

## Scientific Writing Tips (for Science Journals, not General Public/Blogs)

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### Fundamental principles:

- 1) ***Writing and publishing scientific papers is in many ways the most important thing you do as a scientist, outside of data collection and analysis!*** It lets others know what you've done (otherwise, research is just pointless intellectual masturbation) and gives you notoriety that will help immensely in getting (or keeping) a job!
- 2) There are infinite ways to write any one paper. None is best. Find your way.
- 3) You will always be learning about how to write better. No one is best. Use your coauthors. Keep an open mind about how to write better, and you WILL improve.
- 4) First and senior authors render final decisions on writing style etc. Don't feel bad if your input is not adopted. It is just a matter of opinion.
- 5) Even greying, balding old senior authors make mistakes, or do not always follow their own advice.
- 6) Just write well. Don't over-analyze and eternally revise. At some point you MUST share with coauthors or submit the damn thing.

### General Tips:

Follow the Intro-Methods-Results-Discussion (and maybe Conclusions) format, usually.

Keep Results-Discussion separate! Data presentation, then data interpretation/implications/etc.

Make it fun! Tell a story! Weave in quotes, or even (rarely) an introductory quote—e.g. see my 2008 JEB paper on elephant limb kinematics, with intro Shakespeare and Bakker quotes, that set the stage for the paper's main point. If reviewers don't like it, fight them. It's your paper. Fuddy-duddy types can write their own way.

Avoid passive voice mostly, but use it occasionally. Variety in writing is good. Passive voice makes it less personal and less fun to read, but the less personal can help you—it is essential in peer review, for example, to reduce aggravation of authors: "The authors need to reanalyse their data" vs "The data should be reanalyzed."

Watch verb tense: usually Methods/Results should be in past tense ("We measured... We found...") but then Intro and Discussion could be present (and future?) tense (for what the paper is about/ what you will do in it—e.g. "Here, we present...", what we now know and what it means) and past tense (for what we knew/thought we did).

Write clearly, in appropriate detail, and concisely. Find your balance therein.

Stringently avoid 1-sentence paragraphs. Also avoid 1-page long paragraphs.

Vary sentence lengths; makes reading more fun. Some short, punchy sentences can pack power, but soon get dull. Long sentences can begin taking too much effort. Run through your text after 1<sup>st</sup> draft and see where you can cut 1 sentence into 2. Generally, do that.

Use topical sentences to introduce paragraphs, and segues between paragraphs. Lead the reader on a logical journey. Subheadings can be highly useful (e.g. kinds of data in Results; kinds of ideas in Discussion), even in the place of segues, but don't overdo anything.

Cite everyone you can, but don't cite wantonly -- e.g. for a simple point, 1-3 references may do; you don't need to cite every single thing; but if citing what the field has done in general, you might want a big list. Remember your reviewers may not be happy if they are not cited. They are human and may care!

Avoid repetitive use of same phrases, e.g. "these reptiles"—use variation—"the crocodiles" "our experimental subjects" etc...

Don't talk about other authors personally unless you must; talk about studies (by certain authors). Rather than "He showed" use "The study by XX showed." Avoids getting too personal, especially if critiquing. But using "Smith (2020) showed" is fine. It's the usage of he/she/they personal articles, or mentioning a name without a reference, that can seem too personal. "That study", not "they".

Use "hypothesis" with caution. Don't use it as the same as "idea" or "expectation" or "question" and avoid using it retrospectively. To me, a hypothesis should be an explicit prediction made before you see your results. Yes, sometimes people dress up the study as a prior hypothesis being tested when really they didn't, and that can be naughty! J Exp Biol almost necessitates that format. But often "question" will do just fine rather than hypothesis. I like to treat hypotheses as a special thing.

Don't be shy if your paper is descriptive. That's good! We need descriptions. Call it descriptive. Don't tart it up as a hypothesis-driven study. Exploration, description, fishing trips, that's all part of science, too. Be honest what your study was really about. Now, to be honest I haven't always done that... so:

Sometimes a study is told better if reframed. That's not necessarily disingenuous, either. I learn a lot about my science as I write it up. Sometimes it is communicated better if the angle is shifted during the writing (e.g. our original hypothesis turned out to be untestable, but we gathered data that turned out to be useful to test another hypothesis; or it would just take too long to explain the convoluted path you took to get to this paper, and no one would care), as long as it does not mislead the reader in understanding or repeating the science. Nowadays, I prefer the maximally honest approach, but storytelling and clarity are important.

