**Scientific article writing**

**Introduction**

Writing a scientific article can be a more complex exercise than it seems at first glance. Scientific writing has, in fact, its own code which differs from that which applies to utilitarian writing or creative writing. Scientific writing requires short, concise and direct sentences, while more freedom is allowed in literary creation. Scientific writing is also governed by precise rules concerning the presentation and the content to be covered. However, even if it can be complex to master, the dissemination of original research results through the publication of scientific articles is essential to enable the development of knowledge, the improvement of practices and the emergence of debates.

Writing scientific articles is an art that must be mastered and practiced to master it well. This ability to present an argument clearly and logically is a skill that will be useful to graduate students who are moving towards a university or intervention career, as well as to young researchers.

**I. Characteristics of a scientific article**

 **1- Specific subject**

A single main axis (a single conclusion). If the article has two conclusions, it may be better to split it into two articles (article ≠ report).

**2 - Precise language**

• Use of numbers, symbols, equations.

• Objective and neutral text, scientific tone

• Complete and concise: Contains all the details to understand and reproduce the results. (However, does not contain superfluous details).

• Very important terminology used.

• English. English is generally the language used in science.

 3- **Straight to the point**

The main objective is to draw a conclusion.

**II. Steps in writing a scientific article**

**Step 1. Select a topic**

The first step is most important, because the subject you want to write about must motivate you and ideally excite you, since you will spend many hours delving into it. The topics that can be the subject of a scientific article are extremely varied. Keep in mind that a manuscript should provide new information or present known information in a new perspective. The most important criteria for publication are quality, innovativeness, reliability and the scientific or clinical importance of the subject.

**Step 2. Conduct a literature review**

This step allows you to know your subject well and position it within the framework of current scientific literature. You will thus be able to determine the innovative nature of your article and direct your writing in order either to fill a gap in knowledge of a particular field or simply to realize whether or not it is worth writing on the subject. This step also allows you to identify journals that might be interested in publishing your article. This step requires a good search strategy.

If you are writing on a current topic, research is very active in this area or a lot of time has passed between the first literature review and the final version of the article, it is often appropriate to redo overview of the scientific literature when submitting your article so that it is as up to date as possible. You wouldn't want to miss a new key article related to your research, just before submitting your own text!

**Step 3. Choose a mentor**

Especially if this is your first publication, it is very stimulating and useful to be accompanied by a mentor. Choose an enthusiastic model who has several published articles to his or her credit, including some in journals that require peer review, especially if that is your goal. Your mentor will be able to guide you through the publishing process, critique your work objectively, support you during difficult times, and encourage you when your motivation wanes. It is important to consult it regularly to avoid unnecessary waste of time. You can consider it your personal tutor, because writing scientific articles is a developing skill.

**Step 4. Set goals**

Writing planning is essential. From the beginning, it is necessary to set content and time goals. What message do you want to send? The ability to clearly identify your main message allows you to keep the main thread of the article and facilitates cuts in the text if necessary. You must plan the dates for the end of the first draft, meetings with co-authors, and submission of the article. In order to meet the set deadline, you must set aside time, at regular times, to write your article.

**Step 5. Identify your readership, a magazine, a column**

Authors too often tend to postpone this step until the very end, don't make this mistake! Choosing the magazine and the column from the start of the project allows you to better guide the writing of the article and better define the message you want to convey. This precaution can prevent you from having to quickly redirect your article on the eve of its publication. Choosing the journal from the start also makes it possible to better adapt the article to the readership and is therefore part of the objective to be achieved. The opinion of your mentor is essential here, and you should decide together on the most appropriate journal for publishing your article.

Your choice of journal will also depend on the importance of the impact factors. These are evaluated and published annually by the Science Citation Index. Several websites distribute in a more or less legal manner, in terms of copyright, a list of periodicals accompanied by their impact factor. When the choice of journal is made fairly early in the editorial process, it also makes it possible to determine the language of publication, that is to say whether or not it is necessary to use a translator along the way.

**Step 6. Follow the recommendations to authors**

Each journal has its own recommendations for authors. There are various instructions addressed to them, affecting both the form and content of the articles, such as the maximum number of words, tables and figures or references, the sections necessary according to the type of article as well as the format of citations and references. This information is usually available on the journal's website. Their early consultation ensures a correct structure of the article and reduces the work required for the final version. When several authors participate in writing the article, these recommendations also provide a working framework for each. The key here again is to become aware of them early, because respecting these recommendations is one of the sine qua non conditions for the article to be accepted.

