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 or research community. In other words, a good scientist is also a good communicator.

A scientific research paper normally follows a standard outline and format (bolded below). A common problem in many scientific papers is that the author does not organize material into the appropriate sections. Thus, pay close attention to the functions of the various sections described herein.

TITLE. The title of your paper is very important. It should be a clear and concise description of the content of the paper. When creating a title, express the subject but do not try to impress the reader with technical jargon. Sometimes a clever, informed phrase can attract readers, but witiness is not the goal. Remember, your goal is to communicate information. A simple, direct title is usually best.

ABSTRACT. The abstract summarizes the essentials of the paper. It briefly describes the purpose, any unusual methodology, and key results of the project. Abstracts are often limited to a few hundred words, so they need to be concise. The abstract is best written after a paper is completed. (For more information on writing a good abstract, see the Abstract UFI.)

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. Interpretations made earlier and now known to be incorrect are disqualified here as well. 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 as presented in the Introduction. If you employed some methods that others have used, you should cite the publications in which those methods are described. In many cases, it is appropriate for geologists to include a subsection (or even a separate section) in which you describe your study site. Headings often used include “Geologic Setting”, or “Location”, or (“Stratigraphic”, “Depositional” or “Structural”) “Setting”. If some statistical analyses were performed on the data, they should be described completely and accurately in the Methodology section. Another worker should be able to easily repeat your methods.

RESULTS. In the Results section, one should report, but not discuss, the primary results. In other words, "Just the facts, please". The verbal report of results is supplemented with tables of data and/or figures (graphs, diagrams, photographs, etc.). Remember, it is not the reader's job to figure out what the various tables and figures are trying to illustrate. An 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 each be numbered consecutively so that the reader
may refer to them when intended, e.g., „The results show a strong correlation between rate of uplift and rate of erosion (Fig. 3)‟. All tables should have a descriptive title, and a caption for each figure should be provided. The caption should include the subject or title of the figure and all other information that will help the reader understand or interpret what is being illustrated.

Notice that much of this discussion of “Results” is focused on Figures and Tables. This is no accident. In geological writing, it is as important (more important?) to carefully plan illustrations and tables as it is the text. Poor illustrations can negate very sound research by failing to clearly illustrate one’s discoveries. In fact poor graphing skills can fail to demonstrate scientific relationships that are present in one’s data. Researchers are responsible for learning how best to graph relationships and how to work with graphics to best illustrate their scientific results (see the related handout on “Preparing Scientific Posters for Geologic Conferences.”).

DISCUSSION. The discussion is the section of the paper in which the author describes what the results mean. Were the original hypotheses supported, or questions answered? How are unexpected results explained? Do findings support or contradict findings from similar studies? These are some of the sorts of questions you might address. If most of the discussion is confined to the specific results of your study, the section may be better titled “Interpretations” or “Analysis of Results”. However, it is usually appropriate to comment on the larger significance and ramifications of your findings as part of a “Discussion” of the implications of the work. This section should include thorough citation of the works of others that are involved in your discussion.

CONCLUSIONS. It is often important to extract the main conclusions from the text and summarize them as the “take home” ideas of the paper. This is frequently done with a numbered list of the points made.

ACKNOWLEDGMENTS. Most scientific articles include a brief, but important, section in which the authors thank various people, granting agencies and institutions who have contributed in some way to the work. These contributions could be in helping to form the original hypotheses, collecting data, aiding data analysis, providing financial resources or collecting permission, or reviewing an earlier draft.

LITERATURE CITED. This section is sometimes called “References Cited”. Here one provides full citations for all works mentioned in the body of the paper and only those works mentioned in the paper. Every research paper follows one or another bibliographic style. Check with professors (or journal editors) to learn the style, or apply a digital style editor, and use it consistently for all citations.

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!

This UFI (Useful Flyer of Information) was developed and written by Mark A. Davis for the benefit of students. It has been modified by J. M. Erickson and the Geowriting class at St. Lawrence University. For other UFIs see the Geology Dept. UFI webpage: