Review Article

Writing articles for scientific journals: a basic guide

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Introduction

Science is based on the systematic observation of phenomena with the aim of formulating hypotheses and general laws to explain them. For science to develop and progress, the clear communication of the findings and ideas that arise from these observations is essential. The principal forum for communication in science is the scientific journal (in printed and electronic form). However, scientific journals are not just a network for spreading information. The findings and ideas that are published must also be accurate and well-founded. Scientific journals contribute to this process by acting as a quality assurance system. The 'peer review' process used to screen manuscripts is designed to ensure that articles published are of a high standard, both in content and presentation.

Unfortunately, although writing articles for publication in scientific journals is a basic and essential task, many people find writing difficult. Examples of articles that are badly written and hard to understand are common. However, with practice, and with the right tools, it is possible to develop a clear and concise writing style. Some simple initial planning will also make the job easier.

Before you start - should you really publish?

Should your work be added to the weighty volumes already filling library shelves? It is not enough merely to claim 'it hasn't been published before.' Publishing simply to increase the size of your *curriculum vitae* is also unacceptable. Although science may sometimes progress through accidental findings, it does not progress through the random accumulation of minor facts. Do not be encouraged by the old saying 'publish or perish'. It is better to list a small number of highly regarded good quality papers than a large number of dubious merit. In the long term poorly written articles of low merit will be detrimental to your professional standing; all these papers will show is your impoverished thinking and lack of commitment to the scientific process. Your words, once published, should be an inspiration to those that read them!

This article is available as AIMS Broadsheet No. 19
Writing articles for scientific journals: a basic guide
from AIMS National Office, PO Box 1911 Milton Qld 4064

The basic steps to publication

Your investigation should be the product of careful planning ***from the outset***. In particular, ensure that you have:

- Clearly defined your aim
- Clearly defined the question to be asked
- Developed a testable hypothesis
- Planned and carefully executed appropriate experiments

After you have collected your experimental data, the following steps summarise the basic processes of writing and publication:

- Prepare, analyse and interpret your results. Apply appropriate statistical analysis where necessary (seek expert help if required)
- Select relevant data (without omitting or censoring important negative results) - Are the data/ideas worth publishing?
- Choose a suitable journal - check the 'Instructions to Authors' for style and format
- Choose the type of article most suited to your findings
- Write the article using a series of drafts to refine the contents
- Have the article reviewed by one or more colleagues (preferably experienced writers who have some experience in the same area)
- Modify the article according to your colleagues' comments
- Check that the article complies fully with the journal's 'Instructions to Authors'
- Submit the article to the target journal
- If the article is accepted, modify the manuscript according to the reviewers' recommendations (or rebut the recommendations) and resubmit

Choosing a journal

When you are ready to submit your work you will find that there are a large number of journals to choose from. Consider the following criteria when you make your choice:

- Each journal publishes articles in a defined area or 'scope' which may be broad or narrow. Which journal publishes in your area of interest?
- Does the journal reach your target audience? Depending on the nature of your article you may wish to publish in a journal that reaches a local, or specific, audience. If your results are of considerable significance to the wider scientific community you will probably want to publish in a major journal of international standing in order to reach the widest possible audience. Researchers who rely on grants to fund their research generally publish in high-impact journals (see below). This strategy is necessary to maintain a good track record and high research profile in order to maximise the possibility of repeat funding.
- Is the quality and standing of the journal appropriate – what is the impact factor of the journal, how does the journal rate with your professional peers? (see below)
- Are there research quantum issues to consider? (see below)

Impact factors

The standing of a journal (and how it compares to others with a similar scope) can be measured by its 'impact factor' as given in the Science Citation Index, Journal Citation Reports. The impact factor of a journal is a measure of the frequency with which the 'average article' in that journal has been cited in a particular year. As a guide, small local or specialist journals with a narrow focus may have an impact factor of ~1.0 (eg. Ultrastructural Pathology, the British Journal of Hospital Medicine and Clinical Laboratory Haematology). Journals with an impact factor of over ~3.0 are regarded as good quality journals (eg. The Journal of Histochemistry and Cytochemistry and the Journal of Cell Physiology). A small number of journals of very high standing have an impact factor of ~20 or above (eg. The New England Journal of Medicine, Cell and Advances in Immunology). For your article to be accepted by a journal with a high impact factor it must describe significant (quality) work of major interest.

