

**SEBHA UNIVERSITY**

Workshop on Scientific Writing



# ***HOW TO WRITE AND PUBLISH A SCIENTIFIC PAPER?***

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# References

- Robert A. Day, (1998), How to Write & Publish a Scientific Paper, 5th Edition



# Outlines

- What is Scientific writing
- Origins of Scientific Writing
- What is a Scientific Paper
  - How to prepare the Title
  - 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
  - References

# SCIENTIFIC WRITING

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*State your facts as simply as possible, even boldly. No one wants flowers of eloquence or literary ornaments in a research article.*

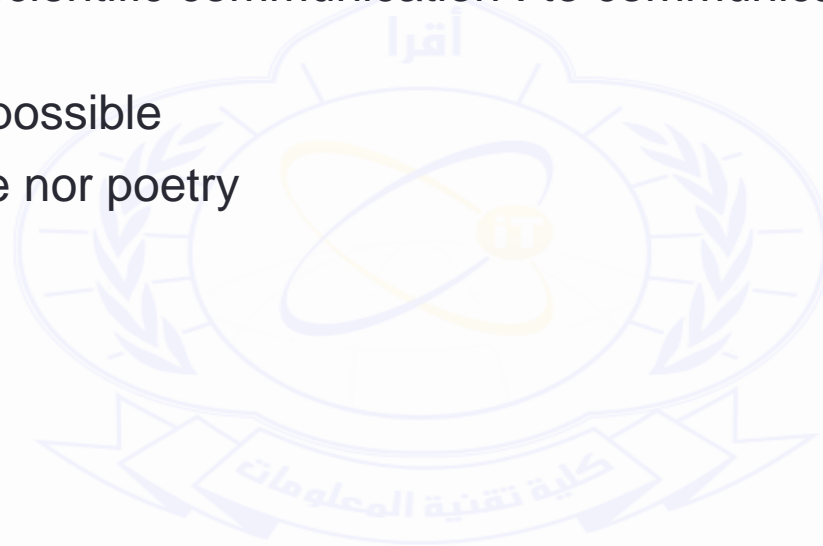
—R. B. McKerrow, one of the leading bibliographers

# What is Scientific Writing

- The efficient way to **Communicate** in scientific community
  - Need of clarity
    - clearly stated problem
    - clearly stated conclusion
  - Clarity is essential for New knowledge “for the first time”
  - Receiving the signals by publishing it
    - Scientific communication = two ways process
    - Need to be received – to be understood

# What is Scientific Writing

- Understanding the signals by audience
  - Purpose of scientific communication : to communicate new scientific findings
  - As clear as possible
  - Not literature nor poetry



# Origins of Scientific Writing

- **I**ntroduction - **M**ethods - **R**esults – **a**nd **D**iscussion (**IMRAD Structure**):
  - Highly structured
  - Requested by most editors because
    - Simplest
    - Most logical way to communicate research results
  - The principle of ***reproducibility of experiments*** became a fundamental tenet of the philosophy of science

# Origins of Scientific Writing

- IMRAD story:
  - Cave paintings (Akakus mountain), 10000 B.C
  - Earliest known book by (Chaldean) account of the Flood, 4000 B.C
  - The Greeks assembled large libraries 190 B.C
  - Alexandria library contained 200,000 volumes in 40 B.C
  - The Chinese invented paper In 105 A.D
  - The greatest single invention in the intellectual history of the human race was the printing press by Johannes Gutenberg in 1455 A.D



# Origins of Scientific Writing

- ❑ The first scientific journals appeared in 1665, *Journal des Sçavans* in France and the *Philosophical Transactions of the Royal Society of London* in England
- ❑ Early published papers "descriptive":
  - "First, I saw this or I did this, and then I saw that or I did that"
- ❑ Louis Pasteur, who confirmed the germ theory of disease (*reproducibility of experiments*) = (IMRAD format)
- ❑ Discoveries of antibiotics in 1900 (penicillin, Streptomycin, tetracycline), ~~tuberculosis, septicaemia, diphtheria, plagues, typhoid, smallpox and infantile paralysis.~~
- ❑ When the Soviets flew *Sputnik* around our planet

# Origins of Scientific Writing

## □ 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**

# SCIENTIFIC PAPER

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*Without publication, science is dead.*

—Gerard Piel, publisher of the new Scientific America Magazine

# What is a Scientific Paper

A well-written scientific paper **explains the scientist's motivation for doing an experiment, the experimental design and execution, and the meaning of the results.** Scientific papers are written in a **style that is exceedingly clear and concise.** Their purpose is to **inform an audience of other scientists about an important issue and to document the particular approach they used to investigate that issue.**

# What is a Scientific Paper

- Please do not think that good English is not critical in science writing. In fact, scientists try to be so concise that their **English should be better than that of workers in other disciplines!** If English is not your first language, then **proofreading by a native-speaker** might be helpful.
- If you have read scientific papers, you will have noticed that a **standard format is frequently used**. This format allows a researcher to present information clearly and concisely.

