

# 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

Download this from <http://arche.univ-lorraine.fr> under  
CC-BY-SA Creative Commons licence



Notes

---

---

---

---

---

---

---

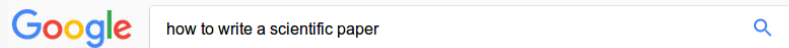
---

---

---

# How to write a scientific paper

Google can tell you !



Tous Images Vidéos Livres Shopping Plus Paramètres Outils

Environ 445 000 000 résultats (0,50 secondes)

Conseil : Recherchez des résultats uniquement en français. Vous pouvez indiquer votre langue de recherche sur la page Préférences.

## 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. ...
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](#)



Notes

---

---

---

---

---

---

---

---

---

---

## 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



Notes

---

---

---

---

---

---

---

---

---

---

## A reference work

Nicolae Al. Pop

360

ISSN 2071-789X

REVIEW

**ECONOMICS**

*Sociology*

Pop, N. Al. (2016), A Reference Work on the Science and Art of Writing a Scientific Paper, *Economics and Sociology*, Vol. 9, No 4, pp. 360-364. DOI: 10.14254/2071-789X.2016/9-4/23

Nicolae Al. Pop,  
Bucharest University of Economic  
Studies,  
Bucharest, Romania,  
E-mail:  
nicolae\_al\_pop@yahoo.com

**A REFERENCE WORK  
ON THE SCIENCE AND ART  
OF WRITING A SCIENTIFIC PAPER<sup>1</sup>**

DOI: 10.14254/2071-  
789X.2016/9-4/23

**Introduction**

**Motto:**

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

Theofil Simenschy

UNIVERSITÉ  
DE LORRAINE

In the modern world, marked by hyper-competition

information and communication among people, dissemination  
of scientific research findings takes on a particular

Notes

---

---

---

---

---

---

---

---

---

---

## Part I

# Tools for scientific writing



Notes

---

---

---

---

---

---

---

---

---

---

## 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
  - L<sup>A</sup>T<sub>E</sub>X, a scientific writing tool



Notes

---

---

---

---

---

---

---

---

---

---

# 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
- Choose Open Access journal
  - ▶ Pay never more 1000\$ and target far below
  - ▶ If you cannot : publish in free paywalled access journals AND in open archives such as <http://hal.univ-lorraine.fr>
- Read the editorial guidelines

## Write and publish

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

this class

UNIVERSITÉ  
LORRAINE

Notes

Notes

# The first page of a scientific paper

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

European Genetic Medicine 4 (2015) 573–579

Available online at ScienceDirect  
ELSEVIER  
www.elsevier.com

Elsevier Masson France  
EM consulte  
www.em-consulte.com/en

Research paper  
Writing a scientific article: A step-by-step guide for beginners  
F. Ecarnot<sup>a</sup>, M.-F. Seronde, R. Chopard, F. Schiele, N. Meneveau  
L40109, Université de Caen, University Hospital Jean-Macé, 1, Boulevard Fleming, 14000 Brest, France

ARTICLE INFO  
Article history:  
Received 14 August 2015  
Accepted 18 September 2015  
Available online 18 September 2015

KEYWORDS  
Scientific publications  
Writing  
Research  
Article

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 to written format. The publication is often used for career advancement, to obtain funding, to obtain academic qualifications, or for all these reasons. We describe here the basic steps to writing a scientific article. We outline the main sections that an average article should contain, the elements that should appear in the text, and some pointers for making the overall result attractive and acceptable for publication.  
© 2015 Elsevier Masson SAS and European Union Genetic Medicine Society. All rights reserved.

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. Developing 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 which only small amounts of time can be devoted on an irregular basis. However, the competition is already quite fierce amongst all the good quality papers that are submitted to journals, and it is therefore of paramount importance to get the basics right, in order for your paper to have a chance of succeeding. Don't you think that your work deserves to be judged on its scientific merit, rather than be rejected for poor quality writing and messy and confusing presentation of the data?

With this in mind, we present here a step-by-step guide to 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.  
The 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].

2. Getting started: things to do before you write a word  
A certain amount of preparatory work needs to be done before you even 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

Corresponding author. Tel.: +33 361 628 530; fax: +33 361 628 382.  
E-mail address: fcarnot@univ-caen.fr (F. Ecarnot).  
© 2015 Elsevier Masson SAS and European Union Genetic Medicine Society. All rights reserved.  
0195-5626/2015 Elsevier Masson SAS and European Union Genetic Medicine Society. All rights reserved.

UNIVERSITÉ  
LORRAINE



## 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<sup>a</sup>.

<sup>a</sup>See [wikicite](#), [crossref](#) & the initiative for open citations



CentraleSupélec

UNIVERSITÉ  
DE LORRAINE

Notes

---

---

---

---

---

---

---

---

---

---

## 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  
on papers themselves.  
Institutions issue affiliation rules to ensure proper automatic  
attribution.

UNIVERSITÉ  
DE LORRAINE

Notes

---

---

---

---

---

---

---

---

---

---

## 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
- Easy export for one click proper citations
- Allow to match most journals citation habits
- Full training courses available [here](#)

Many other reference managers exist

e.g. JabRef

[https://en.wikipedia.org/wiki/Comparison\\_of\\_reference\\_management\\_software](https://en.wikipedia.org/wiki/Comparison_of_reference_management_software)



Notes

---

---

---

---

---

---

---

---

---

---

## 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 ?
- Not the scientist job ! Leave it to a software that knows better.