Information about the Science Citation Index can be found at the following Institute for Scientific Information (ISI) URLs (accessed July 2001):

- http://www.isinet.com/isi/index.html (the main ISI home page)
- http://www.isinet.com/isi/products/citation/sci/index.html (information on the science citation index)
- http://www.isinet.com/cgi-bin/jrnlst/jloptions.cgi?PC=K (the list of journals indexed by ISI)

Research quantum requirements

- A component of government funding to each Australian university is related to research output. The range of criteria used to measure research output (and the relative weighting of these criteria) may change according to government policy. However, currently (2001) one measure is the number of research-based articles that are produced (annually) by University staff and published in scholarly journals and books. To qualify as a publication that is eligible for the research quantum the journal must have an International Standard Serial Number (ISSN) or, in some cases, an International Standard Book Number (ISBN). The journal must also operate using a peer review process. Briefly, acceptable evidence of peer review is a statement by the journal that contributions are refereed, or:
- Listing in one of the ISI indexes URL http://www.isinet.com/journals (accessed July 2001)
- The journal is classified as refereed in Ulrich's International Periodicals Directory (Volume 5 – Refereed Serials)
- The journal is included in the Department of Education, Training and Youth Affairs' (DETYA) Register of Refereed Journals URL http://www.detya.gov.au/highered/research/herdc.htm (accessed July 2001)

Professional issues - research and ethical practice

Quality journals will generally only publish articles that meet certain ethical standards. Before your article is published you may be required to state, or show, that you have adhered to the appropriate ethical guidelines controlling human research (including the use of patient information) and/or animal research. Your employing institution may also have specific ethics and research guidelines. Thus, before you start, your project should be submitted for approval to the appropriate institutional research and ethics committee(s).

The principles and guidelines relating to ethical research practice in Australia are determined by the National Health and Medical Research Council (NH&MRC) and the Australian Health Ethics Committee (an NH&MRC committee). A full list of documents relating to ethical issues is available from the NH&MRC web page:

- http://www.health.gov.au/nhmrc/issues/index.htm (accessed July 2001)

The principal guidelines are as follows:

Research practice guidelines

- The 'Joint NHMRC/Australian Vice-Chancellors' Committee (AVCC) Statement and Guidelines on Research Practice'. In addition to general principles the guidelines include the issues of: data storage and entry; authorship; publication; supervision of students/research trainees; disclosure of conflicts of interest and research misconduct.

Human ethical issues

- The National Statement on Ethical Conduct in Research Involving Humans.

Animal ethical issues

- The Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

The 'Instructions to Authors'

Before submitting your manuscript for consideration it must conform to the criteria set out in the journal's 'Instructions to Authors'. Although each journal may have its own particular requirements, approximately 500 journals now require that submissions conform to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (1-3). The Uniform Requirements are instructions to authors on how to prepare manuscripts, including the format for bibliographic references (2). Although the Uniform Requirements are not meant as instructions to editors on journal style, the style of many journals has been influenced by the Uniform Requirements.

Types of article

Most journals publish a range of articles, each with its own structure and content (see below). The types of article that will be accepted by a journal are usually set out in the publication's 'Instructions to Authors'.

Full scientific article

The main type of unsolicited article for most journals. A full article usually describes new information or research outcomes. Typically, the data will derive from the systematic investigation of a specific question, or a large case series. Articles are formally

structured according to a specific set of guidelines (see below).

Technical note

A brief version of the 'Full Article' usually describing a new, or improved, technique.

Case report

Case reports describe new or unusual examples of disease.

Letter to the Editor

A brief narrative account without a formal structure (introduction, methods etc.). A letter may simply describe a minor but important finding. Alternatively, a letter may either comment on (or challenge) information previously published by the journal, or on current scientific dogma or practice. Letters may not be subject to the full review process.

Review

A review should draw together information previously published in a specific area then integrate, critically analyse and summarise that information in an authoritative manner. The aim of a review should be to answer an important scientific question (conceptually or practically). In addition, a review may suggest new questions or directions of importance, or new strategies for future research. A review may also be written to facilitate the application or understanding of a special technique or method. Reviews are usually solicited from an expert by the journal Editor. Reviews may also be submitted without a specific invitation. However, it may be wise to contact the target journal to determine whether a review will be acceptable.

