Why (and how) would you read (scientific) articles?

 Bernard Bayle
Computer-aided interventional medicine and surgery is a developing field, born at the end of the 1980s. It is necessary to read research articles to have an up-to-date understanding of the State of the Art.

- Course, to know a little bit more about how to read scientific articles (part 1)
- Tutorial (part 2)
WHY BOTHER READING SCIENTIFIC ARTICLES?

First…
What can you find in scientific articles? (1)

Scientific results!
- most inventions are published by their authors
- scientific articles are the way researchers communicate results and ideas to one another
- scientific milestones made accessible to the community
- extends (of course) to engineering and technology where patents are publications that we will discuss later

The bricks for your own inventions...
- research is built on the State of the Art, not to re-invent
- + information to understand the context

... and to learn about the open challenges
“[...] every time one question is answered, the answer unlocks twice as many new questions”. How to Read a Scientific Paper, Scientific dummies
State of the Art
Every article has an introduction, in which the authors have to present:
- the context of the study
- the past contributions in the field
- the article contributions

Scientific rigor
- results have to be introduced as rigorously as possible
- ... but the prerequisites can be a problem!

Experimental protocols
The experiments that led to the claimed results have to be properly presented. In some fields of research, it is compulsory that the reader is able to reproduce the experiments and results, in order to be published.
What can you find in scientific articles? (3)

Article contributions
Depends on the type of article you consider:
- review articles
- (primary) research articles

Review articles
- synthesis of results on a particular subject, the authors being generally contributors to the field of research
- very frequent in the medical field, less in engineering

Primary research articles
- original contributions to a given field of research
- up-to-date results: the competition in research is in this type of publication
WHAT ARE WE TALKING ABOUT?
What and where?

Scientific articles are published:
- in scientific journals
- in the proceedings of scientific conferences
- in magazines

The articles quality and contributions depend on the type of publication:
- in high standards journals, you will find an original contribution to the State of the Art, generally a study resulting from successive research efforts (possibly partially published)
- in the proceedings of scientific conferences, the contribution can limit to one of these steps, though it still has to be original (...or should be)
- magazines generally publish results understood by the great majority of readers
But...

These rules depend on the communities
- some conferences are more selective than journals
- some communities (e.g. medical) often publish very short articles, with limited results
- some scientific publications are definitively fake

So how to trust scientific publications?
- the researchers know very well the level of the scientific publications in their domain. They are actually:
  - authors
  - reviewers
  - sometimes editors
- some statistics rank publications, but not so easy:
  - impact factor depend a lot on the topic...
  - what about acceptance rate?

<table>
<thead>
<tr>
<th>Year</th>
<th>Submitted</th>
<th>Accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>466</td>
<td>66 (oral, 14.2%) &amp; 154 (poster, 33.0%)</td>
</tr>
<tr>
<td>2009</td>
<td>1464</td>
<td>61 (oral, 4.2%) &amp; 322 (poster, 22.0%)</td>
</tr>
</tbody>
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http://www.realclearscience.com
How do the researchers publish their results?

Peer reviewing
- most scientific publications have an scientific and/or publication committee: an associate editor selects reviewers among specialists of the theme to review the articles
- after reviewing the article can be rejected, accepted, or require a (major or minor) revision. In this case a second round starts, sometimes a third...

Is it like... publishing a novel?
- generally, the authors provide the article and accept the copyright and the journal (or conference) charge its readers (or attendees)
- a developing type of publications (open-access) offers the articles to every reader. In this case, the authors contribute (financially) to the article publication, which is generally online only. Another possible controversy...

https://pdos.csail.mit.edu/scigen
... BIBLIOGRAPHY TOOLS
Obstacles:

- most editors do not offer free access to the articles
- some articles are difficult to find, because they have not been edited by the main editors, e.g. Elsevier, Springer, Kluwer, etc.
  
  ... this is in particular the case of some conference proceedings (order).

- old articles are not always available, but generally no need to read the historical articles (>10 years=old, >20 years=very old!)

- the number of articles is presently increasing so exponentially that it is already a problem for Big Data scientists, and a new subject of research!

![Google 404](https://www.google.com/zero)
The solutions

- Universities and research institutions (maybe even some companies) pay the fees: enjoy 😊 and use this access to the editions and databases
- use a scientific social networking tool like Researchgate, or Google scholar
- contact the authors (always a corresponding one, with an e-mail) and ask for their version of the article: they will generally be happy to have people read their articles... in case they are not too famous and read their e-mails by themselves
How to assess a publication value?

If you can (because you have time, expertise, etc.) read it and make up your mind, good articles are not only in the most famous journals:

- in some cases there are very good articles in less famous sources

- in some other (few) cases, there are very bad (false) articles in very famous journals

In case you want to pre-“evaluate” an author or a publication:

- check the publication impact factor (always compare with other of the same field)
- check the authors citations and reputation
- use professional tools for that: Web of Science is the reference, Scopus is another one (+scientific social networking tools, like Researchgate, Google scholar)

[Image: https://en.wikipedia.org/wiki/Kalman_filter]
Finally…

HOW TO READ SCIENTIFIC PUBLICATIONS
How to read scientific articles?

First it depends on what you expect from your reading:

- quick reading allows you to save time and read many articles to choose the ones you want/need to deepen
- if the article is the one you should know perfectly for your research, then it will certainly take you weeks to understand every detail

Understand that you do not have to read from the first to the last line, nor in the proposed order

And of course, take notes:

- never read without taking notes
- you (can) first write down ideas in a non-organized way, in a brainstorm fashion
- you (can) finally synthesize the organization behind the ideas, and even build a mental map if you want to...

https://en.wikipedia.org/wiki/Mind_map
Mental map ??

https://en.wikipedia.org/wiki/Mind_map

How to read scientific articles very quickly?

... and benefit from your reading

The compulsory steps:

- first read the abstract to catch the purpose of the article and the main results
- then have an overview to identify:
  - the structure
  - in the introduction: the claimed contributions
  - in the conclusion: the obtained results, to assess the goal achievement
- finally (only) try to identify the main results in each part. Potentially, it can be done without reading every detail in the text.

And take notes!

- take notes while reading, order them just after
- synthesize a “reading note”: make it short and clear, and potentially rank the article interest for you in the future
So, now…

MAKE YOUR OWN EXPERIENCE:
you have 45 minutes, and the article is 69 pages long…
Tutorial, subject on

http://eavr.u-strasbg.fr/~bernard/education/3a_tis_gmcao/3a_tis_gmcao.html

Read and synthesize in only 45 minutes:


that you can download from the course page, or freely from:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3260536

Discuss with the teachers (20 minutes).

Put things in order.
This course... part 2-2

Read and synthesize the article in only 45 minutes.

Discuss with the teachers (45 minutes).

Put things in order.
This course... part 2-3

Read and synthesize the article in only 45 minutes.
Discuss with the teachers (45 minutes).

Put things in order.