How to write a (good) scientific paper ?

Writing a paper is writing a **story** that tells the readers about your results and how they are important in a given context. **Context is thus essential, and storytelling too.** Otherwise people can't see the point of what you have done and/or get bored while reading.

This is especially important when targeting « high profile journals » that have broader audience (i.e. Nature, Science etc) but also useful when submitting to more technical journals like PRB, PRM, APL, etc.

When to start writing ? When you feel you have a (roughly) complete data set that you can use to tell a story.

Important : **keep the paper concise** !
Important : check the « guidelines to author » from the journal you are aiming at

First : Title

The title must summarize in a few words the story you will tell. Thinking carefully about the title at the beginning of writing process will guide you throughout the writing and avoid diverging from your story telling goal.
Of course, you may change the title **slightly** when the paper is done.

Be aware that most journals have limitations in terms of word count for the title. Usually conjugated verbs are not allowed but there are some exceptions.

Double Exchange Alone Does Not Explain the Resistivity of $La_{1-x}Sr_xMnO_3$

A. J. Millis, P. B. Littlewood, and B. I. Shraiman
Phys. Rev. Lett. **74**, 5144 – Published 19 June 1995

Second : Figures

Prepare the figures in paper-ready format. One figure in one ppt slide.
Figures can have several panels and be composed of graphs, images, sketches etc.
Tables are a separate type of item.

Most journals have a limit on the number of figures (usually around 4). Some journals (e.g. PRB) have no length limit.

- Check the style from the journal for preparing figures
- Use colors and symbols easily to distinguish from one another
- Avoid yellow or light colors
- Copy/paste from data analysis software (e.g CasaXPS, Xpert Epitaxy, etc) doesn't make for good figures
- Ticks on all axes within the graph (not outside)
- Use fonts without serifs, i.e. Arial or Calibri but not Times New Roman
- Make sure that all text is large enough to be readable when printed (keeping in mind that some figures will be page- or half-page-wide

Write the figure captions (not in the ppt but in word or Tex)

Third : Abstract

The abstract will introduce the general topic/field and then **state a pending issue that is important to the community**. Then, one sentence must explain how your paper will address / solve this issue (or contribute to it).

The more important the pending issue is, and the better your work resolves it, the higher impact your work may have : **use this criterion to target the journal you want to submit it to.**

Depending on the journal and paper type, the abstract may or may not be referenced, which will influence how you will write it (and the content of your introduction, see next).

nature

How to construct a *Nature* summary paragraph

Annotated example taken from *Nature* **435**, 114-118 (5 May 2005).

*One or two sentences providing a **basic introduction** to the field, comprehensible to a scientist in any discipline.*

*Two to three sentences of **more detailed background**, comprehensible to scientists in related disciplines.*

*One sentence clearly stating the **general problem** being addressed by this particular study.*

*One sentence summarising the main result (with the words "**here we show**" or their equivalent).*

*Two or three sentences explaining what the **main result** reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.*

*One or two sentences to put the results into a more **general context**.*

*Two or three sentences to provide a **broader perspective**, readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (The above example is 190 words without the final section, and 250 words with it).*

During cell division, mitotic spindles are assembled by microtubule-based motor proteins[1,2]. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family[3]. Hypotheses for bipolar spindle formation include the 'push–pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules[2,4,5]. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled *in vitro* assays that Eg5 has the remarkable capability of simultaneously moving at ~20 nm s^{-1} towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at ~40 nm s^{-1}, comparable to spindle pole separation rates *in vivo*[6]. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated *in vitro* models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.

Manuel Bibes Sept 2021

Fourth : Introduction

Ideally the introduction should not repeat exactly what you wrote in the abstract. One possibility is to find an alternative viewpoint to your results, different from that given in the abstract.

E.g. you have measured a new effect in an existing material system, giving interesting perspectives for applications in say spintronics. You have two view points: one from materials science (or physics), one from applications.

Keep the introduction relatively short and be sure to cite all important references*. Ideally, original research papers than review papers (although a balance is OK).

Typically, the introduction ends with a few sentences (keep it short !) describing the content of the paper. If you plan to tell your story as a mystery novel, don't reveal who the murderer is quite yet !

* For most journals there is a max number of refs, though

Fifth : technical details / methods

Depending on the journal, this comes right after the introduction, or at the very end in a dedicated « Methods » section.

Be as precise as possible : the goal is that someone in another lab is able to reproduce your results following the technical info you provide.

Be sure to include all necessary info, so you don’t have to include technical details on sample prep, measurements etc in the rest of the text (results presentation, discussion etc)

Sixth : results

Describe the results (basically describe the figures)

This may be followed by a dedicated discussion session. More often, the discussion is integrated in the results session

Seventh : conclusion

Summarize in a few sentence the main results. Give some perspectives. Keep all this quite short.

Acknowledgements :

Thank the people who helped you but did not make it to the authors' list* (colleagues who read the paper, corrected English etc ; technicians or other people who gave you a hand with experiments, or gave some hints in discussions).
Thank your funding agencies with the project name and ID.

References :

Highly recommended to use a ref manager like Zotero (helps you reformat references from journal to journal in a zip).

* Who can be an author of a paper ? Someone who made a significant contribution (and ideally would be able to present the paper in a conference). Someone who just read the paper when everything else was done typically can't be an author (but sometimes exceptions are made for political reasons…)