

How to write a scientific paper

N. Fressengeas

Laboratoire Matériaux Optiques, Photonique et Systèmes
Unité de Recherche commune à l'Université de Lorraine et à CentraleSupélec

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How to write a scientific paper

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how to write a scientific paper



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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. ...
5. **Write** a clear Conclusion.
6. **Write** a compelling introduction.
7. **Write** the Abstract.
8. Compose a concise and descriptive Title.

Plus...



11 steps to structuring a science paper editors will take seriously



How to write a scientific paper

Sports therapy specialists can also tell you

Journal List > Int J Sports Phys Ther > v.7(5); 2012 Oct > PMC3474301

IJSPT INTERNATIONAL JOURNAL OF SPORTS PHYSICAL THERAPY

[Int J Sports Phys Ther](#). 2012 Oct; 7(5): 512–517.

PMCID: PMC3474301

PMID: [23091783](#)

HOW TO WRITE A SCIENTIFIC ARTICLE

[Barbara J. Hoogenboom](#), PT, EdD, SCS, ATC¹ and [Robert C. Manske](#), PT, DPT, SCS, ATC²

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Abstract

Go to: 

Successful production of a written product for submission to a peer-reviewed scientific journal requires substantial effort. Such an effort can be maximized by following a few simple suggestions when composing/creating the product for submission. By following some suggested guidelines and avoiding common errors, the process can be streamlined and success realized for even beginning/novice authors as they negotiate the publication process. The purpose of this invited commentary is to offer practical suggestions for achieving success when writing and submitting manuscripts to *The International Journal of*

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How to write a scientific paper

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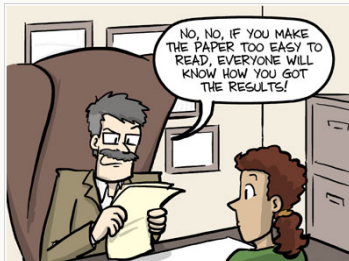
Sign

English Communication for Scientists

PROGRESS

Unit 2: Writing Scientific Papers

As a scientist, you are expected to share your research work with others in various forms. Probably the most demanding of these forms is the paper published in a scientific journal. Such papers have high standards of quality, and they are formally disseminated and archived. Therefore, they constitute valuable, lasting references for other scientists — and for you, too. In fact, the number of papers you publish and their importance (as suggested by their impact factor) are often viewed as a reflection of your scientific achievements. Writing high-quality



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Even YouTube provides tutorials

- Learn how to write scientific papers in under 4 minutes
- How to Write a Paper in a Weekend (By Prof. Pete Carr)
- Judy Swan, Scientific Writing: Beyond Tips and Tricks



A reference work

Nicolae Al. Pop

360

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REVIEW

ECONOMICS

& Sociology

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A REFERENCE WORK ON THE SCIENCE AND ART OF WRITING A SCIENTIFIC PAPER¹

Introduction

Motto:

*„Some think but do not write, others write without thinking;
many think after they write, few write after they think“*

Theofil Simenschy

In the modern world, marked by hyper-competition

N. Fressengeas

How to write a scientific paper, version 1.0.1, slide 4

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Part I

Tools for scientific writing



I Tools for scientific writing

1 A scientific paper

- Papers share the same structure
- References, so important references

2 Separation of content and presentation

- A concept to ease and enhance writing
- $\text{\LaTeX}$, a scientific writing tool
- $\text{\LaTeX}$ How To through practice



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The process of publishing a scientific paper

Choose the right journal

- Get inspired by your university policy
- Choose a journal that is read by your targeted audience
- If you can, choose Open Access journals
- Read the editorial guidelines

Write and publish

- Write your paper this class
- Send it to journal
- Wait for reviewing
- Make corrections if necessary
- Publication occurs if reviewers agree

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Affiliations

Keywords

Article history

Abstract

Contact information

Article reference

A good title will pop up in web searches

File de Cont

European Geriatric Medicine 6 (2015) 573–579



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Research paper

Writing a scientific article: A step-by-step guide for beginners

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1. Background

Every researcher has been face to face with a blank page at some stage of their career, wondering where to start and what to write first. Describing one's research work in a format that is comprehensible to others, and acceptable for publication is no easy task. When you invest a lot of time, energy and often money in your research, you become intimately and emotionally involved. Naturally, you are convinced of the value of your research, and of its importance for the scientific community. However, the subjectivity that goes hand in hand with deep involvement can make it difficult to take a step back, and think clearly about how best to present the research in a clear and understandable fashion, so that others – likely, non experts in your field – can also appreciate the interest of your findings.

