



# Scientific writing tips

*“The time to begin writing an article is when you have finished it to your satisfaction. By that time you begin to clearly and logically perceive what it is you really want to say.” (Mark Twain, 1902)*



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## 1. The title impact

As for any piece of writing or presentation, avoid burying the main message in the middle. Your title will have the highest chances of attracting some interest if the main point is stated in the first few words (see the serial position effect in Fig. 1) – whereas the total should anyhow be limited to 10 or maximum 15 words. Starting your title with “Study of” is exactly the opposite: would your work be scientific if it didn’t involve research, analysis or characterization? You can almost hear the reader thinking “boring”.

On the other hand overstatements also don’t help credibility, even if the implication of your work is a cure for mankind. What is “new” or “novel” today might not be tomorrow – however every scientific publication is a timeless building block which will only be cited if the crucial finding is clearly popping out of the title.

### When writing your title, remember

- Take-home message at the beginning NOT in the middle
- Avoid “new” or “novel”
- Avoid “Study”, “Characterization”, “Analysis”
- No abbreviations
- Shorter is better (limit to 10 – max 15 – words)
- Think of search engines

## 2. The abstract

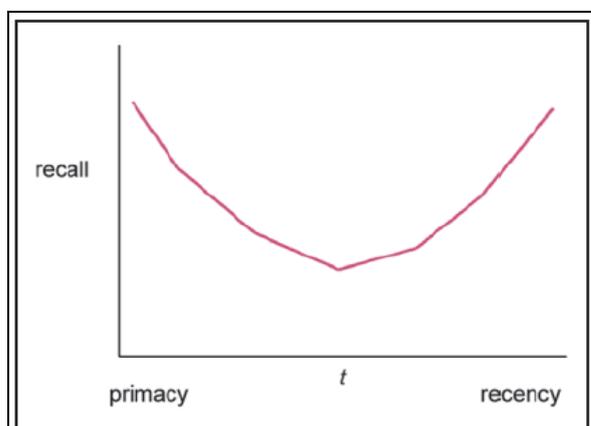
Abstracts are generally not structured according to principles that would increase their readability and the memorability of their most important points. Simply placing the most important message close to the beginning and at the end can help a lot!

In the late 1950s and early 1960s, experimental psychologists studied the relationship between the position of information in a continuous stream and found that material at the beginning and end are more strongly remembered than material in the middle.

1. Write a point that you wish the reader to remember above all else as near to the beginning of the abstract as you can.

2. Write a point that you wish the reader to remember above all else right at the very end of the abstract.

3. Separate points 1 and 2 by as little explanation and background as is necessary to generate context and make them understandable to the intended audience.



**Figure 1.** The serial position effect of free recall. Recall is highest at the beginning (primacy) and the end (recency) of an experience, e.g. reading a discrete block of text. This has obvious implications for the positioning of new and important information in a scientific abstract.



**When you write an abstract, remember**

- \_ As a forethought to your article
- \_ Important take-home points at the beginning and end – NOT in the middle!
- \_ Organize concepts with bullet points prior to writing
- \_ Shorter is better
- \_ Max. 150-200 words (MedLine truncates at 250)
- \_ Main statement – Evidence – Associated values
- \_ No citations, avoid abbreviations
- \_ Think of search engines

**Lay abstract or “Practical Applications”: Bring your science to a larger public**

In max. 150 words, describe the background, relevance and applications of your work for a non-expert scientific reader. This text may be used to highlight your article in the „in this issue“ section, on various online platforms, for marketing purposes and in sister journals.  
<http://www.biotechnology-journal.com>

<http://mc.manuscriptcentral.com/btj>

### 3. Writing structure. IMRAD or RAMID?

The typical structure of a scientific research article is not a secret to most scientists:

**Manuscript structure:**

- I** Introduction
- M** Materials and methods
- R** Results
- And
- D** Discussion

However the typical writer’s block may occur if you just start writing at the beginning. Of course, it may seem straight forward to start with the Introduction, maybe using a previously published article as template. However, do you know where you are going? Do you get to a concise and clear point? Rather than getting stuck somewhere in the writing process, we would like to suggest to start writing with the Results sections. More than that, as your research is progressing day to day, it would be a good idea to keep and update Figures and Legends describing your data in a comprehensive way. The story should crystallize from there.

