

Writing a scientific paper

The structure of scientific papers is well established, and readers have expectations for what they will find when reading a paper. It is best to stick to these expectations. Here are some general guidelines, although different papers will have different needs.

Abstract

- Avoid giving too much background, but do include a statement of the main hypothesis or goal.
- Summarize the main results, but no need to give statistics in the abstract.
- Wrap up with 1-2 sentences (max) of conclusions.

Introduction

- Paragraph 1 should lay out big picture: how does your work help to address a fundamental question in a particular discipline?
- Paragraph 1 or 2 should articulate what isn't known in relation to the big picture question.
- Provide background information that is essential to understanding your findings, and in relation to the fundamental question.
- Your final paragraph should include hypotheses and associated predictions.
- You do not need to tell the readers what you found in the Introduction!
- In general, sub-headers are also usually not needed, and definitely not if there is only one paragraph for a sub-header section.

Methods

- Your Methods should be written in a way that enables someone else to understand what you did and why, and enables them to replicate your study in all respects.
- Organize your Methods in line with the order of what you did to pursue the work. Describe data and/or setting; describe statistical tests; describe downstream analyses, e.g. to integrate the findings of multiple tests.
- If different hypotheses or predictions require different methods, organize those parts of methods by the order of the predictions in the final paragraph of your Introduction.
- Sub-headers are more useful in Methods sections, but often over-used. Consider use of sub-headers carefully.

Results

- Start with 1 paragraph that sets the stage with general descriptive characteristics of the data, sample size, etc.
- Present your results in order of the hypotheses / predictions. Link your results explicitly to the hypotheses / predictions.
- Every figure and table needs to be cited in the text! Typically, figures and tables are provided at the end of the manuscript, but for drafts, it is fine to include them in the main text.
- Every figure also needs a complete figure legend.

Discussion

- Paragraph 1-2: review of major results, linked into hypotheses. First 1-2 paragraphs is very important.
- 3-4 paragraphs that connect the findings into previous research. Turn to your Introduction to identify some papers, but pull in additional research, too.
- 2-3 paragraphs of caveats and future direction.
- Conclusion: 1 paragraph, try to avoid repetition; another important paragraph
- Don't be tempted to combine Results and Discussion. It is usually best to keep these separate.

When you have finished a draft of your paper and are ready for another round of feedback, do these checks:

- Have you clearly stated your hypotheses and predictions?
- Are the following key paragraphs strong and clear: paragraph 1 of Introduction; last paragraph of Introduction; first paragraph of Discussion; last paragraph of Discussion.
- If someone read those key paragraphs and the first sentence of every paragraph, would they understand the paper?
- Does every citation have a corresponding entry in the bibliography?
- Does every figure and table have a citation in the text, and is it included in the document?
- Have you removed as many track changes and comments as possible, only leaving those comments in which you have provided a reply that the original writer of the comment will want to see?

When you are ready to submit the final version of a paper to a journal, do all of the above checks, plus:

- Ensure you have given appropriate credit to all contributors (see these [guidelines](#))
- Carefully read the instructions to authors and be sure you have met all of those conditions.
- Identify possible reviewers.
- Consider options for publishing charges. Many journals charge a fee for publishing, particularly if they are Open Access. In many cases, we can find resources to cover those charges so that you do not need to do so, but not in all cases, especially if the research was not grant-funded. It is important to understand the costs, and to discuss with the mentor and Charlie about potential sources of funding.