# What is a Scientific Paper

- ❑ So its written and published report describing original research results
- ❑ Criteria (test) for **VALID** publication by following standard format (IMRAD structure)
- ❑ Must be published in the right place : Primary journals



# TITLE

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*First impressions are strong impressions; a title ought therefore to be well studied, and to give, so far as its limits permit, a definite and concise indication of what is to come.*

—T. Clifford Allbutt, invented the clinical thermometer

# How to prepare the title

- Importance: read by thousand of people (only few if any will read the full paper)
- Need to reach its **intended audience**
- **Title = Label (identity, not a sentence)** suitable for indexing by Abstracting / Indexing services
  - choice of words
  - order of words
- The author should ask: "How would I look for this kind of information in an index?"

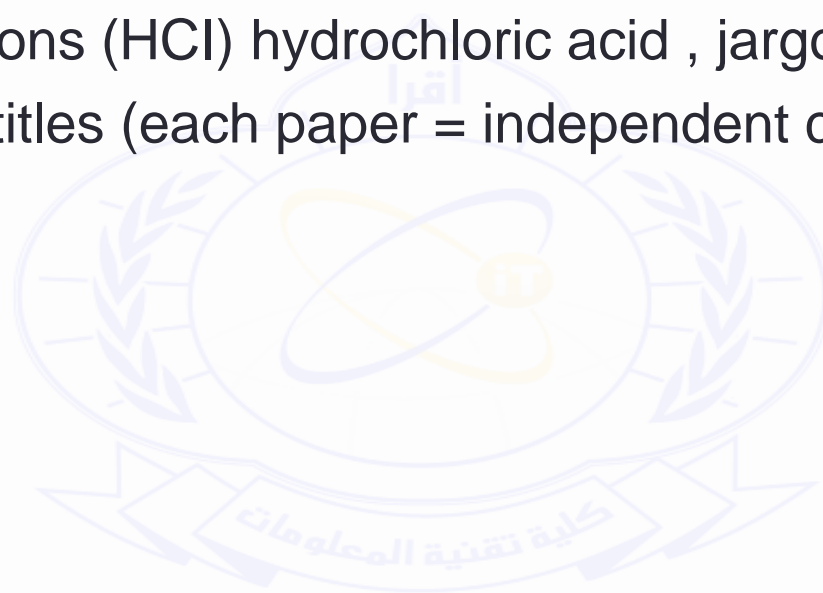


# How to prepare the title

- **Rule : fewest possible words that adequately describe the content of the paper**
  - Not to short : need for specific title (no general)
    - “Swahili Language Dialect”, too general
  - Not to long : not an abstract
    - "On the addition to the method of microscopic research by a new way of producing colour-contrast between an object and its background or between definite parts of the object itself" (J. Rheinberg, *J. R. Microsc. Soc.* 1896:373)

# How to prepare the title

- ❑ no waste words (study on ..., observations on ..., verb)
- ❑ no abbreviations (HCl) hydrochloric acid , jargon,...
- ❑ avoid series titles (each paper = independent cohesive study)

