Writing for Science Subjects: 10 Characteristics of Scientific Writing

1. It is conventional

- This means that scientific writing follows strict rules, with regard to a number of issues:

Structure

- Writing for science subjects is generally more rigidly structured than in other subjects. For example, if you look at articles in scientific journals, you will see that they are usually arranged under a series of headings. Here is a typical structure for a report on an experiment, with suggestions for the kind of information that should be included in each section. It is crucial when writing reports that you should include your information in the correct section.

  Aim
  - Describe the purpose of the experiment

  Abstract
  - Give a short summary of the whole report, including conclusions

  Method
  - Describe the techniques and materials you used. Discuss any difficulties in carrying out the experiment

  Results
  - Describe your observations. Include calculations where appropriate

  Discussion
  - Critically evaluate the significance of your results. Compare with previous studies. Discuss weaknesses in your study and suggest future avenues for investigation

  References

- Remember that this is not the only way to structure a report – for example, some reports will have a table of contents, a literature review, or recommendations. Some might have a separate section for conclusions, which summarises the findings. Your department may have their own specific requirements regarding which sections should be included, so make sure you check the guidelines.

Use of abbreviations

- The use of **abbreviations** is common in scientific writing, especially for long technical terms and it can be a way to make your writing flow more smoothly
- Always give the term in full at the first use and show the abbreviation in brackets
  - "Magnetic resonance imaging (MRI)" or "polymerase chain reaction (PCR)"
  - Subsequently use just the abbreviation
  - See Glover (2009, p. R99)[1]
- Try to use accepted abbreviations (such as MRI) rather than making up your own
- Always be consistent in your use of abbreviations
  - Always **MRI**, not **mri**, **Mri** etc.

[1] Students at the University of Leeds can click on the links in the references section to connect to the articles used as examples in this guide. Students elsewhere can check in their own library catalogues.

Formatting of names, technical terms etc.

- Scientific disciplines have their own rules about how names etc. are written e.g.
    - In biology, species names for animals and plants are given in italics, with the genus capitalised
        - e.g. *Homo sapiens* at first use, later *H. sapiens*
        - Note that there can be specific exceptions e.g. animals or plants are usually referred to by their scientific names for accuracy, but the zebrafish – *Danio rerio* – is generally just called the zebrafish in genetics
    - Gene names are always given in italics, while the corresponding protein products are in normal font
        - In zebrafish, *zic2a* is the gene, Zic2a is the protein
- Every discipline has its own conventions - for chemical elements and compounds, nuclear particles and so on - and it is important that you know those in your subject. Refer to your lecture notes and text books or try the style manual in the resources page.

Use of tenses

- Different tenses are used for writing about different types of information and in different sections of a scientific report
    - Established knowledge = **present tense** e.g.

"Hh function **results** in transcriptional activation of several targets, many of which **encode** transcription factors (TFs)." (Sanek, *et al.,* 2009, p. 3791.)

Review articles are usually written predominantly in the present tense e.g. Glover (2009).

- Describing your experiment (Introduction/ Methods) = **past tense** e.g.

"The aim of this study **was** to investigate and quantify both biological endpoints in human lymphocytes after CT scans in the presence of an iodinised contrast agent". (Jost, *et al.,* 2009, p. 6031.)

"To determine whether *six3b* transcription is regulated by Zic2a in zebrafish, we **employed** antisense MO knockdown assays as previously described." (Sanek, *et al.*, 2009, p. 3792.).

- Referring to figures in your report = **present tense** e.g.

"Table 1 **shows** the results…" (Jost, *et al.*, 2009, p. 6033)

- Results of your experiments = **past tense** e.g.

"OxdRE **formed** a homodimer with non-crystallographic two fold symmetry (Fig. 1A), consistent with previous gel filtration analysis results." (Sawai, *et al.*, 2009, p. 32093)

- Your answer to the question (Discussion/ Conclusions) = **present tense** e.g.

"The findings of the present investigations actually **illustrate** that a dose enhancement in iodinated contrast agent-containing blood samples **can be** determined with both biological endpoints." (Jost, *et al*., 2009, p. 6035-6)

Referencing

- You must reference fully and accurately, according to the required style
- The Harvard style is commonly used in science subjects but not exclusively. Always check with your department!

2. It is clear

- 1 idea/sentence
    - Keep sentences 10-25 words in length (on average)
- 1 theme/ paragraph
    - Keep paragraphs ¼ - ½ page long (on average)
- Sub-headings can help – see Glover (2009) - but check with your department to see if they are permitted
- See Sanek *et al* (2009) for a good example of clarity in writing

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3. It is concise

- Use as few words as possible e.g. "now" instead of "at the present time"; "near" instead of "in close proximity to"
- Keep sentences 10-25 words in length
- Avoid repetition within sentences as repetition just makes the sentence more confusing because everything is repeated unnecessarily and this repetition reduces clarity and flow (because it's repetitious).

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4. It is accurate

- Use simple terms e.g. "identical" instead of "exactly identical"
- Avoid vague terms like "most", "nearly" e.g.
    - E.g. "The concentration was tested every 15 minutes" instead of "The concentration was tested regularly"
- Avoid overgeneralisation e.g. "it is widely accepted", not "everyone knows that"

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5. It uses formal language (but not excessive jargon!)