End your paper on a high note. Leave the reader excited, not uncertain, ideally. A Discussion might ideally be structured: (paragraphs) (1) very concise summary of main findings/hypothesis tests outcomes; hit the highlights and then tell people what's coming in next paragraphs; (2) limitations -- put this in the middle so the paper does not end on a low point and so the limitations can be considered in later paragraphs; (3) and onwards: what your results mean, weaving in literature to synthesize ideas; (4) future directions/implications (don't overdo this! ~1-3 sentences enough!) culminating in a positive, powerful point. #4 could be in a separate Conclusions section. Future directions could be in its own subheading before that. It is sort of cliché to end with future directions, and it's not exciting to do that, so avoid it.

Define jargon the first time you use it, if not common to the field of the journal!

Outlining your paper helps. What is each paragraph about, and how do those messages string together to tell a story.

Ensure your figure captions completely explain the contents of the figures.

Repeat acronyms in figures and occasionally in Discussion etc. Consider supplying a table of abbreviations/acronyms (some journals require this).

Avoid redefining or creating new words unless you have no choice. And don't get bogged down in semantics.

Find your groove- where and when do you write best? Do it there and then, where possible. Write in solid blocks of time, not in spurts; it takes time to build up momentum writing, so spurts tend to waste energy catching up on where you left off.

Toward the end of your paper, dive deep in the literature and find ways to tie it into your paper. Dig up esoteric bits of data, maybe even make new figures/tables with them, to integrate your paper with the broader field. Return to old ideas and discuss them (unless totally obsolete). This gives honour to past workers, which you should hope others do to you later, too!

Don't get too attached to a nice sentence. Be brutal. And accept such strong criticism from others.

The **Acknowledgements** section is your friend! Thank your friends and colleagues that helped you, in that section. It may not limit your word count, and it avoids pissing people off that deserve to be thanked- or looked at another way, it's just nice and could even earn good feelings from others! Keep a list of people who helped you while you do your work, then thank them here. People that missed the cut for becoming coauthors had better be thanked here! People may look to see if they were thanked- I do! Be thorough. There is no justification, really, for being abrupt/exclusive. Don't cut space here-- except don't say "I'd like to thank" – just say "I thank". NEVER disparage people here; I have seen that a couple of times, when authors were angry with someone (e.g. annoying reviewer). Terrible form. \*After revision\*: thank reviewers (named or anonymous), unless they were not really helpful, and thank the editor(s) by name if they helped beyond the usual role of handling reviews. Funding agencies, unless in another section, **MUST** be thanked here. Thank broadly- even if the grant has long ended and you've moved to another uni, you really should thank funders if they supported it in some way, even indirectly (e.g. PIs have salary paid partly by grants during the work; so just by being a co-author on 1 paper, even several grants could be cited). You have nothing to lose by thanking broadly, and plenty to gain.

#### Nit-Picky Stylistic/Aesthetic Tips:

Read scientific writing guides—Strunk&White, Chicago guide, etc... these are well accepted standards. Re-read them after drafting a paper, then go back afresh and get rid of naughty bits. This will teach you to write better.

That/which; use these correctly

Avoid “as” used as “because”. Use it as “as”. Same with “due to” = “because of”. “Due to” implies causation, or a debt; it is vague. “Because of” is clear. “Since” can imply temporal distance; “Because” works better in its place as an explanatory word.

Italicize genus/species names appropriately and use correct, modern taxonomy. Know your taxon.

“This” (in reference to a previous sentence) might be too vague. Sometimes you must write “This result” to be clearer. What this/that refers to may not be clear enough to the reader.

Minimize using nouns as adjectives—e.g. even though it is longer, perhaps try “3D dynamics of the centre of mass of the whole body” rather than “3D whole body centre of mass dynamics.”

Rid your paper of woolly words like “very”. Very is not a very useful word; adds essentially nothing.

We like to use qualifiers because we’re careful scientists and uncertainty is part of our science’s real nature. But sift out excessive use of “essentially” and “somewhat” where not essential.

Use, not utilize. Yuck. Avoid archaic/flowery language that distracts or dresses up text too much. Oriented, not orientated.

Commas are your friend. Use the Oxford comma. Find out what that is and make it habit.

Use “whereas” in place of “while”, while you can.

-izing not –ising, and so on. Usually.

Avoid starting a sentence with same words multiple times in same paragraph, or over-using introductory words like “However”.

Use keywords for journal papers that are NOT in the title, or even not in the abstract. Think about what people will be searching for and how they might find your paper.

## **FINALLY**

Set your text aside for a day or so, come back and edit it fiercely, trying to shorten it. Get a friend to give it a go, even if not a co-author.

Where to Publish? How to Publish? Figure design? Coming in a later instalment.