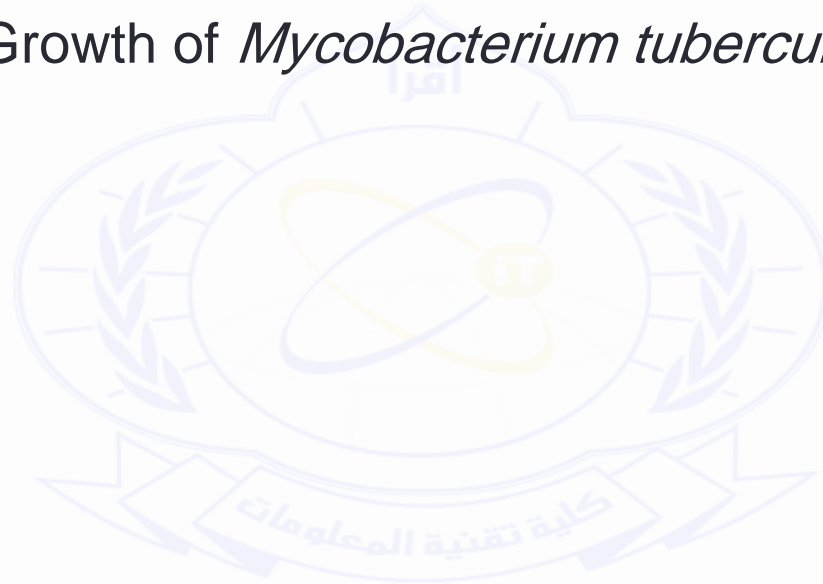


# How to prepare the title?

- What do you think of this titles?
  - Action of Antibiotics on Bacteria
  - Preliminary Observations on the Effect of Certain Antibiotics on Various Species of Bacteria
- Much more suitable:
  - "Action of Streptomycin on *Mycobacterium tuberculosis*"
  - "Action of Streptomycin, Neomycin, and Tetracycline on Gram-Positive Bacteria"
  - "Action of Polyene Antibiotics on Plant-Pathogenic Bacteria"
  - "Action of Various Antifungal Antibiotics on *Candida albicans* and *Aspergillus fumigatus*"

# How to prepare the title?

- Is it still more general? "Action of" ?
  - ▣ Inhibition of Growth of *Mycobacterium tuberculosis* by Streptomycin



# How to prepare the title?

- Types of title that can be used for scientific papers
  - **Indicative titles** indicate the subject matter of a paper but give no indication of any results obtained or conclusions drawn e.g. The effectiveness of bed nets in controlling mosquitoes at different seasons of the year.
  - **Informative titles** give an indication of results achieved and conclusions drawn as well as the subject matter of the paper e.g. Bed nets control mosquitoes most effectively when used in the rainy season.

# How to prepare the title?

- ❑ **Question-type titles** this type of title obviously asks a question. e.g. When are bed nets most effective when used to control mosquitoes?
- ❑ **Main-subtitle (series) type** this approach is not liked by editors of scientific journals because if they accept the first paper they will be duty bound to accept sequels. e.g. The effect of bed nets on mosquitoes: 1.Their effectiveness when used only in the rainy season.

# ABSTRACT

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*I have the strong impression that scientific communication is being seriously hindered by poor quality abstracts written in jargon-ridden mumbo-jumbo.*

—Sheila M. McNab

# Scientific Paper: Abstract

- An abstract is a **shortened version (miniversion)** of the **paper** and should contain all **information necessary for the reader** to determine:
  1. **what** the objectives of the study were;
  2. **how** the study was done;
  3. **what** results were obtained;
  4. and the **significance** of the results.



- **Frequently, readers of a scientific journal will only read the abstract**, choosing to read at length those papers that are most interesting to them. For this reason, and because abstracts are frequently made available to scientists by various computer abstracting services, this section should be **written carefully and succinctly to have the greatest impact in as few words as possible.**
- Although it appears as the first section in a paper, most scientists **write the abstract section last.**