- No contractions ("do not" instead of "don't")
- No colloquialisms/ conversational terms ("exactly" not "bang on"; "approximately" not "near enough"; "children" not "kids")
- No anthropomorphism ("offspring" not "babies")
- Be accurate rather than polite! E.g. "Man/Woman" not "Gentleman/ Lady"
- No run-ons i.e. "etc.", " so on"
- No rhetorical questions e.g. "So, what do these results mean?"
- Try to write in an active style rather than passive

Active	**Passive**
I observed the angle to be…	The angle was observed to be…
The authors suggest…	It is suggested…
We used a standard graphical representation to…	A standard graphical representation was used to…

- Linked to an active style is the use of first person (I/we) rather than third person, and the person as subject of the sentence, rather than things e.g.

First person	**Third person**
I found…	It was found that…
I assumed…	It was assumed that…
Person as subject	**Thing as subject**
I noticed…	Analysis of the data indicated…
In this report I will show…	This report presents…

Examples from: http://www.monash.edu.au/lls/llonline/writing/science/index.xml

- Even in academic journals, opinions about whether it is better to use first or third person vary, so it is essential to check with your own tutors about their preferences, but it is generally thought better to write in an active rather than a passive style
    - Sanek *et al* (2009) is largely personal and active, while Glover (2009) is completely impersonal – which do you find most clear?
- Try Academic Phrasebank (http://www.phrasebank.manchester.ac.uk/) for lots of suggestions on how to phrase your writing in an appropriate way

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6. It is objective

- Objective writing avoids loaded or emotive words that might prejudice the reader, or exaggerate the situation e.g. "scandalous", "ridiculous" or "Sadly, half of the mice use in the experiment died" – in the context of a scientific report, it is not sad (which implies an emotional response) but "unfortunate" since it might interfere with the validity of the result
- You should avoid expressing your unsupported thoughts or beliefs – any opinion you give or claim you make must be supported by appropriate evidence
- You should aim to write as a neutral outside observer, without any emotional or personal investment in the subject
- Look at this example from : http://www.monash.edu.au/lls/llonline/writing/science/index.xml

Subjective style

These results seem to be really quite good. The model fits very well with the data points as can be interpreted by the R^2 values of 0.32 shown in Table 1 above. But the method used to obtain the best values for a, b, and c was a little silly and time-consuming as it required putting lots of values into a changeable Excel spreadsheet over and over to try and get the lowest R^2 value, even though this is probably the only way to do it accurately. Also, this model can be used to extrapolate the PCB concentrations of fish of ages not measured in the study, but that's about it.

Writing more objectively

These results appear to be reasonable as the model fits very well with the data points, as can be interpreted by the R^2 values of 0.32 shown in Table 1 above. However, the method used to obtain the best values for a, b, and c was rather time-consuming as it required putting many values into an Excel spreadsheet many times to obtain the lowest R^2 value. While this is probably the only way to obtain accurate results, a further limitation is that this model can be used only to extrapolate the PCB concentrations of fish within age ranges measured in the study.

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7. It exercises caution – sometimes known as "hedging"

- This also relates to accuracy – in scientific writing it is important to write exactly what you mean
- Take care not to overstate what your evidence can support
- Be especially careful with words like "proves" or "definitively"

Common hedging words*:

Nouns	Adverbs	Verbs
Supposition	Presumably	Appear
Idea	Probably	Postulate
Speculation	Possibly	Suggest
Conjecture	Apparently	Seem
Possibility	Not unlikely	May be
Inference	Seemingly	Speculate

- NEVER use more than one hedging word per sentence!

  E.g. "These results **may possibly suggest** that there is a **likelihood** that this species **could be vulnerable** to extinction"

  Better: "These results suggest that this species is at risk of extinction."

(*From: **Matthews, Janice R., Bowen, John M. and Matthews, Robert W. (2000)** ***Successful scientific writing: a step-by-step guide for the biological and medical sciences*****. 2nd edn.** Cambridge: Cambridge University Press, pp. 112-113).

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8. It avoids direct quotes

- Why? - think about the reasons that you *would* use a direct quote. Do these reasons apply in a scientific report?
- You would only use a direct quote from a source when the exact words used by the author are essential to make your point. In writing for science this situation is very rare because it is the ideas that matter most. Explaining the ideas in your own words better demonstrates your understanding of the issue (of course, you still have to cite the source!).

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9. It gets to the point

- More than any other form of writing, scientific writing is skimmed or scanned – if the reader can't see the point of your work in about 30 seconds, they probably won't read it at all!

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10. It is often illustrated with figures

- Tables, graphs, charts, photographs etc.
- All figures must be good quality reproductions and clearly readable/visible
- Keep it as simple as possible. Don't, for example, plot ten sets of data on the same graph
- Represent each set of data in only one illustration e.g. either a table or a graph, not both
- Figures must be clearly labelled
- Give each one a brief, descriptive title
- Number figures consistently i.e. 1, 2, 3... NOT 1, B, III, d etc
- Each figure should have a legend which briefly describes the experiment and tells the reader what they are looking at
- The key points of the illustration should be discussed in the main text

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References

Glover, P.M. (2009) 'Interaction of MRI field gradients with the human body.' *Physics in Medicine and Biology* 54, R99-R115.

Jost, G. *et al.* (2009) 'The influence of x-ray contrast agents in computed tomography on the induction of dicentrics and γ–H2AX foci in lymphocytes of human blood samples.' *Physics in Medicine and Biology* **54** (20), 6029-6039.

Sanek, N.A. *et al.* (2009) 'Zebrafish *zic2a* patterns the forebrain through modulation of Hedgehog-activated gene expression.' *Development* **136** (22), 3791-3800.

Sawai, Hitomi et al. (2009) 'X-ray Crystal Structure of Michaelis Complex of Aldoxime Dehydratase.' *Journal of Biological Chemistry* **284**(46), 32089-32096.