UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND
SAPERE AUDE

Higher Education Development Centre
Student Learning Development
Whaowhia Te Kete Mātauraka

Introduction to Scientific Writing

A Guide to Science Writing at Otago

Student Learning Development
University of Otago

This booklet is an introduction to some of the skills and strategies that will help you successfully complete your studies at Otago.

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Structuring your document

Different types of writing have their own particular tone or style. In science writing, the tone is generally formal, objective and informative. Examples of science writing you may do include lab reports, journal article summaries, research proposals, theses and grant applications. In this part of the guide, the typical structure of a science document is outlined.

Title

Is the title clear and informative, and does it reflect the contents of the report or paper?

Abstract

Does your abstract describe the background for your study, clearly state the research problem, briefly describe the methods used to investigate the problem, state the results obtained, and summarise your conclusions and link these back to the study context? In a nutshell, the abstract should say what your study is about and explain why it matters. Different disciplines may expect abstracts to be written in a particular style. For example, in some Health Sciences, sub-headings are used in abstracts. Sub-headings are not commonly used in the Social Sciences. Be sure to check your lab manual or with departmental staff for guidance.

Introduction

This section should contain two key things:

1. An introduction to the science that was carried out. This is usually structured as a literature review in a paper or larger report. In an undergraduate science report you should explain the motivation for your current experiment or study and reference relevant background readings or articles. You should also provide a clear statement of the research questions and describe how these link to the study background or context.

2. An overview of what is included in the report including a brief overview of the methods used and the expected results.

Materials and methods

This section is the ‘recipe’. It describes what you did and how you did it. For the report to be a practical and useful document and for the results to be reproducible, make sure you check that:

- It is possible for a trained person reading your report to replicate your study from the information you have provided.
- You have accurately and fully described your experimental procedure.
- You have not included results or discussion in the materials and methods section.

Results

In this section you report what you found in your investigation. Do check that you have:

1. Correctly formatted, labelled and captioned all tables and figures. Check your lab manual for specific instructions but refer to the introduction to tables and figures in the next section for general advice
2. Correctly reported descriptive and inferential statistics and used tables and/or graphs to support clear communication of your results. Try to ensure that tables and figures are located soon after the text in which they are introduced.
3. Not referred to the experimental methods used. These should be included in the methods section.
4. Not discussed the results of similar research. This belongs in the discussion section.

Discussion

This is where you fully discuss and interpret your results, and comment on whether your research supports your original hypotheses or answers your research questions. If your results do not fully answer your original questions, or fail to support a hypothesis, you should try to explain why this might be the case. It is important to acknowledge any limitations to your study design in this section. You can also use this section to

speculate on future research that may be helpful to answer unresolved issues, or point out new research questions that have arisen out of your research. Finally, ensure that you link you findings back to the original context or motivation for your study or experiment. It may be a very small contribution but it is important to explain how your study adds to or supports, existing knowledge.

References & citations

Some specific details to check include:

1. Double-check that you have cited all references used in the body of the text and that your citations and references match. As a general rule keep direct quotations to a minimum. Describe the work of others in your own words and reference your sources. This will also help you to better understand the science that others have carried out.

2. Make sure you have applied the appropriate referencing style correctly and consistently. If you are unsure check your lab manual, the library website or ask your departmental liaison librarian.

3. Check any online references to ensure they are accessible.

Scientific writing conventions

This part of the guide covers the typical rules and conventions of scientific writing. They are important to follow because this is part of how scientists communicate with each other. They are set out as follows:

1. A brief introduction to tables and figures

2. Defining terms and abbreviations

3. Are contractions okay?

4. What about exclamation marks or rhetorical questions?

5. Write to inform not impress

6. Should I be using the active or passive voice?

7. What tense should I use?

8. What are the accepted conventions for numbers, and genus/species names?

9. Remember that the word ‘data’ is plural.

1. A brief introduction to tables and figures

Use tables when you need to present or group data in a logical way. Key points for table presentation include:

- Table caption goes above the table
- Use normal case not title case for the caption
- Number the table followed by the caption
- Refer to the table by number in the text
- Horizontal lines are used only to separate headings from data. Avoid vertical lines to separate columns.

Use figures to illustrate a trend in your data or a feature of your data. Graphs, photographs or illustrations follow the convention for a figure. Key points for figure presentation include:

- Figure caption goes below the figure
- Use normal case not title case for the caption
- Number the figure followed by the caption
- Refer to the figure by number in the text
- For graphs, you usually plot the independent variable on the x axis.

2. Defining terms and abbreviations

The first time you use a technical term, make sure you define it. In some disciplines it is usual to bold the term the first time you use it and thereafter use a normal typeface. Similarly, define acronyms or

abbreviations the first time you use them and thereafter just use the acronym.

3. Are contractions okay?

In formal writing these should be written out in full. For example shouldn't, can't, didn't, becomes should not, cannot, did not.

Wrong	Right
Never use "it's " in formal writing. "It's" can only mean "it is", which is a contraction.	"Its" is used to show possession or ownership, for example, the cell and its mitochondria.

4. What about exclamation marks or rhetorical questions?

Breathless writing and exclamation marks are not appropriate in formal writing, neither is the use of rhetorical questions.

