

How to Write and Publish a Scientific Paper

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1. What is scientific writing

- a) **Need of clarity** - clearly stated problem
- clearly stated conclusion

New knowledge “for the first time”

- b) **Receiving the signals**

Scientific communication = two ways process

Need to be received – to be understood

- c) **Understanding the signals**

- Purpose of Sci. Com. : to communicate new scientific findings
- As clear as possible
- Not literature nor poetry

- Publication = ultimate result of scientific research \Rightarrow same effort as for the rest
- Best English = same sense in the fewest short words (no diversion, metaphors,)

1. Origins of Scientific Writing

- Experience over 100 past years ⇒ **IMRAD** (first sci. Journals :1665)
- **Introduction Methods Results and Discussion** :
 - Highly structured and Rigid (originality in the content not in the form)
 - Requested by most editors because
 - Simplest
 - Most logical way to communicate research results
- **Question** form :
 - What **question** (problem) was studied ? Answer = **Introduction**
 - How was the **problem** studied ? Answer = **Methods**
 - What were the **results** ? Answer = **Results**
 - What do the **findings** mean ? Answer = **Discussion**

- **IMRAD** = easy roadmap for authors – editors – referees – readers

1. What is a Scientific Paper

- Definition : Written and published report describing original research results
- Criteria(test) for **VALID** publication
- Must be published in the right place : Primary journals
(not reports, conference proceedings,...)

- Council of Biology Editors :

An acceptable primary scientific publication must be the **first disclosure** containing **sufficient information** to enable **peers**

- to **asses observation**,

- to **repeat experiments**, and

- to **evaluate intellectual processes**; (conclusion justified by the data)

moreover it must be susceptible to **sensory perception** (printed journal, computer data base, microfilms,...), essentially **permanent, available to the scientific community without restriction** , and available for **regular screening** by one or more of the major recognized **secondary services** (e.g. Institute for Scientific Information,...)

- No newsletter, internal reports, proceedings of symposium (should be (re) published in Primary Journals when speculations matured to conclusions), ...
- **Prepublication peer review (referee's evaluation procedure)**
- Organization : **IMRAD**
 - **M** : Materials and Methods
 - Sometimes : **Experimental section : M+R+D**
(in notes or short communications)
 - **Result section different from Discussion section** : Highly desirable
- A scientific paper is **NOT** literature BUT communication of research results
- No dual publication

1. Title

- Importance : read by thousand of people (only few if any will read the full paper)
 - Need to reach its **intended audience**
 - **Title = Label** suitable for indexing by Abstracting / Indexing services
 - choice of words
 - order of words
 - **Rule** : fewest possible words that adequately describe the content of the paper
 - Not to short : need for specific title (no general)
 - Not to long : not an abstract
 - no waste words (study on ..., observations on ..., verb)
 - no abbreviations, jargon,...
 - avoid series titles each paper = independent cohesive study
- (chronology of appearance ?)* better : **hanging title**

1. How to list the Authors

- **Order** of names? Origin of disputes and arguments

- **Authorship?**
 - takes the intellectual responsibility of the results being presented
 - should have made an important contribution to the study being reported
(referring to original aspects)
 - intellectual input : not easy to measure

- More than one initial recommended

- Corresponding author (reprints address, proofs, ...)

1. How to prepare the Abstract

- **Abstract = brief summary** (250 words) , Miniversion
- **Goal** : allows the reader to decide to read or not
- **IMRAD** structure :
 - state principal **objectives** and scope
 - describe the **methodology** employed
 - summarize the **results**
 - state the principal **conclusions**

(conclusions : 3 times in Abstract, Introduction and Discussion)

- Past tense because refers to work done
- No references
- Self contained (published by it self)
- Economy of words (but no abbreviations)

1. How to write the Introduction

- Should state briefly and clearly your **purpose**
- Decide the **audience**
- Justify **why** did you **choose** that subject and **why** is it **important**
- Start writing the paper when the work is still in progress
- **From problem to solution** (even if some redundancy with Abstract)
- Suggested rules :
 - ⇒ Present first the nature and scope of the work
 - ⇒ Review the pertinent literature (most important background information, state of the art)
 - ⇒ State the methods of investigation, so as the reasons for their choice

⇒ (State the principal results)

⇒ (State the principal conclusions suggested by the results)

- Present tense for the established knowledge
- Mention your previously published papers (abstracts, closely related papers, ...)
- Avoid mistake : do not keep the reader in suspense (not a detective story)
- Define specialized terms and abbreviations

1. How to write the Materials and Methods Section

- **Purpose** : Describe and justify the experimental design so that the experiments could be **repeated** by others (peers)
- **Reproducibility = basis of Science**
- Must give the full details (if not \Rightarrow rejection by the referee no matter the results)
- Past tense
- Chronological presentation (with sub headings)
- Similar to **cookbook recipes** :
 - How ?
 - How much?
- If new method (unpublished) : Provide all the needed details
- Rule : enough information must be given so that the experiments could be reproduced by a competent colleague

- Avoid **mistake** : No mixing some of the results

2. How to write the Results

- **Result section = Core of the paper**
- Presentation of the data but **predigested** : only representative data not all
"The fool collects facts, the wise selects them"
- No more method description
- Not yet data interpretation : the discussion section is designed to tell what they mean
- No references
- **Crystal clarity** : the whole paper will stand or fall on the basis of the results
- **Avoid redundancy**
Most common fault : repetition in the text of what is apparent in Figures or Tables
- No need to cite Figures and Tables

*It is clearly shown in Figure X that ... = **verbiage***

- If n variables tested,
 - present in Table or Graphs only those which affect the reaction
 - For the others: state you did not find under the experimental conditions

Absence of evidence is not evidence of absence

- Past tense

1. How to write the Discussion

- Harder part to define and to write ← Cause of rejection
- Often : many too long
- Show the relationships among observed facts
- Components :
 - Try to present the principles, relationships, generalization shown by the results not a recapitulation of the results
 - Point out any exceptions or any lack of correlation, define unsettled points
 - Show how your results and interpretations agree (or contrast)with previously published work
 - Don't be timid. Discuss the theoretical implications of your work as well as any possible practical applications
 - State your **conclusions** as clear as possible

- Summarize your evidence for each conclusion
- End of discussion : Short summary or **Conclusion** regarding the **significance** of the work

Bad, if the reader at end asks " So what ?"

- **Be modest :**

Scientific truth \neq whole truth

Only spotlight shining on one particular area

Don't extrapolate to a bigger picture than that shown by your data

- Verb tense
 - Present for established knowledge
 - Past for the new (own) results

1. How to state the Acknowledgments

- Acknowledge
 - Technical help
 - Advisors, ... (be specific, they are not responsible for the work)
 - Financial assistance (grants, fellowships, contractors, ...)
- Be courteous

We thank ... NOT we wish to thank

1. References

- Avoid secondary materials (only significant, published references)
- Read carefully “the instruction to authors” of the journal
- Place it at the point of the sentence to which it applies (not all at the end of sentences)

Outline

- What is scientific writing
- Origins of Scientific Writing
- What is a Scientific Paper
- Title
- How to list the Authors
- How to prepare the Abstract
- How to write the Introduction
- How to write the Materials and Methods Section
- How to write the Results
- How to write the Discussion
- How to state the Acknowledgments
- References

