

EDITORIAL

Guidelines of Writing A Scientific Research Article

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Scientific research is an attentive and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, applications, etc. Qualitative research for instance is a field of inquiry that crosscuts disciplines and subject matters. The discipline investigates the why and how of decision making, not just what, where, when. Hence, smaller but focused samples are more often needed rather than large random samples.

Scientific research in medicine articles provide a method for scientists to communicate with other scientists about the results of their research.¹ Therefore, one of the goals of a scientific research publication is to enable this communication.

The research scientists, unlike other professions, must provide documents showing what he or she did, why it was done, how it was done and what was learned from it. This reproducibility makes science and scientific writing distinctive.^{2,3} However; many good scientists are poor writers. Certainly, many scientists do not like to write.^{4,5}

The main purpose of this review is to share with others ideas about the appropriate way of writing their scientific works, to be accepted for publication; however, it is not possible to offer recommendations that are universally acceptable.

Definition Of Scientific Papers:

A scientific writing means describing and reporting of original research results in journals, through scientific paper standard format. It also includes communication about science through review articles, or other types of professional communications e.g. editorial, case reports, brief communication, grant proposals and oral or poster presentations.² To be accepted for publication a scientific writing has to contribute new knowledge and it has to be perceived and understood by its intended audience or reader.

A scientific writing must qualify as primary literature and must be validly published in the appropriate journals.^{2,6} Here, clarity is very essential that means scientific writing should be as clear and simple as possible “No one wants flowers of eloquence or literary ornaments in a research article” R.B. McKerrow. A clear stated research problem and finally clearly stated conclusions are fundamental for scientific writing.^{2,3}

Organization And Language:

Writing a scientific paper is intimidating; however, a suitable approach makes it manageable. The aim is a good research, clearly presented, where the content and not the style is important for the journal editors or readers. Effective organization i.e. following the standard format and appropriate language are essential for clear and efficient communication.⁶ The best language is that which gives sense in the fewest short words.

Good writing is largely a matter of imitation. Published papers can be used as models. Careful review of copies of highly regarded scientific papers in the research area, including papers in the selected journals for submission, is quite helpful. Careful reading and following the instructions for authors to which the paper is planned to be submitted, is important, otherwise the editor who may have the right to edit the language and referees may assume that this is a sign of previous rejection or, at best, obvious evidence of lack of care. Notice how these papers are written particularly, how sections, subheadings, number of figures and tables are structured.² Revision of the manuscript thoroughly before submission is essential.

Generally, submitted writing should be double space using Arial 11 or Times New Roman 12. Tables and figures are attached at the end, usually not more than four tables or figures. It is advisable in this respect to follow the instruction to author of the intended journal.

Text Preparation:

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A standard format is used for scientific articles, in which the author presents the research in an orderly, logical manner. This doesn't necessarily reflect the order in which one did or thought about the work.^{7,8} This format comprises the following sections:^{9,10}

i- The title:

The title of a paper is a label that usually describes the subject matter or contents of the article. The accuracy of the title influences the indexing and abstracting services heavily and it should be in a form suitable for the indexing systems. Improper title will significantly jeopardize the paper; therefore the terms in the title should be specific enough to highlight the significant contents of the paper.^{2,3}

All words in the title and their association with one another should be chosen carefully and presented with great care. A good title is defined as the fewest possible words that adequately describe the contents of the paper. Sometimes a title that summarizes the results is more effective.¹

The title normally is not a sentence, with the usual subject, verb and object arrangement. This is named "assertive title" and not allowed by most of the journals.⁶

The title length should be reasonable not too short or too long. The long title usually contains "waste words" such as "investigations on..." Articles such as "a" and "an" are also "waste words". On the other hand too short titles include general rather than specific terms.

The order of the words becomes even more important. Most grammatical errors in titles are due to faulty word order, e.g., "Pathogenesis of chemical pneumonia in infants induced by inhalation of kerosene" should have read ". Pathogenesis of chemical pneumonia induced in infants by kerosene inhalation". However, the use of a straightforward title does not lessen the need for proper syntax or language structure.²

Titles should almost never contain abbreviations, chemical formulas, generic names, jargon and unusual or outdated terminology. Series titles or title sub-titles arrangements as well are not allowed today by most of the editors, because of scheduling problems and delay and this system almost always provides considerable redundancy.^{2,3} Therefore, each published paper should present the results of an independent, consistent study. Article titles phrased as questions also can become incomprehensible and so they probably should not be used. The hanging title (similar series title but with a colon instead of a roman numeral) is considerably better, avoiding some of the problems mentioned above.

