

Excellent Scientific Writing

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Developing writing skills is a long-term process

Think about continuing on after today

- Writing circles?
- Journal clubs?

The guiding principle of clarity 1

- Clarity relies upon a robust understanding of the rules and conventions of written expression.
- Clear, grammatical and well-punctuated sentences transmit thought to the audience without confusion.
- ***Every sentence carries the possibility both of clear communication & of serious misunderstanding.***

The guiding principle of clarity 2

- Another consequence of the iron rule of clarity is that you have to be exactly clear what you want to say.
- Ensure this inner understanding by beginning writing earlier rather than later in the process.
- Clarity comes from moving words around both in your head and on the page.

The guiding principle of clarity 3

- Question lazy but pervasive habits, such as overuse of jargon and hackneyed expressions.
- Readers respond to fresh expression.
- New ideas demand fresh writing, and fresh writing aids clarity.

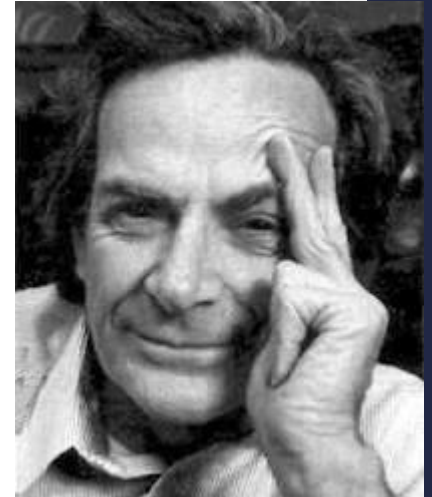


Two sides of the coin

- Researchers do not just “do” research, they must “write” research as well.
- Few other professions require that every stage of one’s work be so meticulously documented and argued.

The scientific method

- The scientific method requires smooth transfer of information.
- Scientific writing that is opaque, convoluted, ambiguous, poorly argued and filled with inaccurate or technically incorrect usage will interfere with the transfer of knowledge.
- ***Writing research is not only science-based, it is language-based.***

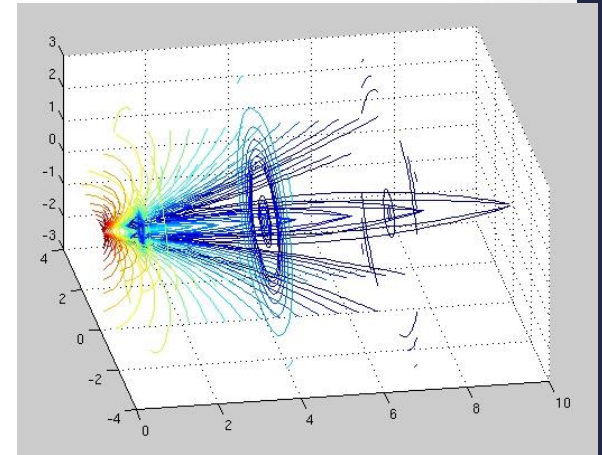


“Science is what we have learned about how to keep from fooling ourselves.”

Richard Feynman

Data gathering is only half the story

- Bad writing can slow down or prevent the publication of good research.
- Researchers can gather excellent data but unless that data can be turned into good writing, its importance can be lost.



Definition of scientific publication

- “An acceptable primary scientific publication must be the first disclosure containing sufficient information to enable peers (1) to assess observations, (2) to repeat experiments, and (3) to evaluate intellectual processes; moreover, it must be susceptible to sensory perception, essentially permanent, available to the scientific community without restriction, and available for regular screening by one or more of the major recognized secondary services [such as Biological Abstracts, Chemical Abstracts etc].”

Council of Biology Editors, 1968

Back to basics

- The rigour of scientific communication depends on an organised presentation of a persuasive, data-backed and clearly-written argument.
- Considering some of the basic skills of effective writing will help.
- **Nurture your interest in language and in writing by reading good writers.**

Answering questions

- I will now take a moment to answer your questions about academic writing.

IMRAD

- The best known formula for organising an academic paper is known as IMRAD:
- **Introduction**
- **Methods**
- **Results**
- **And**
- **Discussion**
- While used primarily in the hard sciences, like physics and biology, it is also widely used in the social and behavioural sciences. *(Note that the IMRAD headings are not necessarily used in the published work.)*

Logic of the IMRAD system

- What question (problem) was studied? *The answer is in the Introduction.*
- How was the problem studied? *The answer is in the Methods.*
- What were the findings? *The answer is in the Results.*
- What do these findings mean? *The answer is in the Discussion.*

Use your abstract to organise

- One easy way to achieve a logical structure is to write an abstract early in the write-up process.
- Your abstract is as much a planning document as it is a summary of your work.
- It echoes the IMRAD format but in denser, more summarised form.
- Consult it often while drafting the whole paper.

