

## Reading and Writing Scientific Literature

Pinnacle Science aims to provide authors at any level, open access assistance when writing manuscripts. Understanding how to read and write scientific research is a critical part of the scientific process. Therefore, the following outline has been created and recommended by editors and authors throughout the scientific community as it pertains to reading and writing manuscripts from original research.

An original research paper will typically include the following sections:

1. Abstract
2. Introduction/background
3. Methods
4. Results
5. Discussion
6. References

Each of these sections contain certain information that is critical to understanding the findings of the research.

### The Abstract

Various journals have unique abstract requirements, however, the typical abstract is usually a 200-500 word review of the entire research project and includes a sentence or two at the end of the abstract to outline the main findings of the research. The abstract will generally include brief sections to summarize the paper. The sections typically include an introduction, methods, results, and conclusion section.

#### General information about an introduction section

When reading an introduction, be sure to evaluate the following:

1. Is the review of the literature relevant, adequate cited, and does it correspond to the purpose of the study?
2. Were statements and claims properly supported with references from previous research?
3. Has the author/s correctly presented previous results of research studies?
4. Is the purpose of the study clearly stated?
5. Does the hypothesis logically follow from the introduction?
6. Are the hypotheses clearly stated and are they testable?

Generally an introduction will include 4-6 paragraphs and follow the basic outline below.

### The Introduction

**Opening paragraph** - This paragraph should be an introduction, supported by previous research findings. Typically, key terms or concepts are identified so the reader knows what to expect and the underlying problem or question that the research intends to address. The opening paragraph should give the reader a broad idea about the research and data that will be discussed.

**Compare and contrast paragraph/s** – Reviews what previous studies have shown? This sections will generally compare and contrast the results from previous studies.

**Relevancy paragraph** –This section or paragraph will infer why the research is relevant and important to science (Note: do not specifically state “this is important to science because...xyz). For example, is the idea novel or are the authors retesting an existing hypothesis because of gaps or limitation in previous research? Sometimes authors explain how the methods of a previous study is limited and they briefly explain how certain research is needed to “fill in the gaps.” This section should lead to the PURPOSE statement in the following paragraph.

**Final paragraph** – The final paragraph might summarize the entire literature review in a sentence or two and then lead to the PURPOSE of your research. The purpose statement should then lead to the HYPOTHESIS statement. A sound recommendation is to always avoid 1<sup>st</sup> person language, even when stating the purpose and hypothesis.

## The Methods

The methods section is a critical piece of the manuscript that provides a detailed synopsis of the entire project. The methods section should clearly articulate what was done, how measurements were recorded, what measurement tools were used, etc. The methods section should also include a detailed overview of the statistical analysis which can be found in the last paragraph of the methods sections. When reading or writing the methods sections here a few aspects to consider. The methods should typically include, at minimum, the following subsections (depending on journal requirements):

- Participants
  - Research Protocol
  - Statistical Analysis
1. Who were the participants, how were they selected, what were the age, height, weight, sex, ethnicities, and other relevant characteristics of the participants?
    - Any characteristic is important to report, primarily if it corresponds to the data and helps strengthen the results of the study.
  2. What is the research design?
    - A clear overview of the research design should be stated.
    - The manipulation of each group and/or condition or time points should be clearly explained with thorough details.
    - Any type of data analysis, equation, or algorithm should be clearly explained and presented if central to the data and the results.
  3. Does the research design allow for adequate testing of the hypothesis?
    - Is there a high level reliability and validity of the methods and measurement tools?
    - Validation and reliability studies should be cited when required.
  4. The statistical analysis section should provide a step-by-step overview of the data analysis. The analysis described in this section should describe the way descriptive data was analyzed and reported (e.g., mean  $\pm$  SD), how inferential statistics were utilized to assess changes in dependent variables or outcome variables. A proper data analysis should correctly correspond to the design of the study.

Pinnacle Science recommends that authors consult with a statistician if in doubt about utilizing the proper statistics.

Authors should always check to ensure any flaws, limitations, or gaps in materials or methods that could affect the validity of the study are appropriately addressed. It is plausible to understand that all studies have inherent limitations, flaws, or shortcomings. However, authors should always address these issues or limitations in the discussion section.

## The Results

The results section of the paper is where authors detail the findings from the statistical analyses and report the correct statistics. In this section, the author will explain the data analysis by presenting data tables, graphs, charts and other forms of data imagery. When reading the results section here a few aspects to consider.

1. Which effects or comparisons are statistically significant? Which are not?
  - Is a p-value, significance level, or some type of inferential statistic provided?
  - If required, were effect sizes reported and used to establish the strength of the findings?
  - Are the differences large or small?
  - Are the differences or effects clinical or just statistical?
  - Can the data have real-world impact?
  - Were the appropriate statistics used based on the design of the study?

2. Do the text, tables, and figures match or clearly explain the data?
3. Clarity and accuracy are essential when reporting the results of the study. Ambiguity and misleading tables and figures should not be tolerated in the peer-review process and authors should always double check to ensure the data is presented professionally and accurately.

## **The Discussion**

The discussion section is a written review of the results. The first couple of sentences in the discussion should highlight or review the main findings of the study. A quality review of the main findings should include a basic representation of the main findings by using percent differences, unit differences, etc. as this helps the reader to summarize the findings before a detailed discussion is presented. The following is a good set of questions to ask when reading or writing a discussion section.

1. Does the first paragraph detail the main findings?
  - Note: There is no need to restate the purpose statement or hypothesis in this section.
2. Do the following paragraphs compare the results to previous research?
  - The comparison to previous research may confirm or disconfirm current findings.
3. Do the conclusions follow the results?
4. Does the author offer any inference regarding the results?
  - The author must refrain from using firm language and always avoid straying too far from the data?
  - It is not recommended for authors to make inferences or speculations that are outside the scope of the study and to avoid generalizations not supported by the data.
  - The author should clearly state how the current findings mesh with previous findings?
5. This section should include limitations in the current research and the authors should provide valuable insight regarding future directions of the research.