Even today, the old adage “publish or perish” remains valid. Many young researchers find themselves under pressure to produce scientific publications, in order to enhance their career prospects, or to substantiate requests for funding, or to justify previous funding allocations, or as a requirement for university qualifications such as a Masters degree or doctoral thesis. Yet, often, young doctors do not have much training, if any, in the art of writing a scientific article. For clinicians, in particular, the clinical workload can be such that research and scientific writing are seen to be secondary activities that are not an immediate priority, and to

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The first page of a scientific paper

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Institutions are touchy on
affiliations



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Keywords index your paper on a worldwide basis: get them right

— end of Course —



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Dates ! Who was the first ? How long was it reviewed ? Date of publication ?

European Geriatric Medicine 6 (2015) 573–579

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Research paper
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The abstract is an ultra short summary of the paper emphasizing new findings

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Even today, the old adage "publish or perish" remains valid. Many young researchers find themselves under pressure to produce scientific publications, in order to enhance their career prospects, or to substantiate requests for funding, or to justify previous funding allocations, or as a requirement for university qualifications such as a Masters degree or doctoral thesis. Yet, often, young doctors do not have much training, if any, in the art of writing a scientific article. For clinicians, in particular, the clinical workload can be such that research and scientific writing are seen to be secondary activities that are not an immediate priority, and to

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With this in mind, we present here a step-by-step guide for writing a scientific article, which is not specific to the discipline of geriatrics/gerontology, but rather, may be applied to the vast majority of medical disciplines. We will start by outlining the main sections of the article, and will then describe in greater detail the main elements that should feature in each section. Finally, we will also give a few pointers for the abstract and the title of the article. This guide aims to help young researchers with little experience of writing to create a good quality first draft of their work, which can then be circulated to their co-authors and senior mentors for further refinement, with the ultimate aim of achieving publication in a scientific journal. It is undoubtedly not exhaustive, and many excellent resources can be found in the existing literature [1–7] and online [8].

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A certain amount of preparatory work needs to be done before you ever write a word of your article. This background work should generally already have been accomplished by the time you are at the writing stage, because it also serves as background to the research project you are writing about. All the time you invest in preparing the protocol for your project is an advance on the writing

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The first page of a scientific paper

- Informative short title
- Ordered author list
- Affiliations
- Keywords
- Article history
- Abstract
- Contact information
- Article reference

How you can be contacted for
further information



Foto di Corsi

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Research paper

Writing a scientific article: A step-by-step guide for beginners

F. Ecarnot^{a,*}, M.-F. Seronde, R. Chopard, F. Schiele, N. Meneveau

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ABSTRACT

Many young researchers find it extremely difficult to write scientific articles, and few receive specific training in the art of presenting their research work in written format. Yet, publication is often vital for career advancement, to obtain funding, to obtain academic qualifications, or for all these reasons. We describe here the basic steps to follow in writing a scientific article. We outline the main sections that an average article should contain; the elements that should appear in these sections, and some pointers for making the overall result attractive and acceptable for publication.

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The paper body

Sections, subsections, figures & tables

- Introductory section
- Sections and subsections
- Self-consistent figures
- Self-consistent tables

The introductory section sets the paper background. It can, or not, have a title.

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of the article that will come out of your project. Then, you probably already performed an extensive literature review to establish the current state of knowledge on the topic, and ensure the originality of your research when developing the protocol, and this can serve for your paper. It is helpful, when you are reviewing the literature, to take notes of important points or phrases that you intend to include in your article, with the relevant references. A software program for managing references (either free versions or commercially available products) can be helpful for managing the large volume of references that you are likely to wade through before citing the most important points.

Usually, you will also have the final results of the statistical analysis of your data. This will form the basis of your results section. Some of the graphical representations of your results will serve as figures for the article, so it is helpful to highlight the most important findings as you read through the results so that you do not forget anything important.

Before starting to write, you should identify the target journal in which you intend to submit your research. This will have consequences for the formatting, but more importantly, for the orientation of your writing style, since the writing must be appropriate for the type of reader you are targeting. For example, are you targeting a specialist journal, where readers are expected to be experts in your field, or a general medicine journal, where readers may be experts from other disciplines? This will have implications for the amount and type of information that you must include. In addition, the editorial policy of the target journal should also be taken into account. For instance, in a given area of expertise, some journals favour papers reporting basic research, whereas other journals give precedence to more clinical work. The choice of a target journal depends on a range of factors, which are beyond the scope of this article. However, at the very least, you should check that your paper falls within the scope of the journal you have chosen.

3. What are the main sections of a scientific article?

The vast majority of scientific journals follow the so-called "IMRAD" format, i.e., introduction, methods, results and discussion. Naturally, there are some exceptions to this rule, and you should always check the instructions when you plan to submit your paper to ensure that this is indeed the recommended format. For the purposes of this guide, we will only discuss the IMRAD format, as it is the most widely used.

