Scientific writing



Pamela Teubig

Two branches of scientific writing

what we write

How we write

Scientific writing?

"A technical form of writing that communicates scientific information to other scientists in a document, book or presentation in written form."

- ☆ Academic Writing
- Science journalism
- ☆ Writing science books
- Science blogging
- Content marketing
- Science writing for social media
- Scientific scripting



Purpose of scientific writing

Present knowledge in a specific structure manner

- Show, demonstrate and explain **knowledge**
- Define research question with arguments
- Give strength to you findings, discuss other literature
- Convince and engage readers
- ☆ Or finish your studies

Publishing

Possible journals?



Starting with a question

- ☆ Title
- Abstract
- ☆ Keywords
- Introduction
- Review of the literature
- Methodology
- ☆ Results
- Discussion
- Conclusion
- References



References

The references form the basis of YOUR research

- Abstract
- ☆ Keywords
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What are **good** references?

How do we cite these?



Tip 8 - References: always go back to the original source!

we start by reading other people's work

CRAAP



HOW TO SPOT FAKE NEWS



CONSIDER THE SOURCE

Click away from the story to investigate the site, its mission and its contact info.



CHECK THE AUTHOR

Do a quick search on the author. Are they credible? Are they real?



CHECK THE DATE

Reposting old news stories doesn't mean they're relevant to current events.



CHECK YOUR BIASES

Consider if your own beliefs could affect your judgement.



Headlines can be outrageous in an effort to get clicks. What's the whole story?



SUPPORTING SOURCES?

Click on those links. Determine if the info given actually supports the story.





If it is too outlandish, it might be satire. Research the site and author to be sure.

Citing a references

Quoting

- direct quote", (Author, year)
- eg. "The term "impact factor" has gradually evolved to describe both journal and author impact." Garfield, 2006, 90.
- ☆ As explained by Author (year) "…".

Rewriting a text

- Impact factor nowadays describes both author and journal impact (Garfield, 2006, 90).
- ☆ Needs PRACTISE!!!



Citing a references



☆ 2 authors

Author1 and author2 (year, page)

.... (Author1 & Author2, year, page)

☆ 3 or more authors

Author1 et al. (year, page)

.... (Author1 et al., year, page)

Citation of group of authors

First quote

(National Institute of Statistics [NIS], 2022)

National Institute of Statistics (NIS, 2022)

Subsequent quote (NIS, 2022)

References

Author: Who is responsible for this work? Date: When was this work published? Title: What is this work called? Source: Where can I retrieve this work? eg. American Psychological Association. (2020). Publication manual of the American *Psychological.* ISBN 978-1-4338-3215-4.

Webpage (last access date)

All correct?

- Cohen, J. (1988) Statistical power analysis for the behavioral sciences. Second Edition. Hillsdale, NJ, Lawrence Erlbaum Associates.
- □ Hair, J. F., Anderson, R. E., Tatham R. L. & Black, W. C. (1995). Multivariate data analysis Fourth edition. Englewood Cliffs: Prentice Hall.
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- Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Second edition Hillsdale, NJ: Lawrence Erlbaum Associates.
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- Tirri, K., & Nokelainen, P. (2008). Identification of multiple intelligences with the Multiple Intelligence Profiling Questionnaire III. Psychology Science Quarterly, 50(2).

... should have a defined structure

- ☆ Abstract
- ☆ Keywords
- Introduction
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- ☆ Conclusion
- References



Introduce relevant topics,

why is your study novel?

The cookbook with all its ingredients

- Abstract
- ☆ Keywords
- Introduction
- Review of the literature
- Methodology
- ☆ Results
- Discussion
- Conclusion
- References



Introduces your study system

Explain how other people could replicate your study....

... digested results provide meaningful information

- Abstract
- ☆ Keywords
- Introduction
- Review of the literature
- Methodology
- ☆ Results
- Discussion
- Conclusion
- References



Objective findings, focus on the result using statistics. Graphs and tables should be self-explanatory.

... discuss YOUR results truthfully

- Abstract
- ☆ Keywords
- Introduction
- Review of the literature
- Methodology
- ☆ Results
- Discussion
- Conclusion
- References



Interpret your results, timing them back to the literature by answering possible knowledge gaps.

Limitations should clearly be stated.

Sell your work!

☆ Title

- Abstract
- Keywords
- Introduction
- Review of the literature
- Methodology
- ☆ Results
- Discussion
- Conclusion
- References

Key results & search terms



Starting with a question

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How we write



English

Advantage and **disadvantage** of English:

- straight forward grammar,
- irregularities

American vs. English spelling (Oxford vs Cambridge)

"On Monday, the students protested against the removal of scientific writing from their curriculum." Nature

"Monday, the students protested the removal of scientific writing from their curriculum." Science

Formal English

- ☆ The English used in scientific paper differs from the one you will encounter in novels, newspaper, spoken, etc...
- Advise: read the articles and absorb the type of language they use.
- Also specific areas have their "own language" and keywords, which you want to use.

