

How to Write a Scientific Paper

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Outline

- Deciding when/what to write for publication.
- Organizing data and sequence of writing sections of the paper.
- Structure of sections.
- Technical writing.
- Ethical issues and roles of authors, reviewers, and editors.

When/What to Write

- Think about the paper when you first start to think about and to do a project—and keep thinking about it as you proceed with the research. **Discuss authorship right from the beginning of a project.**
- Write when you can tell a story.
- **Make an outline** to see if you have a publishable unit.
- Review articles are highly cited and invaluable to the scientific community; consider writing one!

When/What to Write (cont.)

- **Organize data** (make tables, figures, data conversions, statistics, etc.) and put in order to make a story.
- **Make an outline.** This can be quite general at first, but it should include subsections for Intro, M&M, Results, and Discussion.
- Consider the **title** of the paper.
- Discuss **authorship** over and over and over.
- Decide on a **journal**. Who is the audience? Specialty or general journal?
- Discuss **authorship**.

General Principles

- Start from the Inside and Work Out.
- End at the Beginning.
- Set Writing Goals. What sections or paragraph can be written with the time available? Set aside a specific time and place, maintain regular hours, adhere to realistic goals. Don't end a writing session until you have completed a goal.
- Write as well as possible at first, get the main ideas down, and edit as you go along.

Sequence of Writing the Sections

1. Data (tables and figures)
2. Results (text)
3. Materials & Methods
4. Introduction (3 double-spaced pages or less)
5. Discussion (5 double-spaced pages or less)
6. Abstract (1 double-spaced page)
7. Add reference as you go along

Data/Results

- First, organize your data. Decide which data to include, the order to present each piece of data, and any supplemental data.
- Second, make tables & figures. Use the format for the journal. Perform statistics.
- Third, make any necessary data comparisons with the literature or other analyses.
- Finally, write the text. Just state the results; do not interpret the results.

Materials & Methods

- Provide all details necessary for anyone to reproduce what you did.
- Reference methods as much as possible and describe those elements that are different from the referenced work.
- Give a general overview of what you did even if it has already been described.

Introduction (like a funnel)



- General Topic
- Specific Topic
- Question/Issue
- What you did to address the Question or issue

Introduction

- This should be like a funnel; start with broad, general topics and end with specifics of what you did. No more than 3 double-spaced pages.
- **Start** with the general issues and questions—1 or 2 paragraphs.
- **Next** describe more specific issues, facts, discrepancies, unknowns, questions.
- **Finally**, describe precisely what you have done to answer the questions, issues, discrepancies, or unknowns above. Do not give the results.

Discussion

(like an inverted funnel)



- Specific Issue
- Comparison to literature
- Remaining issues and questions
- Overall summary and conclusions

Discussion

- This should be like an inverted funnel; start with some specifics and have some general conclusions.
- Make an outline the topics/sub-sections of the Discussion.
- Put your work within the context of the literature. Show how your work has extended the literature; interpret your work.
- Note weaknesses, limitations, uncertainties of your work and any conflicts with the literature.

Discussion (cont.)

- Clearly identify new observations.
- Propose future work.
- Provide reasoned speculation.
- The last paragraph should summarize the work and provide general overall conclusions.
- Results and Discussion can be merged for a short paper or to facilitate clarity.

Abstract

- This is the most difficult part to write and should be only one double-spaced page (usually 250-300 word limit).
- Opening sentence or two should identify the question, issue, or topic.
- Next sentence should say how you have addressed the question—say what you did.
- Go through the Results and Discussion sections of your paper, identify all the main observations and describe them concisely in the abstract.
- The last sentence should give the main conclusion of the paper.

Writing a Review Article

- Frequently, the Introduction to a Ph.D. or M.S. thesis (or from a grant proposal) can form the basis of a review article. So, consider writing a review from your Thesis.
- Sometimes when writing the Introduction to a research paper, you realize that there has never been a review of the topic of your research. Consider using your Introduction as the basis for a review.

Writing a Review Article (Continued)

- Do a complete literature search using a variety of data basis (PubMed, Scopus, Web of Science, Google, etc.)
- Obtain and read all the papers—not just the abstracts!
- Organize the papers into categories in order to construct the outline of your review.

Writing a Review Article (Continued)

- Write a brief (1-page, double-spaced) Introduction. Explain the general topic in the first paragraph. Next, explain why the topic is important, and then provide a brief description of the issues/topics/categories that you will be reviewing in the paper.
- Make clear and distinct categories (sub-headings or sections) of your paper based on your outline.
- Synthesize the data and conclusions from groups of papers. Do not make your review a simple listing of results from one paper to the next paper.
- Make tables and figures that summarize the literature or that illustrate the data.

