

Tips for writing a scientific report or manuscript

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Written text is the only enduring product of our work.

Structure

• Abstract / Summary

The summary should provide an overview on the questions/hypotheses, the approach used (no detailed methods) and major results [including few numbers!] of your study or project. It should not exceed one page. Conclusions should be given, but no detailed argumentation and no citations.

• Introduction

The introduction should give to the reader the background which is **essential** for the understanding of the **following** questions and experiments. The current state of research is shortly described including relevant (only!) literature. Do not write for your supervisor but for an intelligent reader who is not an expert in the special field. Demonstrate that you can bring your work into a scientific context. It is important to explicitly name the **questions** and **hypotheses** that are investigated in the results section and discussed at the end. Therefore it is recommended to **write** the introduction after (!) you have finished the rest of your text.

Note: That a question has *never been studied so far* is **not** a good reason to study it now. (It rather indicates that it is not very important.)

• Methods

Please imagine that there might be successors repeating your experiments in the future. Therefore describe the methods as you would have liked to find them, when you started. Most relevant is a detailed description of methods that you have newly developed or modified, even if all the details will not be published! Cite standard methods instead of repeating their description. Describe methods in a **general manner**, not referring to the special set of experiments that you have performed.

BAD: "Seven experiments with strain A and five with strain B were performed" [*those details will be visible in a table in the results section- if relevant at all*]

BETTER: "Freshly harvested cells [*strain and cultivation conditions do not matter, while you describe preparation of a cell extract*] were disrupted by ultrasonication. For this 3 ml of a suspension with x.y mg protein per ml"

• Results

- Each chapter of the results section can have a short introduction of one or two sentences (if necessary to keep the text readable). Please structure the text logically ("Because there were hints that ... could be the case, the following experiment was performed.) and not only following the time sequence (Then...)

- Heading in the result section should refer to RESULTS and not to methods

- The results section should contain RESULTS and not technical detail about the experiments.

BAD: "25 assays with 10, 15 and 20 mM lactate were tested as well at 20 as at 30°C in the dark and in the light". Nobody is interested in those details, and these are no results.

BETTER: "... was tested how the cells react on changes of the substrate concentration, temperature and light availability. As shown in Table 1, the activity strongly depended on the lactate concentration." [If you mention a table or figure, always tell the reader what he or she can find there]

- IMPORTANT: Numbers in the text only if you expect the readers to remind them! More than one number per paragraph is usually too much!

- A short summary of the result is allowed within the result section. Keep it readable, nobody wants to know data...

- Headings in the results section should refer to the question addressed, not to the method applied!

• Tables

Each table gets a heading. The first word of each column starts with a Capital letter. Do not repeat the methods section. However, take care that the technical parameters are completely described. If necessary details can be given in a footnote.

• Figures

Figures get a legend instead of a caption. Take care to name the essential process instead of methodical details. Again Capital first letters at the axes.

BAD: "Plot of the lactate concentration versus time"

BETTER: Growth of strain xyz with lactate.

• Discussion

- Start with the most important aspect. One or two short sentences summarise the essentials and the highlights of your study (without special heading).

- Use headings to structure the discussion. Never write more than half a page without a new heading. The headings should not repeat those of the Results or – even worse – the Methods section.

- Crosslink your results. Do NOT repeat everything in the same sequence and with the same topics as in the Results section. [Remember that a short summary of single experiments is allowed in the Results section already]. Instead: Bring up the relevant questions and hypothesis and discuss them from a superior point of view.

- Do not discuss every possible issue, but focus on the relevant aspects. First extract the major results. Then assess the methodological quality. No experiment is perfect. But if after your evaluation of the shortcomings you still have good evidence for your main point, this will avoid critics of the reviewers.

- Do NOT repeat results in the discussion. If necessary include them in a subordinate clause.

BAD: "Many of the cells formed spores." [Result style!]

BUT: "The finding that many of the cells formed spores induces the question whether..."

- After discussing your own results look out in the scientific world. Which progress and new aspects can be derived from your study compared to the literature? If you cite literature do not give long lists, but give the specific aspects of every cited paper.

- A last paragraph could offer perspectives and interesting new ideas. Avoid platitudes like "More intense studies have to be done in the future...."

• **References**

Take care to give complete bibliographic information. Do not generate long lists of references. A short list with the most relevant studies is much more helpful, especially if you describe their contents in your manuscript.

• **Appendix**

Use an appendix to add data and figures that would reduce the readability of your text.

Special Hints

- No text without name, heading, date and page numbers!

- Before you start, have a look on similar and well written reports/manuscripts with respect to design, style etc.

