

BIOL3004

Scientific writing

Boštjan Kobe

Prof of Structural Biology

SMMS, and IMB

Room 76-452, 3365-2132, b.kobe@uq.edu.au

Lecture outline

- Role of scientific writing in research
- Features of scientific writing
- Scientific paper
 - Why, where, when, how to publish a scientific paper
 - Sitting down to write a scientific paper
- Other types of scientific texts and presentations

Research project

- Identify significant biological question
 - Research plan
 - Experimental work/ theoretical analysis
 - Publication/ presentation
- Other work in the field

Scientific writing represents a significant part of most stages of a research project

Why publish a scientific paper?

- For other researchers to learn about your work
- Scientific publications are the most important indicator of a scientist's track record
- A research project is unfinished without a publication

Some major features of scientific writing

- Aim to communicate information in concise and logical way
- Make your paper stand out: convey how your results have changed the world
- Audience, format (eg. required by journal), established mechanics (grammar, spelling) and politics impose constraints on the scientific writing
- The secret is to match the mind of the reader
- In scientific writing there is no such thing as "writer's block": when you have done the work, the ideas are there
- Scientific writing is a *thankless job*: satisfaction must come from the writer for doing a good job; don't expect satisfaction from other people

What does a reader expect from a scientific paper?

- What is the paper about about?
- Is the paper interesting?
- What will the reader gain from it?
- How difficult is it to find the interesting information? Will the rewards outstrip the effort?

Be a reader (read scientific literature) and you will learn how professional scientists do it well

What, where and when to publish

- Publish when you have something reasonably complete to say
- Reach the readers you want to reach
- Consider **impact factor** of journal ?

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 - Impact factor = average number of citations in a given year of articles published in that journal in the preceding two years

Nature	30.979
Science	29.162
Cell	26.626
Journal of Biological Chemistry	6.482
Archives in Biochemistry and Biophysics	2.338
Bangladesh Journal of Botany	0.035
Biotechnology Law Report	0.004
Soap and Cosmetics	0.000

The steps in publishing a scientific paper

1. First draft
2. Revisions leading to final document
3. Submission to a journal
 - Cover letter
4. Review process
5. Revision based on reviewers' comments
6. Publication: proofs, online publication, printed version, reprints



Sitting down and writing a scientific article

Steps

- Overall planning
- First draft
- First revision: structural alterations
- Further revision: polishing the style
- Finishing

Overall planning

- Outline the story as information flowchart
 - You want to decide where you are going to end and what the steps along the way will be
 - Eliminate extraneous information and dead ends
 - If this is done well, the reader encounters new concepts in a logical order and is led through the story
 - If this is done badly, concepts appear without adequate explanation and the reader is confused

Example of scientific story

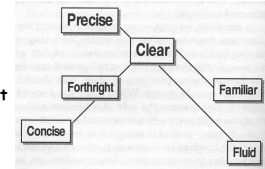
- 1) Pigs are large, domesticated quadrupeds
- 2) Flight is generally associated with possession of wings
- 3) This story is about evidence for porcine flight
- 4) How does one define flight?
- 5) What is the evidence for porcine flight?
 - Descent profiles when dropped
 - Evidence for ascent when accelerated
 - Ability to flap artificial wings
 - Unassisted flight when alarmed
 - Variation between breeds (genetic influences)
- 6) The specificity of pig flight (Do cows fly?)
- 7) Conclusion. Pigs fly under some circumstances, but so would any large object

In this story, information about the pig diet and digestive tract, or swine influenza virus, or the percentage bacon yield from different breeds would be irrelevant.

Style

- Writing style is subjective; there is no right or wrong
- Remember the key objectives of scientific writing

- **Clear**
 - Not complex
 - Not ambiguous
- **Precise**
 - Gene/protein
- **Forthright**
 - Sincere, straightforward
 - Not pretentious, arrogant
- **Familiar**
 - Avoid jargon
 - Define unfamiliar
- **Concise**
 - Avoid redundancy: Interesting to note, as a matter of fact
- **Fluid**
 - Eliminate discontinuities
 - Scientific writing does not have to be dull



Being critical

You need to be critical of the work of others but most importantly **of your own work**

- There is no such thing as scientific fact; science is based on observation, experimentation and interpretation
- It is important to identify what is not known
- Critical assessment presents enough information to recognize the merits of a particular interpretation

Uncritical: Nerk et al. (1915) showed that pigs could fly.

