HOW TO WRITE A GOOD SCIENTIFIC PAPER

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A good research paper addresses a **specific research question**. The research question or study objective or main research hypothesis is the central organizing principle of the paper.

The task of writing a scientific paper and submitting it to a journal for publication is a time-consuming and often daunting task.

Obstacles of effective writing:

1- lack of experience

2- poor writing habits

3-writing anxiety, unfamiliarity with the requirements of scholarly writing

4-lack of confidence in writing ability, fear of failure, and resistance to feedback.

Steps to organizing your manuscript

1.Prepare the figures and tables.
2.Write the Methods.
3.Write up the Results.
4.Write the Discussion.
Finalize the Results and Discussion before writing the introduction. This is because, if the discussion is insufficient, how can you objectively demonstrate the scientific significance of your work in the introduction?
5.Write a clear Conclusion.
6.Write a compelling introduction.
7.Write the Abstract.
8.Compose a concise and descriptive Title.
9.Select Keywords for indexing.
10.Write the Acknowledgements.
11-Write up the References.

- The topic to be studied should be the first issue to be solved. Define your hypothesis and objectives (These will go in the Introduction.)

- Review the literature related to the topic and select some papers (about 30) that can be cited in your paper (These will be listed in the References.)

1.Prepare the figures and tables.

How do you decide between presenting your data as tables or figures?

Generally, tables give the actual experimental results, while figures are often used for comparisons of experimental results with those of previous works, or with calculated/theoretical values (Figure 1).

Strains	Average of peroxisomal membrane structures per cell
msp1Δ /pex1Δ	2.34 ±1.43
pex1Δ	2.34 ±1.30
msp1Δ /pex2Δ	1.93 ±1.17
pex2Δ	1.76 ±1.05
msp1Δ /pex4Δ	2.1 ±1.11
pex4Δ	1.75 ±0.96
msp1Δ /pex5Δ	3.80 ±1.50
pex5Δ	3.66 ±1.85
msp1Δ /pex6Δ	3.55 ±2.03
pex6Δ	3.15 ±1.75
msp1Δ /pex7Δ	4.7±2.03
pex7Δ	4.05±1.39
msp1Δ /pex8Δ	1.8 ±1.22
pex8Δ	1.9 ±1.15
msp1Δ /pex10Δ	2.20 ±1.19
pex10Δ	1.75 ±0.85
msp1Δ /pex12Δ	1.75 ±1.04
pex12Δ	1.49 ±0.69
msp1Δ /pex13Δ	3.52 ±1.78
pex13Δ	2.26±1.42
msp1Δ /pex14Δ	2.21 ±0.97
pex14Δ	2 ±0.94
msp1Δ /pex15Δ	2.28 ±1.39
pex15Δ	2.19 ±1.16
msp1Δ /pex17Δ	6.05 ±1.70
pex17Δ	5.45 ±1.53
msp1Δ /pex22Δ	5.35 ±2.62
pex22Δ	3.35 ±1.22
msp1Δ /dnm1Δ	5.4 ±2.08
dnm1Δ	4.14 ±1.85

Should you use a table or chart?

	ECOLOGICAL GROUP				
Station	**I**	**II**	**III**	**IV**	**V**
75U	91.3	5.3	3.2	0.2	0.0
75R	89.8	6.1	3.6	0.5	0.0
200R	69.3	14.2	8.6	6.8	1.1
500R	63.0	29.5	3.4	4.2	0.0
1000R	86.7	8.5	4.5	0.2	0.0