Writing a Review Article (Continued)

- You need to do the work so that the reader does not have to do the work. In other words, you need to read all the papers and synthesize the main points, conclusions, data gaps, needs for additional work, uncertainties in the literature, what is demonstrated and truly “known” and what is still unknown about the topic.
- Write a concise and informative Conclusion that notes all the main points and describes what further work is needed.
- Check all your references to make sure they are correct.

Features of Epidemiology Papers

- Describe and justify study design.
- Provide details of statistical analyses.
- In Conclusions, give strengths and weaknesses of your study.
- Describe data bases used in your study.
- Remember that no epidemiology study is considered definitive until it has been replicated.

Publishing

- Decide when you have a reasonably complete story to tell with your data. Do not publish each small piece of data as a separate paper; try to make a comprehensive.
- Select the appropriate journal.
- Some journals will not permit you to publish a paper in English that you have previously published in another language. Other journals do permit this.

Open-Access Journals

- Open-access journals generally cost the author US\$1000 to \$3000. However, the paper is available to everyone with an Internet connection.
- Traditional journals generally do not cost the author any money—they are free to the author. Instead, it is the reader who must pay (i.e., the reader or library must have a subscription to the journal.) Thus, these papers are not available to everyone.
- Someone has to pay: either author or reader.

Responsibilities of the Author

- Follow the “instructions to authors” for that particular journal.
- Include all information requested in the cover letter (conflict-of-interest statement, funding information, contact information for all authors, contribution of authors, etc.)
- Format the paper as instructed.
- Show the paper to colleagues for comments.
- Submit the paper as instructed.
- Do not commit fraud; be honest.

Resubmitting the Revised Manuscript

- Make the changes you were requested to make or explain why you disagree with the reviewer.
- Address ALL of the comments of the reviewers and editor.
- Be polite and do not use offensive language.
- Sign any necessary copyright forms.
- Check the proofs and return them in a timely manner.

Responsibilities of a Peer Reviewer

- Inform the Editor if you cannot do an unbiased or timely review.
- Inform the Editor if you are not knowledgeable about the topic.
- Respect the fact that your review and the paper you are reviewing is **CONFIDENTIAL**.
- Be critical but fair.
- Provide useful suggestions to improve the paper.

Responsibilities (cont.)

- Comment on the English and note whether editing is required to improve the readability of the paper.
- Make a clear recommendation to the Editor regarding the acceptability of the paper for publication. (Do not make a recommendation to the author.)
- Make separate comments to the Editor that you do NOT want the authors to see.
- Be polite.

Technical Writing

- **That vs. Which.** “That” is a defining or restrictive pronoun; “which” is a nondefining or nonrestrictive one. Always use a comma before “which,” and never use one before “that.” For example, “The *mdfA* gene, **which** codes for a translocase, is missing in this strain.” “The gene **that** codes for the translocase, *mdfA*, is missing in this strain.”

- **Adverbs** (-ly words) are not hyphenated.
Correct: “The study was environmentally relevant.”
- Incorrect: The study was environmentally-relevant.”
- **Compound adjectives** are generally hyphenated.
Correct: “The experiment used 25-mM NaOH.”
Also correct: “The NaOH was 25 mM.”
- Correct: “Jones et al. (2004) found germ-cell mutations in the mice.” Also correct: “Jones et al. (2004) found mutations in the germ cells of the mice.”

- Put a comma before the conjunction (and, or, nor, but, yet) if the second clause is a complete sentence (has a subject and a verb). For example, “The study was complicated, and it took 2 years.” Also correct, “The study was complicated and took 2 years.”
- Put a comma after the conjunction in a series to avoid any confusion. Use a semi-colon to separate a series that contains subsections with commas.

- “The study used PCR; RT-PCR; hybridizations, including competitive and noncompetitive; and microarray.”
- Use a **colon** to introduce a series or new thought but NOT when the word before the colon is a verb. Correct: “The students should bring the following items: a pencil, a notepad, and a computer.” Correct: “The items requested by the teacher were a pencil, a notepad, and computer.”

- “While,” “since,” and “as” frequently imply time, which is not what you intended to imply. Use “whereas” or “although” in place of the first two and “because” in place of “as.” Is this wrong or right?
“Since the samples were concentrated, the results were transformed.”
- Don’t use the word “very” in scientific writing. Instead, state a quantitative result.
- Write short paragraphs.

References

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