



HOW TO WRITE YOUR FIRST MANUSCRIPT

(also helpful for committee reports & thesis)

Created/updated by: Dawn Bowdish Date: September 2011

Bowdish Lab, McMaster University

Hamilton, ON, Canada

www.bowdish.ca

BEFORE YOU BEGIN

- Writing your first paper is a challenge. Here are some tips that I hope you will find helpful. In a perfect world you are always thinking about how your data will become a story. Ideally as soon as you got your first real result you wrote up a plan for what additional experiments you need to complete the story and had a framework for what story you are working towards. If not, take some time to make a rough outline of what the paper will be describing the hypothesis and laying out the figures you have, hopefully this will direct your thinking.
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- The time to start writing is NOT when you think you are done your experiments. As you write it will become clear what experiments or controls are missing and it is harder to do these experiments if you have stopped doing benchwork entirely. In general, start when you think you are 75% done (and you will realize you are only 50% done).
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- The temptation to stop doing everything and read up on the background is great; however, I have found that a “read-as-you-go” approach is much more efficient. From Day 1 set up some sort of e-alert system (e.g. NCBI via Pubmed or my favourite, Pubcrawler <http://pubcrawler.gen.tcd.ie/>) to keep abreast of papers as they come out, read the most relevant and file the ones you think apply but don’t try to do an entire literature review, most of what you read will not be helpful.
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- Students often inadvertently plagiarize (you can even plagiarize yourself). Figures can be especially problematic (see notes under “Results” section). See these link for descriptions of what is/is not acceptable. <http://ori.dhhs.gov/education/products/plagiarism/> In general the “5 words” rule is used, in that if no more than 5 words in the same order, you are probably okay and “common knowledge” is not plagiarism (e.g. “*Streptococcus pneumoniae* is a leading cause of pneumonia” has likely been said before but because it is common knowledge I did not plagiarize it.)
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- Writing will take you much longer than you think.

TIMELINE

- 6 months in advance: As soon as you have your first piece of data make a paper plan, revise it frequently. Set up a literature e-alert system. Read relevant journal articles (at least the abstract and results) as they come out.
- As you are doing experiments: Get a reference manager program (e.g. Endnote). Make rough figures of your data (don't worry if the expts are not complete, you can write around what you think they will be).

WHAT YOU NEED

- Reference manager (e.g. Endnote, Mendeley is a new favourite), Photoshop/Illustrator for figures, Word processor, time, coffee, colleagues to review for clarity.

HOW TO WRITE

- If you are absolutely sure which journal you are writing for, go to their "Info for authors section" and check out word limits, styles, fonts etc. If you are unsure, write in the style of the journal you read most, they are all fairly similar and it's easy to change styles once you've decided.
- Make a document with these headings, Title (a working title may help you focus but you can leave this until the end), Abstract, Keywords, Introduction, Materials & Methods, Results, Discussion, Acknowledgements and fill them in the below order. I find it helpful to have my hypothesis written at the top of the page before I begin.
- Keywords are more important than you think as these are what PubMed & other search engines will use to label your work. You want your work to be found by both a general audience (e.g. "innate immunity") and specialists (e.g. "macrophage receptor with collagenous structure").

MATERIALS & METHODS: Start here – even if you do not know where you are going, you at least know what you did. Some journals want this section to be quite brief. Consider writing a detailed section and copying to your thesis document, then if required editing to a more abbreviated form for a manuscript can be done.

- o Write in sufficient detail so that your work can be reproduced. If you are using a standard technique and have made no adaptations you can reference it and state "as per..." but do NOT reference another paper that references that technique but doesn't describe it. This is lazy and annoying if you are hunting down the protocol. Find the original reference where the technique is described.

- To get tone and style it is perfectly acceptable to base your writing after another paper which has done the same technique. The plagiarism warning above is slightly lenient here as there are only so many ways to say to say “Western blotting was performed as per standard protocols”.

FIGURES, TABLES & RESULTS: Easily the most important part of the paper. Those who are familiar with your field (e.g. PIs) will likely only read this section so it must stand alone. This section should describe the data with minimal interpretation (i.e. describe what was done and what you see in the figures only). Only rarely will there be references in the Results section. After you get this done, the rest of the paper writes itself.

- As I’m writing this section I put little notes to myself in the intro & discussion section. For the intro – what does the reader need to know to understand this data? For the discussion – why is this important, what do I want the reader to take away? Is this consistent with previous work, if not then why not?

FIGURES/FIGURE LEGENDS: Start each figure legend with a title. Describe what was done in sufficient detail that the savvy reader does not need to consult with the rest of the text (e.g. The clinical strain of *S. pneumoniae*, P1547 was intranasally administered to wildtype C57/Bl6 mice at a concentration of $10E7$ CFU/mouse. Groups of 5 mice were sacrificed throughout the course of the study (Days 1,3,5,7,14) and colony forming units (CFU) in the nasopharynx were assessed by plating PBS washes on selective agar. Colonies were enumerated and data are displayed as mean +/-SEM.). The last sentence should describe how the data was displayed and how statistical significance was ascertained. Most journals will allow you to submit figures without conforming exactly to their requirements in the initial submission but they will require them to be sized correctly, have correct fonts etc for the final submission.