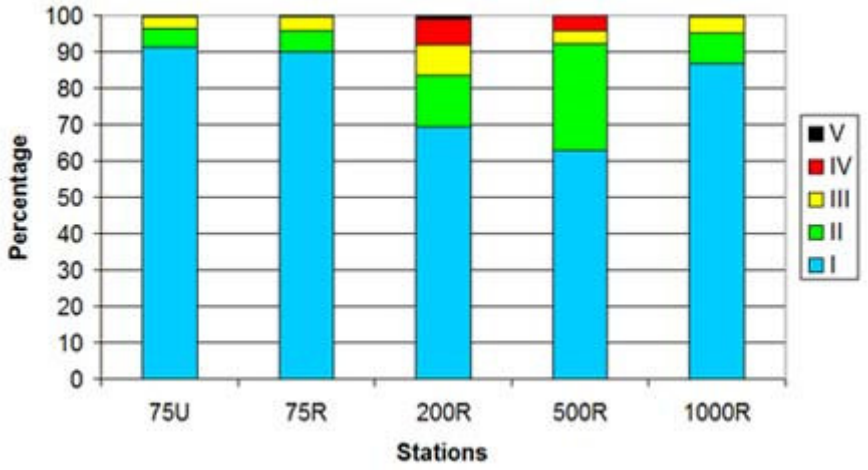


Figure 1. An example of the same data presented as table or as figure. Depending in your objectives,
you can show your data either as table (if you wish to stress numbers) or as figure (if you wish to compare gradients).
Note: Never include vertical lines in a table.

Another important factor: figure and table legends must be self-explanatory

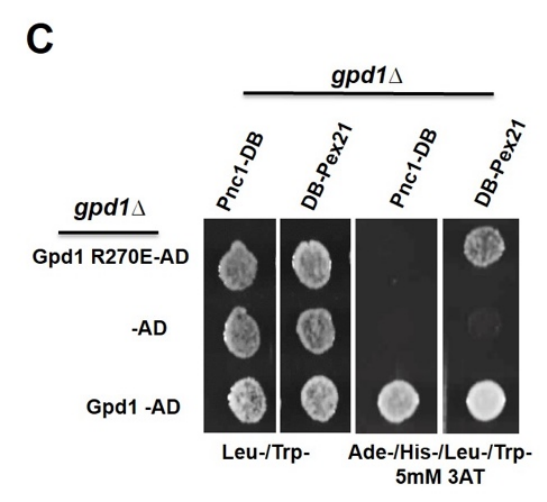


Figure 3-13: Yeast Two-hybrid growth assay to study Pnc1-Gpd1 interaction.Left panel= diploids selected on SD/Leu-/Trp-, Right panel= protein interactions selected on SD/His-/Leu-/Trp- or Ade-/His-/Leu-/Trp- plates supplemented with 5mM 3AT. (C). The BD fusion proteins were expressed in MATα and the AD fusion proteins in MATa cells. The cells were grown overnight in selective medium in 96 well plates. 25µl of each mating partner was mixed with 150µl YEPD andleft to mate for 2 days. The diploids were pinned in selection medium for fusion protein plasmids.
For interaction analysis, diploids were selected on His- or Ade-/His- plates supplemented with 5mM 3A.

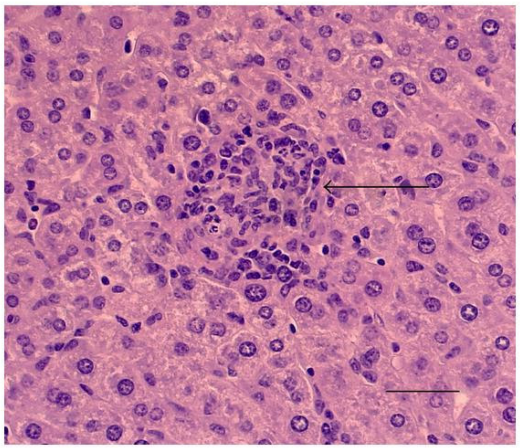


Figure 3

Liver of BALB/c mouse at 30 days of infection by *Brucella ovis*. The mouse was i.p. infected with 10^6 CFU of *Brucella ovis* ATCC25840. Microgranuloma containing predominantly macrophages and neutrophils (arrow). HE. Bar: 100 μm.

If you are using photographs, each must have a scale marker, or scale bar, of professional quality in one corner.

