

Guidelines for Writing a Research Paper

A formal research paper should follow the general format used for a research report published in a scientific journal. It reflects the basic scientific method of asking a question, formulating hypotheses, conducting experiments to test the hypotheses, and interpreting the results. Consult science journals in the library for further considerations.

- Choose a topic that is of interest to you and pertains to a class topic. You will be spending a lot of time with this topic, so you want one that piques your curiosity.
- Make sure that you fully understand the topic of choice.
- Obtain your articles from primary research journals and scientific magazines. This is very important.
- Be careful when writing to avoid misspelled words, run-on sentences, sentence fragments, grammatical errors, and incomplete thoughts. If the sentence/thought is uncertain to you, it will definitely be uncertain to the reader, who may not be familiar with the topic. It is often a good idea to have a "fresh pair of eyes" read through your paper before you turn it in.
- As a general rule, if you write something, you must support it. That means, substantiate your ideas.
- Be sure to include a complete bibliographic notation, and use a consistent formatting method. I am not particular on the format you use, however the notation should include the name of the journal from which it came, author(s), volume number, copyright date or merely the journal date, and the page numbers.
- After reading your abstract, the reader should clearly understand the main ideas of your paper.
- Avoid the use of contractions in formal writing.
- Avoid awkward wording.
- Abbreviations/acronyms must be defined before they are used. Examples: congestive heart failure (CHF), myocardial infarction (MI), and human immunodeficiency virus (HIV).
- Review the difference between the use of colons and semicolons in writing.
- Demonstrate proper English usage, style, and syntax.
- Remember, research paper writing is not a difficult task, but it does require thought, time, patience, and practice.
- This is an interactive process: we will send files back and forth.

I. Title

- The title page should consist of a few well-chosen words indicating the subject of the paper or experimentation. It should be written on a separate page as the title page and should include the name(s) of the person(s) who conducted the experiment as well as the date of the experiment or research. Do **not** write "Title" on your report.

- A. Important variables identified
- B. Appropriate relationship among variables specified
- C. Scope specified
- D. No unnecessary words

Example: “Depositional Environments of the Pictured Cliffs Sandstone, Late

Cretaceousretaceous, near Durango, Colorado” by F.J. Tokar Jr, and J.E. Evans

Example: "Decline in the Index of Biotic Integrity of Delaware Run, Ohio, over 50

Years" by A.J. Gatz, Jr. and A.L. Harig

Example: “A Case Study Examining the Temporal-Spatial Clustering of Polymyositis-

Dermatomyositis in a Northwestern Ohio City” by J. Nath.

II. Abstract

- The abstract is a short paragraph of about 150 words or less that summarizes your experiment or research, and includes pertinent information about your experimental subjects, materials and methods, results, and conclusions. This is the part of the paper readers refer to in order to decide whether they are interested in looking at the rest of the paper.

- The abstract is a meaningful summary of your significant findings. It should be brief, but should be written in complete sentences.

- A. Purpose or hypothesis stated directly or indirectly
- B. Size of sample or population and type of subjects identified
- C. Instruments identified
- D. Experimental design identified
- E. Major results and/or conclusions stated
- F. Appropriate length written in complete sentences

IIIa. Introduction - Context of Problem

- The introduction should include an explanation of the background of the general problem or the area being investigated, telling why this problem is of interest and outlining what information is already known about the problem. It should also present the question you are trying to answer or the hypothesis you are testing.

- A. Background information on the purposes' major variables presented
- B. Background information relevant to the purpose
- C. Background information referenced
- D. Background information provides justification for the purpose
- E. Background information logically organized
- F. Important variables not overlooked in background information

IIIb. Introduction – for Bench-Top Science Study - Purpose/Research Hypothesis

- A. Indicates variables of interest
- B. Indicates relationship/difference among variables to be investigated
- C. Logically deduced from context information
- D. Testable and stated such as to permit collection of data

IVa. Methods – for Research Paper – Data Acquisition

- Describe how a thorough review of the literature was conducted.

- A. Use sources that are contemporary – within the last 5 years. Older sources are okay to provide historical context.
- B. State the type of study. Historical, quantitative, qualitative, or other

IVb. Methods – for Bench-Top Science Study - Subjects/Objects/Organisms

• Write this section in such a manner that it permits duplication by the reader. The audience should be able to perform your experiment just as you have simply by following your instructions.