Check the manuscript before submission

Before you submit your article check it against the review criteria below - does it meet the required standard? In addition, did you ask a colleague (preferably an experienced author) to read and review the manuscript? Finally, ensure the references are correct, units of measurement are abbreviated correctly and consistently, and there are no typographical and spelling errors.

Remember that poor presentation will damage your reputation and credibility.

Review of the manuscript (the peer review process)

Peer review is essentially a quality assurance process. Manuscripts are reviewed according to specific guidelines by experienced scientists (usually two or three) who are expert in the area. The reviewers ensure that the article is within the scope of the journal and of sufficient merit to warrant publication. The aim of the peer review process is also to maintain and improve the scientific content and literacy of manuscripts and to guard against fraud, plagiarism, gross distortions and bias. The reviewers will make general comments and suggestions for your manuscript, they are not required to make specific or wholesale corrections to poor style and grammar, these are your responsibility!

The review criteria generally cover the following points:

Scientific

- Is the work scientifically sound?
- Is the work an original contribution?
- Are the conclusions justified on the evidence presented?
- Are there any major errors in fact, logic or technique?
- Is the paper clearly and concisely written?
- Are the references appropriate, current and complete?

Ethical

- Were the necessary ethical approvals obtained from a properly constituted and expert institutional ethics committee? For example, this should include approval for animal experiments, the use of human tissues and volunteers and privacy issues etc.
- Has the author declared any commercial, financial or other vested interest in the topic material?

Presentation

- Does the title clearly indicate the content of the paper?
- Does the abstract convey the essence of the article?
- Are the figures, diagrams and tables well-constructed and do they present the data effectively?

- Are all the illustrations, figures, diagrams and tables appropriate and essential for an understanding of the text?
- Are the illustrations and drawings of good quality and is the labelling adequate?
- Are the statistical methods appropriate and the data properly presented?
- Are the references error-free and are they presented correctly?

It is important to recognise that you will probably feel a strong sense of ownership towards your manuscript, especially if you are a new and inexperienced author. Your initial reaction to reviewers' criticisms may well be 'how dare they!' Do not regard the reviewers of your article as 'the enemy'. Reviewers should have considered their comments carefully and, overall, their suggestions should improve your article. You can also include appropriate suggestions in your next manuscript - don't make the same mistakes twice! It is acceptable to reject a reviewer's recommendations if you feel that the comments are unjustified or the reviewer has misinterpreted your work. However, you must justify your rejection of the reviewer's recommendations when you resubmit your manuscript.

The structure and content of a full scientific article

The structure and content of a full scientific article is set out below. Before you start writing, think about how your findings fit into this structure. Remember that 'structure' applies not only to the overall manuscript but also to each individual sentence, paragraph and section. Without a clear structure your article will be hard to read and understand.

Title

An advertisement for your work, possibly aimed at a specific audience

The title is critical - make your message clear and simple. The title is effectively an advertisement for your work and will determine who reads it. In fact, the title can be written to catch the attention of a specific target audience. Avoid vague titles such as 'Studies of...' and 'Observations on...', these tell you nothing about the article's contents. For the title to be both useful and eye-catching it must be descriptive and informative. Preferably have an important word first.

For example, a title that leaves the reader guessing is:

> 'An investigation of antigen unmasking for immunoelectron microscopy.'

A more descriptive and informative title might be:

> 'Antigen unmasking for immunoelectron microscopy: labelling is improved by treating with sodium ethoxide or sodium metaperiodate, then heating on citrate buffer.'

Abstract

A concise precis of the major parts of the study

The abstract is extremely important because it is the part of your article that will be available through biomedical databases. The abstract must be concise (usually limited to 150-200 words), briefly summarising the important (core) points of your study, particularly the central methodology, results and conclusions. Overall, include: objectives and purpose, materials, methods, techniques, apparatus and new items or applications of techniques and equipment. Also include species names, drugs, new theories, terminology and evaluations. Ensure your abstract is factually correct and does not contradict the main body of the text.

