

# Research Methodology

How to Write a Scientific Paper

Part Two

# Writing

- State your facts as simply as possible, even boldly
  - Ok: It is clear that factor A up regulates the pathway
  - Better: Factor A clearly up-regulates the pathway

# Writing

- Styles
- Use “We”
- Use active voice
- Avoid vague IT, THERE, THIS/THAT
- Avoid long sentence
- Write a strong sentence core
- One message per paragraph

# Styles

- BOG—Business or Government style, the more traditional style
- CLEAR—Clear Easy Reading, the more modern style
  - **BOG: It is anticipated that** an annual training rate **of** 100 employees will **be** achieved **by the time** the program **is** fully operational.
  - **CLEAR: When** the **program** is operating at full capacity, **we** expect to train 100 people per year.

# Use 'We'

- We-sentence is a more-modern style, reads more interesting, and communicates with the reader more directly
  - In this report, **we** define a mechanism for ... and discover distinct roles for ... **We** use ... assays to ...  
**We** demonstrate that ... **We** provide evidence that ...

# Use Active Voice

- Active voice is more informative, clearer, and more reader-friendly than passive voice
  - The results indicate ...
  - Table 1 shows ...
  - Recent studies have reported ...
  - Zhang and coworkers have suggested ...

# Use Active Voice

- **Bad:** Twelve soil samples of 4 agricultural areas **were investigated** for..., and the correlations between ... **were analyzed**.
- **Good:** We **investigated** 12 soil samples of four agricultural areas for ..., and **analyzed** the correlations between ...

# Use Active Voice

- lyn dupré , The author of *Bugs in writing: A guide to debugging your prose*
- “If you want to learn only one technique to improve your writing substantially, you should learn to avoid using passive voice.”



# Avoid Vague

- Avoid vague IT, THERE, and THIS/THAT
  - IT is unknown.
  - THERE is no where.
  - THIS/THAT could be anything.

# Avoid Vague

- Old style: It is likely that it will rain soon.
- Modern style: It will rain soon.
- Old style: It should be borne in mind that the current research has imitations.
- Modern style: The current research has limitations.

# Logic Issues

- Logic flow
  - Use transitional words to promote logic flow
- Connection
  - Connection of clauses
- Parallelism
- Redundancy

# Logic Issues

Logic Flow	Connection	Parallelism	Redundancy
<p>Also, and, again, further, furthermore, First, then, second, next, lastly, Soon, after, previously, meanwhile, But, yet, still, instead, In short, in other words, Similarly, consequently, accordingly</p>	<ul style="list-style-type: none"><li>• Compound (and, but)</li><li>• Cause/effect (as, because, for, so)</li><li>• In between (semicolon)</li><li>• Condition (if, whether, when)</li><li>• Concession (Although, even if, whatever)</li><li>• Result (so that)</li></ul>	<ul style="list-style-type: none"><li>• Verb</li><li>• Subject</li><li>• Similar parts in a sentence</li><li>• Meaning</li></ul>	<ul style="list-style-type: none"><li>• Wording repetition</li><li>• Sentencing repetition</li><li>• Meaning repetition</li><li>• Wording</li></ul>

# Parallelism

- Verb
  - Incorrect: She **swims, plays** basketball, and **was running** bicycles.
  - Correct: She **swims, plays** basketball, and **runs** bicycles.
- Subject
  - Incorrect: The **ignition** was tested, an **examination of the belts** was carried out, and the **levels of the lubricants** were checked.
  - Correct: The **ignition** was tested, the **belts** were examined, and the **lubricant levels** were checked.

# Parallelism

- Bad: The plant is **not only capable of** growing on high-salt soils, **but also accumulating** concentrations of salts.
- Good: The plant is **not only capable of** growing on high-salt soils, **but also capable of** accumulating concentrations of salts.
- Better: The plant is capable of **not only growing** on high-salt soils, **but also accumulating** concentrations of salts.

# Redundancy/Wording

- Bad: These **differences** grew smaller, and **they** finally faded out after a stimulation of ...
- Good: These **differences grew** smaller and finally **faded** out after a stimulation of ...
- Bad: The result indicates that **this assumption can be considered reasonable in some sense.**
- Good: The result indicates that **this assumption may be reasonable.**

# Redundancy/Meaning

- Bad: A method to evaluate this effect, **rather than to assume subjectively**, was proposed.
- Good: A method to evaluate this effect was proposed.
- Bad: **As a rule**, the temperature was **generally** adjusted to the room temperature.
- Good: As a rule, the temperature was adjusted to the room temperature.



