

MAKING THE MOST OF YOUR RESEARCH TOP TIPS FOR WRITING A GOOD PAPER

Charlotte Harrison



EBB
Metals in Biology



Let's start with the endpoint – publication

- Having your paper published is really great!
- But you want people to read it and think that your paper is influential
- How can we increase the likelihood of that?

Better writing?

- Better written papers are more likely to be cited:

How can we boost the impact of publications? Try better writing

Benjamin Freeling^a, Zoë A. Doubleday^a, and Sean D. Connell^{a,1}

- Analyzed 130 peer-reviewed articles for 11 measurable components of writing style
- These 11 components reflected clarity, creativity, and narrative structure
- “Our analysis suggests that influential articles (those earning 100–1000 cites*) had more positive writing components and were thus written more with the **reader** in mind
- This was regardless of career stage or where you aim to publish”

But who is the reader?

- Intuitively, your readers are your peers, who are very specialized and will read the main text and understand every aspect of your paper
- To increase impact: share your work with scientists outside your direct field, those whose research topic is not that close to yours
- Your target audience, not-so-specialist readers, is much wider than your specialized readers
- The reader is also the editor at your chosen journal and the referees

Writing with the reader in mind

- Examples from specific papers and tips will broadly follow the layout of a manuscript – abstract, introduction, methods, results, discussion, plus a few general points
- Examples not specific to a particular specialty
- **Any questions?**

The story of your research

- A publication is the story of your research
- You've spent several hours a day for months or years working on your project – you understand it inside out
- It is tricky to imagine how little an outsider knows about it
- And how little effort they are probably willing to invest trying to understand it
- So you need to tell your research story in the clearest way possible

A general point – passive voice

- **Have you heard of passive voice?**
- A writing style that's everywhere in scientific literature,: 1) out of habit 2) to sound objective
- Stresses what experiences the action, not who performed the action; Avoids using 'we'

The outbreak of typhoid fever was caused by unhygienic conditions

- Most journals encourage the use of active voice: lively, concise, emphasises what caused the action - better for the reader

Unhygienic conditions caused the outbreak of typhoid fever

We found that unhygienic conditions led to the outbreak of typhoid fever

- It's hard to break old habits.....

Title and abstract

- Many people will read the title, scan the abstract and then either decided to read further, or move on.
- Only your peers will be inherently interested in your paper
- Crafting a title and an abstract that will draw non-specialists in is crucial
- Should be concise and enticing, but specific enough to clearly communicate what the paper is about
- **Have you ever thought about writing about your work so that it is enticing?**

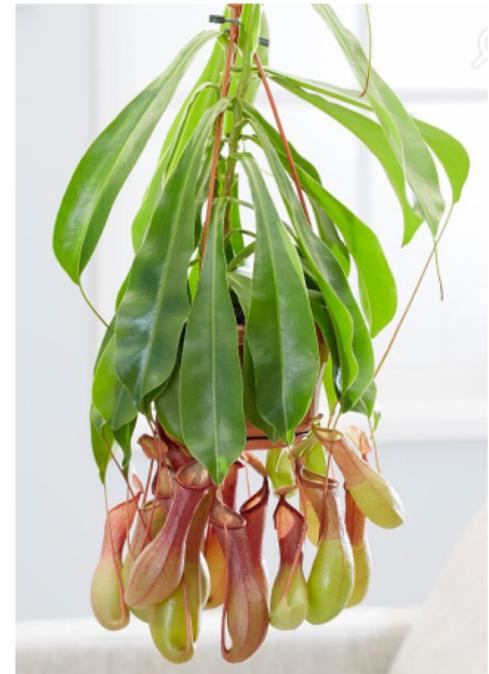
Example of a not-so-great title

SCIENTIFIC REPORTS

OPEN

Microbiome and Biocatalytic Bacteria in Monkey Cup (*Nepenthes* Pitcher) Digestive Fluid

- Any thoughts?
- Identification of diverse biocatalytic bacteria in pitcher fluid from a carnivorous *Nepenthes* plant
- Pitcher fluid from a carnivorous *Nepenthes* plant contains diverse biocatalytic bacteria



Abstract

- A concise self-contained description of:
- previous understanding
- **the question you addressed**
- your overall approach
- your most important results
- your main conclusion
- a broader consideration of what the conclusions tell us

1. Basic introduction to the field, comprehensible to a scientist in any discipline

2. Detailed background, comprehensible to a scientist in a related discipline

3. One sentence stating the general problem studied in the paper

4. One sentence summarizing the main result

5. Two or three sentences explaining how the main results add to previous knowledge

6. One or two sentences to put the results into a more general context

7. (Optional) Two or three sentences to provide a broader perspective, readily comprehensible to a scientist in any discipline

During cell division, mitotic spindles are assembled by microtubule-based motor proteins. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family. Hypotheses for bipolar spindle formation include the 'push-pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled in vitro assays that Eg5 has the remarkable capability of simultaneously moving at $\sim 20 \text{ nm s}^{-1}$ towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at $\sim 40 \text{ nm s}^{-1}$, comparable to spindle pole separation rates in vivo. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. [...] We anticipate our assay to be a starting point for more sophisticated in vitro models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.

