

Some hints and advice on paper-writing for (graduate) students

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General considerations

Publishing is a lot of work and takes up a great proportion of your time. So why all the hassle? First of all, when you do basic science funded by the community, you have a responsibility of documenting your work for the public. For the scientific community, it is true that as long as you haven't published your work, you haven't done it, since it remains invisible for your colleagues. In addition, scientific work is only considered solid if it has gone through quality control by the peer reviewing system, which is usually the prerequisite for getting published in a scientific journal. Last but not least, your scientific success will be measured by the number and quality of the papers you have published. Thus, having papers published will make it easier for you to obtain a stipend, get a grant, or a job! So, for good reasons, try hard to get published and do it as early in your career as possible. Below you find some help to do so.

How to get started

- **Print out your data** in the form of preliminary figures/tables. Don't invest too much time into formatting at this point, because the figure selection or their outline may still change.
- **Write down ideas:** What is your main message? How can the data be interpreted? How do the data/their interpretation fit into general theory?
- Make an **outline on how to structure** your paper. What are the aims, what the outcome of the study?
- **Start writing** with the “**material and methods**” and “**results**” sections. These sections are most easy to write; writing the results will make clear to you what results you actually have. It is a good idea to write the “introduction” last, since only then it will be clear to you what you are actually introducing. After you are more or less done with the body of the paper, write the abstract.
- **Read the important published paper** that relate to your study before you start with the discussion.
- You may well take a good, similar paper **as a guide** on how to structure your own manuscript.

The writing process

- Write and think in **paragraphs**. A paragraph deals with a specific topic, and it is a great help in the beginning to write a **subheading naming this specific topic** for each paragraph (the subheadings can later be deleted). This will help you to write

consistently just about one given topic in each paragraph. A paragraph starts with an introductory (lead) sentence, followed by sentences giving evidence for the conferred message, potentially followed by discussion sentences comparing the data with earlier studies, and a concluding sentence, that ideally connects this paragraph with the next one (i.e. a transitional sentence). In the last sentence of a paragraph, **never introduce something new**. This is also true for the end of a section or the end of a paper, the end should never contain something new (because you cannot elaborate on it, explain it any further, and reader is left unsatisfied). The paragraph structure is less important for “materials and methods” and “results”. A single sentence can usually not be a paragraph.

- Generally write in **active voice**.
- **Read the published papers** within the realm of your study **before you write**, this will improve your style.
- Try to **phrase sentences in a plain way** – remember that many of your readers will not be native speakers in English.
- In case you want to use identical phrases from other papers, you need to indicate this by quotations and cite the source. Everything else is **plagiarism**.
- Think about a potential target journal **before** you start writing.

Citations

- **Cite generously but not extensively** other papers that relate to your work. This shows that you have read the relevant literature and that you are able to embed your paper in the general scientific framework.
- **Everything you cite, you need to read** yourself! This important, because people often cite papers wrongly (because they are too lazy to read them carefully) and if you just take these uncritically into your text, the mistakes will continue. Science also proceeds through the re-interpretation of data, and you can only contribute to this if you read the literature yourself!
- Always **cite studies** that have done/found things **for the first time**. Note that sometimes it may take considerable effort to find these papers, but it is important to give credit to these pioneer studies. Additionally, cite important, fundamental studies (use your own judgement to identify those studies).
- Do not only cite the big names in your field (those that everyone cites), but primarily people that, in your opinion, have done good work.
- It's OK to cite yourself or (previous) work from your group if appropriate, because you know best your own and the work of people working in your group, or previously worked there.
- Primarily cite original scientific paper rather than reviews. If you want to support a general statement, it is, however, often appropriate to cite a review.
- Cite “**personal communication**” if needed but get permission from the person first. Citation of data that cannot be tracked by anybody, such as “unpublished data” “personal observation” “in prep” are only acceptable for minor points. Some journals do not allow such citations at all.
- **Use a reference program** (Endnote, ProCite, Mendeley); this allows you to easily change the style of the references in case you will submit to a different journal as originally planned (or you have to resubmit after rejection).

Journal selection

- **Aims and Scope** of the journal: do they fit your study?
- Do **lengths and style requirements** fit your planned manuscript?
- Were articles with **similar topics** recently published in the journal? Are there people in the editorial board that do similar research and thus may be interested in your work (this usually greatly improves the chances of getting published)?
- **Impact factor:** the average number of times articles from the journal published in the past two years have been cited (see: Journal Citation Reports in “ISI Web of Knowledge” provided online e.g. by UZH library).
- **Open access:** more and more important. Author pays for the paper, and the paper becomes freely accessible to anyone.