Formal Style

- ☆ Scientific literature must be written in a formal style of writing.
- It is as if you are writing to an unknown person. You do not know the target.
 - I performed lab experiments to prove the results. But previous findings don't support our results.
 - Lab experiments were carried out to validate the results, however, are in contrast with previous findings.
 - Tushar el al., (2022) suggest that parents genes inherit into their children.
 - ☆ Genes are inherited by parents to their offspring (Tushar et al., 2022).

Formal Style: Quick tips

Informal	Formal	Informal	Formal	
Look into	Investigate	Lack	Deficiency	
But	However	Put in	Insert	
Whole	Complete	Chance	Opportunity	
Anyway	Nevertheless	Use	Utilize	
l think	In my opinion	Say no	Reject	
Hurt	Damage	Show	Demonstrate	
See	Observe	Seem	Determine	
Need	Require	Throw away	Discard	
Bad	Negative	Luck	Fortunate	

Passive voice vs. active voice

☆ The use of passive voice makes it easier to write in formal English.

eg.

I conducted experiments and also followed the protocol strictly.

Experiments were conducted by following the protocol strictly.

Transition word

☆ Do not use to simple language

To make your sentences more complex, flowing and engaging, use transition words like: in addition, additionally, moreover, furthermore, etc.

Times

- Present tense provided the foundation of scientific writing: suggest, is provided, is caused; eg. Figure 1, Presents the irradiation rate employed in the experiment.
- Be careful with past tenses: it denotes something which is completed;
 - Statistical analysis was carried out....
 - After 2010, the area had been revolutionised....

Precision

Objective of scientific writing: correct, factual and relevant knowledge.

eg.

Hereditary breast cancer is caused by gene mutations and is inherited. The same set of genes also causes ovarian cancer too. Ovarian cancer causes cancer in the female reproductive area.

Hereditary breast and ovarian cancer are used by gene mutations. BRCA1 and BRCA2 are common breast cancer-causing genes (Ref et al., 2022).

Building sentences

- 1. Follow a grammatical subject as soon as possible with its verb.
- 2. Place in the stress position the "new information" you want the reader to emphasise.
- 3. Place the person or thing whose "story" a sentence is telling at the **beginning** of the sentence, in the topic position.
- 4. Place appropriate "old information" (material already stated in the discourse) in the topic position for linkage backward and contextualisation forward.
- 5. Articulate the action of every clause or sentence in its verb.
- 6. In general, provide context for your reader before asking that reader to consider anything new.
- 7. In general, try to ensure that the relative emphases of the substance coincide with the relative expectations for emphasis raised by the structure. 30

In practise

The seven principles of scientific writing

(1) Place the "new information" you want the reader to emphasize in the stress position at the end of the sentence. Save the best for last.

(3) Place "old information" (material already stated) in the topic position, to link reader backwards.

(4) Follow a subject as soon as possible with its verb.

We have directly measured the enthalpy of hydrogen bond formation between the nucleoside bases 2'deoxyguanosine (dG) and 2'deoxycytidine (dC). dG and dC were derivatized at the 5' and 3' hydroxyls with triisopropylsiyl groups; these groups serve both to solubilize the nucleosides in non-aqueous solvents and to prevent the ribose hydroxyls from forming hydrogen bonds. Consequently, when the derivatized nucleosides are dissolved in non-aqueous solvents, hydrogen bonds form almost exclusively between the bases. Since the interbase hydrogen bonds are the only bonds to form upon mixing, their enthalpy of formation can be determined directly by measuring the enthalpy of mixing. From our isoperibolic titration measurements,

(2) Place the person or thing whose "story" a sentence is telling at the beginning of the sentence, in the topic position.

(5) Provide context for your reader before asking that reader to consider anything new.

the enthalpy of dG:dC base pair formation is -6.65±0.32 kcal/mol.

(6) Articulate the action of every clause or sentence in its verb.

(7) In general, ensure that the emphasis of the *substance* coincides with the expectations for emphasis raised by the structure.

From "The Science of Scientific Writing" by George Gopen and Judith Swan.

The thing about verbs

- As precise as possible!
- accumulate, cite, cause, conclude, deduce, detect, explain, ...

Write out all verb forms

There are no shorten forms of verbs in a scientific text:

- isn't, can't, don't,
- It's has nothing to do with this and is allowed to be used

Verbs to avoid: got



"My supervisor got excited when I got some *results* using samples I got from Africa. However, she got angry when she got to know that I had got hold of them illegally."

