How to love writing a paper

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It is funny how terrifying a humble white page can be. Luckily, science writing has a certain structure, and you do not need to be a writer, just an author. There is a lot of imagination and creativity in doing experiments, but usually less so in the writing involved. So sit back, relax, and let your science speak for itself.

In Nature journals, we often follow the hourglass model for the layout of a paper (see Figure), going from a general point of view of the field, down to the specifics of the work, before opening up again toward the end. That means starting with an introduction to the field before focusing on the details of the paper (e.g., the problem, how it was solved, and main conclusions), and then placing this new work in context: How does it compare to the state of the art and where it might lead? This approach maps the paper in roughly the following sections: Introduction-Problem-Methods-Results-Discussion-Outlook. The abstract is a mini version of the paper, where the different sections are mapped out with a couple of sentences each.

Paper writing usually comes after the experiment is finished and conclusions (even if preliminary) have been drawn. The foundation of every paper is what sets it apart from the literature: the data. Figures, tables, etc., constitute the backbone of a paper, and by laying them out, a story starts to form. Figures must be planned in a way that fully supports the ‘story’ told in the paper,¹ leading the readers to not only understand and evaluate the data, but to arrive at the same conclusions. Opt for simplicity² over complex features; weak data will not improve through complicated and overcrowded presentation. Figures and captions should be self-contained; they should keep the reader focused instead of sending them chasing related important information in the main text, thus breaking the flow. Figures will evolve with the writing, as the main message and structure of the paper become clearer. All panels should be referred to

throughout the paper; some may prove to be redundant and should be omitted, while others will become more central to the narrative. Write the captions before the main text, not the main text as a caption.

The easiest part to write (and usually the driest) is the Materials and Methods section. Nevertheless, it is an important part of the paper, as it should contain all the necessary information to recreate the same experiment and obtain the same results. The section includes a description of the chosen tools, including sample details, growth or sample design, experimental techniques, theoretical model, and computational methods. It should offer to the readers all of the necessary tools to understand and appreciate your work.

The Results section discusses major findings; its layout is already set by the figures, which constitute an enormous help in the writing (it also highlights the importance of figure planning). The reflection at this point remains inward, toward a particular experiment. The connection with the literature and the rest of the world has not been established yet.

Take a break before returning to the top of the hourglass model and diving into a literature review for the Introduction section. It is safe to assume that most researchers are on top of their fields; there was a rationale behind the experiment. All of this knowledge should be organized to guide the

<https://wellcomecollection.org/works/nugmen9p>

Basic introduction to the field
The general problem
“In this work, we...”
Materials/methods
Key results/conclusions
Main advance over literature
Key implications/future research

reader: What is the field dealing with? What are some basic notions? Why is it interesting? All relevant works, no matter how close, should be included, with their differences clearly explained. Ignoring obviously related works or citing them in irrelevant places to hide the overlap from the editors/reviewers will most certainly backfire. This Introduction section is all about context and should climax around an existing gap in knowledge—the Problem this work is trying to address. Showcasing the importance of this matter will then allow the reader to truly appreciate the solution offered. Its last paragraph starts with a classic opener, “In this work, we...” and explains the main discovery in a few sentences. This should link well with the Methodology section by expanding on the details, which is luckily already written.

Context is very important for papers under consideration in the Nature family; without benchmarking this work against others, it is hard to appreciate the advance reported. The purpose of the Discussion section is to convince readers (and reviewers) that the interpretation of the data is not only robust, but also relevant to the field as a whole. It is important to stick to conclusions supported by the data without hype,³ because exaggerating tends to have a negative counter effect to reviewers and readers. The Discussion is not about repeating parts of the Results section with more emphasis. It is meant to provide answers to the open issues described earlier by linkage to the narrative of the introduction. Finally, the Outlook is the last section to be written, and it is meant to discuss implications of the findings and future research—what could be next?

When the body of the paper is complete, these ideas can condense into a handful of sentences for the abstract. The abstract can make or break any paper—people read it to decide whether they should invest more time to read the full paper—so it should leave the reader longing for more.

The title, although the last thing to be written, is the first thing to be read by the public, so it should be engaging, clear, and precise about what was done, and should strike the right

balance between too technical and too vague. As it constitutes the gateway to the paper, the title (and abstract) should contain keywords that make it searchable.

A good level of English at the submission stage is necessary to allow the reviewers to understand and assess the work; the editors will edit the language if needed, but only post-review. Short sentences and simple structure work best; there is no need to embellish the text. The space and time of the readers are limited. After all, most of them are busy, non-native speakers who need to understand the key messages. The paper should provide them with the necessary notions, mathematical tools, and definitions needed to understand the background and the novelty of the published work. Too many technical keywords and abbreviations can make the paper cold and hard to follow. There are plenty of reported abbreviations in the literature, so inventing new ones is usually not needed. Keeping in mind how researchers read papers,⁴ paragraphs should start with the main message and then develop it further. This way, even those reading the paper diagonally will not miss the point.

For some journals (including those in the Nature family), there is no need to format the paper before submission. A plain text file with figures embedded in the text (ideally double-spaced) with numbered pages and titles in references will make the editors’ and reviewers’ lives easier.

Writing a paper can be a stressful process, but it is no doubt a very fulfilling one. There is something magical about proudly announcing a new discovery to readers, who are by default hungry for new knowledge. Enjoy the process and make sure to transfer the enthusiasm for your science in your writing!

References

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