Your article should thus contain (in this order) an introduction, a methods section, a results section and a discussion. Added to this will be the abstract, which is more or less a summary of these main sections, and of course, the title. At the end, there must be a list of bibliographic references, the tables, and the legends to any figures. Finally, there may also be some other optional sections, such as acknowledgements, conflicts of interest or authors' contributions.

Below, we will discuss each of these sections in detail, outlining the main points to keep in mind when writing them.

3.1. The introduction section

The introduction is of prime importance in grabbing the reader's attention (Table 1). In particular during the review process, the introduction must get the reviewers "hooked", wanting to read more, and thinking to themselves, "How come I never thought of that?". In this section, you will thus explain why you undertook your study, what you aimed to achieve with it, and how this constitutes a useful addition to the existing body of evidence on this topic.

In concrete terms, you should start by explaining briefly, using appropriate references, what is already known about this subject. You should then narrow the field down somewhat and identify the areas where there is still some uncertainty, citing, where appropriate, any previous (and possibly conflicting) data. This will logically lead to a description of an explicit gap in the knowledge that your study hopes to fill. This is an essential element in justifying the utility of your work. Having now explained how your study is going to contribute something new and useful, you should clearly state your working hypothesis, followed by your objective(s), and very briefly, the strategy implemented to achieve these goals (Table 1).

In the background, the reasons that prompted you to undertake your research should be clear to the reader, and justified by the state of scientific knowledge with appropriate references. It is not necessary to write an entire article in the literature on the topic; a careful selection of the most pertinent publications is sufficient. Similarly, it is not necessary to state everything that may seem over simplistic or eminently obvious. Yet you should try to achieve a suitable balance between relevant background information, and executive detail. In this regard, you should keep in mind the target audience you are aiming for. This will depend on the profile of the readership of the journal in which you intend to submit your research, as mentioned above. If you are targeting a specialist journal, then your background can be more detailed and technical than if you are addressing an audience of non-specialists in your field.

The introduction should logically flow towards the identification of the gap in knowledge that you hope to fill. This is your opportunity to state the added value of your study, or the new information that your study will yield. Will your results change clinical practice? Will they help the scientific community at large to move towards consensus on a previously controversial topic? By providing hard evidence in one direction or the other? This is your chance to make a sales pitch for your article in the appropriate terms, of course.

As far as possible, try to avoid diverging from the subject at hand. Every sentence should serve a purpose. Many journals have a limit on the length of the introduction, with a maximum number of

Table 1
Outline of the main features of the introduction section, with examples.

Feature	Example
Background describing what is known on the subject	Peritoneal cavity intervention is the cornerstone of therapy for acute non-traumatic epistaxis, but may be associated with procedure-related complications.
What is not known? What elements are still subject to controversy? What is the exact gap in the knowledge that your study hopes to fill? Cite any existing data, especially conflicting data that make controversy	It remains unknown whether: To date, it has not been proven... ...study to date has investigated the effect of... There are few data to quantify... The effect of... remains unclear
Objective (i.e., working hypothesis). Cite the exact parameter you plan to measure. Cite the type of patient population or clinical context. Cite any secondary objectives.	We hypothesized that the administration of... would induce... in the context of... The effect of... on... Through a prospective, single-blind, randomised, observational/interventional study

The paper body

Sections, subsections, figures & tables

- Introductory section
- Sections and subsections
- Self-consistent figures
- Self-consistent tables

Sections are compulsory, except in letters. Subsections are not.

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In concrete terms, you should start by explaining briefly, using appropriate references, what is already known about this subject. You should then narrow the field down somewhat and identify the areas where there is still some uncertainty, citing, where appropriate, any previous (and possibly conflicting) data. This will logically lead to a description of an explicit gap in the knowledge that your study hopes to fill. This is an essential element in justifying the utility of your work. Having now explained how your study is going to contribute something new and useful, you should clearly state your working hypothesis, implemented to achieve these goals (Table 1).

In the background, the reasons that prompted you to undertake your research should be clear to the reader, and justified by the state of scientific knowledge with appropriate references. It is not necessary to include any literature on the topic; a careful selection of the most pertinent publications is sufficient. Similarly, it is not necessary to state certain truths that may seem over simplistic or eminently obvious. Yet you should try to achieve a suitable balance between relevant background information, and excessive detail. In this regard, you should keep in mind the target audience you are aiming for. This will depend on the profile of the readership of the journal in which you intend to submit your research, as mentioned above. If you are targeting a specialist journal, then your background can be more detailed and technical than if you are addressing an audience of non-specialists in your field.