Critical: Nerk et al. (1915) claimed that pigs could fly based on a significant divergence from vertical descent when pigs were dropped off a large cliff. The experiment was flawed by the lack of appropriate controls, such as cows.

Style: some suggestions (1)

- Avoid long sentences
- Use active verbs: it makes sentences shorter!
 - 'We found' not 'It was found'
- Avoid writing zero (empty phrases that add nothing)
 - Plays a key role, the fact that, the presence of
- Avoid redundancy
 - Already existing, alternative choices, at the present time
- Avoid cliches
 - It has long been known that pigs fly under certain circumstances (= I haven't bothered to look up the reference)
- Don't plagiarize
 - If precise wording is absolutely crucial, use quotations and provide the reference and acknowledge the author

Style: some suggestions (2)

- Restrict use of adjectives and adverbs
 - Especially pseudo-quantitative ('large, remarkable, striking')
 - Adjectives: use 'of' instead
 - Try deleting all adjectives and adverbs and see which made any contribution
- Avoid repeated sentence constructions (e.g. 'however, furthermore' over and over again)
- Don't use editorial commentary
 - Now I am going to tell you about early experiments on flying guinea pigs and we'll come to full sized pigs later.
- Avoid jargon, conversational and vernacular styles
 - Scientific English is an international language
 - 'It's pretty obvious that pigs would fly if they could shift their bums': colourful, but incomprehensible to the average literate German
 - 'The problem with pig aviation lies in the uneven distribution of weight towards their posteriors': may be boring, but brings home the bacon

Style: some suggestions (3)

- 'Which/that'
 - Use 'that' for defining clauses (tells us which one)
 - We will select the option that measures porcine flight accurately
 - Use 'which' for nondefining clauses (adds a fact about known option)
 - We will select the Option A, which measures porcine flight accurately
- Don't use no double negatives
- Just between you and I, case is important
 - Not all unfamiliar words start with uppercase
 - Check PubMed if in doubt about the case
- Remember to never split the infinitive
- 'And/or': should be left to lawyers
- 'Since': is a temporal expression (use 'because').
 - Since pigs do not fly voluntarily, the experiment involved dropping the animal from a large cliff.

The layout of a scientific paper

1. **Title:** often the only part read
2. **Authors:** may indicate if it is worth reading
3. **Abstract:** the whole story in condensed form
4. **Figures:** gives the main results quickly to an expert. The legends therefore need to be self-explanatory.
5. **Introduction:** particularly non-experts interested in the topic need to see what has been done in the past in the field and what is the question; the last paragraph then summarizes the main outcomes of paper
6. **Discussion:** what is the authors interpretation of the results
7. **Results:** the most important content but only for the few very interested
8. **Methods:** only read by experts in the field or workers trying to use the same approach
9. **Acknowledgements**
10. **References**

Where to start

- **Establish constraints**
 - Audience
 - Format (the way document arranged)
 - Mechanics (grammar, spelling)
 - Politics
 - scientific writing is honest
 - ethical issues, intellectual property
- **Variables**
 - Writer/field
 - Purpose

Starting (1)

- **Title**
 - Often the only thing many people may read
 - The paper will not make an impact if it doesn't grab someone browsing the long list of titles in *J. Porcine Aviation*
- Studies of the aerodynamics of large living falling bodies: likely to be consigned to the large body of uncited and unread literature
- Definitive proof that pigs can fly: will be a citation classic
- Do pigs fly?: rhetorical questions in titles are not recommended

Starting (2)

- **Abstract**
 - The next most read part of a paper
 - Easily accessible (PubMed)
 - Summarizes the story in a very condensed form
 - Will be read only if the title catches the readers attention

Starting (3)

- **Opening paragraph**
 - Provides the reader with indication what is to come
 - Watch for "no content" statements, cliches, plagiarising
 - 'Since time immemorial man has been interested in the aeronautical behaviour of his fellow inhabitants of the earth.'
 - Don't make claims that imply the writer is going to solve the lack of knowledge
 - 'Pig flight has been investigated extensively as a model for mammalian aviation in general', or 'Despite intensive study, little is known about pig flight'.
 - Set the scene and grabs the reader's interest
 - 'Nobody has ever seen a pig fly, but the phrase "pigs might fly" is part of the vernacular.'