**Writing order:**

- R** Results
- And
- M** Materials and methods
- I** Introduction
- D** Discussion

Now align the figures and show them to a colleague: can he or she understand the story from there? Great – this means you have good reasons to start writing the article of which, once published, the majority of readers will only scan through those figures anyhow. This is an extra reason to represent your results in a clear and informative layout. Preferably include a scheme to round up with.



The Results section can now be written: without repeating any of the content already described in the figure legends, the rationale behind the experiments should be explained in some more detail. The rest of the manuscript is just as straight forward: describe the methods used to obtain the results, then introduce your work with an overview of current literature and finally discuss your results. In no time and without block you will have written a solid draft of a good scientific article!

## 4. Keep it short



Of all instructions to authors, **word limits** can be the most difficult to handle. In the first place, it is essential to keep the maximum length in mind before writing. You will agree that nothing is more difficult than shortening a the written text produced with a lot of pain and effort.

Notwithstanding that exceeding the suggested length may become expensive in journals with page charges, there is a good reason to keep it short: A shorter manuscript usually has more impact than a longer one, particularly if the longer manuscript has a body text that is full of very field-specific detail.

Our rule of thumb is that on an average scientific article, depending on the font, about 600-700 words equal one typeset page - excluding figures. Thus, you have to realize that 12000 words equal 20 pages – who will read/print/look at this?

Tips for shortening your manuscript without losing information and impact:

### **Introduction** > 1000 words

- Concentrate on the latest publications of relevance, and limit the description of background to the parts necessary for understanding of your subsequent discussion
- Cover only as much historical background as is necessary for the contextualization of the topic for a broad readership.
- Try to avoid detailed lists of genes, gene products, acronyms etc. in the introduction. If necessary place it in a table

### □ **Manuscript body** too long/detailed

- Concentrate on the (novel) principles, draft them as bullet points and present them in a way that can be broadly understood
- Condense the detail that is necessary for specialist readers into **tables** or information boxes

### **Concluding section** > 300 words:

- Cut all background information and detail that is not necessary for understanding your principle insights
- Concentrate on presenting say up to 3 most important points and give some form of future perspective for the field

The memory effect of your most important points is substantially increased if intervening detail is kept to a minimum necessary for understanding. Improved readability does not necessarily guarantee citability, but poor readability is sure to reduce the potential citability of your topic.



## 5. Get the figures right

When starting to write a scientific manuscript you need to prepare figures of your data. Basically collecting these data is part of the day-to-day work and assembling them in clear, informative and complete figures is a challenge. As figures are the first thing a reader will glance over, this is the first thing a reviewer will check when evaluating your submission.

Ask yourself whether the information has to be visualized or could be stated in a Table or in the main text body. In journals which are still printed there will likely be some charge for color figures, so check first whether your information can be represented in grayscale or whether color is needed.

Do not include too many panels, six are the maximum. On the other hand, instead of 8 figures with one single panel these might also be combined into two or three. If you have too many data to show provide supporting material online. To summarize your results prepare a visual scheme, diagram or overview. This is especially advisable for complicated signaling pathways.

### **a) Figure or Table?**

#### **Figure:**

- Showing trend or picture
- Shape rather than numbers
- Compare few elements

#### **Table:**

- Recording data (raw or processed)
- Showing actual data values, precision
- Multiple comparisons

### **b) Figure legend**

The legend should be a short description of the experimental details, and should enable the reader to fully understand the figure without reading the text. Start with a summary what it's all about and explain some details about the results and system used. Include how many times the experiments were performed and the number of number of animals or replicates. Provide clear statistical analysis. Ensure that all abbreviations and symbols are described. With clear figures and legends, you have a higher chance that your article will actually be picked up and read!



### c) *Figure preparation made simple*

Most journals' author guidelines will tell you that high resolution images are needed. But if you are not a graphics expert, how can you create good figures in a simple way?

In general, figure **resolution** should be at least **400 dpi** (dots per inch) at printing dimensions. Expect your figures to be printed either to fit the width of **one column (8 cm)** or to fit the **width of the page (17 cm)**. Avoid extreme height-to-width ratios ("noodles" and "skyscrapers"). **Resizing:** Increasing the resolution of an image will result in a proportionally smaller image size. Example: you have an image 20 x 30 cm with a resolution of 96 dpi; increasing the resolution to 400 dpi will result in an image 5 x 7 cm. Text editors automatically compresses tiff files (and other uncompressed graphics) so the image quality will decrease. Therefore **do not embed TIFF files** in DOC files – however, JPEG files remain unchanged.

