# How to Write the Scientific Papers ?

# Structure, Format, Content and Style

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# **Part 1: Basic Concept**

# Part 2: Description of Each Section



Part 1: Written and oral communications skills are probably the most universal qualities sought by graduate and professionals schools as well as by employers. You alone are responsible for developing such skills to a high level.

### **Science Communication:**

- Popular Articles
- Scientific Papers

# **Scientific Writing:**

□ To tell a story, but .....

### **Goals of Writing?**

- Publish
- Develop a good reputation

### Why a Scientific Format?

- To communicate scientific findings
- To allow the Paper to be read

You *will* see improvement in your own scientific writing skills by repeatedly practicing reading, writing, and critiquing of other's writing

### Ask Yourself:

- What is the message of the paper?
- What is the new result or contribution that you want to describe?
- What do you want to convince people of?

### **Before starting to write:**

- Spend some time thinking about content
- Write down ideas
- Creating a general outline

## As you get ready to write:

- Try to summarize the initial ideas
- □ Start to organize into a logical structure

# **Language Format**



- Use Past Tense
- □ First vs. Third Person: (i.e., " I (or we) undertook this study ....)
- Use direct subject-verb relationships, including the active voice where appropriate

Example 1:

- □ ACTIVE: "the mouse consumed oxygen at a higher rate...
- PASSIVE: "oxygen was consumed by the mouse at a higher rate.."
  Example 2:
- **Bad:** It was determined that the activation was higher in Condition A than B
- **Okay: We determined that the activation was higher in Condition A than B**
- **Better:** The activation was higher in Condition A than B
- **Better: Condition A generated higher activation than Condition B**

#### Transition words and linking phrases :

Connect ideas, not points .

- **Caveats: However, but, nevertheless**
- **Cause and Effect: Therefore, then, consequently, if then**
- **Support:** In addition, furthermore, moreover, also, indeed
- Contrasts: In contrast, whereas
- **Summary:** In sum, in conclusion, to summarize
- **Examples: For example, for instance**

### To make a paper readable

- 12 point standard
- **Font (Times, Geneva, Bookman, Helvetica, etc.).**
- Text should be the double space on 8 1/2" x 11" paper with 1 inch margins, single sided.
- □ Start each new section on a new page.
- Use paragraphs to separate each important point (except for the abstract).
- Presents your points in logical order.
- Use present tense to report well accepted facts for example, 'the grass is green'.
- Use past tense to describe specific
- Avoid informal wording, don't address the reader directly
- Do not use jargon, slang terms, or superlatives

In formulating the outline it is important to know that most engineering or science journal articles have a well-accepted general format.



- 1. Title
- 2. Authors and Affiliation
- 3. Abstract
- 4. Introduction
- 5. Methods
- 6. Results
- 7. Discussion
- 8. Acknowledgements
- 9. Literature Cited



# **Basic Concept Prescribed order**



## **Experimental Process**

- What did I do in a nutshell?
- What is the problem?
- How did I solve the problem?
- What did I find out?
- What does it mean?
- Who helped me?
- Whose work did I refer to?
- **Extra Information**

- **Section of Papers** 
  - Abstract
  - Introduction
  - **Materials and Methods**
  - **Results**
  - **Discussion**
  - **Acknowledgements (optional)**
  - **Literature Cited**
  - **Appendices (optional)**

# **100**

## Heading, Introduction, Title and Key Words

#### **Section Heading:**

- **Capitalized, centered at the beginning of the section**
- Double space from the lines above and below
- Do not underline or put a colon at the end

#### Introduction: if more than one experiments use subheading

- Capitalized
- **Either bold italics or underlined**

#### Title, Authors' Names, and Institutional Affiliations :

- □ Title -centered at the top page -Informative
- Authors' names and institutional affiliation
  - :double-spaced from and centered below the title.
- More than two authors
  - separated by commas

#### Key Words:

- □ If your title is insufficient
- □ Key result of the study in the title

### **Structure, Format, Content and Style**



### Abstract:

The abstract is a critical element of the research paper. The abstract should inform the reader in a succinct manner as to what the article is about and what the major contributions are those are discussed. Summarizes in one paragraph, the major aspects of entire paper.

- **The question (s) you investigated (or purpose), (from Introduction)** 
  - **State the purpose very clearly in the first or second sentence**
- **The experimental design and methods used, (From Methods)** 
  - Clearly express the basic design of the study
  - Name or briefly describe the basic methodology (key techniques)
- **The major findings key quantitative results or trends (from results)** 
  - **Report those results which answer the questions you are asking.**
  - Identify trends, relative change or differences, etc
- **A brief summary of your interpretations and conclusions (from Discussions)** 
  - **Clearly state the implications of the answers your results gave you**

## Abstract

# Style:

- ONLY text
- Single paragraph (concise and summarizes)
- □ The length about 200-300 words maximum
- □ Limit your statements (each segment of the paper)
- Past tense
- □ Active voice when possible.