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As far as possible, try to avoid diverging from the subject at hand. Every sentence should serve a purpose. Many journals have a limit on the length of the introduction, with a maximum number of

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What is not known? What elements are still subject to controversy? What is the exact gap in the knowledge that your study hopes to fill? Cite any existing data, especially conflicting data that make controversy	It remains unknown whether: To date, it has not been proven... ...study to date has investigated the effect of... The effect of... remains unclear
Objective (i.e. working hypothesis). Cite the exact parameter you plan to measure. Cite the type of patient population or clinical outcome. Cite any secondary objectives.	We hypothesized that the administration of... would reduce/increase... in the course of... There are few data to quantify... Through a prospective, single-/multi-centre, observational/interventional... study

The paper body

Sections, subsections, figures & tables

- Introductory section
- Sections and subsections
- Self-consistent figures
- Self-consistent tables

Figures are self-consistent and have numbers and captions. They are placed above or below the text.

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Table 1

The main elements to be included in a successful title.

Feature	Example
Cite the main factors studied	State the name of the drug or intervention
Cite the population/context studied	In acute myocardial infarction/low-risk primary prevention/early phase septic shock
Cite the design	Randomised, double-blind, controlled trial/observational study/case-control study
Cite the main finding	Increases/decreases/prevents...
Put the most important aspect first	If the focus is on the intervention, because this is what distinguishes your article from others, then state the title with the intervention name
Avoid imperative formulations that serve no specific purpose for international consensus documents for drug names	Avoid terms such as "a report of..." or "the effects of...". If there are effects, state what they are! (Clinical trial, therapeutic, prognostic...)
	Commercial names should be avoided. They indicate proprietary (if the pharmaceutical company), and may be confused as indirect preference for a particular company. Also, they are not always the same across different countries
	Reverse subtitles for names of study groups. Specific recommendations may apply, depending on your target journal

examples of what constitutes an efficacious title. Bear in mind that your target journal may have a limit (in terms of number of words or characters) on the length of the title. Here again, keeping it short is harder than coming up with a 4-line title.

3.7. References

The reference section lists all the sources you have used as a basis to prepare your hypothesis, and build your research. It is your ethical and professional responsibility to document your work adequately, and provide full transparency in identifying your sources. It is also imperative to cite the sources on which your hypothesis are based, to prove that they are in fact sound. The references support your work and place it in the context of other studies on the same topic, while at the same time providing guidance for readers who would like to engage in further reading on the topic.

Many young researchers find it hard to judge when it is necessary to cite a reference. Basically, any idea or fact that emanates from another source (other than yourself) needs to be

supported by a reference. However, universal truths or facts that are widely established do not need to be referenced (e.g. cardiovascular disease is very common, or cancer is a major cause of death). However, ideas, or more particularly phrases or names that were coined by someone else do need to be referenced (e.g. patients with the "McConnell Sign" – The paper by McConnell describing the sign should be cited here. Or, patients were classified according to the BAKC criteria – the paper describing the BAKC criteria should be cited here).

When citing references, apart from specific papers that give their name to a sign or classification system as in the examples above, you should give precedence to articles published in English-language, peer-reviewed journals. Citing sections from published books is also acceptable, but you must be very specific and list the exact names and titles of the chapters concerned, with the page numbers, and the names of the authors and/or editors of the book, with its publication details.

Internet sites should be avoided where possible, as should personal communications and unpublished data. If you have several possible references, you may prefer to choose the most

Title citing Drug/Intervention, Context, Design & Main Finding: Use subtitles sparingly for study group names	
Abstract: Comprehensible by itself. Introduction, methods, results, conclusion.	
Introduction	Include current state-of-knowledge, with references. Identify the gap in knowledge that you wish to fill with your study. Outline objectives (primary and secondary).
Methods	Describe in detail what you did, and how. Detail selection criteria for study population. Describe the main interventions, analyses, techniques... Detail endpoints (primary and secondary). Ethical considerations must be outlined. Statistical methods to be described in dedicated paragraph.
Results	Describe study results. Avoid commentary and false pretensions. Give a result for every method presented in previous sections. Use appropriate illustrations (Tables and Figures).
Discussion	Start with recap of your main finding. Put your results in perspective with other reports in the literature. Explain significance of results, and how they contribute to the state-of-knowledge, or to new advance knowledge. Outline strengths and limitations.
References	List all sources used as a basis for your work. Check accuracy of all references, even if copied from other papers.

Fig. 1. Summary of basic guidelines regarding the items to include in each section of a scientific manuscript.

The paper body

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Tables are a special type of figure,
with separate numbers.