# Paragraph Style

- A paragraph should have
  - A clear, well-defined purpose
  - A topic sentence that gives the main subject of the paragraph
    - “Latin abbreviations like i.e. and e.g. are best avoided. If you must use them, punctuate them properly (i.e., like this). I prefer to use the simple English phrases ‘in other words’ and ‘for example’ instead.”

# Paragraph

- A mix of long and short sentences.
- Avoid contentless beginnings:
  - There are, There is, It is, This, These.
- Avoid rambling paragraphs and artificial breaks

# Figures

- For data-structures, progress charts, simulation results, etc.
- Figures are referenced by numbers
- Try to put references to figures in the text on the same page
- Caption explains the figure
  - Bad: Figure 3. Step 2 of the algorithm.
  - Good: Figure 3. Swapping out-of-order data elements pointed to by  $i$  and  $j$ .

# Graphs

- Use the caption to point out what the reader should notice
- Label both coordinate axes
- Don't print a grid, rather use tick marks
- Make sure the ranges are appropriate
- Don't clutter up the graph with "cuteness"

# Some Notes

- Start early! Writing takes time
- Don't think about formatting when writing
- Don't start a sentence with a symbol
  - Bad: 2 is the only even prime.
  - Good: The only even prime is 2.
- State the types of your variables
  - ... the set  $S$  ...
  - ... the function  $F$  ...

# Some Notes

- Always strive for complete sentences.
  - Bad: We now have the following  
**Theorem.**  $H(x)$  is continuous.
  - Good: We can now prove the following result.  
**Theorem.** The function  $H(x)$  is continuous.

# Some Notes

- Place words between adjacent formulas
  - Bad: Add  $p$   $k$  times to  $c$ .
- Only use the symbols  $\exists, \forall, \Rightarrow, \dots$  in logic
  - Bad:  $C \subset P \Rightarrow C \subset A_n$
  - Good:  $C$  is a subset of  $A_n$  whenever  $C$  is a subset of  $P$
- In general, avoid unnecessary jargon.

# Some Notes

- Don't use the same notation for two different things
- Stick to consistent usage
  - Example:  $i = 1 \dots m, j = 1 \dots n$ .
  - Bad:  $i < j$  and  $p_j < p_i$ .
- Vary sentence structure and the choice of words



# Some Notes

- Always avoid ambiguity
  - “Optimal font caching”, “the node x is left”, . . .
  - But “random number generator” is OK.
- Spell out small numbers when used as adjectives
  - The method requires two passes.
  - Method 2 is illustrated in Fig. 1.

# Some Notes

- When using “it”, make sure it’s clear what it is referring to
- Avoid frequent repetition of “this”, “they”, “just”, and “then”
  - Bad: This is done by . . .
  - Better: This step is done by . . .
  - Consider not using “this” at all!

# Some Notes

- Let the document rest a couple of days before you polish it
- Have someone read your draft before submitting
- Read books by great authors. It will sharpen your style

# Some Notes

- Dealing with page limits
  - Conferences usually have a page or word limit for articles
  - Don't cheat with tiny fonts, narrow margins, etc!
  - Try to eliminate redundant material
  - Trim the technical section, if necessary

# Some Notes

- Normally, integers less than ten are spelled out, e. g. Six cells
- Integers larger than ten and fractional numbers are written in Arabic digits, e.g., 12, 5.6, etc.
- Fractional numbers are considered plurals

# Some Notes

- In technical papers, there are usually symbols, and the question arises as to which article to use in front of symbols. Should we say a  $M/M/1$  queue or an  $M/M/1$  queue?
- The first time a symbol is used, explain what it means
- Try avoiding negative words like “not,” “un,” “non,” etc., as well as double negatives such as “not invalid,” “not uninteresting”

# Some Notes

- The phrase “a lot of” is used for uncountable objects. The same goes for “a large amount”
- The words “work” and “research” are already in plural form
- Do not use abbreviated forms like “don’t.” They should be spelled out
- Avoid using multiple superlatives

# Some Notes

Bad	Good
A lot of users	Many users
Highly improves/Largely improves	Greatly improves
In contrary to	Contrary to/In contrast To/As opposed to
Works/Researches	Work/Research
Don't	Do not
Very best/Most optimal	Best/Optimal
Comprises of	Comprises/Consists of