**Step 7. Writing the first draft**

It is necessary to read about the subject before starting to write. Once your literature review is completed, you can begin writing the article by drafting a plan including the titles and subtitles. A well-constructed text framework greatly facilitates writing and is one of the key factors in favor of publishing an article.

Each type of article has its own structure. This may vary from one newspaper to another. Hence the importance of consulting the recommendations for authors and the articles already published in the periodical of your choice. Research articles usually all have the same structure. However, it is not necessary to start writing the article with the introduction, instead start with what comes to mind spontaneously, even if it is the body of the text. This starting technique avoids many blockages. In a research manuscript, the “method” section is often the easiest to write, so it serves as a good introduction. As for the introduction and conclusion, you can save them for the end.

As for the writing style to adopt when writing a scientific article, it is said that the most suitable one is an absence of style! It is not a question of adopting a literary or poetic style, but rather of being precise, clear and brief.

In the following paragraphs, we present the elements that each section of an article presenting the results of a research should contain. The sections are presented in the suggested writing order: methodology, results, discussion, introduction, conclusion, references, abstract and exact title.

**1) Methodology (approximately 20% of the text)**

This section is a good starting point for writing an article. It must contain sufficient elements so that the study is reproducible. When applicable to your research, the following elements should be present: data source, sample size, inclusion or exclusion criteria, research protocol, definition of variables, data analysis and statistical tests. Ethical considerations (patient consent, approval by an ethics committee) must also be part of this section. However, you should not present results in this section. In this section, all verbs should be written in the past tense.

Methodology is the foundation of a scientific article. Its relevance and rigor will determine the merits of the adequacy between the results and the evidence they represent. A deficient methodological section may lead to the article being rejected.

2) **Results (approximately 20% of the text)**

Results are the heart of any research article. Present only data that matches the research question. Results must contain data only; no context, literature review or data analysis should be included in this section. This information can be found in the introduction or discussion. In the results section, the presentation of data should follow the order of listing in the methodology. In this section, verbs should also be written in the past tense. Tables, which generally illustrate this part, help organize data to make it more accessible. Figures and tables provide maximum information in a minimum of space and clearly express what is difficult to explain in words.

3) **Discussion (around 40%)**

This is usually the hardest part to write and often the weakest. This section often begins with: “Our study demonstrated…”. Make sure the discussion is supported by reliable data; extrapolation of results should be avoided. Highlight the particular significance of your results, the originality of your findings and the limitations of your study. It is also in this section that you must position your results in the literature and highlight their value. The discussion should also be fluid. The quality and interest of this document reflect the scientific culture and intelligence of the authors. In short, the discussion should focus on three aspects: whether or not the objectives of the study were achieved, the quality and validity of the results and the comparison of the results with those observed by other authors.

4) **Introduction (approximately 10% of the text)**

It presents the state of scientific knowledge at the time of writing the article to allow the reader to understand and evaluate the results that will be presented to them and it provides the justification for the study that you are presenting. Typically, it has three paragraphs. Again, it is not necessary to cite EVERYTHING that has been published on the subject, it is important to select key articles. The hypotheses and objectives of the study are clearly presented here.

In the introduction, the author must absolutely identify:

* The problem;
* The objective of the article (respond to the identified problem);
* The research hypothesis.

**5) Conclusion**

The conclusion, the last section of the article, is sometimes presented in the last paragraph of the discussion depending on the requirements of the journal. It responds to the hypothesis posed in the introduction, synthesizes the results and places them in a scientific context.

The conclusion is short and must follow the following outline:

\* Description of the essential new result, placed for the record in its experimental context, with if necessary, some remarkable numerical values;

\* Synthesis of scientific interpretation and original contribution in the scientific field concerned

\* Remarkable implications for research, for beneficiaries, whether theoretical, practical, broad or specific

\*Outlook. End your articles with an opening towards future areas of research induced by the results presented (these areas must have a direct link with the problem raised in the introduction).

**6) References**

Regarding references, three things are essential: quality, respect for recommendations made to authors and good document management.

The credibility of your article depends largely on the quality of your references. Hence the importance of a good literature review before writing your article. Make sure any statement borrowed from an author is referenced. Favor sources from original results and primary sources. Avoid quoting an author who quotes an author who quotes an author. Only cite what you have read. References must be accessible to the reader, so do not cite a reference that does not meet this criterion.

Make sure that the format of the bibliography, the way of citing references in the text and the number of references comply in all respects with the recommendations made to the authors of the targeted journal and column. The number of references also varies depending on the type of article you are writing.

