

## LABORATORY NOTEBOOK INSTRUCTIONS

### 0. BACKGROUND

Scientific knowledge is disseminated via published research articles. Accuracy and integrity of such presentation depends on reliable record keeping. The skill of writing the Laboratory Notebook is a vital part of industrial and academic research, required by law to establish intellectual and patent rights, and vital for the task of writing a laboratory report, publishing a paper or producing a senior thesis.

A laboratory notebook is the written record of everything that was done (good and bad) and all relevant plans, observations, notations, interpretations, and conclusions. Resist the temptation to keep an overly tidy notebook that has been whitewashed of mistakes; it is supposed to be a record of work in progress and should provide sufficient detail for you or for somebody else to recreate the experiment. The laboratory notebook is the ultimate source of data and other information necessary for putting it into a cohesive picture, and for the hindsight required for effective trouble-shooting of future procedures.

Students are required to keep a lab notebook for the Animal Behavior labs in BIO342. Each lab notebook will be evaluated by the professor for completeness. The class TAs are also available to provide advice and constructive criticism. In some cases, the handouts for lab exercises will include grey highlighting when students should be writing in their lab notebooks. However, not all lab exercises include this aid. Later in the term, students will also evaluate each other's lab notebooks. The notebook should be sufficient to reconstruct the work that is done throughout the semester.

### 1. ORGANIZATION

1. Laboratory notebooks should be bound books.
2. Writing must be legible and in durable ink (mistakes can be crossed out).
3. Use the first page for your name, address and contact information (although a lab notebook should NEVER leave the research lab, in a teaching lab you may take it with you if necessary).
4. Include a Table of Contents. Use 2 pages to list a title, date and pages for experiments.
5. Number all of the pages. Do it when the notebook is new.
6. The entry for each lab exercise should include the following information:
  - a. when the research was done (The date, including the year, should be on every page.)
  - b. where it was done (This is especially important for field work.)
  - c. who did the research (Recording your lab partners' names and cell phone numbers for each week will be helpful in contacting them later.)
  - d. what was done and how it was done (step by step)
  - e. why it was done (your goal and hypothesis)
7. The entry for each lab exercise should be structured according to the following sections:
  - a. Experimental Title
  - b. Date and Name of Collaborators (*i.e.* partners)
  - c. Experimental Objective / Plan
  - d. Experimental Execution
  - e. Observations, Results and Data
  - f. Graphs and Analysis
  - g. Conclusions

### 2. EXPERIMENTAL TITLE, OBJECTIVE AND PLAN

(These items should be written **before you begin working.**)

1. The title, as given in the lab handout, should be recorded.
2. The objective should be a single brief statement written after reading the protocol. It may include any hypotheses to be tested.
3. The experimental plan should be a brief outline or flow chart based on reading the protocol and should include recipes for solutions with necessary calculations for concentrations, volumes or pH.
4. This is where safety issues should be noted (e.g. how to deal with chemicals or practices).
5. The plan may also include prepared tables with labeled columns and rows for recording data during observations.

### 3. EXPERIMENTAL EXECUTION

(These items should be recorded **while you are working**.)

1. Record what you actually do, including all mistakes, missed steps, pipetting errors etc.
2. Identify precisely what equipment was used.
3. Describe/diagram settings, adjustments or calibration.
4. If the protocol said “wait 15-25 min”, be specific: “start wait 3:56pm” and “stop wait 4:17pm”.
5. Record chemical lot# and expiration dates.
6. If in doubt, write it down. You never know what may be a relevant factor in an experiment.
7. Record what parts of the experiment you do and what parts someone else does.
8. If necessary, attach instructions from the lab handout and make a note of what has been attached. This adds clarity but does not substitute for a record of what you did. Indicate any changes to the published protocol.

### 4. OBSERVATIONS AND DATA

(These items should be recorded **as the data are collected**)

Record honestly without bias. Record as you go along, in the notebook, in ink, immediately. (Lab Notebooks are not homework.) The raw data are precious – treat them with care and respect. Record data as completely as possible.

1. Define any meaningful abbreviations that are used.
2. Take care with numbers.
  - a. Use the leading zero as in 0.15g rather than .15g.
  - b. Always write the units when units exist.
  - c. Clearly write down all calculations.
3. Give computer files informative names.
4. When data are recorded directly on a computer, note the name and location of the file.
5. When data are recorded in another notebook, indicate, in your own notebook, the location of those data.
6. If errors are found later, or notes are added at a future date, indicate the date of the new annotation.
7. Do not use odd scraps of paper or the edge of your lab manual to record data or make calculations. Only if your data are in a notebook will they be available for future analysis.
8. Never erase, overwrite, or white out. Cross out erroneous material with a single line.
9. Never tear out pages.

### 5. GRAPHS AND ANALYSIS

(These items should be recorded **during lab time** while the data are still fresh in your mind.)

Graphs (either hand drawn or computer generated) provide a quick visual summary of data. They should be included in the lab notebook to provide a visual image of the work that was done in lab.

1. Label axes including appropriate units.
2. Include succinct figure legends.
3. Graphs produced on a computer should be securely attached to the notebook, indicating on the page what has been attached and indicating what computer software was used to generate the graph as well as the name and location of the computer file.
4. Write all calculations clearly, showing all of the steps and all of the units.
5. Record which statistical tests were applied to the data, which factors were analyzed, and which computer program was used for the analysis. Don't forget to record name and location of computer files.

### 6. CONCLUSIONS

(These items may be performed after the lab work **while the analysis is being done**.)

1. Briefly interpret your results in relation to your hypothesis.
2. If results were not as expected, explain how they were different, and propose an explanation for why they are different.
3. State your conclusions clearly.
4. Include brief suggestions for improvement in experimental design.
5. Include brief suggestions for future experiments.