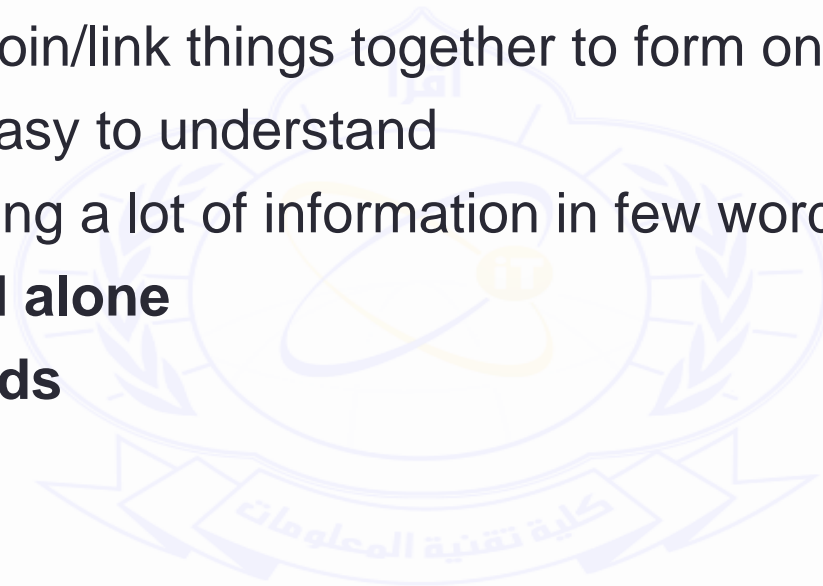
# How to Prepare the Abstract

- **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, If you can tell your story in 100 words, do not use 200.
- The Abstract should be typed as a **single paragraph**

# How to Prepare the Abstract

- Qualities of good abstract:
  - ▣ **unified** – to join/link things together to form one unit.
  - ▣ **coherent** - easy to understand
  - ▣ **concise** -giving a lot of information in few words
  - ▣ able to **stand alone**
  - ▣ **200-300 words**



# How to Prepare the Abstract

- Some questions that should be answered in an abstract are:
  - **Why** did you do this study?
  - **What** did you do, and how?
  - **What** did you find?
  - **What** do your findings mean?
- If the paper is about a new method or apparatus (machine), the last two questions might be changed to:
  - What are the advantages (of the method or apparatus)?
  - How well does it work?

# The Impact of Service Quality and Communication in Developing Customer Loyalty: The Mediating Effect of Customer Satisfaction

## Abstract

Satisfaction with the services of banks is just a launching point in constructing long-term relations with customers. Customer loyalty is one of the main determinants of the achievement of the marketing partnership. However, how customer satisfaction can be transferred to loyalty is the key problem. The aim of this study is to examine the influence of service quality and communication on loyalty through customer satisfaction. The scope of this study concentrated on Yemeni's banking industry. Quantitative data was collected from 233 customers. Convenience sampling employed to determine the research respondents. The analysis was based on 160 usable questionnaires. Several data analysis techniques were conducted, such as frequencies, correlation and regression to examine the nature and the significance of the relationship between the variables. The findings revealed acceptable levels of agreement with satisfaction and loyalty factors. The results suggested that higher perception of service quality and communication led to stronger perceptions of customer satisfaction and loyalty. The results also showed that satisfaction is an essential mediator to promote loyalty to bank customers through developing effective communication and excellent service quality. Since the promotion of customer loyalty is a major concern for banks, this study is thought to contribute marginally to Yemen banks.

# Skeleton for Abstract

## Introduction

(Why did you do this study ?)

Satisfaction with the services of banks is just a launching point in constructing long-term relations with customers. Customer loyalty is one of the main determinants of the achievement of the marketing partnership. However, how customer satisfaction can be transferred to loyalty is the key problem.

# Skeleton for Abstract

## Method

(What did you do, and how? )

The aim of this study is to examine the influence of service quality and communication on loyalty through customer satisfaction. The scope of this study concentrated on Yemeni's banking industry. Quantitative data was collected from 233 customers. Convenience sampling employed to determine the research respondents. The analysis was based on 160 usable questionnaires. Several data analysis techniques were conducted, such as frequencies, correlation and regression to examine the nature and the significance of the relationship between the variables.



# Skeleton for Abstract

**Results**  
(What did you find?)

The findings revealed acceptable levels of agreement with satisfaction and loyalty factors.

# Skeleton for Abstract

## Discussion

(What do your findings mean? )

The results suggested that higher perception of service quality and communication led to stronger perceptions of customer satisfaction and loyalty. The results also showed that satisfaction is an essential mediator to promote loyalty to bank customers through developing effective communication and excellent service quality. Since the promotion of customer loyalty is a major concern for banks, this study is thought to contribute marginally to Yemen banks.

# INTRODUCTION (PAPER ITSELF)

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*A bad beginning makes a bad ending.*

—*Euripides* — Greek Philosopher

# Scientific Paper: Introduction

- **Why** is this study of **scientific interest** and **what** is your **objective**?
- This section discusses the results and conclusions of **previously published studies (literature review)**, to help explain why the current study is of scientific interest.
- All about **justification** of research interest!!

# Scientific Paper: Introduction

- The Introduction is organized to move **from general information to specific information**.
- The background must be **summarized** concisely, but it should not be **itemized**.
- Limit the introduction to studies that **relate** directly to the present study.
- Emphasize your **specific contribution** to the topic.