# Some Notes

- The words “figure,” “table,” “theorem,” “lemma,” etc. may be used as proper or common nouns
  - Proper noun: Fig. 1 illustrates
  - Common noun: In this figure, we illustrate ...
- Do not start a sentence with “also.” Use words such as “Besides,” “Moreover,” “In addition” instead

# Some Notes

- Don't use "**however**" or its synonyms twice in one paragraph
- **It should be mentioned, noted, pointed out, emphasized, etc.** -- Such preambles often add nothing but words. Just go ahead and say what is to be said.
- **It was found, determined, decided, felt, etc.** -- Are you being evasive? Why not put it frankly and directly?

# Some Notes

Word/Phrase	Mean
Compare with	To examine differences and similarities
Compare to	To represent as similar
Correlated with/ Correlated to	Although things may be related to one another, things are correlated with one another
As	For comparison to a phrase
Like	For comparison to a noun

# Some Notes

- Note these singular and plural forms

Singular	Plural
Criterion	Criteria
Datum	Data
Medium	Media
Phenomenon	Phenomena

# Some Notes

- We should not mix active and passive constructions in the same sentence
- When to use Passive Voice?
  - When it is more important to draw our attention to the person or thing acted upon
  - When the actor in the situation is not important

# Some Notes

- Never use “!”
- Don’t use “?” as it possible
- That and which
  - If the clause can be omitted without leaving the modified noun incomplete, use which and enclose the clause within commas or parentheses; otherwise, use that.

# Some Notes

- Don't start a sentence with numbers
- Don't start a sentence with abbreviations, as it possible
- The word "following"
- The word "using"

## Human / non-human subjects

### Human subject only

Observe  
Record  
Compare  
Identify  
Describe  
See  
Speculate  
Conclude  
Believe  
Know  
Collect  
Aim

### Human or non-human subject

Show  
Demonstrate  
Indicate  
Suggest  
Support  
Confirm  
Imply  
Need



## Verb tense to use throughout your paper

Section	Verb tense	Examples
Introduction	<u>Present or past tense</u> for describing the evidence that exists <u>Past tense</u> for describing your aims or hypotheses	It is known that ... There is no evidence that ... Therefore, we investigated whether ...
Methods	<u>Past tense</u> throughout	Participants were recruited from ...
Results	<u>Past tense</u> for results <u>Present tense</u> to refer to tables, etc.	We found that ... Figure 1 shows that ...
Discussion	<u>Present tense</u> for answers to questions <u>Present tense</u> to discuss the literature <u>Past tense</u> to discuss the results	Our findings suggest that ... Evidence from cohort studies shows that ... We found that ...

**Long or Incorrect version****Shorter or more correct version**

---

Determine, detect	Assess, measure, investigate
Correlated (as an adjective or verb)	Associated
Due to the fact that, for the reason that, on account of, owing to the fact that, on the basis that	Because
Level	Concentration
Documentation	Documents
Taken into consideration	Considered
Dosage	Dose
Elucidate, clarify	Explain
Functionality	Function
In the event of, in the eventuality of	If, when
Alleviate, moderate	Lessen, ease
Methodology	Methods
In close proximity to	Near
At the present moment, at this point in time	Now
The majority of	Most
Dyads	Pairs
Prioritise	Rank
Relationship	Relation
Adjuvants	Risk factors
Symptomatology, complaints, events, clinical picture	Symptoms
Terminology	Term
In order to	To
Usage, utilise	Use

# Some Notes

## Establishing the importance of the topic

One of the most significant current discussions in ... is ...

It is becoming increasingly difficult to ignore the .....

X is an important component in the ..., and plays a key role in Y.

Recent developments in X have heightened the need for .....

In recent years there has been an increasing interest in In years, .....

Recent developments in the field of X have led to a renewed interest in .....

# Some Notes

## Highlighting a problem in the field of study

However, a major problem with ... is .....

To date there has been little agreement on what .....

More recently, literature has emerged that offers contradictory findings about .....

One observer has already drawn attention to the paradox in ...

In many Xs a debate is taking place between Ys and Zs concerning .....

# Some Notes

## Highlighting a knowledge gap

So far, however, there has been little discussion about .....

However, far too little attention has been paid to .....

The research to date has tended to focus on X rather than Y.

In addition, no research has been found that surveyed .....

So far this method has only been applied to .....

However, there have been no controlled studies which compare differences in .....

