A GUIDE To SCIENTIFIC WRITING

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TYPES OF SCIENTIFIC COMMUNICATION

a) Research communications, e.g.

i. research paper;  
ii. research note;  
iii. scientific article;  
iv. review article;  
v. conference paper;  
vi. poster;  
vii. thesis or dissertation;  
viii. book chapter;  
ix. annual report; and  
x. newsletter.
b) Project proposal, document, review, and evaluation.

c) Extension and popular communications, e.g.

   i. extension manual;
   ii. extension leaflet;
   iii. magazine article; .....etc.
WRITING A RESEARCH PAPER

- Before you start writing a paper for publication, you should target a journal for your paper because different journals have different styles of presentation.

- Therefore, you should read carefully the *Instructions to Authors* and follow them to the letter.

- In general, a research paper is written using the IMRAD System, i.e. Introduction, Materials and Methods, Results and Discussion. There are of course exceptions.
A typical research paper consists of the following:-

1) **Title**: Since it is the ‘label’ of the paper, make it brief, expressive, and suitable for indexing. It states the subject of the paper rather than its conclusion.

2) **Authors**: List the names of the persons who have done the work and written the paper.

3) **Addresses**: Include full addresses of authors to enable readers to correspond with the authors.

4) **Abstract**: Briefly describe the problem (objectives), materials and methods, and the findings.
5) **Introduction**: Describe the problem and the state of knowledge that led to the research embodied in the paper, and state the objective(s) of the study, in the last paragraph.

6) **Materials and Methods**: This section deals with how did you study the problem. It includes the design of the experiments, materials and methods used to collect the data and how they were analyzed. In some disciplines, this section is called Methodology, and includes methods of data collection and analysis.
7) **Results:** Describe what you did find. Present data in tables or figures, or both, to support the text. However, the same data should not be presented in both tables and figures.

8) **Discussion:** Interpret the findings, compare them with previous work, and indicate their implications for further research.

9) **Acknowledgement:** Give credit or thanks to those who helped substantially.

10) **References:** List the references quoted in the text.
Guide lines for the parts of a research paper

Title

i. contains as few words as possible; it is a label, not a sentence,

ii. describes the contents of the paper accurately,

iii. describes the subject as specifically as possible,

iv. is as easy to understand as possible,

v. avoids abbreviations or chemical formulae, and does not capitalize articles (a, an, the), prepositions (in, to, between, of) or coordinating conjunctions (and, or, for, but, nor), and

vi. usually indicative rather than informative; it states the subject of the paper rather than the writer's opinion.
Avoid, as much as possible, main title-subtitle arrangement, because it is important for the reader that each published paper presents the results of an independent, cohesive study.

**Author(s): The name(s) should**

i. be complete enough to ensure proper identification;

ii. include only people who are truly authors,

iii. be listed in the order of importance to the work being reported or else in alphabetical order, and

iv. each should have an address, presented according to the style of the journal for which the paper is being written.
Give the name and address of the department and the institution in which the work was done. If any of the authors is no longer at that institution include his current address.

Abstract

A good abstract

i. is short – usually less than 250 words, and in one paragraph,

ii. stands on its own, is intelligible in itself without reference to the paper

iii. briefly reports the objective(s) of the investigation, the materials and methods used, the main results, and the principal conclusions and their significance,
iv. self-contained,
v. does not include procedural details.
vi. does not contain reference to the literature
vii. does not contain reference to tables or figures, abbreviations or acronyms unless they are standard (FAO, WHO, DNA, RNA) or explained.
viii. should be written last to ensure that it reflects accurately the contents of the paper,

The Discussion and the Abstract are the most difficult sections to write. Most of the Abstract is written in the past tense, because it refers to work done.
Introduction:

A good introduction is relatively short, no more than two type-written pages. Specifically it

i. defines the nature and extent of the problem studied.

ii. relates the research to previous work – perhaps by a brief review of the literature. In theses and dissertations, the review of literature should be a separate, extensive chapter.

iii. does not rely on the information quoted by other authors;
iv Provides the rational and defines the objective(s) of your study.

Most of the introduction should be written in the present tense, because you will be writing primarily about the problem and the existing knowledge relating to it.
Materials and Methods:

This section should contain a full description of what was done and how it was done, and the chemicals, tools, equipment, and other experimental material used. The simplest way to organize this section is chronologically. You must provide all the information needed to allow another researcher to judge (evaluate) the validity of the conclusions or actually repeat your experiments. This section should include :-

i. Experimental plants, animals or micro-organisms exact descriptions (genus, species, cultivars, strains…etc). (if a large number of varieties, breeds, strains or mutants are used, prepare a table identifying the source and properties of each.),
ii. Site (s), location (s) and date (s) of the experiment (s)

iii. The design of experiment (s),

iv. The material used, with exact technical specifications and their source or method of preparation.

v. The methods used.

