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For the past 125 years, the name Elsevier has been synonymous with excellence in publishing. That tradition carries on today. Every year, Elsevier accepts and publishes more than 250,000 journal articles. More than 20% of the key international scientific publications recognized by the Institute for Scientific Information (ISI) are published by Elsevier. http://www.elsevier.com/aboutelsevier

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How to write a scientific article

Introduction
The task of writing a research article can be daunting. You may have completed groundbreaking research, but unless the article is correctly written, at best publication will be delayed and at worst will never be published.

The purpose of this article is to try and give the reader an overview of how to write a well-structured research article for publication. It is principally aimed at new authors and is generic enough to encompass all disciplines.

Do I need to write a research article?
This might seem like an obvious question, but it is one worth asking yourself. Editors and reviewers are looking for original and innovative research that will add to the field of study. Ensure that you have enough numbers to justify sound statistical conclusions. If the research you are going to report relates to a larger study, perhaps it is better to produce one important research article, rather than a number of average incremental articles.

In deciding where to send your article, consider the reader. Does your article address a question of international or mainly local interest? If the latter is true, it may be better placed in a national journal than in an international one.

The structure of an article
Scientific writing follows a rigid structure. A format developed over hundreds of years and considered to be the most efficient means for communicating scientific findings to the broader research community. Moreover, the format has the advantage that it allows the article to be read at several levels. Some people will refer to just the title, others may read only the title and abstract, while those who want a deeper understanding will read most, if not all, of the article.

Most disciplines use the format of title, authors, abstract, keywords, introduction, methods, results, discussion, acknowledgments, references and supplementary material. Though the headings are standard for most journals, there is some variation, so it is essential to read the guide for authors of the journal you intend to submit your article to prior to writing.

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Style and language

It is important to refer to the journal’s guide for authors’ notes on style. Some authors write their article with a specific journal in mind, while others write the article and then adapt it to fit the style of a journal they subsequently choose. Regardless of your preference, some fundamentals remain true throughout the process of writing a scientific article. The object is to report your findings and conclusions clearly, and as concisely as possible; try to avoid embellishment with unnecessary words or phrases. The use of the active voice will shorten sentence length. For example, carbon dioxide was consumed by the plant... is in the passive voice. By changing to the active voice it can be shortened to the plant consumed carbon dioxide...

The following shows how tenses are most often used in science writing:

- For known facts and hypotheses, the present tense should be used.
  - The average life expectancy of a honey bee is 6 weeks.
- When you refer to experiments you have conducted, the past tense should be used.
  - All the honey bees were maintained in an environment with a consistent temperature of 23 °C.
- When you describe the results of an experiment, the past tense should be used.
  - The average life span of bees in our contained environment was 8 weeks.

If English is not your first language it is recommended that you ask a native English speaker to review the article before you submit it for publication. Alternatively you could use a language editing agency. Visit http://www.elsevier.com/languagepolishing

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The listing of authors should only include those who have made an intellectual contribution to the research, who will publicly defend the data and conclusions, and who have approved the final version. The order in which the names of the authors appear can vary from discipline to discipline. In some fields the corresponding author’s name appears first.

Title

A title should describe the article’s content clearly and precisely, and allow the reader to decide whether it would be appropriate to consult the article further. The title is the advertisement for the article – a poorly titled article may never reach its target audience, so be specific. Omit unnecessary words such as ‘A study of’, ‘Investigations of’, ‘Observations on’, etc. Do not use abbreviations and jargon. Indexing and abstracting services depend on the accuracy of the title, extracting keywords from it that are used in cross-referencing.

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Abstract

The abstract should summarize, in 50 to 300 words, the problem, the method, the results, and the conclusions. The title is the simplest statement about the content of your article. In contrast, the abstract allows you to elaborate on each major section of the article. The abstract should give sufficient detail so that the reader can decide whether or not to read the whole article. Together, the title and the abstract should be able to stand on their own, as they are processed further by abstracting services. For this reason it is advisable not to include references to figures or tables, or citation of the reference in the abstract. Many authors write the abstract last so that it accurately reflects the content of the article.
Main text

Introduction
The introduction should be brief, ideally one to two paragraphs long. It should clearly state the problem being investigated, the background that explains the problem, and the reasons for conducting the research. You should summarize relevant research to provide context, state how your work differs from published work and importantly what questions you are answering. Explain what findings of others, if any, you are challenging or extending. Briefly describe your experiment, hypothesis(es), research question(s), and general experimental design or method. Lengthy interpretations should be left until the Discussion.