### d) *How to make chart figures from Excel and similar software*

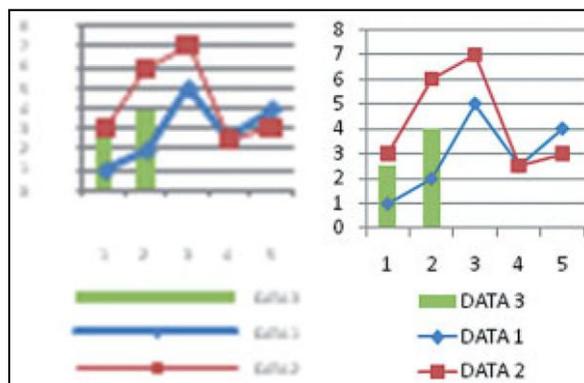
a. Open your excel sheet and scale the chart to **at least 400%** of the expected printing size (in practice, you can simply scale the chart to fill the whole screen)

b. Select the chart, **copy**

c. Open PowerPoint, and use Edit-**"Paste special...": paste as PNG file**

d. Submit the resulting ppt/pptx file.

Alternatively, paste your chart in an image editor of your choice, and save as **PNG or TIFF**; do not save charts or any line art as JPEG. **Do not copy-paste by using ctrl-v or by selecting "paste": this results in an excel object, not an image.**



The example demonstrates the importance of scaling a chart or any picture before copying-pasting as an image.

Some useful tutorials on the web:

Photo editing: [http://www.geofflawrence.com/photoshop\\_tutorial\\_size.php](http://www.geofflawrence.com/photoshop_tutorial_size.php)

Photo and digital imaging tips: <http://www.photoghetto.com/image-tips/index.asp>

Reduce the file size of a picture: <http://office.microsoft.com/en-us/help/HA101922001033.aspx>



## 6. Copied text ~ plagiarism

Wiley-Blackwell now uses a plagiarism check provided by [www.ithenticate.com](http://www.ithenticate.com) as a standard for all publications. Ithenticate provides a **percentage of similarity** between the source document and a large database of publications and websites, similar to what is known as a blast comparison of nucleotide or protein sequences. But what does plagiarism mean?

- The definition of **plagiarism** is “**the representation of another person's words, ideas, or information as if they were one's own**” (<http://plagiarism.org>). In other words: do not publish previously published work! However you may reuse some of your own and „CITED“ [1] material.
- Check the **copyright transfer agreement** ([www.wiley.com/go/ctalsweinheimglobal](http://www.wiley.com/go/ctalsweinheimglobal)). The CTA states

**a.** Contributors may re-use **unmodified abstracts** for any non-commercial purpose. For on-line uses of the abstracts, Wiley-Blackwell encourages but does not require linking back to the final published versions.

**b.** Contributors may re-use figures, tables, data sets, artwork, and **selected text up to 250 words** from their Contributions, provided the following conditions are met:

- (i) Full and accurate credit must be given to the Contribution.
- (ii) Modifications to the figures, tables and data must be noted. Otherwise, no changes may be made.
- (iii) The reuse may not be made for direct commercial purposes, or for financial consideration to the Contributor.
- (iv) **Nothing herein shall permit dual publication** in violation of journal ethical practices

- Check COPE - the **Committee on Publishing Ethics** ([www.publicationethics.org.uk/about](http://www.publicationethics.org.uk/about)).
- Check types of plagiarism (<http://plagiarism.org>)
- The publisher will perform a routine check provided by [www.ithenticate.com](http://www.ithenticate.com) which yields a Similarity Index. The Editor will evaluate each case individually, so that there is not such a thing as a cut-off percentage for plagiarism: the Editor may very well find an article with 40% copied but cited material acceptable whereas 20% non-cited copied text can be considered fraud.