The experimental data are rather controversial, and there is no general agreement about .....

# Some Notes

## Focus and aim

This paper will focus on/examine/give an account of .....

This paper seeks to address the following questions:

This essay critically examines/discusses/traces .....

The purpose of this paper is to review recent research into the .....

This paper will review the research conducted on .....

The aim of this study was to evaluate and validate .....

# Some Notes

## Highlighting inadequacies of previous studies

Most studies in the field of X have only focussed on .....

The experimental data are rather controversial, and there is no general agreement about .....

The research to date has tended to focus on X rather than Y.

Researchers have not treated X in much detail.

Previous studies of X have not dealt with .....

# Some Notes

## Referring to Literature

What we know about X is largely based upon empirical studies that investigate how ..... [ ]

During the past 30 years much more information has become available on ..... [ ]

In recent years, there has been an increasing amount of literature on ..... [ ]

A large and growing body of literature [ ] has investigated .....

Recent evidence suggests that ..... [ ]



# Some Notes

## Referring to Literature

Surveys such as that conducted by Smith [ ] have shown that .....

It has been demonstrated that X results in..... [ ]

Several attempts have been made to ..... [ ]

Previous studies have reported ..... [ ]

A number of studies [ ] have found that .....

The causes of X have been widely investigated [ ] ...

# Some Notes

## Referring to Literature

Xs have been identified as major contributing factors for ... [ ]

It has been suggested that levels of X are independent of the size of the Y [ ]

In 1990 Patel et al. [ ] demonstrated that ... led to .....

In 1981, Smith and co workers [ ] demonstrated that

# Some Notes

## Being Critical

One question that needs to be asked, however, is whether .....

A serious weakness with this argument, however, is that .....

One of the limitations with this explanation is that it does not explain why... .

The key problem with this explanation is that .....

It seems that Jones' understanding of the X framework is questionable.

# Some Notes

## Being Critical

Smith's interpretation overlooks much of the historical research .....

One major criticism of Smith's work is that .....

Another problem with this approach is that it fails to take X into account

Perhaps the most serious disadvantage of this method is that .....

# Some Notes

## Discussions

A strong relationship between X and Y has been reported in the literature.

Prior studies that have noted the importance of .....

The present study was designed to determine the effect of .....

The results of this study show/indicate that .....

This experiment did not detect any evidence for .....

On the question of X, this study found that .....

# Some Notes

## Discussions

The most interesting finding was that .....

Another important finding was that .....

In this study, Xs were found to cause .....

Surprisingly, X was found to .....

One unanticipated finding was that .....

These findings of the current study are consistent with those of Smith and Jones [ ] who found .....

# Some Notes

## Discussions

This finding is in agreement with Smith's [ ] findings which showed .....

These findings further support the idea of .....

A possible explanation for this might be that .....

Another possible explanation for this is that .....

It seems possible that these results are due to .....

This inconsistency/discrepancy may be due to .....

# Some Notes

## Suggestions for future work

Further research should be done to investigate the .....

Future studies on the current topic are therefore recommended.

A further study with more focus on X is therefore suggested.

Further work needs to be done to establish whether .....

Further experimental investigations are needed to estimate .....



# Some Notes

## Suggestions for future work

It is suggested that the association of these factors is investigated in future studies.

Further research might explore/investigate .....

# Some Notes

## Writing Conclusions

This essay has argued that X is the best instrument to  
.....

This study set out to determine .....

The purpose of the current study was to determine .....

This project was undertaken to design ....., and evaluate  
.....

Returning to the hypothesis/question posed at the  
beginning of this study, it is now possible to state that  
.....

# Some Notes

## Writing Conclusions

It was also shown that.....

The most obvious finding to emerge from this study is that .....

# References

- Online dictionaries
  - [www.thefreedictionary.com](http://www.thefreedictionary.com)
  - [www.merriam-webster.com](http://www.merriam-webster.com)
- Spell and grammar check
  - <http://spellcheckplus.com>
- Question
  - <http://forum.wordreference.com>

Any questions?

**THANKS FOR YOUR ATTENTION**

# Some Notes

- Articles can be rejected for several reasons
  - Many conferences accept only 15%
  - Your article may not “lie within the scope”
- But you will get valuable reviews
  - Think twice before complaining
  - Reviewers are anonymous, don’t try to guess who it is
  - Use the criticism constructively – if they misunderstood it, others will too
  - Consider sending it somewhere else