# Scientific Paper: Introduction

- The last sentences of the introduction should be a statement of **objectives** and a statement of **hypotheses**.
- This will be a good transition to the next section, [Methods](#), in which you will explain how you proceeded to meet your objectives and test your hypotheses.

# How to Write the Introduction

- Should state briefly and clearly your purpose (**audience hook**), What problem was studied
- **Decide the audience**
- Justify why did you choose that subject, why is it important
- It is a **wise policy** to begin writing the paper while the work is still in progress
- From **problem to solution** (even if some redundancy with Abstract), let the reader follow the development of the evidence

# How to Write the Introduction

- Suggested rules :
  - Present first the nature and scope of the work (**problem definition**)
  - Review the **most relevant 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



# How to Write the Introduction

- ❑ 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

# MATERIALS AND METHODS

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*The greatest invention of the nineteenth century was the invention of the method of invention.*

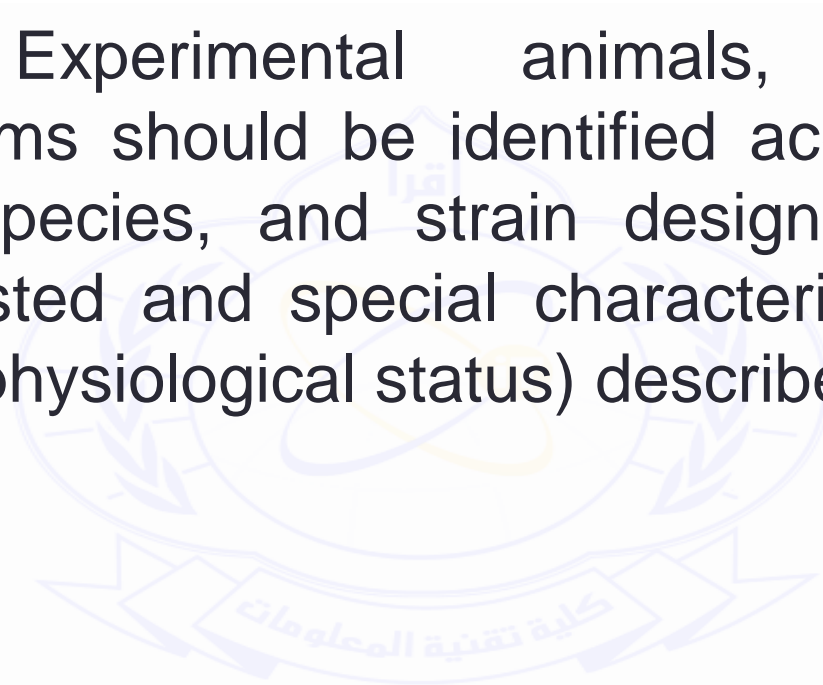
*—A. N. Whitehead*

# Scientific Paper: Materials and Methods

- This section provides all the **methodological details** necessary for another scientist to **duplicate** your work.
- It should be a narrative of the steps you took in your experiment or study, **not a list of instructions** such as you might find in a cookbook.
- Include the exact **technical specifications** and quantities and source or method of preparation (questionnaire, survey, case study, ...).

# Scientific Paper: Materials and Methods

- **Example:** Experimental animals, plants, and microorganisms should be identified accurately, usually by genus, species, and strain designations. Sources should be listed and special characteristics (age, sex, genetic and physiological status) described



# 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  $\text{P}$  rejection by the referee no matter the results)
- **Past tense**
- **Chronological** presentation (with sub headings)

# How to Write the Materials and Methods Section

- Similar to **cookbook recipes** for measurements and analysis:
  - ▣ How ?
  - ▣ How much?
- If a reaction mixture was heated, give the temperature. Questions such as "how" and "how much" should be precisely answered by the author and not left for the reviewer or the reader to puzzle over.

# How to Write the Materials and Methods Section

- **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
- **Give a copy** of your finished manuscript to a **colleague** and ask if he or she can follow the methodology

# RESULT

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*Results! Why, man, I have gotten a lot of results. I know several thousand things that won't work.*

*—Thomas A. Edison*



# Scientific Paper: Results

- ❑ Experiment result representation without attempt to **interpret their meaning**.
- ❑ You will not present the **raw data** that you collected, but rather you will **summarize** the data with text, **tables and/or figures**.
- ❑ Use the text of the paper to state the results of your study, then refer the reader to a table or figure where they can see the data for themselves.