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(Materials and Methods or Experimental Methods, etc.) The key purpose of this section is to provide the reader enough details so they can replicate your research. Explain how you studied the problem, identify the procedures you followed, and order these chronologically where possible. If your methods are new, they will need to be explained in detail; otherwise, name the method and cite the previously published work, unless you have modified the method, in which case refer to the original work and include the amendments. Identify the equipment and describe materials used and specify the source if there is variation in quality of materials. Include the frequency of observations, what types of data were recorded. Be precise in describing measurements and include errors of measurement. Name any statistical tests used so that your numerical results can be validated. It is advisable to use the past tense, and avoid using the first person, though this will vary from journal to journal.

Results
In this section you objectively present your findings, and explain in words what was found. This is where you show that your new results are contributing to the body of scientific knowledge, so it is important to be clear and lay them out in a logical sequence. Raw data are rarely included in a scientific article; instead the data are analyzed and presented in the form of figures (graphs), tables, and/or descriptions of observations. It is important to clearly identify for the reader any significant trends. The results section should follow a logical sequence based on the table and figures that best presents the findings that answer the question or hypothesis being investigated. Tables and figures are assigned numbers separately, and should be in the sequence that you refer to them in the text. Figures should have a brief description (a legend), providing the reader sufficient information to know how the data were produced. It is important not to interpret your results - this should be done in the Discussion section.

Discussion
In this section you describe what your results mean, specifically in the context of what was already known about the subject of the investigation. You should link back to the introduction by way of the question(s) or hypotheses posed. You should indicate how the results relate to expectations and to the literature previously cited, whether they support or contradict previous theories. Most significantly, the discussion should explain how the research has moved the body of scientific knowledge forward. It is important not to extend your conclusions beyond what is directly supported by your results, so avoid undue speculation. It is advisable to suggest practical applications of your results, and outline what would be the next steps in your study.
Acknowledgments

This section should be brief and include the names of individuals who have assisted with your study, including, contributors, reviewers, suppliers who may have provided materials free of charge, etc. Authors should also disclose in their article any financial or other substantive conflict of interest that might be construed to influence the results or interpretation of their article.

References

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The references section that appears at the end of the article includes all references cited in your article. This section is in contrast to a bibliography, common in books, where works read but not necessarily cited in the text are listed. The manner in which references are presented also varies from journal to journal and you should consult the journal’s guide for authors.

Supplementary material

Typically raw data are not included in a scientific article. However, if you believe the data would be useful, they can be included. Increasingly this is becoming more common as journals move to an online environment and the cost of including supplemental material is lowered. Supplementary material can include raw data tables, video footage, photographs, or complex 3D models. If you have more than one set of materials to include, give each a separate number e.g. Appendix 1, Appendix 2, etc. For full guidelines on supplementary material submission, please visit http://www.elsevier.com/artwork

Further reading


How important is the quality of the English language in an article?

The findings reported in an article may be cutting edge, but poor language quality – including errors in grammar, spelling or language usage – could delay publication or could lead to outright rejection of the article, preventing the research from receiving the recognition it deserves.

With ever-increasing standards of excellence in both research and publishing, it is in an author’s best interest to make sure his/her article is in its best possible form when submitted for publication - that includes the quality of the written English, adherence to the guide for authors and the presentation of factual, accurate data.

In fact, we hear from numerous editors that the poor quality of English masks the possible academic merit of some articles and they will return the article to the author. Editors find it increasingly hard to find reviewers for articles and so there is an increased pressure to send articles to review out in good English.

What impact does language quality have on the peer-review process?

Once an article enters the peer-review process, it will be evaluated by both reviewers and editors on its academic content and merit.

The responsibility of providing an article written in a reasonable standard of English, and structured with adherence to the guide for authors, lies with the author. Editors and reviewers are not responsible for making language corrections.

Well-structured articles with correct language usage help ensure that the peer-review process runs smoothly by allowing editors and reviewers to focus on academic merit, and could result in the faster publication of research.

What should authors do before submitting an article?

We suggest authors consider using a language editing service to improve the English language usage and quality of an article. A number of language editing companies provide their services to our authors at competitive rates. Details can be found at http://www.elsevier.com/languagepolishing
Choosing the right journal, article formatting and cover letter

- Check aims and scope of the journal to see if your article is a good fit.
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- Check the guide for authors which will include information on the types of article accepted, editorial team contacts, graphics specification, acceptable language and article length.

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- When preparing tables, if you are using a table grid, please use only one grid for each separate table and not a grid for each row. If no grid is used, use tabs to align columns (instead of spaces).
- When you create your article, as a general rule, please make sure it appears in the following order, although please check each journal’s guide for authors for specific instructions.

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- Details of any previous or concurrent submissions.
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Peer review has two key functions:

• To act as a filter by ensuring only good research is published to determine the validity, significance and originality of the work.
• To improve the quality of research submitted for publication by giving reviewers the opportunity to suggest improvements.
• Some journal editors will ask authors to provide the names of possible reviewers.

