How to write a scientific paper or a report

Document provided on the WEB: ecos.epfl.ch (“teaching”)

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• **Which take-home message?**

  • Do your science well, and **write it well**, so that it is accepted by the scientific community

  • **Communicate in English in science**. It is almost the only way to be spotted elsewhere in the world and to be fully integrated in the scientific community

  • Whenever possible, **start in English** from the beginning. It is best to think in English, then write in English, … and you can still dream in French
• **What will your take-home gift be?**
  
  • A guideline for writing a scientific paper
  
  • For your convenience, it is in French
• ** Communicate (1) **

  • The communication process is like a chain with inter-dependant steps and cascade effects:

    Source ⇒ Emitter ⇒ Transmitter ⇒ Receptor ⇒ Target

  • Failing at one step can **interrupt** the communication process or **alter** the message
    • The target puts **constraints** on the previous steps

  • The reader has to operate a severe **selection** among the bulk of information he gets
    • This will be achieved according to the **quality** of the written communication which is at hand
• Communicate (2)

• In science, until the results of the research have been published, the work is not finished

• This contributes to scientific knowledge and your contribution will be recognised by the scientific community

• There are rules and the reader expects you to be: ordered, logical, brief, clear and demonstrative
  • Always conform to the editor’s guidelines

• There are some advantages of written over oral communication
• Report or paper ? (1)

• A scientific paper is a type of report that has to conform to standards of science ethics as well as format
• To be considered as a valid primary paper, it must:
  • contain original unpublished results
  • be peer reviewed
  • be issued in an adequate journal
  • contain enough information to allow for reproduction of the results
  • be issued in a permanent form
  • be accessible without restriction (at least by libraries and data bases)
• Report or paper? (2)

• A report is a written description of some work and is not intended to be published

• Papers in conference proceedings, institutional journals or as MSc/PhD theses are considered to be secondary papers and are usually not accepted in the reference list of international journals (“grey literature”)

• Whenever possible, a master thesis or a PhD thesis should be designed so as to able to produce papers
  
  • Partition chapters according to planned papers, each one organised according to the common standards
How to design and conduct the work? (1)

- Define precisely the problem
  - What is the question?
  - What are the aims?
  - What do I want to demonstrate?
  - Who do I want to convince?
  - What is the best method?
  - What is the best statistical analysis?
• **How to design and conduct the work? (2)**

• Collect the available information

  • What has already *been done*?
  • *Who knows* something?
  • Build a network of information *sources*
  • *Search and select* with key-words
  • Make a *first analysis* and search for *clues*
  • Organise ideas and set *priorities*
• How to put structure into the writing?

• Set a working schedule (working plan)
  • Set yourself some constraints and deadlines
    – This helps to focus on the main topics

• The classical writing format IMRAD (writing plan)
  • The most convenient, logical way to communicate science, which is the standard form:
    – Introduction
    – Methods
    – Results and
    – Discussion
    – Conclusion
    – Abstract

• The reader likes to find things in the right place
• The introduction

• It places the problem in context and explains why this paper was written
• It emphasises the importance of the work
• It has to attract the reader’s attention
• It has to raise questions or show a paradox
• It describes the current knowledge and shows why more work is needed
• It can give a short overview on how the question is going to be answered
• At the end it states the hypotheses which are addressed

• Use the present tense when describing current knowledge, past tense when citing results of authors
• **Material and Methods**

  • It provides the **details** on the piece of research
    – Study site and/or species
    – Sampling procedure and experimental design
    – Analytical procedure
    – Statistical procedure
    – Nomenclature

  • Information should be **sufficient to allow for the reproduction** (verification) of the work
    • Providing some references for well known and admitted methods may be sufficient

  • If there are several aspects to be presented, **subdivide** in paragraphs or subsections

  • **Use the past tense**
• **Results (1)**

  - Recall methods and present the main results
  - Give the facts, without interpreting them
  - Be clear, unambiguous and straightforward
  - Make the best choices for the demonstration, “predigest” the data and present them in a synthetic form
    - Present bulk of data in tables or figures, only mention in text most important results and overall patterns
  - If necessary, present the full data set in an appendix
  - Keep the same presentation order as in the section Material and Methods
• Results (2)

• In general, references are not cited in this part

• Provide well conceived tables and figures
  • They allow the text to be condensed
  • They allow for rapid access to the main results and comparisons are easier to make
  • They offer a more synthetic view of the data