# 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

# How to Write 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

## ❑ **Past tense**

# DISCUSSION

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*It is the fault of our rhetoric that we cannot strongly state one fact without seeming to belie some other.*

*—Ralph Waldo Emerson, American essayist*

# Scientific Paper: Discussion

- In this section, you are free to explain **what the results mean or why they differ** from what other workers have found.
- You should **interpret** your results in light of other published results, by adding additional information from sources you cited in the [Introduction](#) section as well as by introducing new sources. Make sure you provide accurate citations.

- **Relate your discussion back** to the **objectives** and **questions** you raised in the Introduction section.
- do not simply re-state the objectives. Make statements that **synthesize all the evidence** (including previous work and the current work).
- Limit your conclusions to those that your data can actually support. You can then proceed to speculate on why this occurred and whether you expected this to occur, based on other workers' findings.

- Suggest **future directions** for research, new methods, explanations for deviations from previously published results, etc.

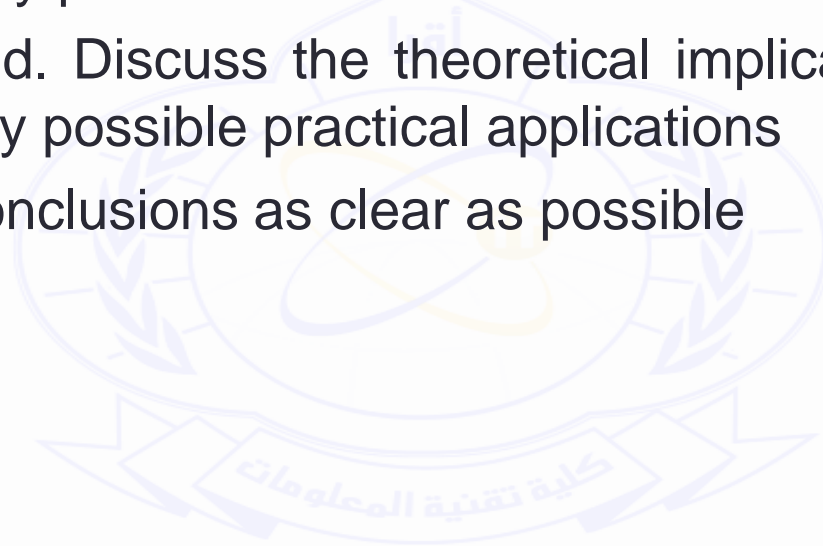


# How to Write the Discussion

- ❑ **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



# How to Write the Discussion

- 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, **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

# ACKNOWLEDGEMENTS

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# How to State the Acknowledgements

- 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

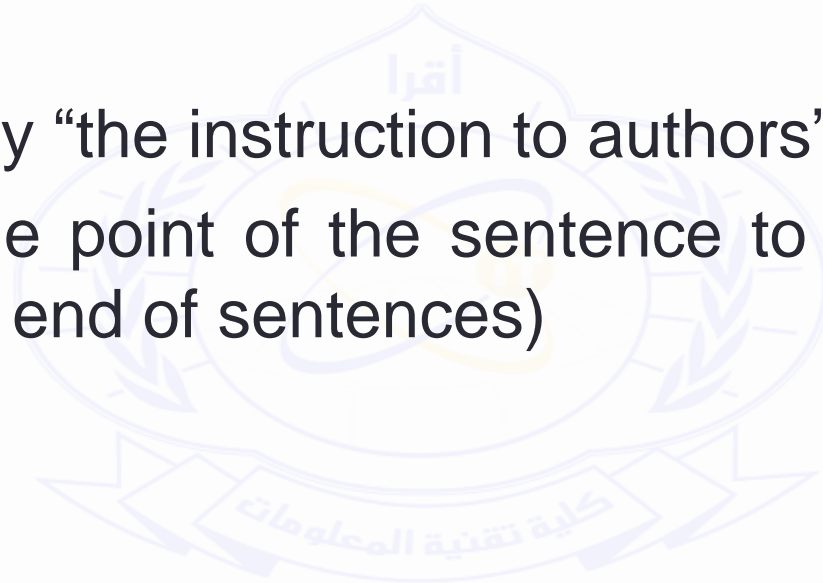


# REFERENCES

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# 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)





Thanks...