Key words

Specific words that identify the area of interest covered by the article

Choose key words carefully from the Medical Subject Headings (MeSH) of *Index Medicus*. As a guide, what words have been used previously by authors in the same field? A computer literature search should retrieve your article easily - what words select articles similar to yours?

Introduction

Why did you perform the study? What gap in knowledge did you attempt to fill? What controversy did you try to resolve?

The 'Introduction' should provide relevant background and present your article as an example of clear scientific thinking. The introduction should identify the subject of the study, state hypotheses and/or define the problem to be solved (what is done, what needs to be done). This section should orientate your research in respect to previous concepts and should be accompanied by a brief review of relevant literature. To construct a good introduction Mimi Zeiger (4) suggests using the analogy of a funnel. A

funnel has a wide opening, then narrows. The introduction thus funnels from something known, to something unknown then, finally, to the question the paper is asking. The introduction may end with the experimental approach used in the study.

Materials and Methods
What did you do and how did you do it?

Describe the subjects of your study, the controls and the materials and methods used. Give enough information so that others can repeat your work unaided. Avoid unnecessary detail by referencing well-known or established methods and describing your own modifications appropriately. Include the source of the chemicals you used and the supplier's address according to journal style.

Results
What happened? What did you find?

In 'Results' you should present your experimental data in a logical sequence that supports your hypothesis. Include photographs, diagrams, tables, histograms and statistical analyses where these are essential for a proper understanding of the data. Include important *negative* results that contradict your hypothesis as well as positive results.

Discussion
What do your findings mean and how do they relate to the findings of others? What happens next?

Interpret your data in relation to the problem, or hypothesis, stated in the introduction. Ensure your evidence is adequate and relate your observations to those of others. If your conclusions differ from previous findings, discuss reasons that may account for the difference. Finally, consider the impact of your findings on future studies.

References - Literature cited
Your sources of information

You must state the source of any ideas, facts, tables, figures, paraphrases and quotations etc., given in your article, including those from your own work published elsewhere. Citations allow the reader to follow up those ideas and facts etc., and to check your interpretation of that information. Full referencing is also essential to avoid being accused of plagiarism and may be required by copyright law. It is important that you read the original of every article cited, including references you have obtained from other papers. It is quite common for articles to be misinterpreted and/or misquoted with mistakes being perpetuated for many years by subsequent authors! Also, do not rely solely on reading the abstract of a paper as it may be misleading or inaccurate. In addition, typographical and spelling errors are common in reference lists. The accuracy of references is your responsibility so check them carefully. You cannot rely on another author to quote a reference correctly.

Your sources are cited (indicated) at the appropriate point in the text using the format given in the 'instructions to authors' of your target journal. The citation should be placed as near as possible in the text to the corresponding material (depending on journal style) so that they are clearly linked. A single citation, or string of citations, at the end of a paragraph is not acceptable.

The presentation of bibliographic citations in the body of the text, and in the reference list, is determined by standard conventions (2, 5-10). The two most common systems in use are the name-and-year system (the Harvard system) and the citation-sequence system (the numerical or Vancouver system) (7,8,10). The citation-sequence system is recommended in the 'Uniform Requirements' (2). For a full description of these two systems, including detailed instructions on how to format references from all types of publication, see:

- 'Style manual for authors, editors and printers' (Australian Government Publishing Service) (7)
- 'Scientific style and format: the CBE manual for authors, editors, and publishers' (CBE Style Manual Committee) (8).

Note that, in actual practice, individual journals have their own publication style which may incorporate minor variations on the basic system format. Variations include punctuation, full or abbreviated journal titles and the use of italics, etc.

Journal titles - abbreviations

Some publications use full journal titles, others use abbreviations. Where an abbreviation is required use the standardised form given by *Index Medicus*. For example, the Australian Journal of Medical Science becomes: Aust J Med Sci. Single word titles such as 'Science' are not abbreviated.

