How to write a great research paper

Structure

- Abstract (250 works)
- **Introduction** (2 pages)
  - The problem / hypothesis / motivation
  - My ideas
- Methods (2-3 pages)
- Results (1-2 pages)
- Discussion (5 pages)
  - Conclusions and further work (0.5 pages)
The introduction (2 page)

- Describe the problem
- State your contributions
...and that is all

The introduction (2 pp)

- Describe the problem
  - Why is this interesting? Who else thinks so? What other related work is there -- on collections, on your group?
- State your contributions
  - What are you trying to do about it?
**Introduction: state the aims**

- Write the list of aims first
- The aims drive the paper: the paper substantiates the *(falsifiable)* claims you make
- Reader thinks “gosh, if they can really deliver this, that’s be exciting; I’d better read on”

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**Introduction:**

*Everything in scientific writing should be refutable*

<table>
<thead>
<tr>
<th>NO!</th>
<th>YES!</th>
</tr>
</thead>
<tbody>
<tr>
<td>We describe the collection. It is really cool.</td>
<td>We give the context and systematic update of an understudied collection. The unexpected features of the material studied are...</td>
</tr>
<tr>
<td>We study its contents</td>
<td>We examine the the faunal coverage to genus level, and compare local specimen records to the historical distribution of species.</td>
</tr>
</tbody>
</table>
No “rest of this paper is...”

- Not: “The rest of this paper is structured as follows. Section 2 introduces the problem. Section 3 ... Finally, Section 8 concludes”.

- Instead, use forward references from the narrative in the introduction. The introduction (including the contributions) should survey the whole paper, and therefore forward reference every important part.

introduction

We adopt the notion of transaction from Brown [1], as modified for distributed systems by White [2], using the four-phase interpolation algorithm of Green [3]. Our work differs from White in our advanced revocation protocol, which deals with the case of priority inversion as described by Yellow [4].
No related work yet

- **Problem 1:** the reader knows nothing about the problem yet
- **Problem 2:** describing alternative approaches and studies gets between the reader and your results
- **The Discussion should be the longest section and include most of this**

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Methods

- Include **everything**
- **Remember** you want it to be replicable, so write as if you were explaining to someone else how to repeat your work
- This is not the “boring” section
- This is where you get to brag about how much you have done

Publishing vs. student work

- **Published work is a little different** -
- **Do not** recapitulate your personal journey of discovery. This route may be soaked with your blood, but that is not interesting to the reader.
- Instead, choose the most direct route to the idea.
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Results

- Look at your methods section
- For every paragraph in the methods, write 1-2 paragraphs of results to say what you got!
- Re-check - did you leave anything out? Add it to both results and methods
Results

- For every paragraph in the methods, write 1-2 paragraphs of results to say what you got!
  - This means, write it out
  - DO NOT USE BULLET POINTS

Results: illustrate!

- All of your figures and tables should go in the Results
- Explain / summarise each figure or table in the text. If it isn’t explained it can’t be included

... the collection included a total of 199 specimens, which cover the majority of the species in the family (Table 1).

... the number of specimen lots that showed presence of formalin in the fluid solution increased with the number tested (Figure 3).
Results: illustrate!

- Every table or figure needs a detailed caption in addition to be explained in the text of the paper.

... All work was conducted in the NMINH collections facility, a separate building off-site from the public galleries, dedicated to collections use and storage (Figure 1). ...

Figure 1. A generalised floor plan of the NMINH off-site collections storage building. Approximate total floor area on three levels is 2100m².

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The payload of your paper

Introduce the problem, and your idea, using **EXAMPLES** and only then present the general case and wider implications

The details: evidence

- Your introduction states aims
- The body of the paper provides the roadmap to achieve the aims
- Check each aim in the introduction, identify the evidence, and discuss it in the discussion
- Evidence can be: analysis and comparison, case studies, similar projects in other fields
Related work

Fallacy  To make my work look good, I have to make other people’s work look bad

The truth: credit is not like money

Giving credit to others does not diminish the credit you get from your paper

- Warmly acknowledge people who have helped you
- Acknowledge weaknesses in your approach
Credit is not like money

Failing to give credit to others can kill your paper

If you imply that an idea is yours, and the reader knows it is not, then either

- You don't know that it's an old idea (bad)
- You do know, but are pretending it's yours (very bad)

Conclusions and further work

- Be brief.
The process of writing

- Start early. Very early.
  - Hastily-written papers get bad marks, or get rejected.
  - Papers are like wine: they need time to mature
- Collaborate
  - Be active in contributing to work
  - Be active in seeking out contributions from your team members
Getting help

Get your paper read by as many friendly guinea pigs as possible

- Experts are good
- Non-experts are also very good
- Each reader can only read your paper for the first time once! So use them carefully
- Explain carefully what you want from readers, and be a good reader!
  - (“I got lost here” is much more important than “Mamal is mis-spelt”.)

Listening to your reviewers

Treat every review like gold dust
Be (truly) grateful for criticism as well as praise

This is really, really, really hard
But it’s really, really, really, really, really, really, really, really, really, really important
Listening to your reviewers

- Read every criticism as a positive suggestion for something you could explain more clearly.
- DO NOT respond “you stupid person, I meant X”. Fix the paper so that X is apparent even to the stupidest reader.
- Thank them warmly. They have given up their time for you.

Language and style
Basic stuff

- Follow instructions!
- Submit by the deadline
- Keep to the length restrictions
  - Do not narrow the margins
  - Do not use 6pt font
  - Supply extra evidence (e.g. species lists, catalogue) in an appendix
- Always use a spell checker

Visual structure

- Give strong visual structure to your paper using
  - Standard sections and sub-sections
  - Do NOT make up your own format!
  - Do NOT use bullet points
- Follow all formatting instructions for figures and tables!
### Use the active voice

The passive voice is “respectable” but it DEADENS your paper. Avoid it at all costs.

<table>
<thead>
<tr>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>It can be seen that...</td>
<td>We can see that...</td>
</tr>
<tr>
<td>34 tests were run</td>
<td>We ran 34 tests</td>
</tr>
<tr>
<td>These properties were thought desirable</td>
<td>We wanted to retain these properties</td>
</tr>
</tbody>
</table>

"We" = you and the reader

"We" = the authors

### Use simple, direct language

<table>
<thead>
<tr>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The object under study was displaced horizontally</td>
<td>The ball moved sideways</td>
</tr>
<tr>
<td>On an annual basis</td>
<td>Yearly</td>
</tr>
<tr>
<td>Endeavour to ascertain</td>
<td>Find out</td>
</tr>
<tr>
<td>It could be considered that the speed of storage reclamation left something to be desired</td>
<td>The garbage collector was really slow</td>
</tr>
</tbody>
</table>
Summary

If you remember nothing else:

- **Identify your key idea**
- **Make your contributions explicit and complete**
- **Explain your work in a larger context (use examples)**