Different types of peer review

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<td>Open</td>
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Reviewers will then make a recommendation to the editor to accept, accept with revisions or decline the article. To find out more about peer reviewing or to become a reviewer visit http://www.elsevier.com/peerreview
After your article has been accepted

Once your article is accepted for publication, it will be published online on ScienceDirect as an article in press and allocated a Digital Object Identifier (DOI). The DOI means articles can receive citations immediately. Further information is available on http://www.doi.org

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• Checking your article for completeness
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• Ensuring your artwork is added properly
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• Further explanation of this process is below*

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These freely-available pages are dedicated to specific topics and will include a concise but informative synopses written by the author, as well as author contributions with references, links to resources, cited working articles and web results and topic relevant web links. The pages also offer authors the opportunity to increase their visibility within a particular field of topic-relevant research.

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Impact Factors and other quality measures

Impact Factor

The Impact Factor is the most widely referenced quality measure amongst academic publications. It is defined as the ratio between citations and recent citable articles published in a journal; the average number of citations received per published article. The following is an explanation of how Thomson Reuters calculate Impact Factors.

Calculating Impact Factors

Citations in 2007 to articles published in:
- 2006: 187 total citations
- 2005: 318 total citations

Number of articles published in:
- 2006: 54 total articles
- 2005: 46 total articles

Calculation:
\[
\text{Impact Factor} = \frac{505 \text{ total citations to articles published in 2005 and 2006}}{100 \text{ number of articles published in 2005 and 2006}} = 5.050
\]

Impact Factors vary greatly by subject discipline and comparison is only meaningful within the same subject category or group.

H-index

The H-index rates a scientist’s performance based on his or her career publications, as measured by the lifetime number of citations each article receives. The measurement is dependent on both quantity (number of publications) and quality (number of citations) of an academic’s publications.

If you list all of a scientist’s publications in descending order of the number of citations received to date, their H-index is the highest number of their articles, H, that have each received at least H citations. So, their H-index is 10 if 10 articles have each received at least 10 citations; their H-index is 81 if 81 articles have each received at least 81 citations. Their H-index is 1 if all of their articles have each received 1 citation, but also if only 1 of all their articles has received any citations.

How is the H-index different from the Impact Factor?

The main difference is that the H-index refers to the performance of an individual scientist or journal.

• The H-index is based on lifetime citations received by a scientist’s articles. The Impact Factor is based on only 2 years’ worth of citations.

• Both rankings measure the average performance of an individual scientist or a journal. Some articles will receive many more citations, and some fewer, than the ranking figure.

Usage

Usage is a new concept for measuring journal value and impact. It can be defined as how often the full-text article is downloaded or viewed. Counting Online Usage of Networked Electronic Resources (COUNTER) is attempting to standardize usage reporting and develop a Usage Factor metric.

Libraries already use usage statistics heavily to evaluate their collections and spending. Authors are also interested to see how much their work is downloaded. For more information visit http://www.projectcounter.org

To find out more about these journal measures and others, please visit http://www.elsevier.com/wps/find/editorsinfo.editors/biblio

http://www.elsevier.com/authors
Helpful websites

Author Pack
This Author Pack will tell you all you will need to know about becoming an author with Elsevier. More information is available on http://www.elsevier.com/authors

ScienceDirect
ScienceDirect provides access to more than 11 million full-text articles online, for more information on how to access these articles please visit http://www.sciencedirect.com

Scopus
Scopus is the largest abstract and citation database of peer-reviewed literature. For more information on how Scopus can help your research and to view your cited articles please visit http://www.info.scopus.com

Scirus
Scirus is the most comprehensive science-focused search engine on the Internet, visit http://www.scirus.com
Scirus Topic Pages will develop continuously to form a topic-centered communication and collaboration platform for scientists, if you are interested in creating a topic page, please visit http://www.topics.scirus.com

2collab
2collab is a collaborative web-based service for researchers and scientists which lets users store and organize their favorite internet resources such as blogs, websites, reference materials, citation lists, research articles, and more. http://www.2collab.com

ISI Web of Knowledge/Web of Science
Impact Factors are measured by Thomson Reuters using the ISI Web of Science database. More information on Impact Factor measurements can be found at http://www.webofknowledge.com

MEDLINE and PubMed
MEDLINE is an online database of 11 million citations and abstracts from health and medical journals and other news sources. http://medline.cos.com/
PubMed is a service of the US National Library of Medicine that includes over 18 million citations from MEDLINE and other life science journals for biomedical articles. http://www.pubmed.gov

Digital Object Identifier (DOI)
To learn more about how the DOI system identifies content within the digital environment please visit http://www.DOI.org

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