HOW TO WRITE A GOOD TECHNICAL ARTICLE

TERRY CONNERS

ASSOCIATE EXTENSION PROFESSOR, DEPARTMENT OF FORESTRY, UNIVERSITY OF KENTUCKY, LEXINGTON, KY USA

I HAVE FIVE CARDINAL RULES FOR WRITING TECHNICAL ARTICLES:

1. Tell a story. Keep the organization of your article linear and focused.
2. Be clear, be concise. Try to engage your readers, not bore them with well-known information or arcane minutiae. Don't sacrifice clarity in an attempt to shorten your writing, however.
3. Use the active voice and simple sentence construction.
4. Use HEADINGS, and break each major section into short subsections. Short subsections are easier for readers to digest, but be sure to organize them well.
5. Bring the reader up to speed. All of us are so immersed in our own field of expertise that we often forget just how mysterious our specialty can be to outsiders. Avoid unexplained jargon.

I HAVE THREE FURTHER RECOMMENDATIONS:

- Write the *beginning* of your Introduction only after you've written everything else except your Abstract. Go ahead and write a working introduction if you like, but plan on throwing it away. Sometimes it takes a while to "get into the groove" of writing what you are trying to say–accept that and don't try to be protective of your own writing.
- Write your Abstract last.
- Write your article, set it aside, then reread it with an eye to finding out all the dumb things you wrote and all the obvious things that you left unwritten too. Make a second draft, then a third. Read it out loud, and if it sounds good to your ear, take one last look at it before you submit it. None of us is a good enough writer to write a good article in one or two drafts.

PARTS OF AN ARTICLE:

1. **THE TITLE**
    a. Be descriptive and complete, but keep it as short as possible.
2. **THE ABSTRACT**
    a. This needs to be written last, because you can restate parts of your already-written Problem Statement, Procedures and Conclusions. Be clear and keep it short; this is your sales pitch to a potential reader. It's also the only part of your article that nonspecialist readers might ever read.

Submitted to Wood and Fiber Science 10/15; presented at the SWST Annual Meeting 2015.

3. **THE KEYWORDS**
    a. Keywords aren't part of the research, nor are they part of the report, so they are usually neglected until authors submit an article to a journal. Nonetheless, keywords are used in computer searches to help find articles, so take care to be complete.
4. **INTRODUCTION**
    a. **THERE ARE THREE PARTS TO A GOOD INTRODUCTION:**
        i. THE GENERAL BACKGROUND OF THE PROBLEM YOU ARE ADDRESSING
            a) Don't be too generic or obvious ("wood decays", for example) (Cardinal Rule #2). If you are writing about a topic that is outside the training of the usual readers of the journal, you need to find a way to educate your readers about the essence of your discipline so that they can appreciate the fine work you did in the rest of the article (see Rule #5).
            b) Describe the problem or lack of information you have observed, because this will give your readers a context for the literature review which will follow! It is sometimes appropriate to state an hypothesis instead of a problem.
        ii. THE LITERATURE REVIEW
            a) Adding citations helps people locate related articles. This means that if someone has found one of your cited articles they are going to be more likely to find your article as well. Therefore, try very hard to be complete when you do your literature review. Look internationally.
            b) Don't just list other researchers who have worked in the area you are reporting on. Help your reader to understand the meaning of what your research predecessors did – it is only by carefully explaining the value of their work that your readers will be able to appreciate the importance of what you are writing. Compare and contrast, poke holes, celebrate the success of others – and at the end, note what has been left unexplored, because this leads to the final part of your Introduction.
        iii) The Problem Statement
            a) Your problem statement might be more limited in scope than the general problem or hypothesis you wrote about earlier. C*larity* is your principal objective; conciseness should be your second objective. A problem statement should be a separate paragraph; <u>don't bury it</u>.
            b) Believe it or not, many authors neglect to write a Problem Statement, or they may inappropriately place it in the middle of the Materials and Methods section, long after the reader has gotten confused and tired of figuring out what the author was trying to do. (It really doesn't matter at that point, because tired readers stop reading.)