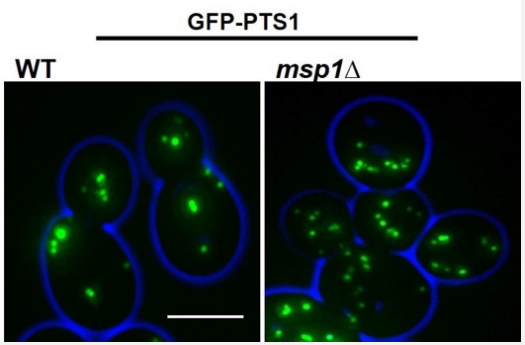
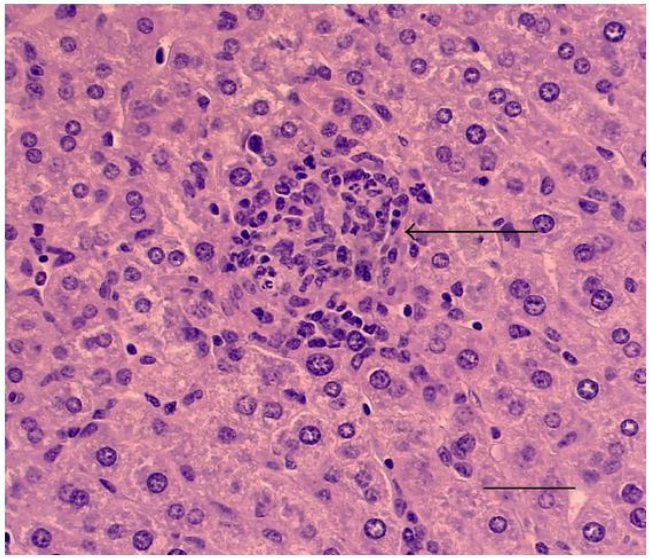
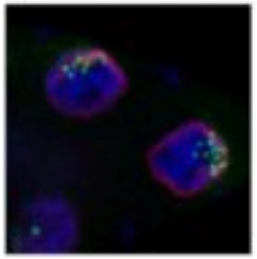


Figure 4-14: Peroxisome distribution between bud and mother cells in msp1Δ cells.WT and msp1Δ cells expressing GFP-PTS1 were grown on glucose medium and analysed with epifluorescence microscopy.
Bar =5µm.

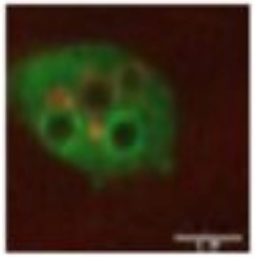
Figure 4: Using scale bars to annotate image size Scale bars provide essential information about the size of objects, which orients readers and helps them to bridge the gap between the image and reality.