### The Abstract should not contain :

- Lengthy background information
- Reference to other literature
- Incomplete sentences
- Abbreviations or terms
- Any sort of illustrations (figure or table, or references)



#### Introduction : should not exceed two pages

#### Must answer the following questions:

- What was I studying?
- Why was it an important question?
- What did we know about it before?
- How will this study advance our knowledge?

#### General Intent: (Purpose)

- Rationale behind the work (Briefly explain your rationale)
- State the purpose of the work (hypothesis, questions or problem).
- Enables to understand and appreciate your objectives.

#### **Basic Ideas:**

- What we know about the problem?
- State the purpose and /or hypothesis investigated
- Provide a clear statement of the rationale Approach :
  - Describe the importance (significance) of the study
  - Defend the model
  - State your specific hypothesis (es) or objective(s
  - Describe the experimental design.

- Literature
- problem studied



# Introduction



# Style:

- Use the past tense (except to established facts)
- □ Use the active voice as much as possible
- □ First person is okay, (do not over do it)
- □ Organize your ideas ( one major point with each paragraph).
- Present background information only as needed
- □ State the hypothesis/objective precisely do not oversimplify.
- Pay attention to spelling, clarity and appropriateness of sentences and phrases.

# Introduction

### How to Write?

#### Introductory paragraph

Begin your Introduction by clearly identifying the subject area of interest. Do this by using *key words* from your title in the first few sentences of the Introduction to get it focused directly on topic at the appropriate level.

- **Start with an attention- from a general topic (broad statement that establishes)**
- □ Narrow the topic in successive sentences (art and introduce a gap in knowledge)
- **End the introduction with a general statement of the problem**

#### Middle paragraph

Establish the context by providing a brief and balanced review of the relevant published literature that is available on the subject.

- **The literature review identifies the seminal historical contributions**
- Outline the state of knowledge
- Justify the novelty of the article's contribution

#### **Final paragraph**

- **End the introduction by outlining the specific contribution of the article**
- **Tell the reader the overall organization of the paper**



# **Materials and Method**



Materials and Method is the easiest section to write. The objective is to document all specialized materials and general procedures. It is not to be a step by step description of everything, nor is a methods section a set of instructions. It is not supposed to tell a story. Materials and Method may be reported under separate subheadings or can be incorporated together.

#### Explain clearly how you carried out your study:

□ No specific page limit

- key concept is to keep as concise as much as possible)
- People wants to read material selectively
  - Reader may only be interested one formula or part of procedure

#### Materials:

- Describe materials separately if the study is so complicated
- □ Include the information (material and equipments) -which are not commonly found

#### Methods:

#### Describe all of the techniques which used to obtain the results

- **Report the methodology (not details of each procedure)**
- **Describe the methodology completely**
- Present methods (under headings if specific groups of procedures)
- **Generalize report how procedures were done**



# **Strategy for writing the Method Section**

#### **Explanation Depends upon the Conditions**:

The Organism	Source-collected and study carried out ( where ,when and how)
Studies:	Size (weight, length, etc)
	How they were handled before the experiment
Field study:	Exact location of the study area
	latitude and longitude position of the site
	Both physical and biological characteristics
	Date (s) of study
	Map (labeled as a figure)
Experimental or Sampling design:	Include the tested hypotheses, controls, treatments, variables Measured.
	What you actually measured?
	What from the data take?
How the data were analyzed:	How the data were summarized (Means, percent, etc)
	Hw you are reporting measures of variability (SD)
	Data Transformation e.g., to normalize or equalize variances etc.)
	Numerical or graphical techniques used to analyze the data

# **Materials and Method**

### Style:

- Use past tense throughout-the work
- **Can be used active voice to a certain extent**
- Use third person
- Avoid use of first person

**Problems** : The Methods section is prone to being wordy or overly detailed

- □ Avoid repeatedly using single sentence to relate a single action.
- A related sequence of actions can be combined into sentence to improve clarity and readability.

#### What to Avoid?

- Materials and Method are not a set of instructions
- Omit all explanatory information and background





A major function of the text in result section is to provide clarifying information. The results section should be organized around a series of Tables and/or Figures sequenced to present key findings in a logical order. The text of the results section follows sequence and highlights the answers to the questions/hypotheses

Description

### What is the Result?

#### The Answers of the question is the key result.

Key results depend on your questions (include obvious trends, important differences, similarities, correlations, maximums, minimums, etc.).