Introduction – content

- The introduction frames the question that your research set out to answer
- Clearly and concisely establishes the context of the main question that your paper tries to answer
- How the paper relates to previous research in the field
- Why is the question important – the ‘hook’ that shows the readers why they should care
- Can briefly describe methodology and the rationale for choosing it, and the main conclusions

Example introductions

- Mo, F., *et al.* Engineered off-the-shelf therapeutic T cells resist host immune rejection. *Nat Biotechnol.* <https://doi.org/10.1038/s41587-020-0601-5>
- Engineered T cells are effective therapies against a range of malignancies, but current approaches rely on autologous T cells, which are difficult and expensive to manufacture.
- Chen, P.B., *et al.* Directed remodeling of the mouse gut microbiome inhibits the development of atherosclerosis. *Nat Biotechnol.* <https://doi.org/10.1038/s41587-020-0549-5>
- We postulated that a rational molecular approach for directed microbiome remodeling would require two basic elements: 1) molecular scaffolds that can potentially exert differential bacterial growth-modulating activities against selected members of the gut microbiota and 2) a predictive in vitro screen for compound selection for the in vivo studies.
- Less is sometimes more: 300-450 words

Introduction – hints and tips

- Sets the scene for the reader
- Avoid jargon – words you may use everyday!
- Avoid abbreviations

AD

Alzheimer's disease, Aujeszky's disease, anaerobic digestion

CRS

Cytokine release syndrome, chronic rhinosinusitis

IFN

Interferon

- 'It has been shown that'

It has been shown that Sars-Cov-2 uses angiotensin-converting enzyme 2 to gain entry into lung cells

The growth of acronyms in scientific literature: DOI: [10.7554/ELIFE.60080](https://doi.org/10.7554/ELIFE.60080)

Introduction – hints and tips

- **What is a noun string?**

- Series of nouns or other words, all of which modify the final noun:

Nanoparticle drug release was examined

- Ambiguous and awkward - is the released substance a “nanoparticle drug,” or just a “drug”?

We examined drug release from nanoparticles.

We examined the release of drug from nanoparticles.

Four chamber polystyrene vessel tissue culture treated glass slide

- Tissue culture-treated glass slides mounted with four polystyrene chambers



A little bit about methods

- Who's heard of a reproducibility 'crisis'?
- In 2011, scientists from Bayer collected data from 67 projects : only in ~20–25% of projects were the relevant published data completely in line with their in-house findings.
- Scientists from Amgen reported in 2012 that they were unable to reproduce the findings of 47 of 53 landmark oncology papers from academic labs.
- “Instead of arguing about whether results hold up, let's push to provide enough information for others to repeat the experiments”, Philip Stark, Department of Statistics, University of California, Berkeley, USA (2018)
- <https://www.vox.com/future-perfect/21504366/science-replication-crisis-peer-review-statistics>

Methods

- Methods should be coherent and self-contained, such that a competent person could repeat the study and reproduce the results by following the instructions given.
- For some journals, very specific details can be moved to a supplementary section or appendix, so as to not disturb the overall flow of the paper.
- **Has anyone seen reproducibility statements at the end of a paper?**

“Biologically independent experiments reported here were performed by different researchers using independent splits of the mammalian cell type used.”

A method might be obvious to you, but not to others...

What's going on here?

I'm making meringues.
The recipe says separate
2 eggs...it just doesn't
say how far.



Results

- To present, in a logical order, the research data that are relevant to the central arguments of the paper
- Not necessary the order in which you did the experiments
- Figures and tables should be logical, clear and complete
Legends should be as self-contained as is reasonable
- Relevant statistical analysis described
- Important trends made clear
- Summary at the end of each paragraph