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Cite the main finding	Increased survival/prevention...
Put the most important aspect first	If the focus is on the intervention, because this is what distinguishes your article from others, then state the title with the intervention name
Avoid imperative formulations that serve no specific purpose	Avoid terms such as "a report of..." or "the effects of...". If there are effects, state what they are
Use international common denominators for drug names	Chlorazepate, Tegaserod, paracetamol
	Commercial names should be avoided. They indicate proprietary (if the pharmaceutical company), and may be confused as indirect preference for a particular company. Also, they are not always the same across different countries
	Reserve subtitles for names of study groups. Specific recommendations may apply, depending on your target journal

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Abstract: Comprehensible by itself. Introduction, methods, results, conclusion.	
Introduction	Include current state of knowledge, with references. Identify the gap in knowledge that you wish to fill with your study. Outline objectives (primary and secondary).
Methods	Describe in detail what you did, and how. Detail selection criteria for study population. Describe all tests, interventions, analyses, techniques... Detail endpoints (primary and secondary). Ethical considerations must be outlined. Statistical methods to be described in dedicated paragraph.
Results	Describe study results. Avoid commentary and false pretensions. Give a result for every method presented in previous sections. Use appropriate illustrations (Tables and Figures).
Discussion	Start with recap of your main finding. Put your results in perspective with other reports in the literature. Explain significance of results, and how they contribute to the state-of-the-art of knowledge, or to new advance knowledge. Outline strengths and limitations.
References	List all sources used as a basis for your work. Check accuracy of all references, even if copied from other papers.

Fig. 1. Summary of basic guidelines regarding the items to include in each section of a scientific manuscript.

The paper end

Conclusion, acknowledgments and references

- Conclusion
- Acknowledgments
- Other mandatory sections
- References

The conclusion summarizes the main findings

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recent one, or the one published in the most reliable and reputed source journal. Try to give priority to original research articles, rather than reviews. If you want to cite an idea from a paper where the authors already cite another source for the same idea, then you should return to the original article and verify the exactitude of what you are citing, then cite the original authors, not the intermediate paper. It is your responsibility to ensure the accuracy of all the references you cite, and it is up to you to provide sufficient detail so that a potential reader can find that paper. You should check the accuracy of every reference yourself, even those that you have taken from other published papers. It is not the job of your chosen target journal to format your references or verify their exactitude.

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Funding

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Disclosure of interest

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Authors' contributions

Drafted the manuscript: FE.

Reviewed for critical content and approved final content: all.

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I Tools for scientific writing

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2 Separation of content and presentation

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The need for references

Standing on the shoulders of giants

A scientific issue

In a scientific paper, *all sayings* must be

- either demonstrated,
- or taken from an identified **referenced** source.

A network issue

The way papers are linked through proper referencing

- shows the links between scientific domains,
- shows how people work together,
- provides a world-wide basis for scientific knowledge^a.

^aSee wikicite, crossref & the initiative for open citations

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Do not forget the references

Researchers and advisors are touchy about references

An acknowledgment issue

Using other people work without citing it properly is **BAD**.
A good citation allows to find the way to the original work.

An evaluation issue for researchers

The quality of a researcher's work is often evaluated on the
number of times her/his papers are cited.
Career and salary may depend on it.

A reputation issue for institutions

International ranking is often based on papers citations rather than
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Institutions issue affiliation rules to ensure proper automatic
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Reference management

Real time tracking of the papers you read to ease proper referencing upon writing

Zotero

UL favorite

- Keeps tracks of web searches as you read
- Keep references in collections
- Allow participative work on a reference collection
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Many other reference managers exist

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Focus on content, not on presentation

All journals have different guidelines for presentation, though all articles share the same structure

Journal articles share the same structure

- All journal articles have title, authors, affiliations, abstract, references. . .
- which are **typeset differently**, depending on the journal.

Scientific writing is focusing on content

- OK for writing a short descriptive title, a meaningful abstract and properly referencing others work
- But who cares about character font or size and paper layout ?

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Markup languages: a universal solution

XML, HTML, WikiML, SVG, PDF... and $\LaTeX$

Specify **what** things are, not *how*

This is a title

```
\title{My really neat short and descriptive title}
```

Abstract example

```
\begin{abstract}
A good research paper can be hampered by a poor abstract.
The students following this class should thus focus on
paper content rather than on its layout, so that they
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OK, I specify what things are

Who will specify how things are ?

The rendering job is done by a software, upon your directives

- The web browser renders the HTML language

- L^AT_EX renders this presentation as directed:

```
\documentclass{beamer}
\mode<presentation> {
  \usetheme{Warsaw}
  \usecolortheme{wolverine}
  \setbeamercovered{dynamic}
}
\usepackage[frenchb,english]{babel}
\usepackage[utf8]{inputenc}
\usepackage{xcolor}
\usepackage{listings}
\title{How to write a scientific paper}
\author{N.~Fressengeas}
...
```

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Portability: another advantage of Markup languages

In the HTML world

Think of responsive websites which can be rendered differently on computers and smartphones using the same source code

In the $\text{\LaTeX}$ world

- The same $\text{\LaTeX}$ code can render articles for different journals
- $\text{\LaTeX}$ code is plain text, available on all platforms
- $\text{\LaTeX}$ code is stable through time
- $\text{\LaTeX}$ can, in some conditions, be converted to HTML



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$\LaTeX$, a typesetting system

Read more: The not so short introduction to $\LaTeX$ or Une courte (?) introduction à $\LaTeX$

Origins

- Written originally in 1983 by Leslie Lamport
- Uses $\TeX$ for typesetting
- Free open source software
- Current $\LaTeX$ engine: pdf $\LaTeX$

$\LaTeX$ step by step

1. Use your favorite text editor to produce $\LaTeX$ code
2. Run the pdf $\LaTeX$ engine on the source code to get the PDF



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$\text{\LaTeX}$ all-in-one writing environment

TeXStudio, Kile, TeXShop, TeXMaker, WinEdt, TeXnicCenter. . .

All-in-one environments simplify the use of $\text{\LaTeX}$

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- Multiple file management
- Spell-checking
- . . .

Collaborative online environment

- Overleaf for collaborative $\text{\LaTeX}$
- CoCalc for a collaborative environment including $\text{\LaTeX}$ and various scientific softwares, allowing interactions between them^a

^aFor example: embed R, sage ou python calculations in $\text{\LaTeX}$

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L^AT_EX, dedicated to scientists

A few features

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A state-of-the-art typesetting system will do the presentation for you

Neat equation rendering

```
\[ \sum_{n=1}^{+\infty} \frac{1}{n^2} = \frac{\pi^2}{6} \]
```

$$\sum_{n=1}^{+\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$$

Journal specific class files

Specifying the journal as your document class will set lay-out up for you

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My first article

```
\documentclass[12pt]{article}
\title{My very first article in \LaTeX}
\author{Nicolas Fressengeas}
\begin{document}
\maketitle
\begin{abstract}
This is my very first article in \LaTeX. I
    will thus try to keep this abstract
    short
\end{abstract}
An introductory material can come before
    the first section
\section{\LaTeX\ is so great}
I love using \LaTeX. That is the reason why
    this section is named this way.
\section{Make the students understand it}
There is simply no other way to write, or
    beam, science. May my students
    understand this after this class !
\section{Conclusion}
This is nearing to the end of the first
    part of this class dedicated to tools
    . Now is the time to practice, before
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\end{document}
```

My very first article in L^AT_EX

Nicolas Fressengeas

September 25, 2018

Abstract

This is my very first article in L^AT_EX. I will thus try to keep this abstract short

An introductory material can come before the first section

1 L^AT_EX is so great

I love using L^AT_EX. That is the reason why this section is named this way.

2 Make the students understand it

There is simply no other way to write, or beam, science. May my students understand this after this class !

3 Conclusion

This is nearing to the end of the first part of this class dedicated to tools. Now is the time to practice, before going into more scientific details.



CentraleSupélec

Learn $\text{\LaTeX}$ How-To through practice

Typeset a Wikipedia article of your choice using $\text{\LaTeX}$.
Leave out and figures and references, for the moment.
Try to target a specific journal using its $\text{\LaTeX}$ class.



Part II

The process of writing an article



II The process of writing an article

- 3** Build the reference database
 - Read, share and remember
 - The BIBT_EX tool
 - Practice time
- 4** Design the article
 - Successive approximations writing
 - Self-consistent figures and table
 - Practice time
- 5** Write the article
 - Usual Layout
 - A specific writing style



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Read before you write

Be sure to stand on the shoulders of the giant

Literature review

Scientific & technological intelligence

- Scientific writing is always about a first-time-ever
- Read related work
- Record related work
- Get your scientific intelligence organized
- Get help from a reference manager

Reference managers

- https://en.wikipedia.org/wiki/Comparison_of_reference_management_software

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► Complex la Doc

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Efficiently recording relevant literature for further reference

BIB_TE_X: a reference management software and a raw text file format

BIB_TE_X: manage your reference and get them cited in **L^AT_EX**

- Store your references in one, or several, .bib files
- Cite a reference as you write `\cite{ref-key}`
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The BIBTEX file format

A raw text file for all your bibliographic data

A sample BIBTEX item

```
@article{ECARNOT2015573,  
  title = "Writing a scientific article: A step-by-step guide for beginners",  
  journal = "European Geriatric Medicine",  
  volume = "6",  
  number = "6",  
  pages = "573 - 579",  
  year = "2015",  
  issn = "1878-7649",  
  doi = "https://doi.org/10.1016/j.eurger.2015.08.005",  
  url = "http://www.sciencedirect.com/science/article/pii/S1878764915001606",  
  author = "F. Ecarnot and M.-F. Seronde and R. Chopard and F. Schiele and N.  
    Meneveau",  
  keywords = "Scientific publications, Writing, Research, Article"  
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Tune the elements you need

■ @article, @book, @inproceedings, @phdthesis...