If the conclusions made in the paper are limited to a particular region, then this region must be named in the title.²

ii- Authors and Addresses Listing:

The listing of authors should include only those who actively contributed to overall design and implementation of the experiments, or any intellectual contribution. Researchers have to take responsibility for papers that have their names on them; otherwise they are unquestionably abusing the system of credit.⁹⁻¹⁰

The order of the names often creates a real dispute. There are no agreed-upon rules or generally accepted convention about this. In the past there was a general tendency to list the senior person or a professor first or often put at the last, as a result, the terminal spot seemed to acquire prestige. To avoid argument some authors agree to list their names alphabetically. The authors should normally be listed in order of their importance to the experiment. A tendency has been to define the first author as a senior author.⁶

The proper and consistent form of authors' names normally is first name, middle initial, and surname. Using only initials would compromise the retrieving system. A full name and a full address should be considered obligatory.^{2,6}

In general, scientific journals do not print degrees after authors' names and do not include titles such as Dr. However, most medical journals do list degrees after names, but degrees are not given in references even in medical journals.⁸

The address serves two purposes, it helps to identify the author; it also indicates how to contact him or her. E-mail address at least for the main author, usually the correspondent author, in case of inquiries should be added. The addresses should be listed in the same order as the authors. New address should be

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indicated in a “Present address” footnote. The papers published by three or more authors from different institutions, each author’s name and address should include an appropriate designation.

iii- The Abstract:

The abstract is a brief summation of a paper. It should be short and simple and not exceed the length specified by the journal (commonly, 250 words) and irrelevant detail should not be included. The abstract often spares the need for reading the full paper. On the other hand, a poor quality abstract will seriously slowed down scientific communication.

The abstract usually summarizes each major section of the paper; introduction, methods, results, discussion and conclusions. A well prepared abstract can quickly, accurately and briefly state the problem, the principal objectives, extent of investigations and the principal conclusions. It can identify the basic content of a document, to determine its relevance to the interests of potential readers.⁴

The abstract should be able to stand alone without any footnotes and it should never give any information or conclusion that is not stated in the paper. The abstract should not include abbreviations or citations. References to the literature must not be cited in the abstract; likewise, the abstract should not include or refer to tables and figures. Terms should not be abbreviated unless a long term is used several times within the abstract.

Most or the entire abstract should be written in the past tense, as it refers to work already done.⁵ It should typically be typed as a single paragraph but some medical journals now run “structured” abstracts consisting of a few brief paragraphs, each preceded by a standardized subheading.

Another common form of abstracts is the indicative abstract or descriptive abstract which is designed to indicate the subjects dealt with in the paper, much like a table of contents. Because of the descriptive rather than substantive nature, this form can seldom serve as a substitute for the full paper and it should not be used as ‘heading’ abstract in research papers. Descriptive abstract is useful in review articles and conference reports and it is often of great value to reference librarians.^{2,8}

iv- Introduction:

The introduction summarizes the relevant literature so that the reader will understand why the researcher was interested in the question he asked. It is meant to supply sufficient background information for easy evaluation of the results. It should also provide the rationale for the present study, stating briefly and clearly the purpose in writing the paper. One to four paragraphs should be enough. The introduction usually ends with a sentence explaining the specific question you asked in this experiment.²

Much of the introduction should be written in present tense as it represents the problem and the established related knowledge at the start of the work.

The following are suggested rules for a good introduction²;

- 1) The main purpose is to introduce ‘the paper’ therefore it should present clearly in a reasonable, understandable, meaningful way the nature of the problem investigated.
- 2) It should state clearly the global, international, national and local magnitude of the problem of the research.
- 3) It should briefly review the relevant literature to orient the reader.
- 4) It should state the method of investigation, and the defense for the reasons of the chosen method.
- 5) It should state the principal conclusions suggested by the results. It is wise not to hold back the findings until late in the paper.
- 6) Any specialized terms or abbreviations should be identified.