Results - example

- PNAS is good at this

Myofibroblasts secrete matrix proteins and are critical for fibrogenesis (27). Two marker genes for myofibroblasts are Acta2 and Col1a1. In healthy kidney, Acta2 expression was largely restricted to smooth muscle cells. After IRI, there was strong up-regulation of Acta2 across all stromal clusters, with the exception of mesangial cells, and Col1a1 was also strongly induced in fibroblasts. We could observe that cortical fibroblasts only transiently up-regulated Acta2 and Col1a1, with a peak at day 2 after IRI, whereas medullary fibroblasts showed sustained expression of Acta2 but not Col1a1 at 6 wk. Medullary fibroblasts also increased as a fraction of the total stromal cells over time. **These results suggest an unappreciated plasticity of kidney stroma.** We could verify the injury-induced transient up-regulation of α -smooth muscle actin (α SMA), the protein encoded by Acta2, in cortical fibroblasts but not medullary fibroblasts, by immunofluorescence analysis. **These results suggest regional differences in the response of fibroblasts to injury, with medullary fibroblasts progressing to a myofibroblast cell state and cortical fibroblasts reverting to their prior quiescent state.**

Results – signposting



- The reader was not there with you on the journey to publication...so you have to point them in the right direction
- Interestingly, unexpectedly...
- Nature Medicine: Importantly, we found that peripheral monocytes and lymphocytes do not express substantial amounts of pro-inflammatory cytokines
- WHY?

Discussion

- Provide an analysis of the results and clear, scientifically sound conclusions based on the data analysis
- Relate clearly to the main question posed in the Introduction – how the presented evidence substantiates the main claims of the paper (or if not, why not)
- Conclusions should not exceed, and the text should objectively state, the limitations of the study
- Highlight any need for additional research – and what this might be
- Explain how the reported findings fit into the bigger picture

Discussion

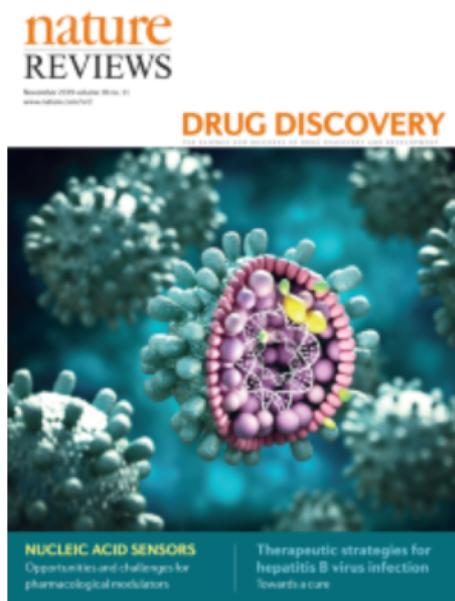
- From a paper entitled: 'Dissecting cellular crosstalk by sequencing physically interacting cells': <https://doi.org/10.1038/s41587-020-0442-2>
- **How do the findings fit in with existing research: These findings are in line with recent reports demonstrating that** T_{reg} cells have a greater capacity to form stronger and longer interactions with DCs, compared with naive T cells in vivo⁵; this suggests that T_{reg}-DC interactions are a central...
- **Further work:** As targeting DCs to enhance or block T cell activation is largely limited, **further investigation of these unique co-stimulatory molecules (for example, CD40, EB13 and DLL4)** can lead to improved strategies for vaccination and immunotherapies
- **How the findings enhance the bigger picture: Application of PIC-seq to essential cell-cell interactions**, such as conjugates of hematopoietic stem cells, cells presenting tumor antigens and tumor-infiltrating lymphocytes, or disease-associated microglia and damaged neurons, **has a clinical potential to discover important signaling pathways and therapeutic targets.**

Discussion

- From a paper entitled: 'A Mouse Model of SARS-CoV-2 Infection and Pathogenesis' doi: 10.1016/j.chom.2020.05.020
- Advantages of the current study over previous studies
- A transgenic mouse has been explored to mimic SARS-CoV-2 infection (Bao et al., 2020). When compared with such transgenic mouse model, our hACE2 mouse model has several advantages. First... there is no endogenous mACE2 expression in homozygous hACE2 mice... Second, the tissue distribution of hACE2 in our mouse model matches the clinical findings....Third..... allows real-time monitoring of hACE2 expression.

Reviews and commentaries

- Why do you read reviews and commentaries?
- Have you got an example?



- My one big plea: a review article should not just be a summary of the literature
- Literature reviews are boring (but sometimes useful)
- Readers are looking for thoughts, opinions and insight

A review must be readable

- Lively, clear, declarative writing
- General enough to orient a reader not familiar with the specifics of the field being discussed
- Avoid special terms
- What challenges exist? How might these challenges be addressed
- What are your thoughts and opinions – based on evidence
- Give both sides (all sides) of the story
- Final paragraph should be a conclusion – not a summary: future prospects, implications, unanswered questions; Where is the field going?



THE UK'S EUROPEAN UNIVERSITY



www.kent.ac.uk

University of
Kent