

BIOL3004

Scientific writing and publishing

Prof Boštjan Kobe

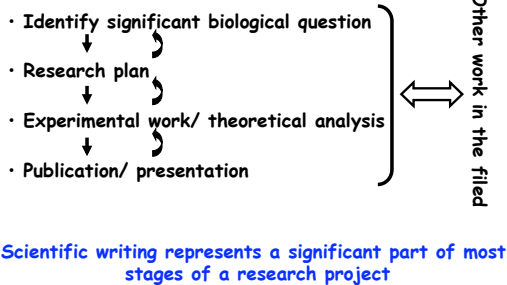
SMMS, and IMB

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



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

Ingredients of good science paper

- Novelty of research
- Comprehensive coverage of relevant literature
- Good analysis (including statistics)
- Thought provoking discussion

Ingredients of good science reporting

- Good organization
- Appropriate use of figures and tables
- Right length
- Writing to intended audience

Some major features of scientific writing

- 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

Scientific writing

Scientific writing is not about grammar but about **comprehension**.

Sloppy manuscript = sloppy science

What does a reader expect from a scientific paper?

Questions a reader will ask:

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

Be a **reader**: read many papers

- Think about their quality
- Learn how it is done well
- Recognize when it is not done 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

?

What, where and when to publish

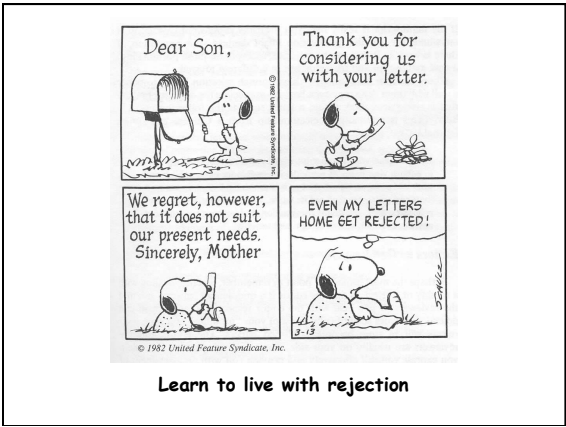
- Publish when you have something reasonably complete to say
- Reach the readers you want to reach
- Consider **impact factor** of journal

• 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



Getting started with writing

Steps

- **Starting:** do you have the data?
- **Overall planning:** outline
- **Writing first draft**
- **First revision:** structural alterations
- **Further revision:** correct mistakes, polish style
- **Feedback and rewriting**

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
 - Don't be tempted to include everything you know

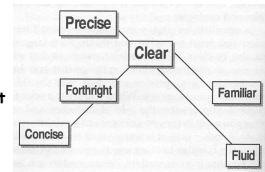
Example of scientific story

- 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 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**

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 (e.g. 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 instructions to authors: Cell

Information for Authors

Cell was launched in 1974 as the journal of exciting biology. Now a part of *Cell* Press, a family of 10 journals, *Cell* maintains editorial independence from its sister journals. *Cell*'s Ph.D.-trained scientific editors work with authors, reviewers, and editorial board members with the goal of publishing 26 issues of the most interesting discoveries in biology every year, including an annual Review Issue. Every paper published in *Cell* is freely available starting 12 months after publication.

Aims and Scope

Cell publishes findings of unusual significance in any area of experimental biology, including but not limited to cell biology, molecular biology, neuroscience, immunology, virology and microbiology, cancer, human genetics, systems biology, signaling, and disease. The basic criterion for considering papers is whether the results provide significant conceptual advances into, or raise provocative questions and hypotheses regarding, an interesting biological question. In addition to primary research articles in four formats, *Cell* features review and opinion articles on recent research advances and issues of interest to its broad readership in the Leading Edge section.

Editorial Process

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

Bourne PE. Ten simple rules for getting published. *PLoS Comput Biol.* 2005 Oct;1(5):e57.

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