

Scientific writing

Science Communication 101

- The hook
- Question? - resolution
- Analogies
- Relatable to everyday life
- Social math
- The story arc

How to find the pitch?

1. The hook *Here is what we know:*

2. The knowledge gap *Here is what we don't know:*

3. The study motivation *Here is how we are going to fill this knowledge gap:*

4. The methods *Here is what we did:*

5. The results *Here is what we found:*

6. The take-home message *Here is why we should care:*

<https://teamshrub.files.wordpress.com/2016/03/guide-to-pitching-papers-ims2014.docx>

Nature abstract

Annotated example taken from *Nature* 435, 114–118 (5 May 2005).

One or two sentences providing a **basic introduction** to the field, comprehensible to a scientist in any discipline.

Two to three sentences of **more detailed background**, comprehensible to scientists in related disciplines.

One sentence clearly stating the **general problem** being addressed by this particular study.

One sentence summarizing the main result (with the words “**here we show**” or their equivalent).

Two or three sentences explaining what the **main result** reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

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

Two or three sentences to provide a **broader perspective**, readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (This example is 190 words without the final section, and 250 words with it).

During cell division, mitotic spindles are assembled by microtubule-based motor proteins^{1,2}. 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) family³. Hypotheses for bipolar spindle formation include the ‘push–pull mitotic muscle’ model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules^{2,4,5}. 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*⁶. 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.

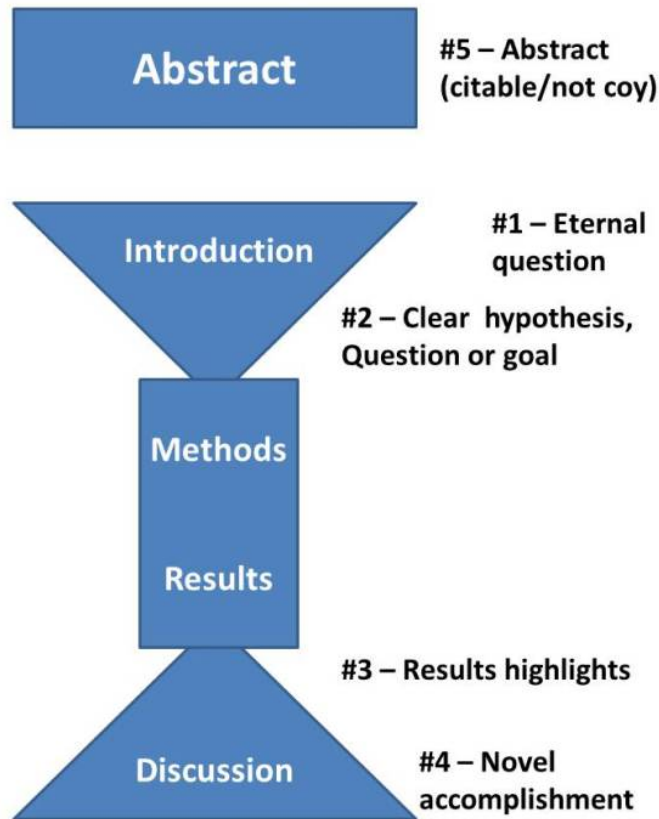
<https://www.nature.com/documents/nature-summary-paragraph.pdf>

Manuscript structure

A manuscript or PhD chapter is like an hourglass or an ink blot – it needs to start with the big picture, get specific, then broaden out again AND the content needs to match across sections – maintaining the same order of findings, but also key paragraphs connect across the manuscript.



The Five Key Paragraphs



<https://dynamicecology.wordpress.com/2016/02/24/the-5-pivotal-paragraphs-in-a-paper/>

Writing backwards

1. List the key findings – one sentence each, order from most exciting to least, or another logical order
2. Make figures for each key finding – place in pre-determined order
3. Write results around each finding – place in pre-determined order
4. Write methods around each result – only include methods needed to describe the science leading to the results presented
5. Write first paragraph of discussion – summarise all the key findings in order
6. Write the last paragraph of the intro – describes the research questions, hypotheses and/or objectives of the study – the study roadmap
7. Write the next paragraphs of the discussion – one paragraph per each key finding in order, discussions often also include a study limitations paragraph and a future research directions paragraph
8. Write the introduction paragraphs – one paragraph per topic of each of the key findings, should match with the content in the discussion paragraphs
9. Write the first paragraph of the introduction – provides the big picture context and sets out the clear knowledge gap of the study.
10. Write the conclusion paragraph – the last paragraph of the discussion or it's own section, should explain why the research matters and put the key findings back into the big picture context set out in the first paragraph of the intro
11. Write the abstract – should include your entire pitch and should ideally follow the Nature abstract structure

