

The Discussion

I have included a few comments that address larger and general issues common to discussions that I hope will give you a better overall idea of how to improve this section in your writing. First you need to be clear on what this section entails, so let me provide you with a general overview of what constitutes a good scientific discussion.

The discussion is the most important component of a scientific manuscript, and I think it is fair to say that scholarly articles are accepted or rejected based in large part on the quality of this section. It is here where you must take what you have learned from your work and integrate it with what is known from previous research to produce a new synthesis – a different way of visualizing, if you will – the problem at hand. It represents the culmination of all the preceding sections, but within some larger context that promotes a greater understanding of underlying principles and not simply a reiteration of detail and fact. In the best studies, the discussion will provide a new or modified intellectual position that may alter our sub-discipline in some meaningful way. It is here that the author's personality and creativity will go beyond (within the scope of your experiment, of course) the codified style that dominates the previous sections. I once read that a thoughtful discussion of the results can transform a pedestrian paper into a stellar one – and I believe that. Of course it's one thing to wax poetic on the beauty of a great discussion, it is quite another to produce such a work. Without a doubt, this is the most difficult section for nascent biologists to produce. Indeed, many are never able to do it on their own.

Within the context of the previous description, I've tried to list some common problems and ways to avoid these to get a better draft.

Content:

- 1) Avoid paragraphs that have little or no relationship to the problem you propose to address. Unrelated sections typically read like textbook explanations of topics, concepts, or practices. While some of points may be useful when integrated with your data, few useful links are made with a simple discussion. As a result, these sections provide few insights or useful syntheses for the reader and probably need to be deleted.
- 2) You must successfully integrate your work with that of others. In later paragraphs where you talk about your data, the discussion will be greatly weakened by a lack of citations of previous work. I see students make statements that couldn't possibly have come from their results, but have not been credited to others (in its strictest interpretation, this is plagiarism). Even in places where citations are given, the relationships between known and new data are typically not explored, leaving the reader in the dark as to why the point was cited to begin with, and lending an uncomfortable discontinuity to the text. I get the impression that the cited work is almost an afterthought with no real attempt to tie it to their data.

- 3) Discussion topics that are scattered result in discontinuous sequence of unrelated points, and increases the chance that some sections are not relevant to your research agenda. While the inclusion of paragraphs inappropriate to the discussion is an easy fix (just delete them), you also run the danger of overlooking several important result conclusions that should be discussed. Omissions are more problematic in that they must be composed from scratch and be somehow seamlessly integrated into your existing framework. I suspect that both problems occurred because students failed to identify & enumerate important conclusions, organize these in a good outline format, and further develop the outline into a coherent idea map (with cross-referenced citations) before they began to write. Consequently, the discussion lacks continuity and purpose.
- 4) Finally, typical discussions have too few links to the introduction. You recall that one of the major functions of the introduction is to provide the appropriate background necessary for the reader to understand and evaluate the quality of your work. To that end you discuss what is known and perhaps more importantly, what is not known about the problem. The assumption here is that the discussion will “fill gaps” in our current understanding that were emphasized in the introduction. Stated another way, a good discussion will satisfy the need you earlier created in the reader to understand what was previously unknown. In essence, your introduction and discussion must work together to get your message across.

Style:

Errors of style are replete in most first drafts. Most professors typically mark 2-3 examples and it is their expectation that you will find and correct the remainder. We hope that by studying these you will avoid similar mistakes in future re-writes. Avoid the following problems:

- 1) *Use of vague terms.* Students have a proclivity for using words or terms incorrectly or at least not optimally, i.e., student writing styles are not as disciplined as they should be. As a result points can be vague, confusing, or even give the wrong impression to the reader. My advice to new writers is that you write to illuminate not impress.
- 2) *Poorly written text.* Problems with grammar, syntax and inappropriate sentence structure are also commonplace. Consequently, some areas in most discussions produce more confusion than clarity. The solution here is proofread, proofread, and proofread.
- 3) *Paragraph topic sentences that are either missing or unclear about the purpose of the paragraph.* Remember that all paragraphs must have a topic sentence, that when read sequentially, will reveal the general direction, results and conclusions of the paper. Typically I find many missing topic sentences in theses. In others,

the topic sentence doesn't reflect the information contained in the paragraph body. Missing topic sentences are not conducive to a good discussion, but once identified should be relatively easy to fix.

- 4) *Lack of internal organization.* Points within paragraphs often appear disorganized because they have not been couched within some structural framework. As a result students often switch between back and forth between to major categories several times in a paragraph, giving the discussion a feeling of redundancy.
- 5) *Redundancy.* Many students will have redundant text both within and between paragraphs in their first drafts, which adds to the disorganized appearance of the paper. As discussed above the major problem is a lack of topic organization prior to writing.
- 6) *Conclusions or narrative not supported by the data.* You must avoid presenting as fact, editorial or opinioned text that is not clearly supported by your data. Ways exist, for example, to comment on how your data may or may not support the assumptions upon which existing policy is based without directly commenting on the policy itself.
- 7) *Lack of parsimony.* Many theses contain a lot of what my major professor, Dr. Beitinger, would call "fluff" – nice airy stuff that sounds all warmth and sunshine, but on closer inspection is unnecessary to convey the point effectively. I would guess that, ignoring all other comments, most students could shorten their work by 20–25%. Excessive text encourages redundancy, is seldom illuminating, and generally detracts from the paper.

I think that once you have a better understanding of what a scholarly discussion entails and how it fits into the scientific format, you will be better equipped to critique your own work. The major problem with many discussions is that they lack a solid foundation and so have little depth or continuity. So where to from here?

- 1) For starters, you will need to identify the major conclusions that come from the data. You then need to determine how these conclusions fit into the larger picture of fish survival, activity, management, etc.
- 2) Under each of these major categories, determine the important individual points that will need to be addressed.
- 3) Expand each of these points to include a list of previous research (citations) that may bear on the final synthesis.
- 4) Next, construct an idea map that links each of the points (future paragraphs) together in a logical progression AND mirrors the highlights brought forth in the introduction. This step is especially important in that it lays down the *line of continuity* that holds the manuscript together. **Review this document you're your major professor before continuing.**

- 5) Construct a thoughtful and informative, yet concise topic sentence (read them in sequence with those from other sections) for each point. **Review this document you're your major professor before continuing.**
- 6) Write.
- 7) Let the ms sit for a day or two and then re-write. Good writing is re-writing – the more iterations it goes through with you the fewer it has to go through with me.

In general your writing skills are probably better than your first draft will suggest. By following the rules above and taking your time you will produce a quality product on the first attempt. In their rush to complete their thesis by some set deadline, however, students may try to jump ahead in the process. Unfortunately, there are no short-cuts to a quality manuscript (believe me if I knew of any, I'd use them myself); slow and steady really does win the race here.