

(Note: These write-ups were distributed to graduate students at Michigan State University's W. K. Kellogg Biological Station by Jeff Conner and Gary Mittelbach. They are posted here with permission from both – Spencer Hall, Indiana University, 3/2010)

Tips for scientific writing (Jeff Conner)

Be careful of cause and effect – don't say that something led to something else unless you have evidence. This is true for your results and also for literature that you are reviewing.

Make sure that the papers you cite make the specific point that you are citing them for, preferably based on original data or theory in that paper rather than the point being stated in the paper's introduction or discussion. It is astounding how common mis-citation is.

Introduce important concepts explicitly, not as asides or phrases in sentences with a different main point.

Logical flow is critical – make sure each sentence in a paragraph follows from the one before it, and each paragraph follows from the preceding paragraph. Use the outline function in your word processing program, and don't forget topic sentences! In fact, you can start the outline of each section as topic sentences, and then flesh out the paragraphs.

For each sentence ask yourself: is each word and phrase really necessary, relevant to the point you are making, in the right place, and does each word and phrase mean exactly what you want it to mean? Ask the same questions for each sentence in a paragraph, each point you are trying to make, and for each paragraph.

Don't repeat – make sure each sentence in a paragraph has a unique point to make, or is summarizing the entire paragraph (that is, the topic sentence).

Write like you speak – if you don't use certain words or phrases in conversing, especially about science, then you probably shouldn't use them in your writing either. Make your words and sentences direct, active, and easily understandable. On the other hand, don't be too colloquial or chatty.

The job of the **Introduction** is to convince the reader that the study you did is interesting and important – how do your results fill a key gap in our understanding of the field (not just any old gap in our knowledge)? Always try to frame your work as broadly as possible – for example, if it is a paper on pollination ecology, try to frame it more broadly than just pollination ecology so that other ecologists might be interested. It is always a good idea to end the Introduction with a list of two or three questions or hypotheses addressed by the paper, and then use these as a framework for the results and especially the discussion sections.

If your study is quite complex, then the **Methods** section can be quite difficult to write, but it is critical that your readers can understand exactly what you did. Include a lot of detail if it helps understanding, but leave out details that don't. Sometimes a chronological organization works best, that is, describe the study in the order you did it, but other times you need to group the Methods more conceptually.

Avoid having the text in the **Results** section be a simple list of each result or statistical test – integrate, summarize, synthesize, and point out the most important messages you want your readers to take away from the paper.

In the **Discussion** you can very briefly summarize your results, but spend most of the discussion putting your results in the broader context of the field, both in terms of theory and previous empirical results. The discussion should mirror the conceptual framework you laid out for the paper in the Introduction.

Writing and publishing a scientific paper (Gary Mittelbach)

Tips on writing

1. “Write with precision, clarity, and economy: use the active voice and first person whenever appropriate” - instructions to authors, *ECOLOGY*. This is good advice, no matter what you are writing.
2. Buy a copy of Strunk and White’s, *The Elements of Style*, 1999, Prentice and Hall Publishing. Study it and use it.



Pappy’s tips for good writing.

1) **Use short sentences and short first paragraphs.** Hemmingway, when challenged to tell a story in six words, wrote, *For sale: baby shoes, never used*. Also, “Write with nouns and verbs, not with adjectives and adverbs. The adjective hasn’t been built that can pull a weak or inaccurate noun out of a tight place”, from Strunk and White.

2) **Introduce paragraphs with a topic sentence.** The greatest topic sentence ever written (in Gary’s opinion), is from Hemmingway’s *The Old Man and the Sea*. In this story, Santiago had gone far out to sea. Fishing alone from a small skiff, he hooks an enormous marlin and battles him all day and into the night. Exhausted, Santiago finally captures his beautiful fish. But it is too big to get in the boat – he must lash him to the side and set his sail for home. Hemmingway then writes, “They sailed well and the old man soaked his hands in the salt water and tried to keep his head clear. There were high cumulus clouds and enough cirrus above them so that the old man knew the breeze would last all night. The old man looked at the fish constantly to make sure it was true. It was an hour before the first shark hit him”. Note the three words, “the first shark”. In this one, blockbuster sentence, we know that the old man’s battle with the marlin has been both won and lost. Not every sentence you write will have such power and clarity, but strive to introduce each paragraph or new train of thought with a sentence that grabs the reader’s attention and tells them what is coming next.

3) **Leave something in the tank to start the next day.** “I learned never to empty the well of my writing, but always to stop when there was still something there in the deep part of the well, and let it refill at night from the springs that fed it”, from Hemmingway, *A Moveable Feast*. Nothing is as hard as facing a blank page. Therefore, before you have used up all your ideas for the day, stop. Take time to jot down what will come next. That way, if you are interrupted, you will know where to start up again.

4) **Junk is junk, no matter how long you labored to produce it. Don’t hesitate to throw junk away.** “I write one page of masterpiece to ninety one pages of shit,” Hemmingway confided to F. Scott Fitzgerald in 1934. “I try to put the shit in the wastebasket.” It’s painful to realize that the paragraph that you spent a half day writing simply doesn’t work. But, that happens. Delete it (or put it in your “outtakes” file) and move on. Oh the other hand, a well-written sentence or paragraph is a treasure – use it as often as you can.

Publishing a scientific paper (Gary Mittelbach)

- I. Authorship. Discuss this early on, but don't get hung up on it.
- II. First steps
 - A. What's the story you want to tell? This is the most important step.
 - B. Rough out the figures and tables. These outline the story. Stats support the story, but they aren't the voice.
 - C. What's the target journal? This affects the manuscript format. It also affects who will read your paper and what impact it will have. Shoot high, but don't be unrealistic. Match the journal to the story.
- III. Writing the paper
 - A. Writing is hard work. Set realistic expectation. Block out time. Find a quiet place to work where you can spread out and leave your stuff day after day.
 - B. Order of progression (in my opinion)
 1. Results
 2. Methods (work on these when you are stuck and can't write anything else)
 3. Discussion
 4. Introduction
 5. Abstract
 6. Literature cited; polish figures and tables (these are tasks for when you are too brain-dead for creative writing)
- IV. Friendly review
 - A. Get comments from smart, critical people. Listen to them. Be willing to revise your masterpiece.
- V. Submitting your manuscript.
 - A. The cover letter can be important, esp. for Science, Nature, PNAS, PLoS, and other high profile journals that don't send out most papers for review
 - B. Be patient and be prepared for rejection
- VI. Dealing with the editor's comments and the reviews.
 - A. Interpreting the editor's comments. Is it accepted, rejected, or something in between.
 - B. Dealing with the review's comments.
 1. Don't get pissed. Take the high road. Look for the value in each comment.
 2. If you have co-authors, you will all need to get on the same page with regard to revisions.
 3. Address each comment explicitly in you revision and in your letter of reply
 4. Revision is part of the process. Be prepared for revision.
 5. Rejection is also part of the process. It sucks, but you have to deal with it.
Persistence is your ally.
- VII. Final stuff.
 - A. Page proofs. What can be cooler than seeing your paper in print. Yeah.
 - B. Make your paper widely available.
 - C. Save your raw data, the analyses, correspondence with the editor and reviewers, etc. You may need it.