TABLES: Each table gets a title. Keep them simple.

RESULTS: Generally each heading describes one figure or group of figures. Start each section with a heading that states what the result is (e.g. MARCO expressing cell lines bind more oxLDL than non-expressing cell lines). The first sentence should be a statement of what you did and why (try to find a more creative way of saying “In order to demonstrate....we did....” as journals say that the phrase “in order to” is over-used.) Next, describe and interpret what the figure shows. The last sentence can be a conclusion that explains how you got to the heading. The order of your results will

change many times. It's a nice idea to have a lab meeting when the figures are done and present the data in the order you have decided on and get some feedback to see if the audience follows where you're going with it.

SUPPLEMENTARY DATA VS DATA NOT SHOWN: In general, the less "data not shown" the better. This should be reserved for data that is not required to understand the paper such as control experiments (e.g. "Modified BSA signaling was enhanced (Fig X) but unmodified BSA binding was unaltered (data not shown)) or negative experiments (e.g. "SRA enhances TLR2 signalling (Fig 1A) but not TLR4 or 6 signalling (data not shown)). Supplementary data is a minefield these days (<http://jem.rupress.org/content/early/2011/06/01/jem.20111061.full>). In general supplementary data should include files that you can't print in a journal (e.g. movies) or data that is required to reproduce the experiments (e.g. a complicated flow analysis). Supplementary data is read a lot less by the general public so don't put anything key to your story here.

INTRODUCTION: Don't just reference data from your own lab. People from your lab will not be reviewing your paper and will be annoyed if you are myopic. Go wide. Start general – what is the big picture? Why are you doing what you are doing? Next, consider what people will need to know to understand your work and give them a brief review. Consider your work in the context of what is already known – what questions were left unanswered out there that led you to do this study? Finish the last paragraph with what your hypothesis was/is and a basic summary of your findings (very few details, remember nobody has read the paper yet).

DISCUSSION: I find this is the most difficult section to write. What is the big picture of your story and how does it answer some of those unanswered questions out there? Are there results that are inconsistent with other's work – if so, why do you think that is? (Careful here – at this point you know what the holes in your work are, don't lead a reviewer right to them). This is the section to interpret your results. In the results you explained what the figures show, now tell the reader what they mean. Beware of over interpretation (e.g. "this highlights a heretofore unknown mechanism of bacterial recognition in the upper respiratory tract" rather than "we now know how bacteria are recognized in the upper respiratory tract"). How have you added to the field? Where will this take you in the future?

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experiments but not being involved in the design and/or interpretation) is acknowledged here as are individuals who gave good advice or ideas that contributed to the paper. A nice touch is acknowledging technical support staff (e.g. at the animal facility).

FINISHING UP:

- Pick your journal, edit word lengths etc accordingly (keep your original as you may be modifying it again for a second journal)
- Spell check. Then grammar check.
- Send out the “good rough draft” to all authors and a few colleagues, especially those who are critical of your work as they will give the best critique. Take comments and revisions seriously and alter appropriately.
- Send the version you are sending to the journal to all authors as you are submitting to the journal. Inform them each time you send it to another journal.

GENERAL POINTS:

- Brevity is beautiful. This is not an undergrad essay that you are trying to fill a word limit. Simplify.
- Be positive. Do not say “ Authors Y & Z did not do their statistics correctly and that is why our results don’t agree” as AuthorsY&Z are likely going to be your reviewers so try phrasing it as “Although previous studies demonstrate the opposite results, these may not be comparable due to our adjusting for age and sex differences.”.
- As counter-intuitive as it sounds, try not to use the passive voice. We are often in the habit of doing it (e.g. “Westerns were developed using ECL from Pierce” instead of “I developed the Western with ECL from Pierce”) but it can be overdone. If you can be direct, be direct.
- Avoid excessive use of conditional statements (e.g. Use “Scavenger receptors are phagocytic receptors.” NOT “Scavenger receptors have been shown to be phagocytic receptors.”). In fact, there is almost no case in which “it has been shown to be...” cannot be changed to something more direct.
- It sounds intuitive but don’t use words that you don’t know the definition of and don’t reference papers that you haven’t read (at least the results section).
- Editors hate the use of the words “interestingly...”, “surprisingly...”, etc. The data should stand alone and be interesting, surprising or whatever, you don’t need to spell it out.
- Online submissions can take hours – you’ll need all the authors’ addresses & emails and may need to resave your figures. Book some time.

- Consider writing to an editor and saying “we’ve done this, these are the results – would this be of interest to your journal?”. If they say no, move on, at least you didn’t waste any time doing an online submission.