



Writing for Science (Transcript)

If you are watching this video, you are probably completing a lab report or writing the final paper for your scientific method research project. That can be a challenge for everyone. Science is tough and writing science is tough too. I'm Professor Murray and I teach biology at GMC. In this video I will give you some tips to help you start writing scientifically. You have already learned good writing skills and how to use scholarly databases in this writing nook, so I will not cover any of that in this video. So let's get started.

When scientists complete their research, they write a scholarly paper and submit it to a scientific journal. Then the publishers send it to other scientists to review. And sometimes they repeat the experiments. The final research paper must be close to perfect to be accepted for publication. Scientists' work can be excellent, but if their writing is poor, it could be returned to them because of bad grammar.

Now, what can you do to make your paper clear, precise, and easy for the reader to understand? The first thing you should do is to make a good plan for writing your paper. Think about the key points you want to make. Look at all your experimental results. Take notes as you read through them, and use these to create an outline. Ask yourself the critical pieces of data you want to include in the report. Put them in a logical sequence in your outline.

Now you can begin writing your first draft. An outline will make it easier to put your notes into complete sentences and help you see the big picture. When you read a scientific paper published in a peer-reviewed science journal, it is typically organized in the following manner. The title, abstract, introduction, materials and methods, results, discussion, and references. The completed paper will be in this sequence, but you will begin writing it from the middle. After completing your research, the easiest part of the paper to write is the methods and results. You have your sequence of data, tables and figures, and then using your outline, you can begin writing the first draft of your results and the discussion. Do not be tempted to start writing the introduction, because that is the hardest part to write. In your discussion, briefly restate your research problem, then describe and analyze your results. What did your findings suggest? Did your results match your prediction? Why or why not? Recommend other types of experiments for further analysis of your research.

You may have already written the first draft of an introduction, but now it is time to write the final draft of it. At this point, you have learned more about your experiment, so you have more to include in it. In your introduction, you should tell the reader why you are conducting this experiment. You should write essential background information about everything in your experiment so the reader understands your project. Write a clear problem statement. Explain how you are going to test it. You should also include your hypotheses in the introduction. Be sure to include in-text citations that refer the reader to the scientific literature you use in your list of references.

Now you have your first draft of your introduction, methods, results, discussion, and your list of references. Great, let's go get a pizza. But no, I'm afraid this is where the hard work of editing begins. Expect to do several rewrites. Rewriting is very typical for writing science.

- First, double check your results. Do they match the notes you made in your lab notebook? Do the results match what you have written in your discussion? Did you use the correct units for everything? Is the math correct?
- Second, check your grammar and spelling. Spell checkers are not very good at recognizing scientific terms, so be careful when using them.
- Third, remember to write all non-standard abbreviations in their entirety the first time they appear in your paper. You may use the acronym after that. For example, CRISPR is the acronym for Clustered Regularly Interspaced Short Palindromic Repeats. CRISPR is revolutionary gene editing technology that has dramatically benefited medicine and agriculture. Just Google the gene therapy casgevy to read about its groundbreaking success in editing the gene for sickle cell disease.
- Fourth, use active voice. Instead of saying the DNA was amplified by the grad student, you should write the grad student amplified the DNA.
- Fifth, be careful not to put too much information in one sentence like the one I wrote in my master's thesis: "Complementary DNA's for two aquaporin water channel genes were amplified, cloned and sequenced to initiate a study to confirm the presence of IQP 3 messenger RNA. Bands exhibiting 1.2 and 1.3 and were observed through northern blot analysis and microinjected into Xenopus oocytes that significantly elevated water permeability compared to control oocytes at neutral pH." Probably should have made this a little easier for the reader to understand. Make it concise. Try to simplify everything that you can, without leaving out important details, of course. Leave out needless words. Instead of saying "in the absence of", just say "without." Or how about "conduct an investigation of", just say "investigate." There's no need to use extra words and phrases just to make it sound more scientific.
- Sixth, avoid ambiguity. We like to see more than one meaning in a poem. That is what makes it interesting. But in science, it frustrates the reader and could cause errors that might lead to disasters. Or at Boeing, maybe? After you have made all your edits, cleared out the clutter, and feel pretty good about your paper, read it out loud to yourself or to someone else. Hearing yourself read it usually will tell you where to go back and make changes.
- Finally, you will write your abstract if required. It will be the last part to write because it is a compressed summary of your paper and results. I always thought that was like reading the last few pages of a mystery novel first. You might have only read the abstract when you searched for scholarly papers, but a well written abstract can provide most of the information you need about the author's paper.

The last page of your paper is a list of the references, Literature Cited. Always use the American Psychological Association Citation Formatting Style, affectionately called APA. You can learn about APA style in the GMC Library, the Writing Nook, and the APA Style course on Moodle. So I hope I have given you some useful tips for you to earn an A on your lab report or project paper. I will leave you with something a wise professor once told me to do. Write to others as you would have them write to you.