5. MATERIALS AND METHODS

The Materials and Methods section is frequently neglected, and it's one of the sections that can often be most improved in a second draft. This is a common way to write this section:

- a description of the Material: the wood species used, the specimen size(s) chosen and
- a description of the Methods: the tests conducted

This does seem to fit the needs for this section, but what is missing in almost every instance is a preliminary paragraph or two that explain the overall structure of the experiments!

a. THERE ARE THREE PARTS TO A GOOD MATERIALS AND METHODS SECTION:

i. INTRODUCTORY PARAGRAPH

a) Every Materials and Methods section needs an introduction. In just a paragraph or two, describe the overall approach to solving the problem or validating your hypothesis. If you give readers this information at the beginning, they won't struggle to discover your logic as you describe your choice of materials and experiments. This is an appropriate place to tell readers why you chose to use certain material/species, and why you chose to solve the problem with certain kinds of tests or experiments. You can tell readers all about the details regarding specimen preparation and testing protocols in the following subsections; if your reader chooses not to read the details you provide, they can still understand the significance of the results you discuss in the next section.

ii. DESCRIPTION OF THE MATERIALS CHOSEN FOR YOUR EXPERIMENTS

a) Now that your readers know the species you used and the types of testing you conducted, you can immediately proceed to describing how you selected your material or cut your samples (or whatever, as appropriate to your research). This subsection can sometimes be called **Sample Preparation**. I often read very confusing descriptions of how mechanical testing specimens were cut from a larger sample. Consider whether a diagram would make this subsection impeccably unambiguous.

b) Did you pretreat your specimens in some fashion prior to testing (drying or grinding them, for example)? Describe the conditions or protocol clearly. Don't burden your readers with descriptions of every piece of apparatus used, nor with the manufacturers of said equipment, unless the apparatus was unusual or custom-made and an exact match would be required for a reader to duplicate the experiments. (An oven is an oven is an oven …)

iii. DESCRIPTION OF THE TESTING METHODS USED IN YOUR EXPERIMENTS

a) Break up the description of testing procedures into as many subsections as makes sense to you. Remember–use HEADINGS (Rule #4).

b) Depending on your experiments, there may be a logical order in which to set forth the descriptions. This will help your readers to follow what you did.

6. RESULTS AND DISCUSSION

a. Document your results for each procedure described in your Methods section. It would be appropriate to use a parallel set of subsections.

b. An overall Discussion section normally follows your Results, but you may need to make short comments within individual Results subsections as well (e.g., "the specimens always burned so the data weren't useful."). Don't try to be too analytical in these short subsections, keep your writing focused on the matter at hand. Pay attention to your headings and weed out anything that strays beyond the topic.

c. Your (overall) Discussion section is where you evaluate the entirety of your project's results. For example, you may have found that "such and such" a relationship exists but only when factors A & B are present. You may have already stated that in your subsections, but this is your opportunity to place your findings in context. Take the time to clearly explain how the results are connected, particularly if you have multiple experiments on which to report. Clearly explain what your results mean. You will summarize these results in the next section.

d. Tables and diagrams are sometimes overloaded with information. Take a critical look at what you want to present and see if you are presenting it effectively. The easiest way to present data is not always the best way for a reader to understand your results. Make sure that tables and figures are referred to in the text.

7. SUMMARY AND CONCLUSIONS

a. Authors often forget to summarize their results and proceed directly to a list of conclusions, but this presumes that the reader has read (fought, struggled) his or her way through the entirety of your article to get to this point. If you take the time to clearly lay out a summation of your findings it will help the reader who hasn't the interest or the time to read every sentence in your article.

b. The Conclusions part of your article is where authors can tell the readers how they resolved the Problem Statement/Hypothesis from the Introduction section. Make the resolution clear to the reader and point out any unresolved issues. A bulleted list of findings is often useful and appropriate.

c. One problem I've observed is that authors sometimes cite new references in this section. This is an inappropriate place for citations; any discussion belongs in the Discussion section.

8. ACKNOWLEDGEMENTS

a. Acknowledgements are often overlooked, but there are probably few studies that have been accomplished without advice from others or financial assistance. Perhaps some of the testing was conducted by an otherwise-uncredited graduate student. Be generous, be gracious; an acknowledgement costs you nothing.

9. LITERATURE CITED

a. Follow the specified format for the journal to which you are submitting your article.
b. Double-check to be sure that every article listed is actually cited in your article – and vice versa!