In some research areas and journals, scientific papers typically follow only the first three rules. For submission of the paper it is important to structure the introduction according to the target journal style.

So as to keep the literature neat and tidy for the readers you have to mention, usually at the end of the introduction, if part of this work has been published before, or closely related papers have been or about to be published elsewhere.

v- Keyword List:

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The keyword list in addition to those already present in the title is very useful for the indexing and abstracting services. Sensible use of keywords may increase the ease with which interested readers can locate the article.

vi- Materials and Methods:

The scientific method requires that the results be reproducible and the researchers must provide enough details explaining clearly how they carried out their study for a competent worker to repeat their study and reproduce the results. Therefore, the main purpose of this section is to describe in detail the employed method and if necessary to defend the experimental design.^{2,3}

Careful writing of information about the method used highlights the validity and the scientific value of the results and permits the extent of the results generalization. Furthermore, short discrete bits of information in material and methods leads to omission of essential details to the meaning.^{3,8}

Materials should be described with great care. The exact technical specifications, quantities and source or method of preparation should be stated clearly. Sometimes it is even necessary to list relevant chemical and physical properties and not the trade names, unless necessary, of the reagents used. Experimental animals, plants and microorganisms should be identified accurately. Sources should be listed and special characteristics (age, sex, genetic and physiological status) described. Patients' selection criteria and exclusion and an "informed consent" statement should be included in the manuscript. Likewise approval and ethical clearance by the appropriate committee should be noted.

The presentation of information in this section should be organized to enable the reader to understand the logical flow of the experiment(s); subheadings work well for this purpose. To meet the internal consistency of writing the methods and results, the subheadings when possible, should be constructed to match those used in the results. The methods order of presentation is usually chronological. However, related methods should be described together.³

Measurements have to be precisely written and statistical analyses are often necessary, but the data and not the statistics should be featured and answered. Ordinary statistical methods should be used without comment or lengthy description; advanced or unusual methods may require a literature citation. If the method is new (unpublished) provision of all needed detail is a must, if published or unfamiliar, the literature reference should be given. If several alternative methods are commonly employed, it is useful to identify the method briefly and to cite the reference.

Tabular forms and figures are useful in presenting the properties of several data. Table footnotes and figures legends can help in presenting the methods.³

The materials and methods should be written in the past tense and accurate use of language is a must. Always watch for spelling errors, both in manuscript and in the proof. It is advisable to minimize the use of passive voice however; passive voice often can validly be used, as the specification of who did the work is irrelevant. Most journals prohibit the use of first person.⁶

vii- Results:

The result is the core of the paper, as it constitutes the new knowledge. The whole paper must stand or fall on the basis of the results. The writing of the result should be short and engaging and must be presented with crystal clarity, particularly if it is preceded by a well-written section of materials and methods and followed by a well written discussion. There should be no repetition in the text, figures and tables. The redundancy should be avoided.

The result has two components, first an overall description of experiments without repeating these in details. Second, the data should be presented in the past tense. Any determinations, repetitive or otherwise, should be meaningful. If one or only a few determinations are to be presented, they should be treated descriptively in the text, whereas, repetitive determinations should be given in tables or graphs. It is often important to define even the negative i.e., not found aspects of the experiments. Description of statistics methods should be meaningful.²

viii- Discussion:

The primary purpose of the discussion is to show the relationships between observed facts and to highlight the most significant results. This is usually the difficult section to write. The true meaning of the

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data may be completely difficult to understand by the interpretation presented in the discussion. Many papers are rejected by journal editors because of a faulty discussion, despite their valid data.⁴

The essential features of good discussion components may include;

- Presentation of the principles, relationships and generalizations shown by the results without summing up the results.
- Answers must be given to the questions which appeared in the introduction.
- Introduction and discussion should function as a pair, the answers appeared in the introduction has to be answered in the discussion. Failure to address the initial questions commonly afflicts discussions.
- It must point out any exceptions or any lack of correlation and defines unsettled points, without covering up or fabricating non-fitting data.
- It must show how the data and interpretations agree or disagree with previously published work.
- It must discuss the theoretical implications of the work, as well as any possible practical applications.
- The conclusion has to be stated as clearly as possible. Summarizing the evidence for each conclusion.