- I recommend to write every text for a defined reader who intelligent, well educated and interested in your study, but not experienced in the special field you are dealing with. This anticipated reader should not be your supervisor. Very important is to know from the very beginning: What is the message I would like to bring to my reader. Remember: Nobody is interested in your DATA.

- Start with the most important aspect! Reports, master and PhD theses are not structured like a short story with a surprising end. Marginal conditions, exceptions etc. are mentioned after the main point.

- Shorter is better! **Clarity goes over completeness.** One of the best ways to improve a text is to omit unclear passages or parts of a sentence.

- A **number**, not even a **table** or a **figure** are NO RESULTS. A result is an answer to a question or hypothesis that needs written sentences.

- Sentences like "The results are summarised in Table 2" are forbidden. They do not contain a result and leave the reader without any idea what he or she should learn from the table.

WRONG: "The results are shown in Table 1".

CORRECT: "The turbidity increased with time (Tab. 1). The assumption that... could be confirmed. "

- Do not waste space by technical details like: "The accumulation of sulfate was measured as well with cells grown under sulfate limitation as with those grown under limiting concentrations of H₂." Instead describe the result: "Cells grown under sulfate limitation accumulated more sulfate than those adapted to H₂ limitation (Fig. 1)". The reader then knows the main point of your figure.
- Structure your text logically ("This finding posed the question whether...") and not according with "Then ...".
- Use one term for one scientific item. There is no necessity for variation of words for the same thing. Repeated "was done...", "was performed..." is better than "I added ..."
- **Results** are written in **past time**, use present time only for general conclusions. "The protein increased. This allowed to conclude that the cells can use the substrate"
- **Negative finding don't have probative force.** (WRONG: "The cells could not grow with nitrate." Correct: "They did not grow with nitrate.")
- Figures get a legend at the bottom, Tables get a caption. The first letter of column and writing on axes is a Capital.
- Numbers in the text only, when the readers should learn them for ever. However, together with the Methods section, tables and figures legend must describe the experimental conditions completely.
- Numbers below twenty and without a possible fraction are written as word ("seventeen strains", "3 ml", "nine day", "22 days").
- Separate Number and unit by a (protected) space.
- I recommend to use a decimal point instead of a comma also in German texts. Even better: Numbers without decimals ("42, 74 and 90" is better memorable than "41.7, 73.9 and 89.75"; hardly readable would be "41,7, 73,9, 89,75...").
- Use simple strain designations, as they are better memorable. BAD: "Strain Ac.I.I". Better "HC1 or BE2 ". The reader does not understand the meaning of all the characters in "strain JS_SRB50Hy ".
- Words from foreign languages are set in *italics (in situ...)*
- Avoid syllable division in English texts.
- Try to avoid abbreviations (except real standards like ATP, NAD, min etc.). Do not define new abbreviations that are only used for your current text. If you have to use one, define it at the first use.
- A strain designation is not a name: Write "strain CSN" instead of "CSN", only).

- The content of headings has to be repeated in the following text ("3.1 Sulfate transport" [break] Wrong: "This was..."; correct: "The transport of sulfate was...").
- Insert two blank lines before, and one after a heading.
- Write complete sentences, only.
- Write short sentences.
- A very good test for the quality of a written text is to read it loudly.
- Use the comparative degree always together with "than". ("Cells grown under sulfate limitation accumulated more sulfate **than**..." or "... showed increased accumulation rates").
- Verbs are better understandable than nouns. BAD: "Thionate formation took place under sulfate excess, only". Better: "Desulfobulbus formed thionates only if sufficient sulfate was present."
- Use only few font variations, e.g. two different sizes and **bold** and *italic* characters where necessary.
- Genus and species names are set in *italics*.
- Indent a new paragraph if it does not have a new heading. Justification gives a more quiet impression than ragged margins.
- Do not mix formulas and name of chemicals (Na_2SO_4 or sodium sulfate, but not Na_2 -sulfate).
- A cell has a shape, but not a morphology. Morphology is a scientific discipline, but not a property of the cell itself. Temperatures cannot be hot or cold, but high or low....
- Text structuring
Do not use too many number. Nobody wants to learn what is paragraph 3.2.4.3. Normally two, at maximum three levels are sufficient. Eventually one can place "Introduction" etc. in the running head of the page.
- Use a spell and grammar checker before finishing your manuscript.
- Summary
Every scientific text with more than ten pages should have a summary.
- External Sources
Do not commit illegal plagiarism. Cite external sources more accurately than "wikipedia.com" (include at least the keyword).
- pdf File
Generate a pdf File of the final version of your document including all tables and figures (e.g. by means of the public domain software "pdfCreator" that emulates a virtual printer).

And now - **HAPPY WRITING!**