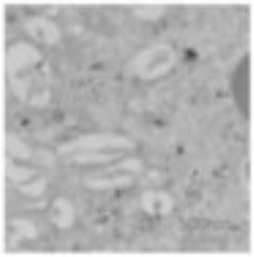
Problem: Poor scale bar examples



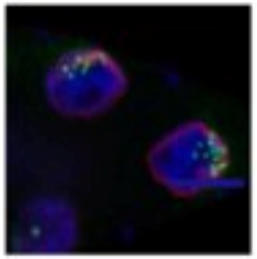
No scale bar



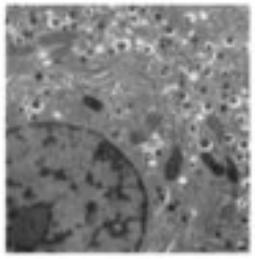
Scale bar illegible, poor compression



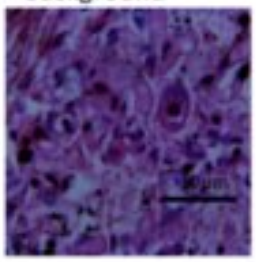
Scale bar blends into the background



Scale bar in color

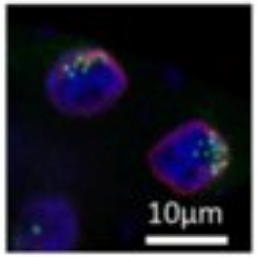


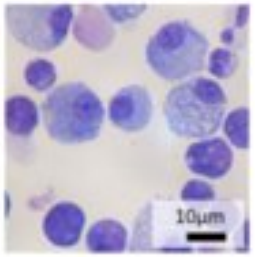
Scale bar too small



Scale bar blends into the background

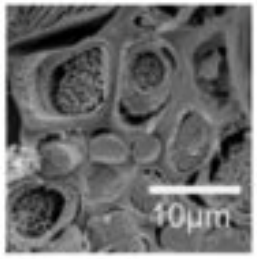
Solutions: Clear scale bar examples

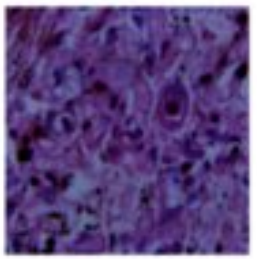




Scale bar stands out against background

Ruler as scale bar, Square: 1cm





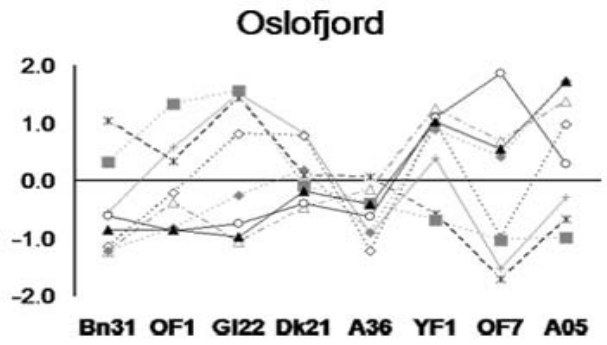
Scale bar below image

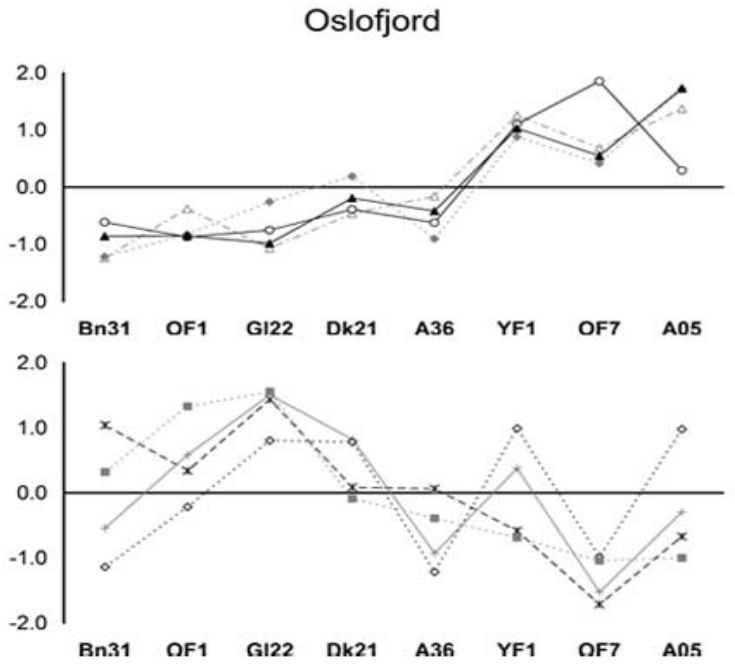
Ruler as scale bar, Square: 1cm

When presenting your tables and figure :