The discussion should end with a short summary or conclusion adequately discussing the significance of the research.^{2,4}

ix- References:

The rule is to list only significant published references. A paper that has been accepted for publication can be listed in literature citing the name of the journal followed by “in press” or “forthcoming”. All parts of every reference against the original publication must be checked before the paper submission and again at the proof stage.^{2,4}

In manuscript submission it is essential to follow the Instructions for Authors of the targeted journal. Almost infinite varieties of reference styles are used, most journals cite references in different ways, and the most common style is Vancouver style which is emphasized below:

The Vancouver Style of Reference Formatting:

A new acceptable system has to be established for correct and complete referencing of scientific and medical publication. This system has to overcome the ambiguity of old systems and to make uniform and complete citation formats. This will facilitate quotation and reference compilation for researchers and postgraduate students.

The initiation to establish a uniform system for formatting manuscripts and references were started in the conference of Biological Editors in 1960. Vancouver style, a common style for presentation of papers for publication, was adopted in 1979 in Canada by the International Committee of Medical Journals Editors (CMJE). It is also known as: Uniform Requirements for Manuscripts Submitted to Biomedical Journals. This system facilitates formatting scientific papers for more efficient peer reviews and publication.¹¹

The main aspects of Vancouver system can be summarized as follow.

- References should be numbered consecutively throughout the text in the order in which they appear.
- The order of author(s) initials, punctuation, title of article, year, journal title in conventional abbreviation, volume and page numbers constitute a full reference citation.
- No references should be included in the abstract.
- Identify references in the text, tables and legends by numerals in parenthesis e.g. (1), (1, 3) or (3-6).
- If there are three or more authors acknowledge only the first author such as Mohmadani AA et al. Two authors should both be cited. e.g. Mirgani and El Sanosi (2007) stated that..... Note that numerals in parenthesis at the end of a sentence are written before the full stop.
- The list of references should give the numbers which indicate order of citation.
- All authors should appear in the list of references i.e. all references are listed in full.
- The following are examples of commonly used reference formats including punctuation:

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- **Reference in journals:** (Author(s). Title of article. Title of journal (in italics with no full stops) Year; Volume number: Page numbers.^{11,13}
Example: Vokes EE, et al. Head and Neck Cancer. *New Eng J Med*; 1993; 328:184-194.
- **Reference in books (authors of a book.** (Author(s). Title: subtitle. Edition. Place of publication: Publisher; Year.¹¹
Reynolds, E. H. The process of epilepsy: is kindling relevant? In: *The Clinical Relevance of Kindling* (eds T. G. Bolwing and M. R. Trimble), John Wiley and Sons, Chicester. New York. 1989. pp, 149-160.
- **Author(s) of a chapter in a book.** (Author(s) of the chapter. Title: subtitle of a chapter. In: Author(s) (or editors) of the book. Title: Subtitle of a book, Place of publication: publisher; Year; page numbers.^{11,13}
Smith, C.J. 1989. Basal cell carcinomas. In *Histological aspects of cancer*, ed. C.D. Wilfred, pp. 278-91. Boston: Medical Press.
- **Reference on line:** There are innumerable sites on the internet the common available form <http://www.naped.edu/books/0309074029/html>.

Other styles are mainly used in thesis or by some journals such as **Name and Year System, Alphabet-Number System and Citation Order System** are not discussed here to avoid confusion.^{2,4}

Software Manager Reference:

Reference Manager is an online search tool for reference database. It provides a simple way to search on line bibliographic databases and retrieve the references directly into Reference Manager. It can also import data files saved from a variety of online services CD-ROMs and library database. Reference Manager is most commonly used by people who want to share a central database of references and need to have multiple users adding and editing records at the same time. It offers different in-text citation templates for each Reference Type. When writing papers, the researcher may want to have a different in-text citation style depending on the reference type the researchers citing, or journal they are writing for.

Reference Manager Web Publisher allows publishing a reference databases to an intranet or internet site. This allows anyone with a web browser to search and download references into their own bibliographic software. Others can even edit the reference information.

Titles and Inclusive Pages:

To give the article titles in references or not is governed by the journal style. The article title makes it easy for interested readers and librarians to choose among the cited references.

