** = conclusion

(Doesn’t necessarily mean to write more!)

**H** = heading incorrect or incomplete **B.S.** = be specific!

**?** = Unclear or confusing. What are you trying to say? **DQ** = discussion questions

= Something is missing or wrong. (You should know what!) **PLQ** = prelab questions

**E?** = What is your evidence for this statement? **WQ** = wrong question (You didn’t answer the question asked.)

**INTEGRITY**

**Only original work is acceptable in this class. Integrity is your most important possession.**

* ***An assignment is considered copied if any part of it is similar to another student’s or other source.*** *(*Rearranging words or replacing them with synonyms does not make work original.)
* ***“Working together” is the sharing of ideas. This is encouraged. “Copying” is a sharing of how those ideas are expressed. This is not acceptable.***

**CONSEQUENCES:**

***First infraction:*** Loss of credit on the assignment for all involved students.

***Second infraction:*** Loss of credit on assignment and semester grade dropped one grade.

***Third infraction:*** Failure in course.