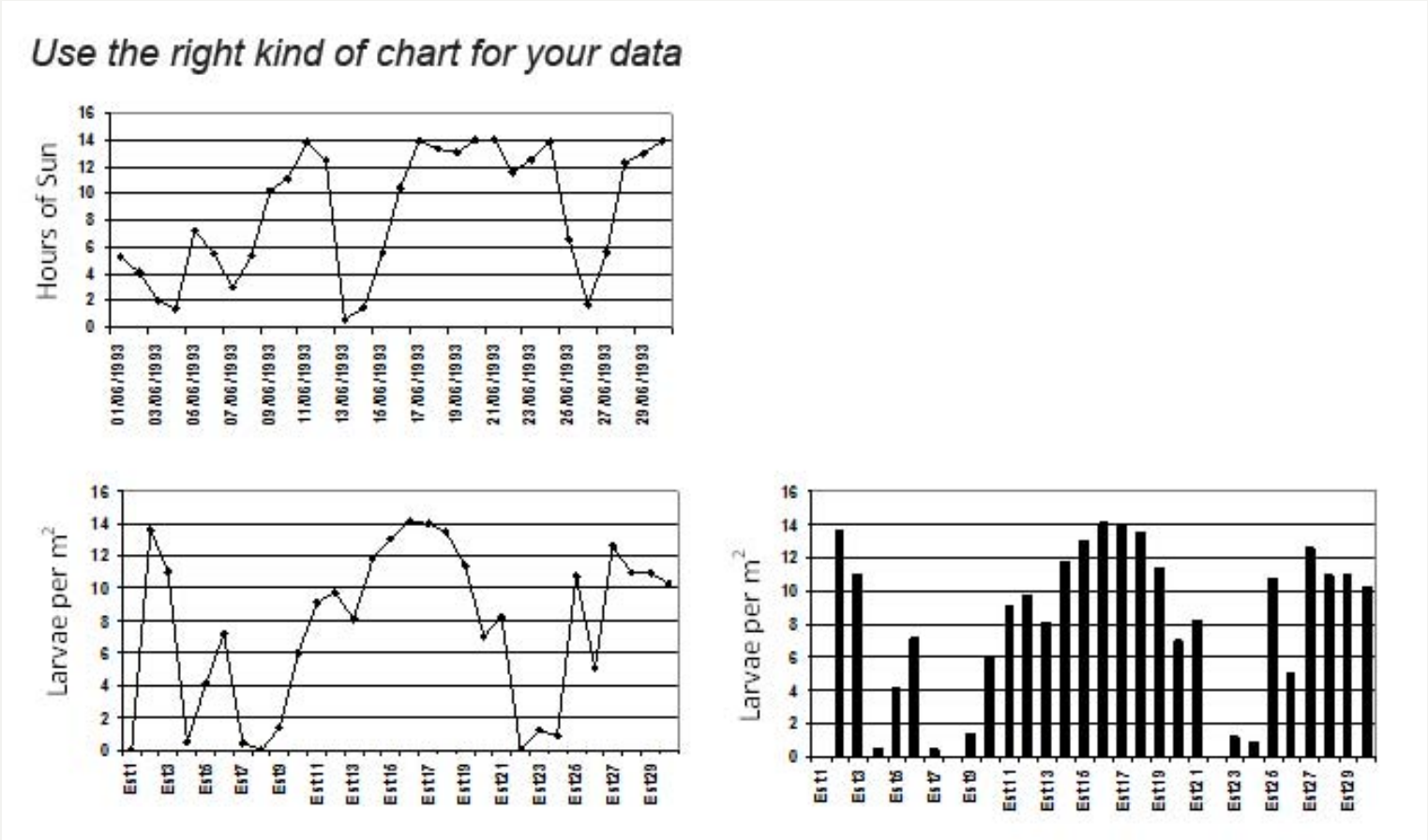
- Avoid crowded plots , using only three or four data sets per figure; use well-selected scales
- Think about appropriate axis label size
- Include clear symbols and data sets that are easy to distinguish.
- Never include long boring tables (e.g., chemical compositions of emulsion systems or lists of species and abundances). You can include them as supplementary material.

Don't clutter your charts with too much data





Another common problem is the misuse of **lines and histograms.** Lines joining data only can be used when presenting time series or consecutive samples data. However, when there is no connection between samples or there is not a gradient, you must use histograms



Step 2: Write the Methods

This section responds to the question of how the problem was studied. If your paper is proposing a new method, you need to include detailed information so a knowledgeable reader can reproduce the experiment.

However, do not repeat the details of established methods; use References and Supporting Materials to indicate the previously published procedures. Broad summaries or key references are sufficient.

Reviewers will criticize **incomplete or incorrect methods descriptions** and may recommend rejection, because this section is critical in the process of reproducing your investigation. In this way, all chemicals must be identified.

Do not use proprietary, unidentifiable compounds.

To this end, it's important to use standard systems for numbers and nomenclature.

