

# **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