**BIOL175/ 375: Analysis of a Scientific Paper**

The main purpose of a scientific paper is to report new results and to relate these results to previous knowledge in the field. Papers are one of the most important ways that scientists communicate with one another. We will be reading many in this course.

**1. Organization of a Scientific Paper**

In most scientific journals, scientific papers follow a standard format. They are divided into several sections, and each section serves a specific purpose in the paper.

A paper begins with a short **Summary** or **Abstract**. Generally, it gives a brief background to the topic, describes concisely the major findings of the paper, and relates these findings to the field of study. As will be seen below, this logical order is also that of the paper as a whole.

The next section of the paper is the **Introduction**. In many journals, this section is not given a title. As its name implies, this section presents the background knowledge necessary for the reader to understand why the findings of the paper are an advance on the knowledge in the field. Typically, the Introduction describes first the accepted state of knowledge in a specialized field; then it focuses more specifically on a particular aspect, usually describing a finding or set of findings that led directly to the work described in the paper. If the authors are testing a hypothesis, the source of that hypothesis is spelled out, findings are given with which it is consistent, and one or more predictions are given. In many papers, a “roadmap” to the rest of the paper is presented in the last paragraph of this section; the authors may even divulge one or several major conclusions of the paper so that the reader knows the major answers to the questions just posed.

The next section of most papers is the **Materials and Methods**. In some journals this section is the last one. Its purpose is to describe the materials used in the experiments/field research and the methods by which the experiments/field research were carried out. In principle, this description should be detailed enough to allow other researchers to replicate the work. In practice, these descriptions are often highly compressed, and they often refer back to previous papers by the authors.

The third section is usually **Results**. This section describes the experiments and/or field methods and the reasons they were done. Generally, the logic of the Results section follows directly from that of the Introduction. That is, the Introduction poses the questions addressed in the early part of Results. Beyond this point, the organization of Results differs from one paper to another. In some papers, the results are presented without extensive discussion, which is reserved for the following section (the Discussion). This is appropriate when the data in the early parts do not need to be interpreted extensively to understand why the later experiments were done. In other papers, results are given, and then they are interpreted, perhaps taken together with other findings not in the paper, so as to give the logical basis for later experiments.

The fourth section is usually the **Discussion**. This section serves two main purposes. First, the data in the paper are interpreted; that is, they are analyzed to show what the authors believe the data show. Any limitations to the interpretations should be acknowledged, and fact should clearly be separated from speculation. Second, the findings of the paper are related to other findings in the field. This serves to show how the findings contribute to knowledge, or correct the errors of previous work.

Finally, papers usually have a short **Acknowledgements** section, in which various contributions of other workers are recognized, followed by a **Reference** or **Literature Cited** section which gives references to papers and other works cited in the text. Some papers may also include an **Appendix** or **link to on-line materials** which contain detailed supplemental information or data.

Papers also typically contain several **Figures** and **Tables** throughout the text. These may be illustrations of a study area or piece of equipment, or contain data described in the paper. The figures and tables also have legends, whose purpose is to give details of the specific information contained in the figure or table. *TIP: Scan the figures and tables to get an idea of the most important results.*

**II. How to Read and Understand a Scientific Paper**

1) Read the paper. *Slowly*. You will not understand many of the words, symbols, and terms you come across. Every time you find something you don't understand, write it down on a second piece of paper.

2) Look up the unknown words/phrases/symbols using books and/or the internet. Write down what your unknown words mean.

3) Re-read the paper. In the margins, write down questions that you have as you read the text.

4) Look up papers cited in the References/Literature Cited. These cited papers will contain background information on this experiment, area, or method that will help you to understand your paper. Obtain those papers that you feel will be most beneficial to your understanding/interpretation of the paper. Read them. Make notes as they pertain to your original paper. *Hint: If you notice that a paper is cited multiple times, it is probably a very important paper and you should obtain it.*

5) Put down the paper and do something else for a few days.

6) Re-read the paper. In the margins, write down questions that you have as you read the text. [This isn't a typo. You should do this step again.]

7) Synthesize the information and apply what you learned from the paper to the purpose at hand.