

Scientific Writing



Scientific Writing (SW)

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Scientific Writing

We can't all be William Shakespeare or Charles Dickens. But with a little thought and discipline we can improve our ability to describe our scientific work, either in a report for our manager or in a publication for the scientific community.

Why is this important? There are several reasons, but two pressing ones. We want people to read our work and to appreciate what we have done, so our writing needs to be logical, easy to read and free of mistakes. Nobody has the perseverance to read confused, boring material filled with spelling mistakes and grammatical errors.

Managers, and journal referees, are busy people. They have lots of things to do. Referees don't get paid for judging a publication, it's something they do to assist the community and maintain a journal's standards. They don't have time to waste on poorly written, error filled articles. So, if you want your work to be accepted, present it well.

The Introduction

First, why did you do the work? There had to be a reason, you were hoping to solve a problem, or demonstrate a new idea, or fill a gap in scientific understanding. Second, justify your work. This is slightly different from the first point; you want to show why your work was needed. Was it just to measure some values for a client, or to calibrate an instrument, or were you developing a new theory? Third, explain what you did to solve the problem. Finally, summarise how you did it, so the reader knows what's ahead. This is important, as sometimes people need to judge the level of their interest in a topic, do they need (or want) to read the whole story?

The Main Body

The most important consideration here is a logical progression through the material you want to describe. Readers get confused if they have to hop from place to place to follow an argument so structure your description so that it progresses stepwise in a coherent way. Papers reporting experimental work typically include *Materials and Methods*, *Results*, and *Discussion* in their body. This helps you to group your discussion and to organise it sensibly and sequentially. The body of your work is like a roadmap, readers should be able to follow the route, without a GPS, and even glimpse the road ahead (by this I mean that in a well written paper it is frequently possible to anticipate the structure to come (the destination – you have already indicated this in the Introduction).

Materials and Methods

Personally, I believe that this section should be brief, but informative. Do not skimp on experimental detail but don't overcomplicate your writing with flowery language. Describe what you did and how you did it, what instrumentation you used and the methods you used. In my opinion explanations and justifications for choosing the

methods you used, if warranted, belong in the discussion. If there is anything special, unexpected, or novel in your approach you can explain these things early in this section, ideally in the first sentence. The goal is to ensure anyone wishing to repeat sections of your work can do so easily, so descriptions should be meticulous.

Results and Discussion

Results and *Discussion* sections are usually combined. Results make little sense to most readers without interpretation, especially so if you are using them to develop a theory. Each paragraph should contain a message or argument. State this up front and then justify it by showing how your results can be used to enforce the method. This deviates from the normal approach of stating things in chronological order but is more impactful and keeps the reader's attention. So, explain in the first sentence what you want readers to remember from the paragraph as a whole. Focus on what happened and develop your message in the remainder of the paragraph, including only information that is relevant and will convince the readers of your interpretation – don't waffle.

Conclusions

Now's your chance to leave a lasting impression. State the most important results of your work. It is important to not simply summarize the points already made previously — this is your chance to convince the reader that your work is important and interesting. Interpret what you have done and show how you have succeeded in addressing the needs described in the *Introduction*, and to what extent. Don't rehash the previous descriptions, the *Conclusion* must be interesting and memorable for the reader as it is what they will take away from the description of your work.

At the end of your *Conclusion*, critically consider including what could or should still be done to expand the work described in the paper. If it's work that you intend doing, and you wish to indicate this to others ("hands off"), you can use a phrase such as "In the coming months, we will . . ." If you are happy to leave it to others you could say "One remaining question is . . .". If your paper includes a precise and well-structured *Introduction* and an effective *Abstract*, do not repeat points made in the *Introduction* in the *Conclusion*.

Abstract

No scientist can (or wants to) read every paper published. Even in their chosen field it is difficult to keep up. So, scientists select what they feel they need to read by using the Abstract. This helps them decide if they want to (acquire and) read the full paper, and it prepares them for the details presented in the paper. An effective abstract helps readers make these decisions. Because it is typically read before the full paper, the abstract should present what the readers want to know to help them decide if it is necessary to read the full paper.

What information will help convince a reader to read your paper? Typically, readers are mainly interested in the information presented in a paper's *Introduction* and *Conclusion* sections. They want to know why you did the work and what your results were. Then those that are interested and who work in the field might want to know the full details of the work. So, an effective Abstract should focus on motivation and results. It, therefore, should include the most important elements of the paper's *Introduction* and *Conclusion*.

How to prepare a manuscript for International Journals

"I think that sometimes researchers are not trained by their supervisors in writing scientific papers during the PhD period, which is the best time to learn the principles and discipline of publishing". Dr. Angel Borja.

As a whole, there is practically no proper training in scientific writing for chemistry students.