Notes

---

---

---

---

---

---

---

---

---

---

## Markup languages: a universal solution

XML, HTML, WikiML, SVG, PDF... and L<sup>A</sup>T<sub>E</sub>X

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
can summarize it properly in an attractive abstract.
\end{abstract}
```



Notes

---

---

---

---

---

---

---

---

---

---

## 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<sup>A</sup>T<sub>E</sub>X 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}
...
```



Notes

---

---

---

---

---

---

---

---

---

---



## 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 $\LaTeX$ world

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



Notes

---

---

---

---

---

---

---

---

---

---

## $\LaTeX$ , 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

- Use your favorite text editor to produce  $\LaTeX$  code
- Run the pdf $\LaTeX$  engine on the source code to get the PDF
- View the result with your favorite viewer



Notes

---

---

---

---

---

---

---

---

---

---

## L<sup>A</sup>T<sub>E</sub>X all-in-one writing environment

TexStudio, Kile, TeXShop, TeXMaker, WinEdt, TeXnicCenter...

### All-in-one environments simplify the use of L<sup>A</sup>T<sub>E</sub>X

- Integrated code writing, L<sup>A</sup>T<sub>E</sub>X-compiling and PDF viewing
- In-line help on code writing
- Multiple file management
- Spell-checking
- ...

### Collaborative online environment

- Overleaf for collaborative L<sup>A</sup>T<sub>E</sub>X
- CoCalc for a collaborative environment including L<sup>A</sup>T<sub>E</sub>X and various scientific softwares, allowing interactions between them<sup>a</sup>

<sup>a</sup>For example: embed R, sage ou python calculations in L<sup>A</sup>T<sub>E</sub>X



Notes

---

---

---

---

---

---

---

---

---

---

## L<sup>A</sup>T<sub>E</sub>X, dedicated to scientists

A few features

### Focus on content, forget about presentation

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



Notes

---

---

---

---

---

---

---

---

---

---



## Part II

# The process of writing an article



Notes

---

---

---

---

---

---

---

---

---

---

## II The process of writing an article

- 3** Build the reference database
  - Read, share and remember
  - The  $\text{BIB}_T\text{E}_X$  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



Notes

---

---

---

---

---

---

---

---

---

---

## 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 community reference manager

### Reference managers

### My favorites

- [https://en.wikipedia.org/wiki/Comparison\\_of\\_reference\\_management\\_software](https://en.wikipedia.org/wiki/Comparison_of_reference_management_software)
- For yourself: JabRef
- Community work: Zotero
  - ▶ Domptez la Doc

UNIVERSITÉ  
DE LORRAINE

Notes

---

---

---

---

---

---

---

---

---

---

## Efficiently recording relevant literature for further reference

BIB<sub>T</sub>E<sub>X</sub>: a reference management software and a raw text file format

### BIB<sub>T</sub>E<sub>X</sub>: manage your reference and get them cited in L<sup>A</sup>T<sub>E</sub>X

- Store your references in one, or several, .bib files
- Cite a reference as you write `\cite(ref-key)`
- Get the references automatically filled in with the layout of your choice



CentraleSupélec

Notes

---

---

---

---

---

---

---

---

---

---

## The BIB<sub>T</sub>E<sub>X</sub> file format

A raw text file for all your bibliographic data

### A sample BIB<sub>T</sub>E<sub>X</sub> 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"  
}
```

### Tune the elements you need

- @article, @book, @inproceedings, @phdthesis...
- ECARNOT2015573: an arbitrary key
- Self-explanatory fields, some required, others optional

ERSITÉ  
ORRAINE

Notes

---

---

---

---

---

---

---

---

---

---

## 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 L<sup>A</sup>T<sub>E</sub>X designed raw text editor<sup>a</sup> can help fill .bib file

<sup>a</sup>TexStudio, 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<sup>a</sup>
- Export a .bib BIB<sub>T</sub>E<sub>X</sub> file

<sup>a</sup>Use references of your own or from a Wikipedia article

ERSITÉ  
ORRAINE

Notes

---

---

---

---

---

---

---

---

---

---

## 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



Notes

---

---

---

---

---

---

---

---

---

---

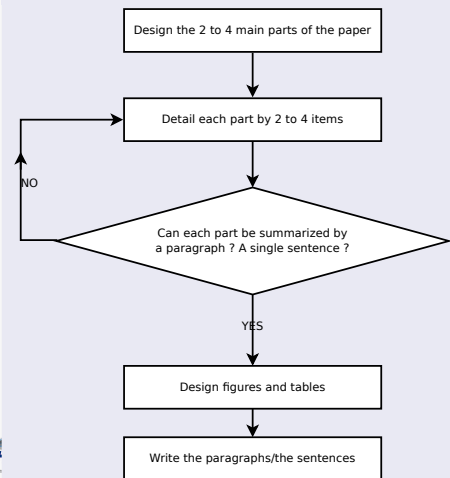
## Successive approximations writing

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

### A paper being written

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

### A simple algorithm



Notes

---

---

---

---

---

---

---

---

---

---







## As you write and cite, the reference list builds up

BIB<sub>T</sub>E<sub>X</sub> and L<sup>A</sup>T<sub>E</sub>X magic

Place at the end of your paper

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



Notes

---

---

---

---

---

---

---

---

---

---

## 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<sup>a</sup>
- Link your bibliography database

<sup>a</sup>Don't worry, L<sup>A</sup>T<sub>E</sub>X will stack them at the end of the paper, but this will change as text is added



Notes

---

---

---

---

---

---

---

---

---

---

## 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



Notes

---

---

---

---

---

---

---

---

---

---

## 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
  - ▶ . . .



Notes

---

---

---

---

---

---

---

---

---

---

## 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

UNIVERSITÉ  
DE LORRAINE

Notes

---

---

---

---

---

---

---

---

---

---

## 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.



Notes

---

---

---

---

---

---

---

---

---

---