The “organs” of a paper

Title

- **Make the title a message**, rather than a mere introduction of the topic, e.g.: “Pollinators prefer larger flowers of *S. dioica*” rather than: On the relationship of flower size and their attractiveness for pollinators in *S. dioica*.
- The title can be a question – this is especially appropriate if the message you want to give is not yet 100% supported: “Are larger flowers of *S. dioica* more attractive to pollinators?” Note that not all journals allow a title in the form of a question.
- Make title comprehensive and informative, maybe catchy, but use as few words as possible.

Abstract

- Give a **simple** but not simplified **message** that can be easily grasped; avoid too many details. Check the length requirements of your target journal.
- **Say** primarily **what you found**, not what you did.
- It is a good idea to **number the main points** of your abstract 1), 2), 3) (at least in the draft version)...that will help you to write more clearly and focus on the most important things. Note that some journals will not allow the numbering in the final version, but some actually require this form of numbering.
- Start with an introductory statement and end with a conclusion or a suggestion for future investigations.
- **Be consistent:** use the same order in your abstract than you used in the results (discussion) section. This makes the manuscript a lot easier to follow (consistency in structure is also important for the whole paper).
- Use simple past tense.
- No **abbreviations** or **citations** in abstract.
- Remember that most colleagues will only read the abstract of your paper; therefore, **it is a very important part** of your paper!

Introduction

- Introduce the field, **starting from the general** to the specific (the “funnel” approach). Note that introductory sentences too general make the reading boring; try find a beginning that arrests the reader, e.g. write “Pollination of flowers has been investigated since centuries, however, many mysteries have never been solved”

instead of: “Pollination of flowers has been investigated since long and a lot of data has been assembled.”

- Focus on the **following questions**: What does theory in the literature say? Which similar studies have been done? What did they find? Where are gaps in our knowledge? Which hypotheses have never been tested? (To cover these issues, obviously, you need to do extensive reading). Why did you do your study? What makes your study different from other, similar studies? Why is your study necessary/important for the field?
- End introduction with a **list of the questions** that you are addressing in the study, or aims you are pursuing, or hypothesis that you are testing, e.g.: “This study aims to test whether 1) orchids are insect- pollinated, 2) insects pollinate orchids 3) pollination in orchids is done by insects”
- Although it seems counter-intuitive: **write the introduction last**, because only when the body of your paper is ready, you know what you are introducing.

Material and Methods

- Introduce the **general biology of your organism** in a “natural history” section (alternatively this can be done in the introduction).
- Say exactly **what you did** and what you used, include company names and locations.
- Try to create a logic rather than a chronological setup: think about what methods should be described together, even if you haven’t done them at the same time.
- Ask your lab-mates that have used the same methods if you can use bits and pieces of their previous manuscripts. If they allow it, shout them for a drink. Be aware that you cannot use identical text twice, even if you wrote it yourself, this would be considered plagiarism or self-plagiarism.
- Passive voice is sometimes used in the methods section.

Results

- This section can be short, with rather technical writing. Like in the methods, use past tense throughout.
- Follow a **logic order** when presenting your results. Be consistent in your order with abstract and discussion as much as possible.
- Name your experiments, e.g. experiment 1, experiment 2.
- Think about what you want to **present as a table** and what as a **figure**. Sometimes data can be present either as table or figure, but usually you are not allowed to show data as figure and table. Figures can transfer a strong (visual) message, but tables give exact values. Space is money: often referees are asked to check whether all figures are necessary in a manuscript, therefore, limit the number of figures to those really needed.
- When you describe that you found an effect, also say in the same sentence what the effect was, e.g.: “flowers of *Serapias vomeracea* were significantly larger than *Serapias parviflora*” rather than: “we found a significant difference between the size of the flowers of *S. vomeracea* and *S. parviflora*.”
- Often students write: “we found a difference, but it was not significant”; but: when there is no significance, there is no difference (unless you do not trust your statistical analysis)!
- Use **subheadings** to structure your text.