How to proof read

Shrubs are predicted to increase in tundra ecosystems with climate warming. In the last 50 years, rapid shrub expansion has been documented in arctic Alaska (Sturm *et al.* 2001a, Tape *et al.* 2006) and the Northern Yukon and NWT (*pers. comm.* Trevor Lantz) concurrent with warming temperatures (Chapin *et al.* 2005, Hassol *et al.* 2004, Stafford *et al.* 2000) and satellite imagery shows a greening of Arctic tundra (Jia *et al.* 2003, Stow *et al.* 2004). The correlation between warming and greening has been used to link climate change with shrub expansion (Sturm *et al.* 2001a, Epstein *et al.* 2003); however, the exact mechanisms driving shrub increase remain unknown. Shrub vegetation plays an important role in climate-carbon-albedo feedbacks protecting Arctic carbon stores (Sturm *et al.* 2001b, Grogan and Jonasson 2006). Changes in tundra shrub cover could release frozen soil carbon to the atmosphere accelerating climate change for the planet as a whole.

Number of sentences: 5

Average number of words per sentence: ~ 15 – 20?

The paragraph starts with a short clear topic sentence

References are in the centre sentences

The paragraph ends with a short clear concluding sentence

Scientific writing resources

[Guide to Pitching Papers IMS2014](#)

[The 5 pivotal paragraphs in a paper – Dynamic Ecology](#)

[JC Cahill's "Finding the "Pitch" in Ecological Writing"](#)

[How to Write Backwards](#)

[Novelist Cormac McCarthy's tips on how to write a great science paper](#)

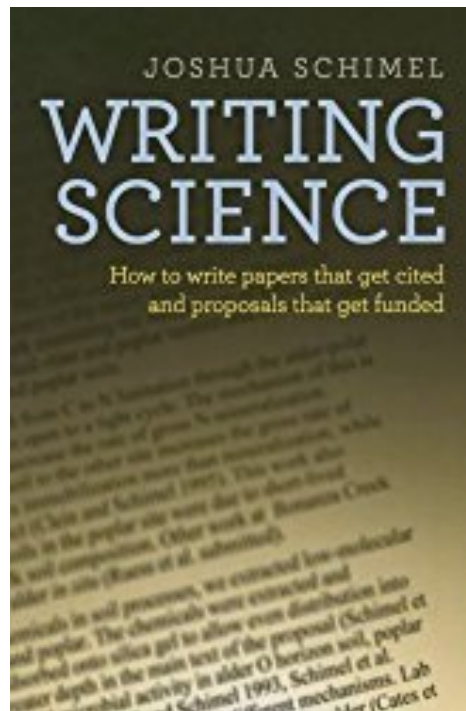
[How to write a paper and the "Nature" summary abstract – Nature Journal](#)

[How to write a paper \(part satire\) – Nature New York Blog](#)

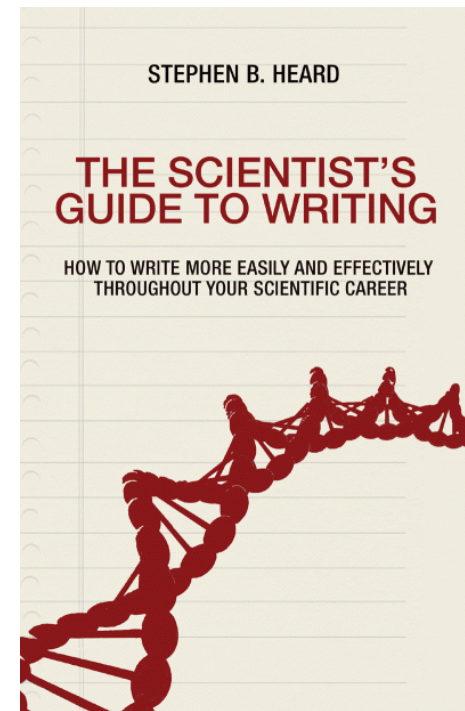
etc.

Scientific writing resources

These are the two current best books on the topic of science writing, if you want to read more.



<https://www.amazon.co.uk/Writing-Science-Papers-Proposals-Funded/dp/0199760241>



<https://www.amazon.co.uk/Scientists-Guide-Writing-Effectively-throughout-ebook/dp/B01C4V8RFW>