Writing a Scientific Research Paper

Writing a high quality scientific research paper is one of the most difficult and important aspects of science. The goal of this brief tutorial is to lay out some key concepts in the process of writing a scientific paper. We will not cover methods for any one field, but rather, provide a general approach to the process. For help with specifics within your field, your best bet is to ask your advisor or other members of your lab for assistance.

When am I ready to write?

The simple answer here is this: when you can prove something that is novel and important. You must have sufficient data to tell a story that reveals something new about nature that is also important. Obviously, you must have a thorough knowledge of the available literature to gauge your results. Additionally, it is essential that you are able to repeat your experiments and achieve the same results. Finally, your advisor will usually give you a "thumbs up" to write when the time is right.

Ok, so I have a story. What do I do now?

The first thing to do is to just get something down on paper. Don't worry too much about the quality of what you are writing at this point. It is critical to something written since it will help you to overcome writer's block. Once you have written your first paper you will find that constant revision is part of the writing process. Therefore, your mission is to get ideas down for each section so that you have something to mould into your final masterpiece.

Typically, a scientific paper consists of the following sections (in order): Title, Abstract, Introduction, Materials and Methods, Results, Discussion / Conclusions, and References. Although this is the order in which the sections will appear in your paper, they are often written out of turn. For instance, your References section will be worked on throughout the writing process. Oftentimes, the easiest section to start with is the Materials and Methods section. Let's start there.

Materials and Methods

This section consists of what you actually did. For instance, you'll describe any software you used, a new technique you invented, what organisms were cultured, etc. You need to be specific about how you did things such that another researcher can repeat your experiments. This section is typically the easiest to write because you have presumably done your experiments many times. Therefore, they should be second nature to you and writing about them should just be a matter of recalling them from memory. Once you have a rough amount of material down for this section, you are ready to begin writing others.

Results

The next easiest section to write is the results section. Here, you will write only about what your data actually are, not what they mean in a greater context (we'll save that for the discussion section). For instance,

"We measured the rate of X to be 274 ± 15 flampoblargins." (appropriate)

"We found the rate of X to be consistent with the Bunny Model." (inappropriate)

The first statement is fine since it indicates a value that is measured. The second statement is inappropriate because it is an interpretation of what the data mean. Such interpretations should be left for the Discussion section.

Discussion / Conclusions / Introduction

Within the Discussion section, you need to interpret your data and present what they mean. It is here that you will talk about why your data are relevant and important and what remains to be done in the field. The catch is, in order for your audience to understand what is going on, you need to make sure that they are familiar with your subject. As such, it can be useful to write the Introduction section along with the Discussion section. The idea here is that, when you want to make a point in the Discussion section, you then just make a note in your Introduction section saying, "Ok, I need to explain this point." By the time you have a first draft of your Discussion section, you'll know what needs to be in your Introduction section.

Title / Abstract

The Title and Abstract are probably the most important sections of the whole paper. The Title immediately clues the reader (and the reviewers) into what your point is and why it's important. As such, your Title should be concise, specific, and interesting. Assuming that you've written a fantastic Title, your Abstract will act as a "movie preview" that readers (again, and reviewers) will use to see if they want to actually read your paper. Your Abstract should be short (usually no more than 250 words) and should briefly describe what you're studying, what's been done, what you've found, and why that's interesting. Writing a good abstract is the key to getting your paper read, and accepted, by reviewers.

Final considerations

The basic idea behind good paper writing is to make sure that you've got good solid chunks of writing down that you can mould and reshape through revision. No one gets it right in one draft and it takes multiple rounds of revision to make sure that you've got everything that you need.