The middle

- Very few people will read the entire paper
- Papers are not read in a linear progression, but readers try to grasp the whole picture as quickly as possible
- The established journal format helps readers find the relevant sections
- Use signposts to guide the reader (eg. subheadings)

How to finish

The end of the paper should provide reader with closure

- **Conclusion** treats results as a whole (Discussion treats them individually)
- **Finishing statement difficult**
 - **Avoid motherhood statements**
'Porcine aviation is bound to be an exciting and fruitful area of future research.'
 - **Better to sum up and echo the opening**
'Clearly the old cliché that pigs might fly has some basis in fact.'
 - **Can finish with future directions, but be specific and avoid generalized clichés** (eg. observe that more research is needed.
'The one key experiment that has yet to be performed is to drop a pig from an aeroplane. Survival of such a fall would provide definitive proof that pigs really can fly.'

References

- **Scholarship in references is very important**
 - Remember other workers in the field will review the paper
- **Use a reference manager program**
?

References

- **Scholarship in references is very important**
 - Remember other workers in the field will review the paper
- **Use a reference manager program (Endnote)**
 - Can download references from the web directly in a database: no typos
 - Can easily switch between different reference formats
 - Can easily insert references while writing
- **Usual reference formats**
 - Name and year
 - By number in order of citation
 - By number in alphabetical list

Authors

- **Who should be an author? In what order?**

Authors

- **Who should be an author?**
 - **Researcher who made a significant technical contribution** to the paper (responsible for ≥ 1 Figure or Table; and/or significant **intellectual contribution**)
- **Order of authors**
 - **First author:** did most of the work
 - **Senior author:** directed the project

An example of journal format instructions; Nature

Formats for papers reporting original research

- [Articles](#)
- [Letters to Nature](#)
- [How to prepare your paper](#)
- [Pre-submission enquiries](#)
- [Readability](#)
- [Format of Articles and Letters](#)
- [Titles](#)
- [Text](#)
- [Methods](#)
- [References](#)
- [Acknowledgements](#)
- [Tables](#)
- [Figure legends](#)
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I. Formats for description of research

Nature's main formats for original research are Articles and Letters to Nature. The journal also publishes a very few Brief Communications.

I.1 Articles are original reports whose conclusions represent a substantial advance in understanding of an important problem and have immediate, far-reaching implications. They do not normally exceed 5 pages of Nature and have no more than 50 references. (One page of undiluted text is about 1,300 words.)

Articles have a summary, separate from the main text, of up to 150 words, which does not have references, and does not contain numbers, abbreviations, acronyms or measurements unless essential. It is aimed at readers outside the discipline.

This summary contains a brief account of the background and rationale of the work, followed by a statement of the main conclusions introduced by the phrase 'Here we show' or its equivalent.

Articles are typically 3,000 words of text, beginning with up to 500 words of referenced text expanding on the background to the work (some overlap with the summary is acceptable), before proceeding to a concise, focused account of the findings, ending with one or two short paragraphs of discussion.

The text may contain a few short subheadings (not more than six in total) of no more than 40 characters each (less than one line of text in length).

Articles typically have 5 or 6 small figures.

Other types of scientific writing

Similar principles apply to any type of scientific writing, but the purpose and constraints may be different

- **Review article:** adjust to the readers, use subtitles
- **Thesis**
 - Break down into chapters to reduce the size of task
 - Introduction ~ review article, individual chapters ~ scientific papers
 - At UQ you can use published papers as substitute for chapters
- **Book:** ~ thesis
- **Report:** ~ scientific paper
- **Instructions:** main constraints audience and format
- **Correspondence:** main constraints audience and mechanics
- **Grant proposal:** focus on aims and expected outcomes; main constraints format, politics, audience
- **Presentations:** oral, poster: more opportunities to make exciting

Further reading

Author: Day, Robert A.

Title: How to write & publish a scientific paper

Publisher: Cambridge, England : Cambridge University Press, 1998.

Library: Biol Sciences T11 .D33 1998

Author: Alley, Michael.

Title: The craft of scientific writing

Publisher: New York : Springer, c1996.

Library: Phys Sci & Engin T11 .A37 1996

Authors: Janice R. Matthews, John M. Bowen, Robert W. Matthews

Title: Successful Scientific Writing: A Step-By-step Guide for Biomedical Scientists

Publisher: Cambridge University Press, 2001

Not available in UQ library