• Nevertheless, never give the same information in both, a table and a figure

• Use the past tense for what was obtained, or the present when describing some figures
• **The discussion (1)**

  • It is where you show the real *importance*, *originality* and *novelty* of your work

  • **Sort** the facts and results to show their *meaning*

  • **Analyse, interpret** and put the various results in relation to make the *main ideas* emerge
    • You must convince the reader that your results mean what you say they do
• The discussion (2)

• Start from specific facts and move towards a general idea (induction)
  • If there are several ideas (not too many), put them in logical order and use a hierarchical approach which brings you to the most important idea
    – Use a subsection with a subtitle for each idea to be explored, and give facts, discuss them and end with a partial conclusion
    – Make links from one subsection to the other
• Demonstrate what you stated in the Introduction (here you are preparing the general conclusion)
• **The discussion (3)**

  • Make some **cross-checks**:  
    • It is worthwhile to go back to the Introduction section and check if one is still on track; “Do I answer the questions or hypotheses?”
    • Go back to the Results and see if all the important results have their place in the discussion and if contradictions exist
    • The deduction of the facts based on the ideas must also be possible
    • The discussion must not go beyond what is possible to say with the presented results
• **The discussion (4)**

  • Remember, any result can be interpreted, even if it doesn’t conform to the expectation, so you should also **present what you do not understand** so far
    • Unexpected results can be the most interesting ones
    • It may lead to a new paradigm, who knows?

  • **Compare** your results with those of other authors and put them in a more **general context**
    • It is here where you make the best use of the literature

  • *Use past tense when referring to other authors; use past tense when referring to your own results and present tense when you come up with ideas*
• **The conclusion**
  • It should refer to the red-thread of the paper, the overall approach, recalling partial conclusions from the discussion
  • It must end the demonstration with some suggestions based on the general idea
  • It is rather open to action

• **What is wrong?**
  • Integrating new facts or new results
  • Introducing new ideas (put this in the appropriate section, for example Perspectives, in a PhD manuscript)
  • Referring to work other than yours
  • Making a summary

• *Use present tense*
The title

- It is a label, not a sentence
- It must attract the attention of the reader, so make it
  - short
  - specific
  - explicit
- It will be the first (and hopefully not the last) contact the reader will have with your piece of work, so
  - choose words carefully
  - avoid unnecessary words (Study on …, contribution to …)
  - avoid abbreviations that may not be understandable to a general audience (or put them as additional information in brackets)
- You may need to provide the editor with a running title
• The keywords

• They should give clues on the main content of the paper
  • They often are chosen so as to give information on methods, study object, theoretical framework, application
  • Words in the title, in the abstract and the keywords are the resource for data base queries
• They must add up information to the title with other words
• Keep their number low (about five)
- **The abstract**

  - It must be a **short version** (about 250 words) of the paper and give a brief description of **each step**, in a clear, simple and attractive way
    - Introduction (aims, hypotheses)
    - Methods (if new)
    - Results (most important ones)
    - Discussion (main ideas and conclusion)
  - It must be **self-sufficient**
    - No references to figures or tables, no citations
  - Based on the abstract, the potential reader will decide whether he will spend more time on your paper or not, once he gets past the title and keywords
• **Which journal to choose?**

  • Choose you journal according to who your **audience** is

  • Check the **Science Citation Index**, and remember that your future academic boss will do it too!

  • Target the **best possible** journal in your field, where you can reasonably expect to be successful

  • Later on, once the editor’s decision is made, you will be able to **resubmit** elsewhere if necessary

  • Use journal’s format from the beginning, refer to **author guidelines** (read several sample papers in that journal)
Start to write

Once you know how you will organize your work (working plan) and what will fit in the manuscript (writing plan, ideas, …), start to write

Do it as soon as possible, even before you have finished your practical work

– you are still fully in the context and everything is in your mind

– thinking more carefully about some aspects (methods and preliminary results) could lead to some improvements

– it helps to overcome the anxiety of the empty page

Be efficient, for yourself, and for the future reader
• Simplify and clarify your writing

• The reader is only interested in your ideas, not in any kind of poetry, so make your story explicit and your writing easy to understand
  • It makes your paper better accessible to scientists whose native language is not English
  • Use simple words and short sentences
  • Organise your text in paragraphs, which separates the various treated aspects and ideas
  • Try to modulate the writing cadence
  • Be straightforward