The *Index Medicus* list can be viewed at URL:

- http://primarycare.medscape.com/Home/Search/IndexMedicus/IndexMedicus.html (accessed July 2001)

The list can also be down loaded from URL:

- http://www.nlm.nih.gov/tsd/serials/lji.html (accessed July 2001)

The name-and-year system (7,8,10)

The reference is cited in the text using the name of the author and the year of publication. Where there are more than three authors use *et al*. (short for *et alii* - and others). There are two ways of including the citation in the sentence, either by referring to the author(s) in person with the year in parentheses, or by placing both the name and the year in parentheses (see below). In practice, these styles are combined as required to emphasise specific points and produce the most readable and concise sentence construction overall. In the reference list the articles are given in alphabetical order (using the authors' names).

In-text citations

Example one

Note: In the first sentence the citation is given so that the emphasis is on the year the technique was introduced.

The technique was introduced in 2001 (Stirling 2001). Since the method was first used in human diagnostics (Woods & Brown 2001) its application has been expanded to include additional sample types (Woods, Brown & Byron 2001). The technique has now been fully revised (Melrose et al., 2002).

Example two

Note: The emphasis here is on the individuals who devised the techniques. The second sentence is clumsy and reads poorly.

The technique was introduced by Stirling (2001). Since the method was first used in human diagnostics by Woods and Brown (2001), its application has been expanded to include additional sample types by Woods, Brown and Byron (2001). The technique has now been fully revised by Melrose et al. (2002).

Example three

Combined method

The technique was introduced by Stirling (2001). Since the method was first used in human diagnostics by Woods and Brown (2001), its application has been expanded to include additional sample types (Woods Brown & Byron 2001). The technique has now been fully revised (Melrose et al. 2002).

The references are arranged in the reference list alphabetically:

Melrose, McIver, Dow, Forster, Siebers 2002
Stirling 2001
Woods, Brown 2001
Woods, Brown, Byron 2001

Format for references in the reference list – examples

Present the details in the following sequence (note the style of punctuation).

- *Journal articles*

  Author(s). Year. Article title. Journal Title volume number (issue number): inclusive page numbers.

  Monaghan W. 2001. Lemierre's syndrome: clinical presentation and role of the microbiology laboratory. Australian Journal of Medical Science 22(2): 72-79.

- *Books*

  Author(s) or Editor(s). Year. Book title. Place of publication: publisher name. Number of pages.

  Day RA. 1995. How to write and publish a scientific paper. 4th ed. Cambridge: Cambridge University Press. 223p.

The citation-sequence system (7, 8, 10)

The references are numbered according to the sequence in which they are used; this number is then cited appropriately in the text. The number first allocated to the reference is used every time the reference is cited. Again, the text can be modified to emphasise specific facts but the citation number must be given. The reference list is also arranged sequentially (not alphabetically). Journals may prefer citations to be inserted in-text, or at the end of the sentence.

In-text citations

Example one

The technique was introduced in 2001 (1). Since the method was first used in human diagnostics its

application has been expanded to include additional sample types (2,3). The technique has now been fully revised (4).

Example two

The technique was introduced by Stirling (1). Since the method was first used in human diagnostics by Woods and Brown, its application has been expanded to include additional sample types (2,3). The technique has now been fully revised (4).

Example three

Note: The last sentence includes only references cited previously.

The technique was introduced by Stirling (1). Since the method was first used in human diagnostics by Woods and Brown, its application has been expanded to include additional sample types (2,3). The technique has now been fully revised (4). The revised method includes a satisfactory technique for samples not previously included (2-4).

The references are arranged in the reference list in the same sequence as they are given in the text (numerically):

1. Stirling 2001
2. Woods & Brown 2001
3. Woods, Brown & Byron 2001
4. Melrose, McIver, Dow, Forster, Siebers 2002.

Format for references in the reference list – examples

Present the details in the following sequence (note the style of punctuation).

- *Journal articles*
  Author(s). Article title. Journal Title year month; volume number (issue number): inclusive page numbers.

  Monaghan W. Lemierre's syndrome: clinical presentation and role of the microbiology laboratory. Australian Journal of Medical Science 2001 May; 22(2): 72-79.

- *Books*
  Author(s) or Editor(s). Book title. Place of publication: publisher name; Year. Number of pages.

  Day RA. How to write and publish a scientific paper. 4th ed. Cambridge: Cambridge University Press; 1995. 223p.