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■ Writing a scientific article: A step-by-step guide for beginners

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Build a .bib database of your own

.bib hand editing or using JabRef or Zotero

.bib hand editing

- Use your favorite raw text editor to manually fill in your .bib file.
- Use references of your own or from a Wikipedia article
- A $\text{\LaTeX}$ designed raw text editor^a can help fill .bib file

^aTeXStudio, Kile, TeXShop, TeXMaker, WinEdt, TeXnicCenter...

.bib assisted editing

- Use JabRef and/or Zotero and/or a reference manager of your choice to build a bibliographic database^a
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Actual paper writing

OK... Research background read and recorded... Research itself ready for writing...

DO NOT start by the beginning

It is **REALLY** difficult to start writing an article without knowing the end

DO NOT start by the end

It is **REALLY** difficult to imagine the end of an article without having written the beginning

Imagine a way to write all the article as a whole

Successive approximation writing



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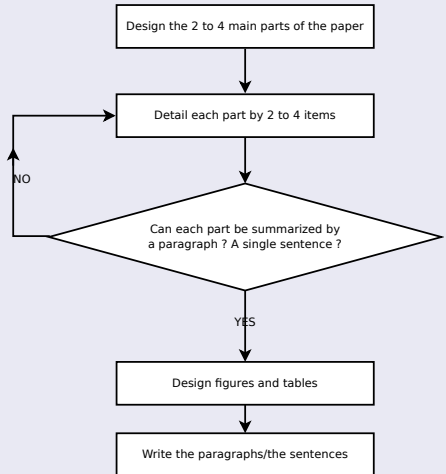
Successive approximations writing

Writing the paper as a whole to keep consistency throughout the writing process

A paper being written

- Introduction
- Part I
- Part II
- Part III
- end matter

A simple algorithm



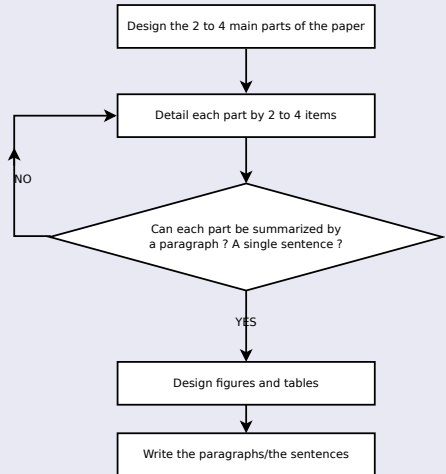
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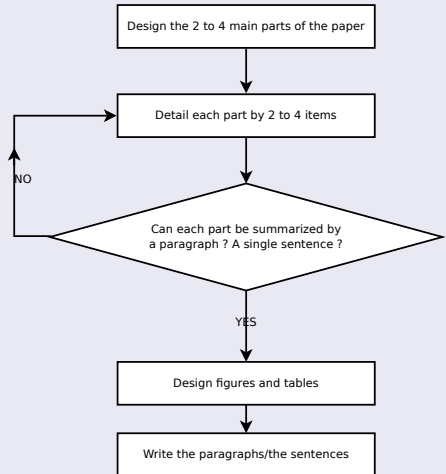
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Figures and tables are really important

The hasty reader reads: title, abstract, author list, figures, references, conclusion... and sometimes the paper

Successful production of good figures requires substantial effort

- Use vector graphics^a for infinite resolution and small file size
- Insure good resolution for pictures
- Keep it clear and simple
- Insure black & white readability
- My favorites to create figures: Python & matplotlib, SageMath and inkscape

^aVector graphics: PDF, EPS, SVG...

Self-consistent figures, tables and captions

A paper should be understandable through the figures, tables, and their captions

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L^AT_EX how-to for figures and tables

Be sure to use PDF^LA_TE_X, otherwise, only EPS file format is allowed

Include the `graphics` package

```
\documentclass{article}  
%  
\usepackage{graphicx} % graphicx is the modern version of graphics  
%  
\begin{document}
```

Create a figure file

- Preferably a vector PDF graphics file
- PNG for bitmap graphics, JPG for pictures