It is important to avoid numbering the references according to their order of appearance from the first draft, because the final version of the article will be very different from this one. You can, for example, enter the name of the author and the year of publication in parentheses, which makes it easier to find articles than using numbers. Using reference management software, such as Endnote or Reference Manager, can be extremely useful, especially when there are many references.

**7) Summary**

The abstract may be structured or unstructured according to the requirement of the journal. A structured abstract contains various subheadings like Introduction, Methodology, Results, Discussion. The length of the abstract is usually limited to approximately 250 words depending on the journal's requirements.

Although you can write the summary at the beginning or end of your writing process, when you write it at the beginning of your writing procedure, you can make a preliminary assessment of the possible reception of the article and receive criticism constructive by presenting it at a conference. A summary already submitted is a good starting point for the rest of the writing, because it already includes a selection of the main ideas. It is the summary that will make readers want to read the entire article or not.

**8) Exact title**

All potential readers will read at least the title. It must be attractive enough to make them want to continue reading the summary or the full article. The title must therefore be carefully chosen and reflect the content of the article in a precise and concise manner.

It must be short, comprehensive and attractive at the same time. It is usually written last to be representative of the work presented.

There may be a subtitle if the title is too long.

**9) The authors**

Authors are the people who actively participated in the design of the research work. By consensus, the number of authors should not exceed six.

The list of authors must comply with hierarchical classification rules.

The initiator and designer of the project must appear last. The authors who carried out the study and wrote the work, each contributing a significant part, are mentioned first. People who participated further in the study are cited in the acknowledgments.

**10) Keywords**

Keywords are important and informative words of the article content.

**11) Acknowledgments**

Acknowledgments are optional. They are intended in particular for translators, people and organizations who collaborated in the study or were at the origin of the funds necessary for it.

**Step 8. Write the other versions**

From the start, expect to have to write a few versions before arriving at the final version, especially if it is the result of a collaboration of several authors. You should present your article regularly to co-authors along the way so as not to end up with unpleasant surprises in the final version! We recommend keeping the different jets in order to be able to recover the material that was eliminated from previous versions. We strongly suggest saving by date or version number in order to easily find your way through your own versions and those of different authors.

**Step 9. Write the final version**

Writing the final version is a stage of “polishing” the article. Make sure the sentences are simple, clear and short. A sentence that must be read more than once to be understood is worth rewriting. At this stage, try to step out of your role as author and put yourself in that of reader, write what you would like to read. Be critical of your own writing. Read the text aloud to assess its fluency, the organization of ideas, the quality of the language and to spot repetitions.

Check spelling, grammar, verb tenses, units of measurement, inconsistencies or abbreviations. Double-check tables and figures, these present crucial information that must be strictly accurate, as they may be the only results read by readers. Pay attention to details, gross errors undermine the credibility of your manuscript and your chances of publication. Make sure twice rather than once that the recommendations to authors are strictly respected.

**Step 10. Submit the article**

After working so hard, you are finally ready to submit the article! Again, check the recommendations for authors and follow the instructions for submitting the article. Don’t skip steps!

Most journals require a cover letter when submitting the article. This letter must present the article very briefly, indicate in which column you wish to publish it and convince the editor that it is of interest to the readership of his journal. Be honest and modest.

**Step 11. Wait for response**

The response to your article submission may take several weeks, especially if there is a peer review process within the journal to which you submitted your paper. Additionally, any article submitted to a journal that offers peer review is not necessarily accepted outright or when first submitted. The answer could be: positive without revision (5%), positive with revision (45%), negative (50%). Indeed, it is very rare for articles to be accepted without subsequent revision necessary.

Most of those that are accepted will require minor or major corrections. It is necessary to respond with open-mindedness and respect to all reviewers' comments, whether or not proposed changes have been made. It is also necessary to highlight the changes you make to the text. A negative answer is always possible. May it not be a source of discouragement for you! On the contrary, the comments received will allow you to improve your article before submitting it again to the same journal or elsewhere.

**Step 12. Repeat steps 9 (write the final version), 10 (submit the article) and 11 (wait for the response) if necessary**

Regardless of the reviewers' verdict, you will undoubtedly need to repeat these steps. The first submission will necessarily be followed by a second and even several others. If your article was accepted with minor revisions, your work will be relatively easy and quick, but if it was rejected, the work could be arduous and time-consuming. Be prepared for this from the start. Discuss with your mentor whether it is best to attempt a resubmission to the same journal or another. Sometimes the choice to submit the revised article to a less elite journal can be a wise decision.