Discussion

- In this section you need to **relate your work to “what’s already out there”**; therefore, you need to do extensive reading before you start with the discussion.
- In the first paragraph, you can **quickly summarize** what you have found and highlight where further work is needed. A fresh angle, and not a mere repetition of the abstract is important here. In the following paragraphs, you can detail aspects of your work.
- Make yourself an **outline of all the important topics** that you want to discuss. Then think of how you can organise the topics into paragraphs and write a **short heading** for each paragraph. Once you have sketched down the most important contents of the paragraphs in raw form, you can still move them around to get your storyline right (remember that in the end, discussion and results should have the same structure).
- Once you are sure in which order to organise the paragraphs, you can start writing them in full sentences. A **typical discussion paragraph** can consist of the following: 1) one sentence short summary of your finding; 2) few sentences what other studies found; 3) how do your results confirm/contradict existing data? 4) conclusion, link to next paragraph.
- What to discuss: what does your data mean? How and why does your data confirm/contrast with earlier studies? What is new about your study? How does your study change existing theory or mainstream thinking about a specific topic? What are the constraints of your experiments? What are the limitations of interpretation? What went wrong, and how may this have influenced your data?
- In the end it is a good idea to give a conclusion and an outlook: what should be done in the future; what are you about to do, etc.

Acknowledgements

- Briefly thank people that helped; be generous. Mention funding source and grant numbers.

Figures, Tables

- Make letters and numbers large enough; make lines broad enough; make the graph intuitively logic: e.g. first bar control, second treatment.
- **Figure legends:** are usually placed below figures. Possible elements of figure legends: First sentence: give the main message of what does the figure shows (including statistical values). Then: how were the data obtained, what is the brief interpretation; explanation of symbols used, e.g. * $P < 0.001$; n.s.: not significant.
- A figure and its legend must **stand on its own**, i.e. not be dependent on the text in the results to be fully understood. Also, an excellent figure should give the visual message without the legend needed (you can check this by showing the figure to others and ask them what they see).
- **Table headings** are usually on top of a table.

At the end

- Let your **lab-mates/colleagues read** the manuscript and take their advice. Advice from a native speaker is particularly helpful.

- **Check the references:** are all cited papers mentioned in the list at the end, and are all references in the list cited in the text of the paper? Such inconsistencies very often emerge during the editing process of a manuscript.
- Once again, check the **style requirements** of the journal where you want to submit. If your manuscript gives a sloppy impression, this will certainly not help getting it accepted.
- Submit the manuscript and wait patiently: usually it takes 2-4 months until you get an answer.
- If you get published, open a bottle of champagne (and share it with your supervisor)! Note that “accept without changes” is a very rare decision. More likely, you will be asked to modify, revise the text (minor revision), re-analyse (major revision) or shorten certain sections of your manuscript.
- Write a **response letter** to the editor explaining point by point what you have changed and why. Make it easy for the editor to see where changes have been made (e.g. use “track changes” and give line numbers where changes have been made in your response letter). Remember that you cannot change things anymore without good reason. Also remember that you don’t need to follow slavishly the reviewers’ demands: they are just (busy) humans and make mistakes, too. Say in your letter where you did not follow the reviewers’ advice and explain why.
- In case of rejection, this is not the end of the world! Analyse the failure to learn from it: Did you make obvious mistakes that you need to correct? Reviewers often spend considerable time with manuscripts, so take their advice to improve the manuscript. Did your study fit into the selected journal? Do you need to make your message more clear in the text? Revise and re-submit.

Miscellaneous

- **Among – between:** Use among for more than two groups, and between for two groups. “The differences between male and female.” “The differences among plant families.”
- Never start a sentence with an **abbreviation** except Dr. Mrs. etc.
- **Use active voice:** “we found a significant correlation” rather than: “a significant correlation was found”. For the material and methods section, passive voice is OK.
- **Hyphenation:** use hyphen if a noun and another noun are used as an adjective: a bee-pollinated flower; species-specific pollination.
- **That, which, and who:** use “which” in non-restrictive situations: “bees, which visit flowers, are insects of the order Hymenoptera.” (meaning: all bees visit flowers). Use “that” in restrictive situations: “bees that visit flowers are attacked by crab spiders.” (meaning: only when bees visit flowers they are attacked) Use “who” only for persons.
- **Number rule:** use Arabic numbers for units of measure (cm, m, g...). For things that are not units of measure (flowers, bees, horses) use words one to nine, and Arabic numbers thereafter: five flowers, 11 horses.
- **Personal communication:** get permission from persons that you are citing.
- **Only:** put in right place: “we only studied pollination in red flowers;” (means: the only thing we did is to study pollination in red flowers) “we studied pollination only in red flowers” (means: we studied pollination but only in red flowers.)
- **Suggest:** if you write “suggest” you don’t need “might” in addition. “Our data suggest that a single gene encodes flower color” instead of: “or data might suggest...”

- **Tense:** write most part of the manuscript in simple past tense and be consistent with tenses within a given part. Write the “aims” of the Introduction and phenomena that occurred in the past and are still occurring in present tense.