The screenshot shows the iThenticate plagiarism check interface. At the top, it displays the document title "Paper Information" and a similarity index of 56%. Below this, the document text is shown, with a section circled in red. The text in the red circle reads: "Teddy has reacted defensively to an exploitative adult world by intuitively developing the persona of the mystic and clairvoyant both to gain the love he desperately needs and, paradoxically, to distance himself from his uncaring family and the grown-up world." To the right of the document text, a "Matching Sources" list is displayed, also circled in red. The list includes four sources: 1. 227 words / 39% - Internet from Jun 26, 2009; 2. 107 words / 15% - Internet from Sep 25, 2009; 3. 47 words / 7% - Internet from Sep 26, 2007; 4. 21 words / 3% - Internet from Nov 21, 2005. At the bottom of the interface, there is a copyright notice: "Copyright © 1998 – 2009 iParadigms, LLC. All rights reserved." and a link to the "iThenticate Manual".



- The Editor will check whether the sources are not cited (A) or cited (B)
  - A. When the **sources are not cited** and
    1. the similarity is high enough to constitute ethical misconduct, the manuscript will be **rejected**. Depending on the response by the author, the Editor may take further steps which could include informing the head of the research institute and/or banning the author from publication for 1-3 years.
    2. The similarity is reasonable, the author will be asked to **revise** before further consideration
  - B. When the **sources are correctly cited**
    1. There is a high degree of flexibility towards e.g. methods and introduction (up to 250 words, see CTA), but
    2. If results or conclusions are copied this can still lead to **rejection** (see A1)
    3. If a review type article has high similarity it at least needs **revision** as there is no point in duplicating already published information. A so-called mosaic-type article (a patchwork of copied work, even if cited) will be **rejected**
    4. Hidden plagiarism is still possible (<http://plagiarism.org>)
      - i. obscuring source locations
      - ii. inaccurate source information
      - iii. the writer falsely claims original presentation and interpretation
      - iv. the paper contains almost no original work
      - v. paraphrased material is presented as the writer's own analysis of the cited material
- Please note that the corresponding author is responsible for ensuring that all co-authors have seen and agreed to the terms of publication.
- Check for plagiarism on
  - EVE2, OrCheck, CopyCheck, WordCHECK, Déjà vu, ...
  - [www.etblast.org](http://www.etblast.org): free but mainly searches PubMed content
  - [www.turnitin.com](http://www.turnitin.com): searches a large database of publications and websites
  - [www.ithenticate.com](http://www.ithenticate.com): searches a large database of publications and websites
  - [www.research.ithenticate.com](http://www.research.ithenticate.com): helps authors, researchers and freelancers to screen papers ahead of submission





## 7. The cover letter

### *Getting through the first editorial assessment...*

Image © Creatas

Until about 10 years ago, many journals did not have an online workflow for article submission and peer review, and authors were requested to print at least 4 copies of the manuscript and separate figures or photographs with rub-on annotations, to courier the package to the publisher. On top of this pile you would need to add a letter - the cover letter.



While online manuscript submission is quick and easy a physical cover is not necessary, but adding a letter to the Editor remains important and is sometimes underestimated. A journal receives several manuscripts a day and the Editor has to decide very quickly whether your article is to be sent out for peer review or not. What can help to convince the Editor that the manuscript is **OURS (Original, Understandable, Reliable and Suitable)?**

For one thing, do not bother to repeat the title, authors and abstract of the article. The Editor can and will read your manuscript for himself! However in the cover letter, you can emphasize

- The importance of your work
- Why it is novel
- Why it fits the journal scope
- Why it will be of interest to reviewers

You also need to include some formal requirements:

- 1) All authors concur with the submission.
- 2) The work has not been published elsewhere, either completely, in part, or in another form.
- 3) The manuscript has not been submitted to another journal and will not be published elsewhere within one year after its publication in this journal.
- 4) The manuscript does/does not contain experiments using animals.
- 5) The manuscript does/does not contain human studies.

Pay special attention on why you think your article is suitable for the target journal. Have a look at the journal's website and *Aims and Scopes* and have a look at recent content and impact – which you have of course done BEFORE you started writing the article... /us /bj



## 8. Common mistakes in scientific texts

### **Avoiding anthropomorphism**

A common mistake in research articles is assigning actions that can only be performed by humans to non-living subjects. Subjects like **method, theory, research, table, figure**, etc. cannot **determine, conclude, find, summarize, compare**, or actively “act” as human subjects do. Examples of incorrect anthropomorphisms along with possible solutions are given in the table below:

<b>Anthropomorphism</b>	<b>Solution</b>
HPLC was able to determine the composition.	We determined the composition by HPLC.
The research found...	The researchers found...
Table 1 summarizes the results...	The summary in Table 1.
Figure 1 compares activities at 4°C and 37°C.	Activities at 4°C and 37°C are compared in Table 1.
Our hypothesis says...	We hypothesize...