• Go back to your writing a few days later, and try to improve both the presentation and the content
  • It may help to read it loudly, or ask a colleague for advice
How to do the reference list (1)

- Make the list of publications that are mentioned in the text, and only these
- They are supposed to have been of some use in the paper and support your arguments
- In principle, journals accept only primary papers
  - For secondary papers, it is sometimes possible to indicate “unpublished”

- Check carefully the citations
  - Official citation of the journal, year, issue, pages
  - Correctness of names and title
• **How to do the reference list (2)**

**Alphabetic order** (subsequent chronological order)

• In the text:

This was shown by Buttler (2010), or, Buttler & Day (2010), or, Buttler, Day & Givadinovitch (2010), or, Buttler *et al.* (2010) (for 3 authors, after it has been cited once with all 3 authors, or if more than three authors)

• In the reference list:


DAY, R. A. 1988b. (…)

• How to do the reference list (3)

• Alphanumeric order (subsequent chronological order)
  
  • In the text:
    This was demonstrated [1], or, this was demonstrated by Buttler [1], or, this was demonstrated in 2010 [1]

  • In the reference list:
    3. DAY, R. A. 1988b. (...)
• **How to do the reference list (4)**

  • **Chronological (citation) order**

  • In the text:

    This was shown in France [1], but also in England [2], later again in another context [1, 3, 4].

  • In the reference list:

    4. DAY, R. A. 1988b. (...)


• **What about the appendix?**

  • It should be considered as *additional information* for optional readings

  • Contains generally tables of data, formulae or other kinds of *detailed information*

  • Sometimes useful for keeping the core paper straightforward and avoiding overloading it with details
• **How to determine the authorship?**

  • No rules, just common sense, respect and agreement
  • Give priority to people who have contributed most intellectually; forget about those who did nothing
  • For people with a same contribution, use alphabetic order
  • If the paper is part of a PhD work, it is conventional to put the name of the PhD student first
  • It is often so that the boss puts its name at the end as the project leader (also strategic reasons)
  • There are some quantitative criteria that may be used
  • An unreasonable authorship list can be damaging for the group
• **How to acknowledge people?**

• Saying thank you to people shows that you are aware of the **human environment** that made you successful.

• Be careful, acknowledge the **right people**, and do it in an **appropriate way**.

• Do not forget the **institutions who supported you with grants** (give the project name or number) or other **persons who provided logistic support**.

• If the paper is part of a PhD work and the student is not first author, it is wise to mention that here.
Send the paper to the journal

- The editor asks generally for 2-4 printed copies of the manuscript
  - doubled-spaced
  - numbered rows and pages
  - including tables and caption to figures
  - and separate paper copies of the figures, labelled according to the captions, with name of first author

- The editor will possibly ask you to send the electronic version of the paper (give indication on the computer program and release)
- Electronic submission tends to become the rule for most journals
• Feedback from reviewers (1)

• The editor will send you back his report with his decision, based on 2-3 anonymous reviewer’s comments, which you should also get
  • Often you also get annotated copies of your manuscript

• If the decision is “accepted without revision”, you are a lucky person, and this is rare

• If the paper is accepted with minor or major revisions, you are still lucky, because, unless you do not comply with the editor’s request, your paper will surely end up in press
  • Do your best and you will be lucky soon
• **Feedback from reviewers (2)**

  • If rejected, you have failed. But there can be several reasons:
    • Maybe there were too many good papers, or yours was just not inline with the present trend
    • Or, your paper contains some serious weakness

  • In any case, take the opportunity of having constructive comments to improve the paper
• Feedback from reviewers (3)

• Revise and resubmit the paper and reconsider possibly the type of journal,

  • if you feel that you did not target the correct journal/audience
  • if you feel the problem in the work cannot be corrected; consider a less demanding journal (still better than not publish at all)

• Acknowledge the problems, but emphasize the contribution that is made despite these
• **The proofs**

  - You will get back from the editor the proofs to be signed, which is the last step before your paper goes in press
  - Do **take time to check** carefully the paper for typesetting
    - Ask a colleague to help you for a cross-check with the submitted version of your manuscript
    - Major errors are not rare and can severely alter your message
    - Usually, there are only a few days to do this, so anticipate
  - At this stage, **only minor changes** will be accepted by the editor
Good luck