Writing a paper starts well in advance of the actual writing. Is your project relevant and publishable? There are a number of criteria that you can use to test this, ask yourself:

- Have I done something new and interesting?
- Is there anything challenging in my work?
- Is my work related directly to a current hot topic?
- Have I provided solutions to some difficult problems?
- If all answers are "yes," then you can go ahead with your manuscript, and target an international journal with a higher Impact Factor.
- If any of the responses are "no," you can probably submit your paper to a local journal or one with lower Impact Factor.

When considering if your work is publishable, remember that reviewers use questionnaires, provided by the journal editors, which ask questions such as:

- Does the paper contain sufficient new material?
- Is the topic within the scope of the journal?
- Is it presented concisely and is it well organized? Are results presented adequately?
- Are methods and experiments presented in a way that they can be replicated?
- Is the discussion relevant, concise, and well documented?
- Are the conclusions supported by the data presented?
- Is the language acceptable?

- Are figures and tables adequate and well designed? Is their information duplicated? Are there too many?
- Are all references cited in the text included in the references list?

Decide what type of the manuscript to write, you have three options:

- Full articles, or original articles, are the most important papers. They are substantial and completed pieces of original research.
- Letters/rapid communications/short communications are published for the quick and early communication of significant and original research. They are much shorter than full articles (strictly limited in size by the journal).
- Review papers summarize recent developments on a specific hot topic, highlighting important points that have been reported, and introduce no new information. Normally they are submitted on invitation by the editor of the journal.

You need to self-evaluate your work.

- Is it sufficient for a full article, or are your results so important that they should be shown as soon as possible (in a rapid communication)?
- You can ask your supervisor (if you are a PhD student) or a colleague for advice on the manuscript type to be submitted. Remember that sometimes outsiders (i.e. colleagues not involved in your research) can see things more clearly than you.
- Whatever type of article you write, plan to submit only one manuscript, not a series of manuscripts. (Editors hate this practice. Journals have limited space, and a series of manuscripts consumes too many pages for a single topic or an author/group of authors)

A common question is how to select the right journal for your work.

- A common way of selecting the right journal is to look at the articles you have consulted to prepare your manuscript. Many of them may be published in one or two journals.
- Read recent publications in candidate journals and find out the hot topics and the types of articles they accept.
- Consider the high rejection rates of the journals (e.g., Nature, Science, The Lancet and Cell are >90 percent). If your research is not very challenging, focus on more humble journals with lower Impact Factors.
- You can find a journal's Impact Factor on its webpage or via Science Gateway.

- Do not send your manuscript to many journals at the same time. Submit to one and wait for the response of the editor and the reviewers.

After selecting the journal for submission, go to the web page and download the Guide for Authors, print it out and read the guidelines.

- They contain editorial guidelines, submission procedures, fees for publishing open access, and copyright and ethical guidelines.
- Use the Guide for Authors in preparation of your manuscript from the beginning, using the proper text layout, references citation, nomenclature, figures, and tables, etc.
- Editors hate wasting time on poorly prepared manuscripts. This can count against you in the publication process. Don't make the editor angry.

Journals have different structures for their articles (although many follow the same general structure), so consult the Guide for Authors. This structure includes:

- A section that enables indexing and searching the topics, allowing the paper to be easily located by topic, author etc. It consists of the Title, the Authors (and affiliations), the Abstract and the Keywords.
- A section that includes the main text, usually divided into: Introduction, Methods, Results, Discussion and Conclusions.
- A section that includes the Acknowledgements, References, and Supplementary Materials or annexes.

The general structure of a full article follows the **IMRAD** format, introduced as a standard by the American National Standards Institute in 1979:

- **I**ntroduction: What did you/others do? Why did you do it?
- **M**ethods: How did you do it?
- **R**esults: What did you find?
- **A**nd
- **D**iscussion: What does it all mean?

One of the most reprehensible things in science is plagiarism.

- Plagiarism and stealing work from colleagues can lead to serious consequences, professionally and legally.
- Violations include data fabrication and falsification, improper use of human subjects and animals in research, and using another author's ideas or wording without proper attribution.
- It's also possible to commit ethics violations without intending to.

- For more information consult Elsevier's Ethics in Research & Publication website.

As you prepare your manuscript, there are some basic principles you should always keep in mind:

- Have pride in your own work – if you do not value it and take care, why should the journal?
- There is no secret recipe for success – just simple rules, dedication, and hard work.
- Editors and reviewers are busy scientists, just like you. Make things easy for them to save them time.

Useful URLs

- <http://www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993/118519636#bookContentViewAreaDivID>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3626472/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3178846/>

References

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2. A Borja, Six things to do before writing your manuscript, "How to Prepare a Manuscript for International Journals", Elsevier online, 2014 (look up the paper and read)
3. R Murray, Skillful writing of an awful research paper, *Anal. Chem.*, 2011, **83** (3), 633.