The Material and Methods section usually has subheadings, and, if possible, the subheadings should be constructed to “match” those to be used in Results section.
Results:

You should

i. reduce large quantities of raw data to a concise form, e.g., means, along with S.E. or L. S. D.,

ii. repeat in the text only the most important findings shown in tables and figures. (Numerical data presented in tables need not be restated in detail in the text, means only may be used.)

iii. refer in the text to every table and figure by number

You should not refer to a table or a figure by writing the results are shown in fig.1, you must describe what the table or figure shows.
a) Tables and figures:

Data may be presented as tables, graphs or diagrams, but never present the same data in more than one way. Tables are good for presenting numerical data; they enable the reader to compare related items. Graphs and diagrams are best for illustrating trends and relationships among sets of variables. Photographs are used to display actual observations.
Tables:

Generally, a table consists of most or all of the following elements: number and title, column (box) headings, row (stub, field or body) headings and footnotes. Footnotes to the tables are keys to abbreviations and symbols. If you do it for Table 1, for example, you don’t need to repeat them for other tables if they are the same footnotes, just write ‘abbreviations as in Table 1. There are also used for indications and explanations of statistical significance, and source (s) of data. You should give the data in the text, not in a table, when there are only few determinations (1-2 columns and 2-3 rows)
When writing a table take the following in consideration:-

i. Give the table a clear, concise and informative title (caption) at the top. The title should be a phrase not a sentence. It should be self-explanatory.

ii. Each table should have a number, and should be numbered sequentially. Try not to use modifiers for table numbers such as table 1a, table 1b. If the table is long, it must be run on successive pages and the number of the table is repeated at the head of each page with the word “continued (cont.)”; the box heads are repeated but the title is not. Do not refer to a table in the text by its position, e.g., the above (or below) table or the following table, but rather as Table 1, Table 2, etc.
iii. Tables should present analysed and summarised data, not raw data. Treatment means should always be accompanied by their standard errors, and when standard errors are included, it is unnecessary either to indicate the results of significance tests by asterisks (i.e.*for P=0.05) or to include least significant differences, since a reader can make any test he wishes at whatever significance level he thinks necessary.

iv. Scanty data that could satisfactorily be presented in the text should not be presented in tables. The table field should contain at least eight items, and at least two columns.
v. Data should be rounded, 75.3 not 75.30469.
vi. Always state the unit of measurement, usually in the metric units
vii. Use zero in data values less than 1, e.g., 0.35 kg.
viii. Use powers of 10 to avoid numbers of string of zeros, e.g., 48 300 000 should be written 4.83x10^7; use also units that reduce excess zeros: 165 kg instead of 165 000 g.
ix. Avoid using a dash (--) or 0.00 in tables for unavailable data, use NA (not available).
x. If percentages are used, distinguish between % by volume (v/v) and % by weight (w/w).
xi. Abbreviations are permitted in tables, e.g., temp, avg, m, t,....etc; do not use a period except after ‘no.’

xii. Generally, two types of footnotes are used with tables: those to show statistical significance (*, ** significant at 0.05 and 0.01 levels, respectively) and those to give supplementary information.

xiii. Do not use a table to present a word list, because this information could easily be presented in the text.

xiv. When the table is long and narrow, doubling up, e.g., dividing it in equal parts and placing them side by side may save space. A vertical double line may separate the two parts.
xv. Align all decimal points, in a column of figures, vertically.

xvi. Analysis of variance tables are not ordinarily included in a research paper.

**Figures:**

- Good figures should be:
  
  i. simple and clear,

  ii. contain relevant legends either at the bottom or on a facing page,

  iii. independent of text and of each other, i.e., each on a separate page,
Scientific papers commonly use a number of types of figures as follows:-

i. Line graphs (curve charts) to demonstrate general relationships between two variables measured along the horizontal and vertical scales. The independent variable is plotted against the horizontal axis, and the dependent variable is plotted along the vertical axis; both axes should be clearly labelled. If there is a space in the graph, use it to present the key to the symbols.

ii. Bar and pictorial graphs (charts) to compare quantities of different items at one time.
iii. Circle graphs (pie charts) to show proportion of a whole. Slices represent either percentages or fractions of the whole which is represented by the entire circle. It is used when the number of components is small and general relationship is more important than precise quantities.