Communicating to others

- **The strategies and protocols for structuring academic papers help ensure that:**
- the information is useful; and (in many cases)
- the methodology is reproducible.

Think about the most logical approach

- Think about the overall argument, and the logical way to describe the results.
- Detach yourself from your data and thereby deepen your understanding.

Important results first

- Fashion your findings into an intellectually coherent account that provides the most important results at the start
- ...followed by a logical approach that leads the reader through your processes and reasoning...
- ...towards a powerful and inescapable conclusion.

The essence of academic writing...

- ...demonstrating your capacity to think deeply about conceptually difficult ideas...
- ...and finding a logical and straightforward way to explain your reasoning.

Ask yourself some questions

- How do your findings fit with what is already known?
- How do they differ?
- What conclusions can justifiably be drawn from your results when they are read in concert with existing knowledge?

What is your “thesis??

- Can you clearly state the core of your argument, your ‘thesis’?
- The thesis is the new idea that you wish to establish in your piece of writing.
- Your thesis should be ‘new, true and significant’ (John Gerring et al)
- Ensure that you can state it clearly and effectively.

Prepare your take-home messages

- The way you organise your paper is driven by your results: by the small number of “take-home messages” you wish to convey.
- Imagine your paper being discussed at a journal club meeting.
- What are things you would want the participants to focus on?
- **Prepare clear statements of these first before proceeding with the paper itself.**

Use these questions to help prepare some preliminary statements

- **What do my results *say*?** (Keep your answer to no more than two sentences)
- **What do these results mean in their context?** (What conclusion/s can be drawn?)
- **Who needs to know about these results?** (Who is your audience?)
- **Why do they need to know?** (What contribution will this work make to others in the field?)

Prepare an outline

- Prepare a detailed outline before attempting to write the paper.
- Your outline should show exactly what evidence you are using and where, and show inter-relationships between data.

Useful outlines

- The most useful outline is highly detailed.
- Work out how many paragraphs will be contained in the paper and what each one will be about.
- Write the theme sentence for each paragraph and note the backing evidence you will present in the paragraph.
- Create informative headings and sub-headings.

Introductions

- The introduction creates an effective context for the paper.
- Place your work into the continuum of research in your discipline and make its connections to this continuum explicit.
- Introductions tend to begin with general statements before moving to specific statements.

Introductions continued

In general terms, you will include:

- A statement of the problem you are addressing;
- Background of the problem, possibly in the form of a brief literature review;
- The research objective and how you achieve it in this work; and
- A brief description of the conclusions you have reached.

Gap statements

- Somewhere in your introduction you will include a statement of gap.

Some forms of words might include:

- However, understanding how these processes interact to regulate invasions remains a major challenge in ecology.
- Despite its acknowledged importance, propagule pressure has rarely been manipulated experimentally and the interaction of propagule pressure with other processes that regulate invasion success is not well understood.

Discussion

- The Discussion continues the theme of the introduction by discussing the patterns you have found.
- ***It interprets results but does not rehash them.***
- The overall flow of the discussion is from the particular to the general: the opposite of the introduction.

An hourglass shape

- General to specific in the intro, specific information in the body, back to general at the end.
- The intro and conclusion must follow the same order.
- This helps ensure a satisfying consistency for the reader.



Begin writing early

- Begin writing while your research is still in progress.
- Everything is fresh in your mind, and colleagues & apparatus are still available.
- The writing process shows up problems with your data or the experiments.

Adopt clear expression

- Complex ideas should be expressed simply, using straightforward sentences that are not overly complicated.
- As a guide, try to ensure that the first sentence of each paragraph (known as the **theme sentence**) does not exceed 25 words.
- Subsequent sentences may be between five and 50 words, with either extreme rare.

Levels of claim

- Take care to reach exactly the right level of claim, based upon your evidence.
- Do not overstate your case.
- Use language flexibly to ensure that you match it to exact meaning.
- For example: can you see the difference between “The results indicate that...” and “The results may suggest...”

Three ingredients of clarity

- **Simplicity** means getting straight to the point and avoiding unnecessary complexity;
- **Familiarity** means using words and ideas that your reader will recognise; and
- **Visibility** means creating mental pictures that the reader will “see” (*concrete writing*).

Sympathy for the reader

- Think about what the **reader** needs to know.
- Detach yourself from your work and empathise with the reader.
- Readers need to **understand** and **make use of** what you have written.

Answering questions

- I will now answer more of your questions

A final thought for today

**The desire to
write grows
with writing**

Desiderius Erasmus
Dutch Renaissance scholar



Write some sentences

Think about the following *kinds* of sentences intended for scholarly publication, and write them with the principles of clear academic communication in mind:

- A context-setting opening theme sentence that contains (preferably begins with) your main key word.
- A sentence that identifies a knowledge gap.
- A sentence that describes the specific aim of your research.