Verbs to avoid: got

- Can add confusion

Considered poor style!

"My supervisor got excited when I got some *results* using samples I got from Africa. However, she got angry when she got to know that I had got hold of them illegally."

"My supervisor became excited when I obtained some results using samples from Africa. However, she grew angry when she found out that I had acquired them illegally."

Punctuation . : ; ! ? " ,

- The point: marks the end of a sentence. Good news its the easiest to use
- The semi-colon divides two sentences into half, which belong together.
- \approx The **colon** introduce a list e.g.
 - The parameters measured were: weight, height, blood sugar levels,
 - ☆ To divide a title, e.g. Research methodologies: scientific writing
- The question mark raises a question. Can be found in the results and the discussion part of a paper.

Punctuation . : ; ! ? " ,

- The exclamation mark is used to show surprise. It is almost completely absent in a scientific paper.
- ☆ The quotation mark is used in a scientific paper to show that they are the words of another author. a list e.g.
- Substitution of the section of the text, bit provides additional information.
 - Anti-viral agents are available to combat several viruses
 e. g. HIV, influenza virus and herpes virus."
 - Anti-viral agents are available to combat several viruses (e. g. HIV, influenza virus and herpes virus)."
 - GSI (Gesellschaft fuer Schwerionen)

Finally: The comma

The comma is one of the more difficult once to use correctly. The use can be summed up in 4 rules:

- 1. Lists are separated with a comma
 - e.g. x, y and z (English English), x, y, and z (American English)
- 2. Use commas like brackets (side sentences)
 - e.g. "Our latest results, obtained using a recently developed technique, also support our overall hypothesis."
- 3. Comma after having linking words,
 - e.g. "however", "furthermore", "additionally" at the start of a sentence, or after a phrase that qualifies or introduces the main part of the sentence.
- 4. No comma "that" case,
 - e.g. "We showed that this hypothesis is false."

Starting a sentence



- In addition, additionally, further, furthermore, indeed, moreover
- However, in contrast, nevertheless, occasionally, of course on the contrary
- Use Instead for because (second part of a sentence)
- So can be replaced with accordingly, as a result, consequently, hence, in short, subsequently, therefore, thus or to this end.

Ending a sentence

- **-** Too
- Also Considered poor style!
- Though _
- Yet

Avoid uncertainty

- A lot -> several, main, numerous, considerable, etc.
- Avoid adjectives like: amazing, incredible, etc.
- Absolute statements: Our results are 100 % proof.

a(n) vs. the

"During his voyages, Darwin noticed *variation* in animals. He became interested in a variation in the beaks of finches. Only a scientist with Darwin's background could have noticed the variation in these birds."

- General statement: absent
- A/an: singular, (e.g. There is a big mess on my table.)
- the: specific, (e.g. The results indicate that the majority of the students will pass research methodology this year.)
- Some words are universal concepts: hygiene
- Indicate possession

ID problems

74		
	_	_

Attribution	Endorsement	Conjunctions				Modality		Evaluation
Attributing or projecting claims to outside authorities	Attributing claims with more or less	Words that link ideas , helping to create a 'flow' in the writing.			Words which express degrees of		Words interpreted as	
in a specific or general way	support or certainty	to link two short sentences into one long one.			certainty, nequency or obligation		which intensify meaning	
	[moutrol]	See WriteSIte for ex	amples, exceptions and exerc	cises. (WriteSite web addres	ss at bottom of this page)		a a a a a i a a a lla a	of other words
According to	[neutral]	Comparison	Contrast	Cause	Exemplifying	may	occasionally	[+ve]
	reports	likowico	However	because	for example,	could	generally	Important
argues (that)	states		In contrast	as	for instance,	can	regularly	significant
discusses	notes	just as	On the other hand	SO	to illustrate this	might	for the main	strong
states (that)	describes	bour anu	On the contrary	so that	such as	will	part	clear
shows (that)	explains	Addition	Instead	since	_	would		effective
expresses	Illustrates		Nevertheless		Restatement	has to	very	main
proves (that)	argues	Additionally	but	Therefore	in other words	had to	just	major
explains (that)	shows	Additionally	yet	Thus	to sum up	should *	simply	beneficial
suggests (that)	finds	Furthermore	still	Hence	in summary	must *	merely	valuable
demonstrates	outlines	Noreover	neithernor		in sum	ought to	only	relevant
	maintains	Similarly	even so	As a result,	in brief	need	even	logical
's argument	persuades	and		Because of this	that is		actually	persuasive
's statement	In the change of	aiso	Replacement	For this reason	to put it another way	perhaps	really	valid
's claim	In the view of	as well	Alternatively	in order for	T :	possibly	in fact	unbiased
's thesis	According to	besides	or	in order that		probably	much	plausible
's position	r	not only	or else	consequently	First(ly),	certainly		useful
In invious	[positive]	but also			Second(Iy),		barely	succeeds in
	affirms	besides	Concession	Condition	Finally,	usually	slightly	
As {argued} by	agrees		Although	unless		sometimes	quite	[-ve]
	stresses		Even though	if	then	always *	almost	problematic
There is (widespread)	asserts		Despite	then	after	never *	nearly	limited
agreement that	demonstrates		Whereas	in that case	afterwards	seldom	scarcely	unrealistic
There is (strong)	emphasises		While	that being so	previously	rarely	hardly	irrelevant
evidence to {suggest}	makes clear				subsequently		absolutely	minor
	[nogotivo]				prior to	definitely	entirely	unnecessary
A number of researchers	lliegativej		NB: Concession words		up 'til now	absolutely	completely	insignificant
(1995; 2003)	Claims		acknowledge		to the present	by all means	totally *	biased
A study by {found}	assumes		opposing positions in		at present	clearly		invalid
that	suggesis		less powerful ways		first and	of course	tends to	questionable
The recent are	holiovos		e.g. {Although} [there are some valid points		foremost	surely	seems	controversial
Ine researchers	belleves		raised by Smith1. there		next	obviously	appears	tails to
{suggesi} inat			are many significant					neglects
's {claim} (that)	overiooks		problems					dismisses
								omits