### **Relative clauses: Which or that? Comma or not?**

Choosing between “which” and “that” to introduce clauses can often be confusing, even for native English speakers. In British English, “which” is used with both essential and non-essential clauses. However, in US English, **essential** clauses (when the clause defines the object as one particular out of many) are usually introduced by “**that**”. Before “that” you do NOT use a comma. The **non-essential** character is indicated by a **comma** and followed by **which**, and it is possible to think “**by the way**” without changing the meaning.

#### **Essential clauses: NO comma, use which or that**

Fatty acids which have multiple double bonds are called polyunsaturated fatty acids.

Land which is surrounded by water is an island.

The mice which were kept at 4°C caught a bad cold.

#### **Non-essential clauses: COMMA followed by which. Think “by the way”**

Fatty acids, **which** are abundant in nature, vary in length and saturation

Tasmania, **which** is surrounded by the waters of Bass Strait, is an island of great natural beauty.

The mice, **which** were kept in cages, were monitored during the experiment.



## 9. Some writing rules

- *Shun and avoid the employment of **unnecessary, excess extra** words.*
- *Make certain all sentences are **full and complete**. If possible.*
- *Avoid **cliches** like the plague.*
- *Take pain's to **spell and, punctuate** correctly.*
- ***BE** Consistent.*
- *Don't approximate. Always be more or less **precise**.*
- *Sedulously eschew obfuscatory **hyperverbosity** or prolixity.*
- *Avoid **pointless repetition**, and don't repeat yourself unnecessarily.*
- *Always try to remember the/E extreme importance of being accurate; neat, and careful.*
- *Don't use no **double negatives**.*
- *Don't never use no **triple negatives**.*
- ***All generalizations** are bad.*
- *Take care that your verb and subject **is** in agreement.*
- *A preposition is a bad thing to end a sentence **with**.*
- *Don't use commas, which aren't necessary.*
- *"Avoid overuse of '**quotation**' marks."*
- *Writing carefully, **dangling** participles must be avoided.*
- ***And** don't start a sentence with a conjunction.*
- *Reserve the apostrophe for **it's** proper use and omit it when its not necessary.*
- *Avoid **run-on sentences** they are hard to read.*
- ***Proofread** carefully to see if you any words out.*
- *Never use that totally cool, radically groovy out-of-date **slang**.*
- *Avoid those **long sentences** that just go on, and on, they never stop, they just keep rambling, and you really wish the person would just shut up, but no, they just keep on going, they're worse than the Energizer Bunny, they babble incessantly, and these sentences, they just never stop.*

From <http://www.union.edu/PUBLIC/BIODEPT/wicked.html>

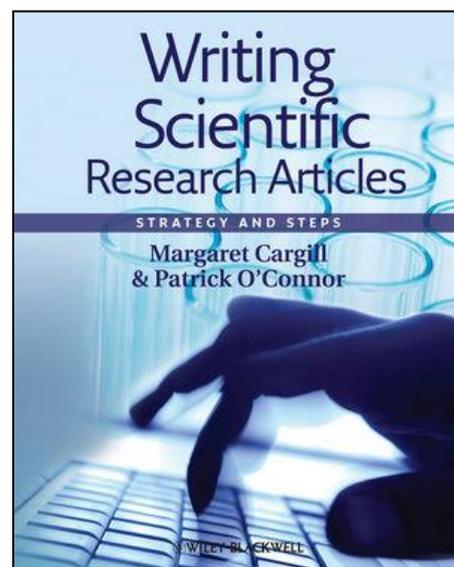


Contributions from Barbara Janssens, Uta Schaefer, Lucie Kalvodova and Andrew Moore

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[barbara.janssens@gmail.com](mailto:barbara.janssens@gmail.com)

**Recommended further reading:**

Cargill, M., O'Connor, P., *Writing scientific research articles*.  
Blackwell Publishing, Chichester 2009,  
ISBN 978-1-4051-8619-3.



Websites of interest

[www.biotechvisions.com](http://www.biotechvisions.com)

<http://authorservices.wiley.com/bauthor>

<http://www.slideshare.net/secret/oymNwGJBTzqRyl>