#### How?

- □ Hypothesis -can be answered experimentally
- Question -can be answered by collecting samples
   -can be answered by accumulating observation
   -can be answered by analyzing observed info.

# **Result:**



- □ Use the past tense
- □ Use the active voice as much as possible.
- □ Write the text of the results section concisely and objectively.
- Describe each of your results (most relevant first)
- **Summarize your findings in text and illustrate them.**
- □ Analyze your data, then prepare table and figure (graph)
- □ In text, refer to each figure as "figure 1", "figure 2," etc. and number your tables as well
- **Each Table or figure must include a brief description of the results**
- **You** Can place your figures and tables appropriately in results section.
- Report negative results

#### What to Avoid?

- Do not discuss or interpret your results
- **Do not report raw data values or intermediate calculations**
- **Do not present the same data more than once.**
- Do not repeat each value from a Figure or Table
- Do not present the same data in both a Table and Figure



# **Description** How do the results compare with earlier work? What is new and significant?

**DISCUSSION** The function of the Discussion is to interpret your results in light of what was already known about the subject of the investigation and explain our new understanding.

- Let the literature lt connects to th
- Let tells how the study has moved us forward (beginning from the end of the introduction)

#### Fundamental questions to answer in Discussion:

Do your results provide answers to your testable hypothesis?

If so, how do you interpret your findings?

Do your findings agree with what others have shown?

If not, do they suggest an alternative explanation?

- What is our new understanding of the problem you investigated and outlined in the Introduction?
   Give your conclusions
- □ If warranted, what would be the next step in your study,

e.g., what experiments would you do next?

#### Content:

- Interpret the results to reach the main conclusions of the article
- **Freedom to publicize the suggestions of his research.**
- □ Never make an assertion if not sure 100%
- □ As a rule, it is better to be conservative.
- **Can be highlighted the important conclusions**
- **To, use evidence to support conclusions (experiment and generally accepted knowledge.**
- Describe the significance of findings clearly

### **Discussion:** Remember:



- If results differ from expectations, explain why?
- If results agree, then describe the theory with evidence

### Writing a Discussion

When you explain a phenomenon you must describe mechanisms

- **Explain all observations as much as possible**
- Draw what conclusions are based upon the results .
- **Suggest future directions (modifications to accomplish another objective)**
- One experiment will not answer an overall question
  - where do you go next?
  - What questions remain?
- Organize -to address each of the experiments or studies (which presented in results)
- Discuss each (same sequence )as presented in the Results (with your interpretation )
- Do not waste entire sentences restating your results
- Recommendations for specific papers will provide additional suggestions.

# **Discussion:**



- Use the past tense (work done by specific individuals including yourself)
- □ Use the active voice whenever possible
- Be concise and make your points clearly
- **Use the first person, but not too much**
- **Make reference in order to support your interpretations.**
- Use subheadings, if necessary
- **Relate your work to the other findings**
- **Discuss reasons for similarities and differences (your research and others)**
- Be sure to state the conclusions (can be drawn from the results)
- **Briefly mention further studies (you would do)**

#### What to Avoid?

Do not introduce new results in the Discussion



### **Acknowledgements, Literature Cited and Appendices**



If, in your experiment, you received any significant help in designing, or carrying out the work, or received materials from someone who did you a favor by supplying them, you must acknowledge their assistance and the service or material provided.

### Authors always acknowledge

- Outside reviewers of their drafts
- Any sources of funding
- Style:
  - Usual style requirements (First Person, objectivity)
  - □ Always brief and never flowery.
  - Place- between the Discussion and the Literature Cited

#### Literature Cited:

The Literature Cited section gives an alphabetical listing (by first author's last name) of the references that you actually cited in the body of your paper.

Avoid:

#### Do not label this section "Bibliography"

Bibliography sections are found in books and other literary writing, but not scientific journal-style papers.

An Appendix contains information that is none-essential to understanding of the paper but May Present information that further clarifies a point without burdening the body of the presentation.

is an *optional* part of the paper is only rarely found in published papers.

#### Headings:

- **Roman numeral in sequence, e.g., Appendix 1, Appendix 2, etc.**
- **Each appendix should contain different materials.** 
  - Raw Data

#### Example:

- Maps (foldout type especially)
- Extra photographs
- **Formulas, or other mathematical procedures**
- Specialized computer programs
- **Full generic names of chemicals or compounds**
- Diagrams

#### Figures and Tables in Appendices :

- Numbered in a separate sequence
  - \* The first Figure Figure 1
  - \* The first -Table 1
- Multiple appendices can be used
- **The Table and Figure numbering must indicate the appendix number as well.**



# Thank You !