• Words with an asterix (*) indicate high modality (ie. 'strong' words). In academic writing, it is often preferable to use medium modality words (e.g. "often" instead of "always"; "may" instead of "must").

• Tip: Only use words which you are comfortable with, otherwise your writing will sound 'forced' or 'unnatural'. Suggestion: highlight the words above you feel confident with now. As you read academic texts (e.g. journals), pay attention to the vocabulary you encounter.

References

Droga, L. and Humphrey, S. (2002) A Workbook for Getting Started with Functional Grammar. Berry, NSW: Target Texts. The Write Site <u>http://writesite.elearn.usyd.edu.au</u> (click on Module 3: Structure \rightarrow Unit 5: Writing Cohesively \rightarrow Section 6: Using Conjunctions)



Summary

ÆE

- ☆ Use a spellchecker and read over it!
- ☆ Use formal English
- ☆ Use link words
- ☆ Use words from a basic scientific lexicon

To believe the Spell checker or not

- 1. You must proof that two plus two equals four!
- 2. A prove that two plus two equals four is given on the first page.
- 3. Vaccines safe lives.
- 4. Spellcheckers chance the way we read our texts.
- 5. The theory of global warming remains to be proven.
- 6. Spellcheckers effect our ability to spell.
- 7. How do tortoises remain a life when hibernating?
- 8. Only a few scientists have received two Nobel Prices.
- 9. The affect of technology on the environment is substantial.
- 10. Tumour cells loose the normal controls of growth.
- 11. We judge how we live our lives form our own perspective.
- 12. The ability to write concisely and accurately is not heredity.

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Ue

More tips

- ☆ Write short sentences (but not to short)
- ☆ Positive sentences
- ☆ Active sentences are often clearer and not as cumbersome
- ☆ Omit needless words
- ☆ Avoid repetitive words.
- "The fact that many young scientists need a *significant* amount of practice to improve their written communication skills is a case in point. It can be seen from the diagram in Figure 1 that those students who regularly handed in written work performed at a higher level than those who did not."
- ☆ Units and spacing are correct
- ☆ Read and think about your work

Conference presentations that leave the audience dumbfounded, confused, exasperated or just plain bored are, unfortunately, a fact of life.

A talent for *conveying* information orally and for well-judged visual presentation is not bestowed on all, while some scientific topics struggle more than others under the necessary weight of details that are as essential as they are overwhelming or intricate.

Harder to accept, however, is that some individuals can sustain a substantial career in research without mastering even the basics of public presentations – and continue to ply the conference *circuit* regardless.

Communication skills seem to count for little in comparison with reputation when it comes to invitations to speak.

Exercise

Now ít's your turn!



- ☆ If you have talked to the supervisors and he / she gave you something to read ... use that :)
- Otherwise... search for your supervisors name and get an article
 - Identify keywords
 - What is your project about...
 (max 2 sentences)

Summary



H.F. Ebel, C. Bliefert, W.E. Russey

The Art of Scientific Writing

SWILEY-VCH

From Student Reports to Professional Publications in Chemistry and Related Fields



Sources





https://scientificwritingtips.files.wordpress.com/2018/07/west_et_al-2018-addiction.pdf

https://scientificwritingtips.wordpress.com/the-cartoons/

https://thephdhub.com/what-is-scientific-writing-features-examples/

Thank you!

Responding to reviewers (may) be frustrating!