- A. Size and major characteristics of the accessible population described
- B. Sampling technique described
- C. Sampling technique appropriate for given purpose
- D. The subjects are a representative, unbiased sample of the accessible population
- E. Size and major characteristics of the sample described
- F. Sample size appropriate

IVc. Methods - for Bench-Top Science Study - Instrumentation

• Include a concise description of the materials, and equipment used and brand names of equipment, concentrations and amounts of solutions, species, size or age, sex, and other information about the experimental subjects should be included.

- A. Instruments described in terms of purpose and context
- B. Instrument appropriate for the sample under study
- C. References given for previously developed instruments
- D. Development, administration, scoring, and interpretation discussed if appropriate

IVc. Methods - for Bench-Top Science Study - Data Collection Procedures

• State the procedure in your own words but be concise. A flow chart is often acceptable. Report your procedure as a past event and give enough detail so that someone else could repeat your work.

- A. Discussed in sufficient detail to permit replication
- B. Procedures appropriate for given purpose

V. Results

• Give the results that you found. Present your findings in a logical, not necessarily chronological, order. Tables, graphs, and charts may be used as needed, to clarify points; however, **all** results must be stated in words and then referred to in a table/chart/graph.

- A. Results related to purpose/hypothesis
- B. Tables and figures titled, labeled, and well organized
- C. Results presented in a clear and logical manner

VI. Discussion - Interpretation of Results

- Give your interpretations of the data and relate them to the questions you posed in the introduction. Be careful to avoid making this section just a repetition of the introduction.
 - A. All obtained results must be discussed.
 - B. Correct interpretations made in terms of the research done
 - C. Issue of practical significance is considered

VII. Conclusions

- This should be a separate section. Sometimes you can round off your discussion section with the conclusions that you can draw from your experiments. Did the results answer your questions? Did they support or disprove your hypothesis?
 - A. Conclusions are clearly stated
 - B. Conclusions are related to the purpose/hypothesis
 - C. Conclusions are substantiated by the collected evidence

VIII. Recommendations

- Relate any sources of error that could have altered your results.
 - A. Recommendations are presented
 - B. Recommendations are specific with respect to changes in future research designs, and/or for practical application of the conclusions, and/or next step studies
 - C. Recommendations are appropriate given the introduction, methods, and results of the study
 - D. Recommendation discussion is well organized and may provide suggestions for future research

IX. References or Literature Cited

- All of the sources in the reference list must be cited in the body of the paper and vice versa. Citation of a reference does not entitle you to "lift" passage of text for use in your report. Any such direct quotation must be set off by quotation marks, and the source and page number indicated after the quote. It is preferable to digest the information and to present it in your own words. Alphabetize all references. And avoid plagiarism.

- References to scientific literature should be arranged alphabetically by first author's last name according to the following examples:

JOURNALS: Ackerman, B. 1985 Temporal march of the Chicago heat island. *J.Clim. Appl. Meteorol.* 24: 547-554

Thorp, J., G. Cady, and E.E. Gamble 1959 Genesis of Miami silt loam. *Soil Sci. Soc. Am. Proc.* 23: 65-70

BOOKS: Schmidt, G.D. and L.S. Roberts 1977 *Foundations of Parasitology*. C.V. Mosby Co., St. Louis, MO

CHAPTERS: Dancis, J. and H. Schneider 1975 Physiology: Transfer and barrier function. In: P. Gruenwald (ed.), *The Placenta and Its Maternal Supply Line*. University Park Press, Baltimore, MD. p. 98-124

- References in the text are of the form (Patterson 1993); if more than two authors appear, the form should be Smith et al. (1994), with all authors listed in the References (Literature Cited) section.

A. References are complete and accurate

B. All references cited

C. If you state a fact that was not obtained from your own novel research, you must substantiate it with a reference citation.

D. References used should be current - within the past 10 years

X. Style

- A. Appropriate English usage
- B. Appropriate layout structure
- C. Unbiased reporting style
- D. Do not use contractions in formal writing
- E. When using abbreviations, they must first be identified, and then referred to using the acronym/abbreviation

Examples: "When treating myocardial infarction (MI),... During the MI, ..."

"Tryptic soy agar (TSA) plates were used... The TSA plate showed..."

F. Reports **must** be typewritten.

G. Remember that good writing is more than just getting the facts down.

- Read research articles/reports published in scientific journals to help you get a better "feel" for this type of writing. If at any time throughout this meaningful learning exercise you need additional assistance, please do not hesitate to contact the instructor.

Example Summary of Points

	Component	Weighting
1.	Title	5
2.	Abstract	15
3.	Introduction	30
4.	Methods	30
5.	Results	30
6.	Discussion	30
7.	References	5
8.	Style	5
		150
TOTAL		