

**Professor Mark Davis of Macalester College created this Useful Flyer of Information (part of a series of “UFIs”), inspired by Reader’s Digest founder Dewitt Wallace.**

## **HOW TO WRITE A SCIENTIFIC RESEARCH PAPER**

Scientific research is not a solitary endeavor. Rather, science is a communal effort. Scientists use findings and ideas of other scientists as the basis for their own studies, and in turn report their findings back to the scientific community. Thus, communication of findings is part of the scientific process. In fact, only by writing papers, presenting seminars, or reporting findings in some other way, does one become a full participant in the scientific research community. In other words, a good scientist is also a good communicator.

A scientific research paper normally follows a standard format (described below). A common problem in many scientific papers is that the author does not put material into the right sections. Thus, pay close attention to the functions of the different sections described below.

**TITLE.** The title of your paper should be a clear and concise description of the paper's content. When trying to think of a title, do not try to be clever, witty or impress the reader with technical jargon. Remember, your goal is to communicate information. A simple, direct title is best.

**ABSTRACT.** The abstract summarizes the essentials of the paper. It briefly describes the project's purpose, methodology, and key results. Abstracts are often limited to a few hundred words, so you need to be concise. Often, the abstract is written after a paper is completed.

**INTRODUCTION.** Good scientific papers explain how the specific study being described is related to other research and ideas on the same topic. Good papers not only report on the specific details of a particular project but also help illuminate larger issues of interest to readers of the discipline. The introduction is where the author helps the reader see the larger context for the specific study. This is accomplished by briefly reviewing some of the relevant literature and explaining how the current project is related to the existing body of work. This is also the time to describe the goals and objectives of the study, e.g., to test certain hypotheses or answer a set of questions.

**METHODOLOGY.** The methodology section, sometimes called "Materials and Methods", is where the author describes how the study was conducted. The description should be complete enough so that the reader can evaluate the appropriateness of the methods to answer the questions or test the hypotheses presented in the Introduction. If you employed some methods that others have used, you should cite the publications in which the methods are described. In some cases, you might want to include a subsection (or a separate section) in which you describe your study site. If you performed some statistical analyses on your data, you should describe in the Methodology section what sorts of analyses you performed.

**RESULTS.** In the Results section, you should report, but not discuss, your results. In other words, "Just the facts, please". In most papers, a verbal report of the results is supplemented with

some tables and/or figures (graphs, diagrams, photographs, etc.). Remember, it is not the reader's job to figure out what the different tables and figures are trying to illustrate. The author needs to summarize the key findings verbally first and then refer the reader to relevant tables and figures for more a more detailed or graphic representation of the results. Figures and tables should be numbered so that you can refer the reader to them, e.g., 'The results showed a strong correlation between rainfall and primary productivity (Fig. 1)'. All tables should have a title, and you should provide a legend for each figure. The legend should include the title of the figure and any other information that will help the reader understand the what is being illustrated.

**DISCUSSION.** The discussion is where the author describes what the results mean. Were the original hypotheses supported, or questions answered? How do you explain some unexpected results? Do the findings support or contradict findings from similar studies? These are some of the sorts of questions you might address in the discussion. Most of the discussion should confine itself to the specific results of your study. However, it is usually appropriate to comment briefly on the larger significance and ramifications of your findings.

**ACKNOWLEDGMENTS.** Most scientific articles include a brief section in which the authors thank various people who have contributed in some way to the article. These contributions could be in helping to form the original hypotheses, collecting data, helping to analyze the data, or reviewing an earlier draft.

**LITERATURE CITED (SOMETIMES CALLED BIBLIOGRAPHY).** You need to provide full citations for all works mentioned in the body of the paper, and you should only cite works mentioned in the paper.

**A FEW FINAL THOUGHTS.** Contrary to what most students have been taught, there is no hard and fast rule about the use of active vs passive voice in scientific articles. Likewise, there is no standard format for citing other sources or for citation style in the Literature Cited section. This means you need to consult with the editor or professor ahead of time to find out the specific instructions for the paper you are writing.

Above all strive to be direct and clear. Ultimately, you are trying to persuade the readers about the significance of your findings. Only in very rare circumstances do results speak for themselves. In most cases they need an ardent and articulate advocate--you!