

# Guidelines for Project Paper

*Adapted from Ytreberg's Guidelines for writing a scientific paper*

## Overall Paper Format

Scientific papers often follow a specific format that is intended to allow information to be conveyed clearly and concisely to the reader. It should answer three fundamental questions: (1) *Why did you do what you did?* (2) *What did you actually do?* and (3) *What did you find when you did those things?*

The format of your paper should follow this basic template, and include the following components:

- Title
- Author list
- Abstract
- Introduction
- Methods
- Results and Discussion
- Acknowledgements (optional)
- References

This basic format can be found in many different places, and is a useful template. However, this specific format is optimized for describing experiments, and it is sometimes difficult to apply it to more theoretical work. Furthermore, it is not entirely obvious how to use this format with a paper that is supposed to involve both novel calculations and a review of prior work. These issues are dealt with in the various subsections below.

**Title:** The title of your paper should allow someone who is looking at a list of papers to understand what your paper is about. It should either summarize your result (“Big things are larger than small things”) or the subject of your research (“Comparing the sizes of big and small things”). For this specific project, a reasonable template would be “[General Electromagnetic Phenomena] and its application to [specific situation you examine]”

**Author List:** For real scientific papers, there are a wide variety of rules and expectations about who is included in the author list. These differ from field to field, but fortunately in this case you are the writer of this paper, so you are the author.

**Abstract:** The abstract should be a one-paragraph summary of the paper, that should be understandable in isolation. The abstract should contain enough information for any reader to know your answers to all three of the above questions.

**Introduction:** This is the part of the paper where you answer the question *Why did you do what you did?* In other words, this is where you provide the background and motivation for your work. For many scientific papers, this section is only a few paragraphs long and provides a brief summary of the prior work and the central hypothesis of the current work. However, this section can sometimes also include summaries and recapitulations of prior theories, and you should use it for this purpose here. In fact, I would suggest you divide this into the following parts:

- **Introduction:** This is a few paragraphs explaining why the topic of the work is important, and how the specific problem you want to investigate fits in to prior investigations. This should cite a number of different refernces.
- **Theoretical Background:** Here you provide a more extensive discussion of the theory behind the phenomenon you are investigating. This can follow a derivation provided in another work, but **must** cite that work and also be in your own words, focusing on specific aspects of the derivation that are relevant for your particular problem.

**Methods:** This is where you answer the question *What did you actually do?* This section should contain enough information for a reader to be able to reproduce what you did and obtain the same results. If you did a numerical calculation, you should provide information about the code you used and your input parameters. If you performed an analytical calculation, you should provide the parameters you used and any further formulae you derived for the specific situation.

**Results and Discussion:** This is where you answer the question *What did you find?* Typically, the “Results” section just describes the findings, while the “Discussion” section interprets those findings and places them in context. In practice, these two parts of the paper can often blur together, so I will not insist that these be kept in separate sections. However, together these two sections should allow the reader to understand both what the results of your calculation were and how they relate to the other work presented in the introduction.

**Acknowledgements:** This is a one-paragraph optional section where you can thank anyone who helped with the project and/or reviewed your paper. For many scientific papers, this is also where funding sources are mentioned.

## Technical Matters

**References and Citations** The style of references and citations is ultimately set by the journal. For this particular paper, I request you use the following conventions:

In the text, cite the reference with a parenthetical note giving the author name and year: “Big things are big (Lastname1 2011) and small things are small (Lastname2 et al. 2013).”

In the reference list, provide information as follows:

- Lastname1, Firstname (2011). Title of the Article. *Journal Title* 209:1100-2200.
- Lastname2, G., H. Lastname3 and K. Lastname4 (2013). Title of the other Article. *Other Journal Title* 25:10.

You can deviate from this format if you need to, but please make sure all the above information is present, and that you are consistent.

**Figures and Tables** These do not count towards your page limit, but can be included in the text. Make them so that they can be easily read and interpreted. Label all axes, and provide descriptive captions so that someone reading the figure caption alone can understand what is being plotted.

**Equations** Equations do not count towards your page limit because even a few equations can eat up a lot of space. Again, I strongly encourage you to use LaTeX since it is a powerful way to make readable equations. In general, I suggest having any equation that is not simple, like  $E = mc^2$ , set out in a separate line with an indicating number, like

$$\mathbf{E} = \mathbf{E}_0 e^{i(kx - \omega t)} \quad (1)$$

## Ethical Matters

It is perfectly fine to use prior work in your own research, as that is the basis of science. However, you **must** credit other people for the work they did, and copying and pasting other people’s words and treating them as your own is **unacceptable**. Indeed, either of these actions are directly in conflict with University policy. For this reason, please adhere to the following rules:

- For any statement about a phenomenon, provide a reference to a work that documented that phenomenon.
- If you use an Equation or Figure from another work, explicitly reference where that Equation or Figure came from. If you modify the Equation or Figure slightly, use a citation of the form (adapted from Lastname 2000).
- Never copy and paste text directly into your document. The only time this would be acceptable is if you were providing an extensive quote regarding some phenomenon. Such quotes are very rare in scientific literature, and are usually not worth the space. If you want to say something similar to a statement in another paper, I would have the relevant text in a separate window and write the relevant text in your paper in your own words. Again, you must provide the relevant reference.

## General Advice

- Write a draft, then edit. It is much better to get something imperfect down and then fix it then spend a long period of time trying to make it perfect from the start.
- It is natural when you are writing to provide new information before the old information, but in practice this often makes the material harder to actually read. See [http://owl.purdue.edu/owl/general\\_writing/mechanics/sentence\\_clarity.html](http://owl.purdue.edu/owl/general_writing/mechanics/sentence_clarity.html) for some examples of this. This can happen at the level of sentences, paragraphs and even entire sections. If your text feels awkward when you are editing it, consider revising the order of clauses, sentences and even paragraphs.
- Each paragraph should start with a clear topic sentence. If you are about to go into a lot of details, the reader needs to know whether these details are specifically relevant to their interests.
- More generally, scientific papers aren't like novels. Do not assume the reader will read every single sentence in order. Instead, it is better if you tell the reader where all the information is and its relevance as soon as possible. For example, at the start of each section, you can provide a brief summary of the section as a whole.
- Related to the above, your paper does not have to provide a historical account of all the things you did. For example, if you spent a week or two generating plots with a code before finding that it had an error, then you do not have to recount all the details of how you found the error and all the work you did in making the first set of plots.
- Additional resources can be found on Prof Ytreberg's website at the following link: <https://sites.google.com/view/ytreberglab/teaching>