Declare the figure at the right place

```
\begin{figure}  
\centering  
\includegraphics{Tux.png}  
\caption{Tux, le pingouin}  
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Inserting figure at the right place

Let $\text{\LaTeX}$ place the figures nicely, it knows what its doing

Editing rules for figures and tables

- Figure as close as possible to its declaration
- Figure **never** before its declaration
- Figure does not break text
- Figure preferably on page top, bottom if possible, on page if necessary
- If text is present on page a minimum fraction of the page is required

Let $\text{\LaTeX}$ place the figure

Declare the figure just before the paragraph where it is referred first

Inserting figure at the right place

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Figure and table reference

Automated numbering of figures and tables for an automatic referencing

The `\label` command

- `\label{AnyKeyYouWant}`
- For figures, table, equations, sections...
- Allows automated referencing to the object it is in

The `\ref` command

- The `\ref{AnyKeyYouWant}` command is replaced by the referenced object number

The `varioref` package

- Numerous figures can be rejected far from their reference.
- In a long document, figures can lie many pages before `\ref`

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As you write and cite, the reference list builds up

B_IB_TE_X and L^AT_EX magic

Place at the end of your paper

```
\bibliographystyle{unsrt} % or any other relevant style  
\bibliography{bibfile1,bibfile2,bibfile3...}
```



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Build the skeleton of your first scientific paper

Ultra detailed outline, figures and automatic citations

Get ready for writing

- Design your paper skeleton using successive approximation writing
- Carefully design self consistent figures and tables
- Declare them in your paper skeleton^a
- Link your bibliography database

^aDon't worry, $\text{\LaTeX}$ will stack them at the end of the paper, but this will change as text is added



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Introduction

Describes the time and space context of the work to make the paper readable as a whole

Introduction probably includes

- The paper specific domain
- A description of the problem tackled
- A review of the past attempts to tackle the same problem
 - ▶ Lots of references here
- A description of the novelties your work proposes
- A review of the article organization and strategy to present the work done
 - ▶ Materials, methods, experiments. . .
 - ▶ Results
 - ▶ Discussion

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Materials, methods, experiments. . .

Describes the methods used so that the work can be *reproducible*

First goal: convince that your methods are scientifically sound

- Be sure to give all the details
- Include experimental framework and detailed conditions
- Include data collection and analysis
- Justify all, either directly or through references

Second goal: make your work *reproducible*

- Be sure to give all the details
- Open the methods as much as you can:
 - ▶ Measurement apparatus model, reference, *and inner details*
 - ▶ Open source software, or precisely referenced software
 - ▶ Detailed experimental sketches
 - ▶ . . .

Materials, methods, experiments. . .

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 - ▶ ...

Results

Results, only results: give the reader a chance interpret them on his/her own

Give raw results in a human understandable manner

- Small tables
 - ▶ Avoid huge tables
- 2D curves
 - ▶ Think twice before going 3D
 - ▶ If approximations or interpolations are done, tell why and how

Consider publishing your data in data warehouses

- Allows the reader to get the numbers
- Insure a long life to your data
- Allow others to browse your data
- Certify your data is sound and honest
- Allow Google and other to index your data
- Produce a DOI for your CV

Results

Results, only results: give the reader a chance interpret them on his/her own

Give raw results in a human understandable manner

- Small tables
 - ▶ Avoid huge tables
- 2D curves
 - ▶ Think twice before going 3D
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Discussion

The only section which can go away from raw facts

Finally, you can write about what you are thinking

Potential advices:

- summarize your problem,
- clarify your hypotheses. . .
- and finally write about what you refrained to say from the very beginning.



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II The process of writing an article

- 3 Build the reference database
 - Read, share and remember
 - The BIB_TE_X tool
 - Practice time
- 4 Design the article
 - Successive approximations writing
 - Self-consistent figures and table
 - Practice time
- 5 Write the article
 - Usual Layout
 - A specific writing style



Scientific writing style

Be clear and concise

Be clear

- Define **everything**: math variables, acronyms. . .
- One word has one specific meaning: chose carefully
- Avoid *and so on*, *etc.* . . .

Be concise

- Do not say anything twice,
 - ▶ unless you have a good reason.
- Avoid literature style effects,
 - ▶ except if it allows even more conciseness.

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Final note on plagiarism and referencing

About using the work of authors, or the shoulders of giants

Using the work of authors is good, and necessary

- Be sure to completely understand the cited work
- Properly reference the previous writings
- Even properly referenced figures can be reused, if their license^a allows so
- If absolutely necessary, the words of others can also be used, between quotes and properly attributed

^aPresent licenses tend to go towards the CC-BY Creative Commons Attributions licence

Advanced team working

Writing a paper is usually a team work. git is the ultimate solution

Using git for collaborative L^AT_EX

- Use gitlab on <https://framagit.org>
- <https://youtu.be/YprjPIMtFnk>
- <https://www.google.com/search?q=git+latex>

