Writing a Scientific Report or Paper

INTRODUCTION:

Results of careful laboratory work are meaningless unless they can be presented in a clear, concise manner to others for comment and evaluation, as a basis for further experimentation by others. Such presentations are usually in the form of a scientific paper published in a reputable scientific journal. Scientific communications have many things in common, which leads to a rather standard style of writing that allows the results and meaning of explanation to be quickly grasped by the reader. Scientists do not have the patients or time to read attractive, stimulating (clever) prose in order to obtain information. The experimental design, results, and explanation of results are what are attractive and stimulating. Thus, first attempts at scientific writing often incorporate florid prose with scientific facts, resulting in a generally unappealing document. The follow discussion should be useful in helping you prepare your laboratory reports, which are scientific reports. Read it carefully before beginning your reports. Your instructor may make alterations or additional comments. The specific format of a scientific paper varies among journals. However, the format presented here is the most commonly accepted, with minor details differing among journals. It is the format you should use in your scientific writing.

FORMAT: SECTIONS OF YOUR LABORATORY REPORT

TITLE
*ABSTRACT
INTRODUCTION
MATERIALS AND METHODS
RESULTS
DISCUSSION
*SUMMARY
LITERATURE CITED

* Note the Summary section (7) of this paper.

Each section heading should stand by itself, centered on the page. The text of that section follows immediately.

WHAT INFORMATION GOES IN EACH SECTION?

1. Title: Choose a title that briefly conveys to the reader the purpose of the paper. Many readers scan journal article titles, and the decision whether or not to pursue an article is based on the information in the title. Generally this information includes: (a) primary factor(s) manipulated or studied; (b) outcome of manipulation that is, the response or effects; © organism studied, if relevant. An example of an informative title would be:

Demonstration of Cellular Expression of Genes Encoding the Pigment-Dispersing Factor (PDF) Precursor in the Lubber Grasshopper Romalea microptera
2. **Abstract:** The Abstract or Summary should be an autonomous synopsis of the entire report. It serves to guide readers seeking the relevancy of the report to their own interests. Abstracts are brief, only one or two paragraphs, in which the author indicates what was done, the reasoning behind it, the results, and conclusions.

3. **Introduction:** The Introduction should indicate why the study was done and give the reader sufficient background to understand the report or paper. The “why” of the study usually includes historical information that leads to an interesting study (yours) and the significance of the study to a specific discipline (such as developmental neurobiology) to which the study belongs. The reader, after pursuing the introduction, should know precisely the importance of the problem being addressed. Note: any historical background (that is, previous studies) must be properly cited. See the Literature Cited section in this paper.

4. **Materials and Methods:** A reader can evaluate the results of your study only if he/she understands the experimental design, the materials used, and the reasoning behind them. Thus, it is important to carefully outline procedures and techniques used. Generally, techniques and procedures that are already published in laboratory manuals and other sources need not be fully described, but briefly outlined and referenced is sufficient. Any unpublished deviations from the standard procedures should be carefully described so that others can appraise the new techniques themselves. Complicated procedures could be graphically outlined. Besides procedures, this section should include models of equipment used, source of chemicals (if relevant), numbers and types (may include sex and/or strain) of organism used, sample size, number of times experimental procedure was performed, and any other pertinent facts.

5. **Results:** It is crucial that the outcome of experiments be carefully organized and clearly presented. This is best accomplished by presenting data in clearly labeled graphs and tables. What the tables and/or graphs are meant to indicate should be clear without reference to the text. However, references to each graph and table should be made in the text of the Results section. Graphs and tables should be numbered in the order in which they are mentioned in the text; that is, tables should be labeled as a consecutive series (Table 1, Table 2, and so on). The text should also summarize information presented in the tables and/or graphs that will be pertinent to the following discussion.

6. **Discussion:** The significance and interpretation of the study should be explained in the Discussion section. In this section, specific points made in the Results section should be discussed in light of previous studies and hypotheses. Often, new hypotheses are put forth, based on experimental outcomes. Some questions that can be answered in interpreting the results in the Discussion section are: Are some of the results due to artifacts? How do you know? How might the experimental design be altered to diminish artifacts? Why are these results the same as (or different from) those previously published studies? What parameters of the experimental design were important in the expected (or unexpected) results? The most important part of the Discussion section is establishing what the results indicate, both for the ongoing study and for future studies. Were the questions, as outlined in the Introduction, answered by this study? If not, how
could the study be redesigned? What future studies are indicated by the results? Be sure to reference additional studies. In brief, the Discussion section is where results are analyzed and conclusions are drawn.

7. Summary: Read the Abstract section. You may use one or the other but not both. The Abstract is favored by your instructor. However, either is acceptable. If you choose the Summary it will be placed after the Discussion section in the scientific report.

8. Literature Cited: Alphabetically list all sources of fact or theory mentioned in your paper that were not generated by you. This will primarily include research articles, but may include review articles and texts as well. Citing references in the text of the paper. Ideas or facts not your own cited in the text must be attributed to their sources. In your laboratory reports you may do this in one of two ways:

The “clock genes” are essential for correct expression of circadian rhythmicity in *Drosophila*. (Meinertzhagen and Pyza, 1996)

or

Meinertzhagen and Pyza (1996) found that the “clock genes” were essential for correct expression of circadian rhythmicity in *Drosophila*.

Scientific Writing: Problems arise in writing scientific papers because of the specific aim of scientific writing: to be clear, concise, unambiguous, and accurate. Due to space restrictions in journals (and time limitations of this instructor) every word must help to convey the required information. The report as a whole should be objective and self-explanatory.

HINTS FOR WRITING A SCIENTIFIC PAPER:

1. Avoid wordiness! This includes eliminating redundancies.

2. Reports are usually written in the past tense. Conjecture (discussion) is often written in the present tense.

3. Do not use footnotes.

4. Be sure that there are more than just graphs and tables in the Results section. Also, make sure that each graph and/or table is referred to and that reference is not made to nonexistent tables or graphs.

5. Check that each section contains the proper information; for example, do not put results in the Material and Methods section.

6. Check that each Literature Cited item in the text and that each citation in the text appears in the Literature Cited section.