APPENDIX A

LAB REPORT WRITEUP INSTRUCTIONS

Lab reports for experimental labs that you will do in biology must include the following sections:

I. Introduction
II. Hypothesis
III. Materials and Methods
IV. Results
V. Discussion of Results
VI. Conclusion
VII. Ideas for Further Investigation (if so specified by instructor)
VIII. Literature Cited

These section headings are centered on the page and the body of each section follows immediately beneath the heading. Do not use a new page for each section.

I. Introduction

The introduction gives background information about the topic that you investigated or performed an experiment on. It summarizes what you have been able to find out concerning previous work done and about the present state of knowledge concerning the subject.

The sources that you use in this section (as well as in the discussion section) must be properly cited. Any time you mention any information in your paper that you did not actually obtain by **your own** experiments or observations, you **must** include a reference to indicate the source of that information. This is referred to as citing the reference (in your English papers you refer to this as footnoting). Scientific papers **do not use footnotes**. To cite a reference in the body of your text, you put author's last name only, with no title (such as Mr. or Dr.) included, and the year of publication in parentheses at the end of the material to be attributed to a particular source. The period at the end of the sentence follows the citation. For example,

The majority of orb weaving spiders weave only one web per day (O'Conner, 1998).

With three or more authors for any one reference, use only the name of the first author, followed by the abbreviation, et al.

California gray whales migrate up to 18,000 km each year (Carlton et al., 2000).

The introduction also presents the question you are trying to answer. If the question has been dealt with for organisms other than those that you tested, you could include that in this section. To find this information you will need to look up key words in your literature search. For example, in searching for information for writing a report on the Predator Prey Experiment in Biology 101, you could look up key words such as natural selection and protective coloration in the index of your text. For the Investigative Report for Bio 102, you will be expected to use additional reference materials. Again, all material that you have gathered from other sources, such as textbooks, journals, your Study Guide, etc., must be correctly cited in the body of the Introduction. In addition, you will need complete bibliographic information for the Literature Cited section (see below) for all references you use.

II. Hypothesis

The hypothesis is a simple predictive statement about what you expect to be the outcome of your investigation. For your lab reports, it should be made **before** you begin your experiment in the lab, not after you have done your library work for your introduction. Do not explain why you expect it to happen in the way you predict. The hypothesis should flow logically from what you have said in the Introduction.

III. Materials and Methods

In this section, the procedure the scientist used is explained in detail so that another scientist could repeat the experiment from the directions in the paper. However, in most cases in this course, you will have followed directions from the *ELI General Biology Study Guide and Laboratory Manual*. If that is the case, you should **summarize** the basic procedure and then refer the reader to that source (correctly citing the *Study Guide* as the source). This reference must also be listed in your Literature Cited Section (see below). Any changes in procedure that you might have made should be clearly described in this section. In Biology 102, you will be required to do an Investigative Lab in which you will design the experiment. In that situation, it is obviously necessary to include the directions in detail.

Whether the procedure is summarized or written in detail, two important points to keep in mind:

1. When you write this section do not write this as though it were directions in your lab manual. For example, do **NOT** write in the following manner: *First pour agar into six petri plates. Then add fungi. Then you put the plates into the incubator.*
Rather, you should describe, either in the first person or in passive voice, how you performed the experiment. For example: *I filled six petri plates with agar and inoculated them with the fungus. I incubated them overnight at 25°C.* **or** *Six petri plates were filled with agar and inoculated with fungus. The plates were placed in the 25°C incubator overnight and examined the next day.*

2. Do **NOT** make a list of the equipment and materials that you used. These are simply mentioned in the narrative as the experimental procedure is explained.

IV. Results

Your results are presented in this section in a straightforward manner, with **no** conclusions or value judgments as to what the data might mean. You must include in this section the following:

1. a narrative summary of your results,
2. table(s) presenting the data you collected
3. graph(s) of the data collected.

A summary might read as follows:

The results of the experiment are shown in Figure 1. The amount of oxygen produced by the plant increased between 10 and 30 degrees Celsius, but decreased between 35 and 50 degrees. The greatest amount of oxygen was produced between 25 and 30 degrees.

V. Discussion

In this section you explain what you think your results mean. You describe any pattern that you saw, or any relationships that became obvious to you. Be careful in concluding that your results are actually meaningful or significant, rather than simply due to normal variation. For example, is a 0.3 beat per minute rise in heart rate a significant increase? The term significant implies a statistical test; you may want to calculate percentage differences in your results, for example, for the purpose of discussing significance.

You also include here any explanations as to why you think your results turned out differently from the way you expected--for example, you may not have waited long enough for something to occur, or you were not able to maintain the correct temperature for a reason you can explain here, or you forgot to add a chemical you were supposed to add or your sample size was too small. In this section you can compare your results to information which is already known about the problem and which you may have learned in your library reading. Remember to cite references here also.

VI. Conclusions

This section is a partial repeat of the discussion section (and sometimes you can combine these two sections). Here you simply state your conclusions, but **without** any of the reasons as to why you reached these conclusions. The conclusions can usually be expressed in one or two sentences while the discussion is often several paragraphs in length. You can conclude that you have support or do not have support for your hypothesis; you never "prove" your hypothesis. A reader could quickly scan this section to find out what your results were in the experiment.

VII. Literature Cited

In this section all published information that you referred to anywhere in your written paper is listed. It includes only those references you actually mentioned in your paper, not information from books you may have read but did not actually use in your paper. The listing must be alphabetical with the last name of the primary author first. The names of **all** authors are given, even if there are five or more authors. If there is no author or editor, use the first noun in the title of the article for its placement. In addition to the names of all authors, you will also need the year of publication and the full title of the book or article. When citing books, the publisher, the place of publication, and the pages referred to are used. When citing a journal article, the name of the journal, the volume number of the journal and the page numbers of the article will be needed for the citation.

Although there are many types of sources that can be drawn from, the following examples represent the most commonly used by students. If you have a type of reference that is not illustrated, please ask your instructor for advice.

Example 1: Textbook or Book

Fautin D. G., D. J. Futuyma, and C. J. Frances, editors. 1998. Annual Review of Ecology and Systematics, Vol. 29. Palo Alto: Annual Reviews.

Raven, P. H. and G. B. Johnson 2002. Biology, 6th Edition. New York: McGraw-Hill.

Example 2: Standard Journal Article

Melcher, J. C., K. B. Armitage, and W. P. Porter, 2000. Energy allocation by yellow-bellied marmots. Journal of. Zoology 80 (2) 425 - 39.

Note that only the first letter of the first word in the article title is capitalized.

Example 3: World Wide Web

If you use an Internet site as a reference source you must first judge whether the site is reliable. In order to do this, you must be able to determine the author and/or the organization. If this is not deemed reliable, or cannot be determined, the site is not usable as a reference.

The format is as follows:

TITLE OF MONOGRAPH OR PAGE [monograph online]. Place of Publication: Publisher; Year of Publication. Availability Information. Date of Access.

It would look like:

RECOGNITION AND MANAGEMENT OF THE PERIMENOPAUSAL PATIENT IN CLINICAL PRACTICE [monograph online]. University of Medicine and Dentistry of New Jersey; 1998 May. From: Femhealth, http://peri-menpause.com Accessed 1999 May 20.