iv. Histograms to show the relative frequency of various values within ranges. Columns should be of the same width
v. Maps to illustrate research sites or show the distribution of quantitative or qualitative data

vi. Line drawings to illustrate objects or specimens or to present numerical data.

vii. Photographs to show the actual appearance of a specimen or something else you wish to describe.
Like tables, number every figure and refer to it by number in the text, and do not refer to a figure by its position, e.g., the above Fig. or the following Fig. A figure should not repeat information already given in a table, i.e., the same data should not be presented in both a table and a figure.
b) Appendices:

Generally, no appendix is included in a research paper. However, it may be necessary in some theses to present data that may be needed by some readers but are too long and detailed to be put in the text.

c) Key Words, Index Terms or Descriptors:

Many journals publish with each article index terms or descriptors suitable for information retrieval systems. For this, select words that reflect the central topics of the paper. Key words may be typed on the page carrying the abstract.
d) **Running Head or Running Footnote:**

Authors may be required to provide a short version of the title to be set as a running head at the top of each right-hand page of the published paper or as a footnote at the bottom of the page.

e) **Footnotes:**

Footnotes are used only when they are needed to present documentary or explanatory material. They should not be used with the abstracts. An increasing number of journals refuse to accept text footnotes.
Discussion:

The first task in the Discussion is to state what are the results by providing a prices of the main features of the results. Then, try to explain them and relate the previous research in the same area showing why they differ or agree, if some other scientist published similar results first, don’t write ‘Ali confirmed the present findings’, but ‘The present findings are in accord (in agreement) with those of Ali’. Finally, you need to explore the implications of your findings with regard to the issues outlined in the introduction, together with suggestion as to what direction and form that future research should take.
A good discussion is characterized by the following:-

i. Does not repeat what has already been written in the review of literature

ii. Relates the results to the questions that were set out in the Introduction, i.e., deals with each of the originally stated objectives

iii. Shows how the results and interpretations agree, or do not agree, with previously published work and why.

iv. Discusses theoretical implications of the work, as well as any possible practical applications

v. Suggests future research that is needed to follow up the results
vi. Avoids unnecessary detail or repetition from previous sections such as the Results section. Only mentions salient points of the results to identify the point being discussed.

vii. Includes an account of any flaws in the design that might have affected the results.

viii. States conclusions with evidence for each in a final paragraph; they should not be mere restatement of findings.

Sometimes the Results and Discussion sections can be combined to avoid repetition.
Conclusions:

Some journals allow use of a Conclusions section, as well as a Discussion section. Make sure that your conclusions are, in fact, conclusions and not a summary of your paper.

Acknowledgement:

Here you can thank any institution or individual who helped significantly in your work.
References: (literature cited)

The reference list should include all works cited in the text. There are many different styles for listing references; every journal prefers its own style. There is not a ‘right’ way and a ‘wrong’ way of listing references, but consistency is a must. You should follow the ‘Instructions to Authors of your chosen journal.'
The three common styles for reference lists in the biological sciences are:

i- Name -year system (sometimes is referred to as the Harvard System),

ii- Alphabet- number system, and

iii- citation-sequence system ( sometimes refered to as the Vancouver system)
**Number-year System (N-Y):**

In this system, the author (s) surnames and year of publication are given in the text; for example: Khidir (2000) or (Khidir 2000 or Khidir, 2000) depending on the structure of the sentence. In most journals, the citation for two authors is as follows: Khidir and Knowles (1970), and for more than two is Khidir *et al.* (i.e., (Khidir and others or Khidir and co-workers). When two or more documents with different authors are cited within a parenthetical citation, they are cited in chronological sequence from earliest to latest.
The list of references at the end of the paper is arranged alphabetically by authors’ surnames. Two or more words by the same author(s) are listed chronologically, by date of publication.

Journal articles are listed as follows:- Author(s) surname(s); author(s) initials; year of publication; title of article; journal title (in italics); volume number; inclusive page numbers.
Books are listed as follows:- Author(s) surname (s); Author(s) initials; year of publication; title of book (in italics); name of publisher; place of publication.