Present **proper control experiments and statistics used**, again to make the experiment of investigation repeatable.

List the methods in the same order they will appear in the **Results section,** in the logical order in which you did the research:

Description of the site

Description of the surveys or experiments done, giving information on dates, etc.

Description of the laboratory methods, including separation or treatment of samples, analytical methods, following the order of waters, sediments and biomonitors. If you have worked with different biodiversity components start from the simplest (i.e. microbes) to the more complex (i.e. mammals)
Description of the statistical methods used (including confidence levels, etc.)
In this section, avoid adding comments, results, and discussion, which is a common error.

Step 3: Write up the Results

This step answer the question "What have you found?"

Hence, only representative results from your research should be presented.
The results should be essential for discussion.

However, remember that most journals offer the possibility of adding Supporting Materials, so use them freely for data of secondary importance. In this way, do not attempt to "hide" data in the hope of saving it for a later paper.

You may lose evidence to reinforce your conclusion. If data are too abundant, you can use those supplementary materials.

to keep results of the same type together, which is easier to review and read. Number these sub-sections
for the convenience of internal cross-referencing, but always taking into account the **publisher's Guide for Authors.**

For the data, decide on a logical order that tells a clear story and makes it and easy to understand. Generally, this will be in the same order as presented in the methods section.

An important issue is that you must not include references in this section; you are presenting your results, so you cannot refer to others here. If you refer to others, is because you are discussing your results, and this must be included in the Discussion section.

Step 4: Write the Discussion

Here you must respond to what the results mean. Probably it is the easiest section to write, **but the hardest section to get right.**

This is because it is the most important section of your article. Here you get the chance to sell your data. Consider that huge numbers of manuscripts are rejected because the Discussion is weak.

You need to make the Discussion corresponding to the Results, but do not repeat the results. Here you need to compare the published results by your colleagues with yours (using some of the references included in the Introduction). Never ignore work in disagreement with yours, in turn, you must confront it and convince the reader that you are correct or better.

Consider the following tips:

1. Avoid statements that go beyond what the results can support.

2. Avoid unspecific expressions such as "higher temperature", "at a lower rate", "highly significant". Quantitative descriptions are always preferred (35ºC, 0.5%, $p<0.001$, respectively).

3. Avoid sudden introduction of new terms or ideas; you must present everything in the introduction, to be confronted with your results here.

4. Speculations on possible interpretations are allowed, but these should be rooted in fact, rather than imagination.

To achieve good interpretations, think about:

How do these results relate to the original question or objectives outlined in the Introduction section?

•Do the data support your hypothesis?

•Are your results consistent with what other investigators have reported?

•Discuss weaknesses and discrepancies. If your results were unexpected, try to explain why

•Is there another way to interpret your results?

•What further research would be necessary to answer the questions raised by your results?

•Explain what is new without exaggerating

5. Revision of Results and Discussion is not just paper work. You may do further experiments, derivations, or simulations. Sometimes you cannot clarify your idea in words because some critical items have not been studied substantially.

Step 5: Write a clear Conclusion

This section shows how the work advances the field from the present state of knowledge. In some journals, it's a separate section; in others, it's the last paragraph of the Discussion section. Whatever the case, without a clear conclusion section, reviewers and readers will find it difficult to judge your work and whether it merits publication in the journal.

A common error in this section is repeating the abstract, or just listing experimental results. Trivial statements of your results are unacceptable in this section.

Step 6: Write a compelling Introduction

Introduction and Review of Literature

The introduction is one of the more difficult portions of the manuscript to write. Past studies are used to set the stage or provide the reader with information regarding the necessity of the represented project. For an introduction to work properly, the reader must feel that the research question is clear, concise, and worthy of study.

This is your opportunity to convince readers that you clearly know why your work is useful.

A good introduction should answer the following questions:

- What is the problem to be solved?
- Are there any existing solutions?
- Which is the best?
- What is its main limitation?
- What do you hope to achieve?

You need to introduce the main scientific publications on which your work is based, citing a couple of original and important works, including recent review articles. However, editors hate improper citations of too many references irrelevant to the work, or inappropriate judgments on your own achievements. They will think you have no sense of purpose.