Electronic journals

Articles accessed from the electronic version of a print journal may be referenced in a similar manner to the hard copy publication, providing there is no difference in overall layout (page and volume numbers etc.). Where the journal appears in electronic format only, the designation [serial online] is given after the journal title (both name-and-year and citation-sequence formats). Where an electronic journal allows alterations to articles after publication, the date of accession should be given in square brackets after the inclusive page numbers: [Accessed year month day] (8).

Authors

Who made a substantial contribution to the work?

The individuals listed as authors accept responsibility for the article's contents. The order of authors must be agreed by all and may be assigned in different ways. For example, the first author may be the person who did the bulk of the writing and organised the paper. The last author may be the senior author and project supervisor with remaining authors in any order. Alternatively, the author list may be arranged alphabetically. Authors may be requested to declare if they have a vested or financial interest in any aspect of the article's contents.

Authorship can be a source of conflict, especially in relation to technical input. The Uniform Requirements state that individuals should have contributed substantially to *all* of the following criteria to qualify as an author (2).

- Conception and design, or analysis and interpretation of data
- Drafting the article or revising it critically for important intellectual content
- Final approval of the version to be published

General supervision of the research group alone does not qualify an individual for authorship, neither does participation solely through technical input or the acquisition of funding and/or collection of data.

Acknowledgments

Who helped? Who paid?

Acknowledge persons who have contributed to the study (including people who provided technical assistance) if they do not qualify as a full author. In addition, include agencies that funded, or otherwise supported, the project.

The writing process

The hypothesis

Hypothesis: a provisional explanation of observed facts, an unproved theory.

A well-formulated hypothesis is essential for a quality study and underpins the writing process. Because a well-formulated hypothesis should make clear what the project is expected to accomplish, the task of writing should be easier. William Whimster (2) makes several suggestions that can be expressed as a simple strategy. First, frame your basic idea as a question. Using Whimster's (2) example: 'Are the number of blood vessels in a tumour (measured in some way) related to tumour growth and /or metastasis in tumours of type X?' The possible outcomes from this question are probably 'yes', 'no', 'yes' or 'no' with qualifications, or 'don't know'. Next, turn the question into an hypothesis using 'because'. The hypothesis form of the question is: 'Because blood vessel formation is essential for tumour growth and metastasis formation, I will find more blood vessel formation in rapidly growing and /or metastasising tumours of type X'. The answer should now be straightforward. You either will, or will not, find more blood vessel formation and these vessels will, or will not, correlate with tumour growth and metastasis (2).

Getting the writing process started

Each individual has their own way of getting started and their own writing style. However, an easy way to get the manuscript started is to begin with the materials and methods - you should already have your experimental procedure written down in note form! Expand your notes into a full text, then follow this with the results section.

Remember:

- You need a plan - you should know what you want to say and in what order
- You don't necessarily need to do the job alone, especially if you are an inexperienced author. A team approach generally produces better results.

Tools for writing

The basic tools for writing are similar whether you are writing fiction or a scientific article. If you want to write well you should identify those skills and make an effort to acquire them. After all, you wouldn't expect to walk up to a complex piece of scientific equipment and expect to use it like a seasoned professional in the first ten minutes! Writing is the same.

The writer Stephen King (11) gives some good advice that scientists would do well to heed:

- Read a lot and write a lot - practice is invaluable
- Develop a writing 'toolbox' that includes vocabulary, grammar and the basic elements of form and style
- Find a place to write - close the door and avoid distractions
- Revise your work using 2-3 drafts - leave two or three days between revisions
- Get several friends (colleagues) to review and critique your work; incorporate those suggestions into the final manuscript.

Active and passive voice

There is continuing debate over whether scientific articles should be written in the active or passive voice. Simply put, the active voice says 'I did', the passive voice says 'it was done'. Depending on the nature of the publication, the choice between styles is up to the author and depends on personal preference.

Active voice:

I incubated the sections in buffer for ten minutes then labelled them using the antibody solution.

Passive voice:

The sections were incubated in buffer for ten minutes then labelled with antibody solution.

The passive style came into vogue around 1900 with the idea that it made science more objective and professional (12). Previous to this date, most writing was in the active voice (12). However, currently there is a strong swing back to the active voice with Lord May, the President of the Royal Society, quoted as saying that he regarded the use of the passive voice in a research paper as the mark of second-rate work (12). Most major journals now accept, or encourage, papers in the active style.