Wrong	Right
This study has shown that the nutrient level is very low! What can be done about it? It can be remedied by…	This study has shown that the nutrient level is low. It can be remedied by…

5. Write to inform, not to impress.

When writing think of the clearest way of expressing yourself.

Some people tend to choose long words over shorter ones, thinking they are more impressive. The result may come across as pompous and tedious to read. Impress the reader with clarity, not with the long words. The goal of writing a science report is to communicate the science. Aim to make your report as easy as possible for others to understand; do not overload them with complex writing.

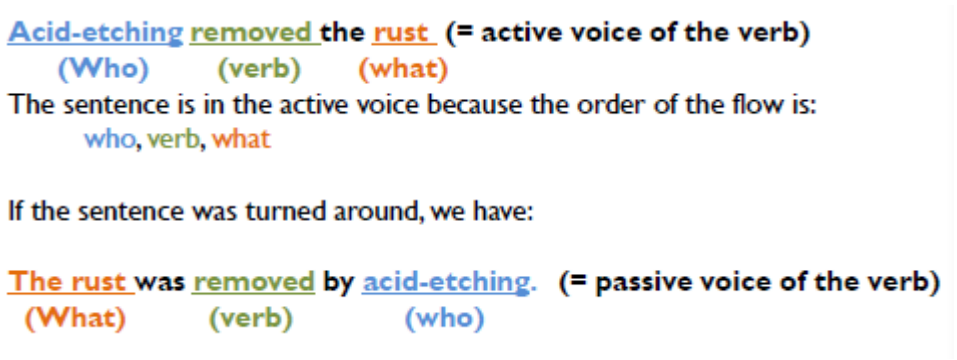
6. Should I use the active or passive voice?

Use active or passive voice according to the emphasis of the sentence. Avoid distorting the passive voice.

What is meant by the active and the passive voice?

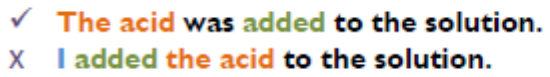
Many people recognise a verb as the 'doing' word of a sentence. The

following sentence has a subject (or 'who') – acid-etching; a verb – removed; and an object [or 'what'] – rust.

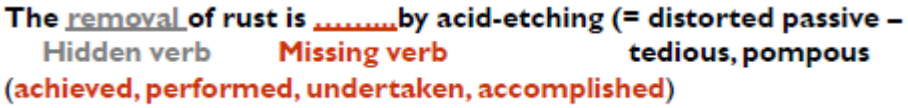


When the order of flow is *what, verb, who*, the sentence is in the passive voice.

Is using the passive voice bad? No. We need the passive; it stops us from having to use the words "I" and "we" that are often considered unacceptable in technical writing. For example, in the method section of scientific reports, the emphasis is on what is done, not who did it:



What happens when we distort the passive voice? What is bad is to take the passive voice one step further into a distorted form. Then the verb becomes hidden. Consider the example above. If the verb 'removed' becomes hidden, it becomes:



Here's the point**:** if you find yourself using the words above you are very likely to be distorting the passive. Keep these words in mind as danger signals and rewrite the sentence.

7. What tense should I use?

Use the tense appropriately and consistently. Decisions about the proper

use of tense can be confusing, so you should check with your paper co-ordinator or course documents if you are unsure. There are no absolute guidelines. However, here are a few suggestions for deciding which tense to use in technical documentation:

- Past tense for describing: methods, results
- Present tense for describing: introduction, discussion, conclusions

8. What are the accepted conventions for numbers, genus and species names?

Numbers

If the number refers to a measured quantity, it should be expressed in figures, irrespective of how large the number is e.g. 2.4 seconds; $5000; 9 kilometres; 6 tonnes; 16 C°.

If not, then the following rules apply:

- Counted numbers of ten or less are written out. Those above ten are numeralised e.g.: "Measurements were taken in five areas" or "Measurements were taken in 20 areas".
- A number at the beginning of a sentence should be written out, e.g.: Twenty samples were taken (but try not to start your sentences with numbers).

Genus and species names

- The scientific naming of a species consists of two Latin names: genus and species (*Cygnus atratus*). The conventions are as follows:
- The initial letter of the genus name is capitalised
- The initial letter of the species is always in lower case
- The whole name is italicised (or underlined if writing by hand)
- A genus name should also be followed by the species name. If the species is unknown use 'species' 'sp' (singular) or spp (plural), none of which are italicised, e.g. Cygnus sp.

9. Remember that the word 'data' is plural

The singular is datum, a word rarely used in scientific writing. "The data are interesting" (not "The data is interesting").

References

Knisely, K. (2005). A student handbook for writing in biology. Massachusetts, USA: Sinauer Associates. 237p.

Pechenik, J.A. (1997). A short guide to writing about biology. USA: Addison-Wesley Educational Publishers. 285p.

Silyn-Roberts, H. (2002). Writing for Science. A practical handbook for science, engineering and technology students. Auckland, NZ: Pearson Education. 180p.

If you would like to talk to one of our staff about scientific writing you can book an appointment for a one-to-one consultation at SLD reception or send us an email at hedc.studentlearning@otago.ac.nz

Check out our resources online at http://www.otago.ac.nz/hedc/students/digital/index.html