Here are some additional tips for the introduction:

- Never use more words than necessary (be concise and to-the-point). Don't make this section into a history lesson. Long introductions put readers off.
- We all know that you are keen to present your new data. But do not forget that you need to give the whole picture at first.
- The introduction must be organized from the global to the particular point of view, guiding the readers to your objectives when writing this paper.
- State the purpose of the paper and research strategy adopted to answer the question, but do not mix introduction with results, discussion and conclusion. Always keep them separate to ensure that the manuscript flows logically from one section to the next.

Hypothesis and objectives must be clearly remarked at the end of the introduction.

Expressions such as "novel," "first time," "first ever," and "paradigm-changing" are not preferred. Use them sparingly.

Step 7: Write the Abstract

The abstract tells prospective readers what you did and what the important findings in your research were. Together with the title, **it's the advertisement of your article.**

Make it interesting and easily understood without reading the whole article. Avoid using jargon, uncommon abbreviations and references.

You must be accurate, using the words that convey the precise meaning of your research.

The abstract provides a short description of the perspective and purpose of your paper.
It is very important to remind that the abstract offers a short description of the interpretation/conclusion in the last sentence.

A clear abstract will strongly influence whether your work is further considered. However, the abstracts must be keep as brief as possible. Just check the 'Guide for authors' of the journal, but normally they have less than **250 words.**

Step 8: Compose a concise and descriptive title

The title must explain what the paper is broadly about.

It is your first (and probably only) opportunity to attract the reader's attention. **so the first impression is powerful!**

Reviewers will check whether the title is specific and whether it reflects the content of the manuscript. Editors hate titles that make no sense or fail to represent the subject matter adequately.

Hence, keep the title informative and concise (clear, descriptive, and not too long). Here you can see some examples of original titles, and how they were changed after reviews and comments to them:

Example 1

•Original title: Preliminary observations on the effect of salinity on benthic community distribution within a estuarine system, in the North Sea

Revised title: Effect of salinity on benthic distribution within the Scheldt estuary (North Sea)

•Comments: Long title distracts readers. Remove all redundancies such as "studies on," "the nature of," etc. Never use expressions such as "preliminary." Be precise.

Example 2 Original title: Action of antibiotics on bacteria

Revised title: Inhibition of growth of Mycobacterium tuberculosis by streptomycin

• Comments: Titles should be specific. Think about "how will I search for this piece of information" when you design the title

Step 9: Select keywords for indexing

Keywords are used for indexing your paper. They are the label of your manuscript.

avoid words with a broad meaning and words already included in the title.
Some journals require that the keywords are not those from the journal name,
For example, the journal Soil Biology & Biochemistry requires that the word "soil" not be selected as a keyword.

Again, check the Guide for Authors

Step 10: Write the Acknowledgements

Here, you can thank people who have contributed to the manuscript but not to the extent where that would justify authorship.
For example, here you can include technical help and assistance with writing and proofreading. Probably, the most important thing is to thank your funding agency or the agency giving you a grant or fellowship.

Step 11: Write up the References

Typically, there are more mistakes in the references than in any other part of the manuscript. It is one of the most annoying problems. Now, it is easier since to avoid this problem, because there are many available tools.

In the text, you must cite all the scientific publications on which your work is based. But do not over-inflate the manuscript with too many references –
Avoid excessive self-citations and excessive citations of publications from the same region.

You can use any software, such **as EndNote or Mendeley**, to format and include your references in the paper.

Length of the manuscript

Again, look at the journal's Guide for Authors, but an ideal length for a manuscript is 25 to 40 pages, double spaced, including essential data only. Here are some general guidelines:

Title: Short and informative
Abstract: 1 paragraph (<250 words)
Introduction: 1.5-2 pages
Methods: 2-3 pages
Results: 6-8 pages
Discussion: 4-6 pages
Conclusion: 1 paragraph
Figures: 6-8 (one per page)
Tables: 1-3 (one per page)
References: 20-50 papers (2-4 pages)