The inclusive pagination is the citing of the first and the last page numbers this may be helpful for potential readers.^{2,11,16}

Journal abbreviations:

This is one aspect of reference citation. The uniform and standard system of abbreviation is now used by almost all the major and secondary services journals. Examples of such universal abbreviations are Bacteriol stands for bacteriology and Physiol stands for physiology. An exception to be remembered is that one-word titles (Science, Biochemistry) are never abbreviated.^{12,14}

Citation in the text:

Some authors get in the habit of putting all citation at the end of sentences. This is wrong. The reference should be placed at the point in the sentence to which it applies. If a reference is worth citing, the reader should be told why.¹⁵

x- Conclusions or Summary

The purpose of the Conclusions section is to put the interpretation into the context of the original problem. Discussion points should not be repeated or irrelevant material included. The conclusions should be based on the evidence presented.

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A summary is unnecessary in most papers. In long papers, a summary of the main points can be helpful, if you stick to the main points only. If the summary itself is too long, its purpose is defeated.

xi- Recommendations.

Scientific papers usually end with a final comment addressing the implications of his findings. Readers expect and always ask what next? Here come the recommendations to suggest certain actions and interventions or suggesting further researches to be carried out on the same field.

xii- Acknowledgements:

This section is optional. It is generally, the last paragraph of the paper. It is the place to acknowledge people, organizations, and financing groups. As simply as possible, the author (s) should thank those persons, other than coauthors, who added considerably to the work, provided advice or any significant technical assistance, or aided materially by providing equipment or supplies. Their titles should not be included. If applicable, grant numbers and sponsors as well as sponsorship under which the work was done, including permission to publish should be stated here. The author (s) should be very specific about related idea, suggestion, or interpretation.

The important element in acknowledgement is simple courtesy. It is wise and always advisable to acknowledgement is to ask the permission of the acknowledged person or company.

Source:

These guidelines were prepared mainly with the aid of Robert Day's entertaining book "How to Write and Publish a Scientific Paper" Robert A. Day and Barbara Gastel: 2006. How to write and publish a scientific paper. 6thed Cambridge University Press (publishers). It would be a valuable addition to your library. The following bibliography is also found very useful. Not exhaustive online sources are cited for further help and orientation. The references listed below are a sampling of the numerous published resources on the topic of researching, writing and assessing research papers.

References:

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- 2- Robert A. Day and Barbara Gastel: 2006. How to write and publish a scientific paper. 6thed Cambridge University Press (publishers).
- 3- Robert S. Day, How to Write and Publish a Scientific Paper, 4th edition, Oryx Press, Phoenix, 1994.
- 4- O'Connor, Maeve. Writing Successfully in Science; Chapman & Hall: New York, 1992.
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- 9- William Strunk, Jr. and E. B. White. The Elements of Style, 3rd ed. Macmillan, New York, 1987.
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- 11- Philadelphia, PA: International Committee of Medical Journal Editors; [updated 2003 Nov; cited 2004 Oct 9]. Available from: <http://www.icmje.org/>.
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SOURCES FOR FURTHER INFORMATION:

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- Chicago style: The Chicago manual of style: for authors, editors and copywriters 15th ed. Univ. of Chicago P, 2003.
- Turabian style: Turabian KL. A manual for writers of term papers, theses and dissertations 6th ed. Univ. of Chicago P, 1996.
- Style manual for authors, editors and printers. 6th ed. Milton, Qld: John Wiley & Sons; 2002. Monash holdings .
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- Day, Robert A. The Development of Research Writing Scholarly Publishing, January 1989, pp 107-115.
- Eisenberg, Anne. Writing Well for the Technical Professions; Harper & Row: New York, 1989.
- Hult, Christine A. 1996. Researching and Writing in the Sciences and Technology. Allyn and Bacon, Boston, MA. 168 pp.

SOME USEFUL RESOURCES ON LINE:

- 1) Instructions to Authors, J. Bacteriol. [<http://jb.asm.org/misc/ifora.shtml>]
- 2) BMJ guidelines for authors [<http://bmj.bmjournals.com/advice/stylebook/basics.shtml>]
- 3) Word usage in scientific writing [<http://www.ag.iastate.edu/aginfo/checklist.html>]
- 4) The International Committee of Medical Journal Editors [<http://www.icmje.org/>].
- 5) Dangling modifiers [http://owl.english.purdue.edu/handouts/grammar/g_dangmod.html]