In case of an article in a book, its listed as follows:-Author (s) surname(s); author(s)initials; year of publication; title of article; initial (s) and surname (s) of editor(s); title of book; name of publisher; place of publication.
ii- Alphabet-Number system (A-N):

In this system, the references are arranged alphabetically in the reference section, then numbered. The citation in the text is by numbers (as superscripts in parentheses) rather than the name and year.

iii- Citation-sequence System (C-S):

Each citation in the text is given a number, written as a superscript, in the order it is first mentioned; the reference list is arranged sequentially by number and is not alphabetical.
Within these three systems, there are many variations. Some of these variations are described below:

- Whether to enclose the year in parentheses or not, in the reference list
- Whether to include a comma or not between the name of the author and year of publication in the text when both are in parentheses, e.g., (Khidir,1995) or (Khidir 1995)
• Whether to write the journal title in full or abbreviated; if abbreviated, it should be according to the abbreviation printed in the journal itself or in the ‘World List of Scientific Periodicals' One-word titles (Science, Nature) are not abbreviated.

• Whether a comma or a semicolon should be used after the initials of the first author if there are three authors and after the initials of the first and second author if there are four authors

• Whether to use the initials of the second author before or after his surname

• Whether to write the title of the paper or not
• Whether to put a comma or a colon between the number of the volume and the number of pages, and

• whether to write only the number of the first page or both the first and last pages of an article.

In preparing the reference list you should remember the following:-

i. Never to use *et al.* or ‘and others’, except if allowed by the journal. Most journals prefer that the names of all authors should appear in the list of references, others cite only three followed by *et al.* Or the first six followed by *et al.* as in biomedical journals.
ii. In the name-year system, all works by an author alone precede his multi-authored works, and two or more articles by the same author (s) are listed chronologically by date of publication.

iii. Works written by an author precede those edited by the same author.

iv. Multi-authored works are alphabetized by surname of the first author, then the second and so on, e.g., Khidir, M. O. and Ali, M. A. precedes Khidir, M. O. and Kambal, A.E.

v. If an author has two or more cited publications in a given year, the publications are distinguished by adding a lowercase letter after the year, e.g., Khidir (1998a); Khidir (1998b).
vi. The title of an article in a journal or a chapter in a book is not italicized nor is it enclosed in quotation marks.

vii. The name of a journal and the title of a book may be italicized. Theses and dissertations titles may be treated as book titles.

viii. The list should include only significant, published references avoid listing unpublished papers, reports...etc. If it is essential to mention such references, you can add them in parenthesis or as footnotes in the text. A paper that has been accepted for publication can be listed in the references section, citing the name of the journal, and volume number (if available), followed by “in press”.
viii. Personal communications are not included in the reference list; they are cited in the text, e.g., M. O. Khidir (pers. comm.).

ix. If you are citing pages from a book, give only the page numbers referring to the information you used. If you are citing a whole book, include the total number of pages.

x. Use the name year system (Harvard System) at first, i.e., name (s) and year in the text. Then, if the journal requires a numbering system (A-N or C-S), change to the latter at a late stage.
There are, generally, two plans for the layout of theses and dissertations. These are outlined hereunder:-

Plan A:- This is the usual plan, and consists of the following:-

1) **Preliminaries:** These are

   i. Title page
   ii. Abstract
   iii. Acknowledgement
   iv. Table of contents
   v. List of tables
   vi. List of figures
2) Introduction
3) Literature review
4) Materials and Methods
5) Results
6) Discussion
7) References
8) Appendix (optional)
Plan B:-

This plan may be necessary if the work is so diverse as to need separate sections. This is not likely for short M.Sc. theses and more often is found in Ph.D. theses. In this plan, the layout is as follows:-

1) Preliminaries (as in Plan A)

2) General Introduction (including literature review)
3) Section 1
   i. Title
   ii. Introduction
   iii. Materials and Methods
   v. Results
   vi. Discussion

4) Section 2
   (Same as in section 1)
There are almost no generally accepted rules for thesis preparation. Different university have their own rules or guidelines about how the text of a thesis or a dissertation should be structured. These must be strictly followed.
• Remember that a dissertation or a thesis is an extended research paper, and all that was mentioned about writing a research paper applies here. Usually, however, there is a Literature Review section, and the Results are presented in a separate section from the Discussion section. Moreover, appendices could be used.
• It is recommended that you begin writing your thesis long before it is due, because it is a long and time-consuming process. Don’t leave everything until the end; write up any set of experiments that has been completed while it is still fresh in your mind. You may need three months on a full-time basis, but because you may not have full-time and your supervisor may not be readily available, allow six months as a minimum.

• You should write the published portions of your thesis as a paper (s) and possibly submit it before you leave the institution.
General convention:

- Italics
- Capitals
- Numerals
- Units
- Abbreviation
- Scientific nomenclature
- Period
- Comma
- Semicolon
- Colon
- Parentheses
- Slant line
- Quotation marks
- Signs
THANK YOU