Helpful hints and some common faults

For detailed advice on this topic see the book by Mimi Zeiger (4).

- An effective writer will always consider their audience (who are you writing for?) and the purpose of their article. The organisation (structure) of your article will help you develop a logical argument
- Keep your language simple, clear and concise. The purpose of your article is to communicate your findings and ideas. Avoid stilted, affected and pompous language - this does not impress, it only hides your meaning
- Restrict each sentence to one topic or idea
- Long wordy sentences are difficult to read and understand. Ideally, a sentence should contain only 15-25 words
- If in doubt - recast the sentence to avoid the difficulty
- Typographical errors and poor grammar and spelling are irritating and interfere with communication. In this context, beware the word processor! Grammar and spell checkers do not identify confused words. For example: complement - compliment; also principle and principal
- Be consistent. Always use the same abbreviations throughout the manuscript
- Only use Système International (SI) units for units of measure (8)
- Use a thesaurus to enrich your language. A printed version is best; the thesaurus in your word processing package may provide only limited alternatives
- If your article is condensed from a thesis, ensure the text flows logically and reads easily.

Searching for relevant articles and information

You will need information to support the arguments presented in your article. There are a number of biomedical databases that will allow you to do this. Examples are Medline and Current Contents which should be available through your library. Each database focuses on a specific area of interest and the journals accessed may, or may not, be the same. Thus, each database may produce different results and, to be thorough, you should search more than one database. All long-standing quality journals are included in these databases but some minor specialist publications and new journals may not. Information is also available on the Internet but may not be subject to peer review.

Plagiarism

Plagiarism is copying without acknowledgment. Plagiarism is the theft of intellectual property and is fraud. You must acknowledge the source of any ideas, facts, paraphrases and quotations with an appropriately cited reference; this includes your own work published elsewhere (10). In some cases plagiarism may infringe copyright.

Copyright

Copyright law in Australia is set out in the Copyright Act of 1968 and its subsequent amendments (7). Briefly, the Copyright Act requires that works are original and gives copyright owners (authors of original material) certain rights, particularly in respect to the unauthorised use of their work, including copying.

These rights arise as soon as the work is created and no registration is required (7). Thus, if you want to publish a work (or include part of it in your own work) and do not own the copyright, you must first seek permission from the copyright holder. Note that parts of other works includes tables, figures and diagrams published previously. The fact that you have received permission to reproduce the work, and the source of the material, must be clearly indicated in an accompanying legend or caption. Who actually owns the copyright of an individual piece of work (employee/employer etc.) may be a complex issue (7). In the case of scientific articles, authors must usually relinquish the copyright of their work to the journal as a requirement of publication.

Resources

Writing scientific articles - the process

- Zeiger M. Essentials of writing biomedical research papers. 2nd ed. New York: McGraw-Hill, 2000.

'Essentials of writing biomedical research papers' by Mimi Zeiger is an excellent text that describes how to write clearly. The book has practical examples that help to develop writing skills.

- Whimster W.F. Biomedical research. How to plan, publish and present it. London: Springer, 1997.

This text contains a wide range of information on writing articles and presenting data. No information on grammar and the use of English is included in this book.

- CBE Style Manual Committee. CBE style manual: a guide for authors, editors, and publishers in the biological sciences. 5th ed. Bethesda: Council of Biology Editors, 1983.

The 5th edition of the CBE style manual contains advice on the process of preparing scientific articles, including: grammar, punctuation and organising and writing the manuscript. Note that the 6th edition does not contain this information.

- Booth V. Communicating in science. Writing a scientific paper and speaking at scientific meetings. 2nd ed. Cambridge: Cambridge University Press, 1995.

- Day R.A. How to write and publish a scientific paper. 4th ed. Cambridge: Cambridge University Press, 1995.

- Lindsay D. A guide to scientific writing. Manual for students and research workers. Melbourne: Longman Cheshire, 1984.

- Woodford F.P. (ed). Scientific writing for graduate students. Bethesda: Council of Biology Editors, 1986.

Grammar and use of English

- Carey G.V. Mind the stop: a brief guide to punctuation. London: Penguin Books, 1976.

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