

Editorial

Writing a Scientific Paper: I. Titles and Abstracts

I graduated from the University of Cambridge in 1960 with a B.A. in physics. At that time a requirement of the examination process was a three hour exam in which one was required to write an English essay on a subject chosen from a long list of topics provided. It was also a requirement of admission to the university that one had passed an examination in Greek or Latin. I studied Latin for eight years. After graduation I went to work at A.E.R.E. Harwell, a government laboratory where there were strict limits on what one could publish. Each paper had to be examined, and approved, by my group leader, my department head and a declassification office before it could be submitted to a scientific journal. With my educational background and these additional checks, the writing of scientific papers was always a matter for extreme care. This does not mean that I do not sometimes read my early papers with embarrassment. There were certainly errors and I cannot claim perfection, but I despair at the quality of many manuscripts I receive nowadays. Good science deserves good presentation, not the sloppy accounts I read too often.

Setting aside the issue of language problems, particularly for our Asian contributors, I feel I should give some pointers and advice for writing scientific papers. I intend writing a few Editorials on this subject and hope my experience will be useful to others?

“Let’s start at the very beginning – a very good place to start” (Sound of Music): the title and the abstract. Although these items are the first in the paper, they have to be written last. It is impossible to abstract something that has not been written! More than half the papers I receive are returned to the authors for amendments to these items. I have the impression that they are usually added as something necessary to complete the submission, and little or no thought is given to them.

When I started my research career there were far fewer journals and they were all available only in printed form. We used to eagerly await the arrival of the latest edition of, for example, *J. Nuclear Materials*, and a weekly newsletter informed us of the latest periodicals available in the Harwell library. At that time one held in one’s hands the complete paper: title, abstract, text and references. The title

and abstract might later appear in *Chemical Abstracts*, etc. but they were originally never seen in isolation.

The situation today is quite different. The title of a paper accepted for *CARBON* will appear on the journal website two or three weeks after acceptance and, for a fee, the original submission can be downloaded. A month later, after the manuscript has been typeset and proofed, one is able to download and read the abstract without charge before deciding whether to pay to download the complete manuscript. The publishers tell us that a vast majority of papers today are accessed via the journal website. The number of printed copies of the journal, which used to be around 1500, has now dropped to less than 500. I know that many readers have full access to the journal website through institutional subscriptions, but there are many people who pay to download a manuscript, and because of this it is essential that both the title and the abstract give an honest indication of what the paper contains.

Let me give an example. I recently received a paper whose title indicated that it concerned the preparation of carbon nanoparticles as a filler for polymers. But this was not true! The authors had only examined one polymer. An honest title would have indicated that the paper was about the preparation of carbon nanoparticles as a filler for polyethylene, or whatever polymer had been examined. Always ask yourself whether the title of your manuscript, **seen in isolation**, gives a full and honest indication of the experimental work reported in the paper.

Another recent submission had a title that told me that a material was synthesised “in a gas pressure atmosphere”. I had to read well into the experimental part of the paper before I learned that the atmosphere was argon! There was no indication of this in either the title or the abstract. What the author should have said was “in high pressure argon”.

Another problem with titles is the way authors think the use of a colon is “cute”. A paper entitled “The synthesis of carbon nanotubes using a xxx catalyst: the effect of the catalyst preparation method” can easily be made more straightforward by writing “The effect of the catalyst preparation method on the synthesis of carbon nanotubes using a xxx catalyst”. The colon is unnecessary [I call such titles

“colonic”, a pun that will perhaps be understood only by native English speakers]. I would willingly accept the title if it were “The synthesis of carbon nanotubes using a xxxx catalyst: I. The effect of the catalyst preparation method”. In other words the authors were writing a series of manuscripts on the use of xxxx catalyst with part II being, perhaps, “The synthesis of carbon nanotubes using a xxxx catalyst: II. The influence of reaction temperature”. The colon should be reserved for a series of multi-part papers. This does not mean that I approve of this practice. Too many multi-part papers have been divided simply as a means to improve the paper count on the author’s CV, and not to improve understanding. The title of this Editorial is an illustration of the correct use of the colon.

As already mentioned, while the title and the abstract come first, they should be written last. One cannot abstract a paper that has not yet been written! The abstract is most important because it is able to give a fuller account than the title of the manuscript’s content, and it is available from the website without paying a fee. It should be concise (one paragraph) and precise, indicating to the potential reader two things: (a) what was done, and (b) important results obtained. That’s all! It is not the place for history, or discussion of results. Many abstracts received can easily have their first few sentences removed because they give the history, something that should be reserved for the Introduction section of the manuscript. The same can often be said of the final sentence or two. A comment such as “The material may be useful in capacitors” is pure speculation and does not belong in an abstract. Of course, if the authors have done experiments to show its usefulness in this application, it should be mentioned. Phrases such as “we think the effect is caused by...” do not belong in an abstract.

Many abstracts I receive start like this “In this paper we report a new method for the production of carbon foams from...”. Immediately there are three mistakes: (a) “In this paper...”, and I thought it was a different paper you were discussing! (b) “. . .we report...” – surely it could not be another person reporting for you! (c) “. . .a new method...”, but scientific journals do not report old methods. The abstract should start: “Carbon foams were produced from...”. This is shorter and gets straight to the point. I have been told that some journals ban the use of “new”, “novel” etc. Everything we publish should be new. There is no need to say so.

Another common start to an abstract is something like “The aim of this work was to...”. Again, this is not necessary. Perhaps your aim was to achieve cold fusion! The reader wants to know simply what you did and what you found.

Many abstracts contain words that can be deleted with no loss of information. “Detailed” and “careful” are common examples. We expect scientists to do detailed and careful work: there should be no need to say so. “A de-

tailed examination of the Raman spectra shows that...” can be changed to “The Raman spectra show that...” without any loss of information. I have just read an abstract that tells me that a certain composite material “was successfully fabricated”. May I assume that if the fabrication were unsuccessful, the process would not have been reported? The word “successfully” can be deleted. Words and phrases such as “also”, “moreover”, “furthermore” and “in addition” can also usually be deleted without any loss or change of meaning.

Another problem with many abstracts is their vagueness. We may be told that “. . .the activation energy was determined”, but to be told that “. . .the activation energy was determined to be 270 kcal/mol” is far more informative and precise. Very occasionally one finds a statement such as “. . .the activation energy was determined to be 270 kcal/mol” in the abstract, but there is no mention of the value in the text! The abstract should be a concise summary of the text, and should not contain any information that is not in the text.

Some abstracts, not many, cite references. This should not be necessary. The author must bear in mind that the reader of the abstract does not have access to the list of references unless the complete paper is downloaded. If it is necessary to cite a reference in an abstract, it must be given in full and not be cited as a number referring to the list of references.

Finally, always remember that the abstract must be able to stand alone. The reader must be able to understand it without reference to the whole paper. For this reason I always read the title and abstract of each submission and make comments on them before I look at the manuscript. I recently asked an author the question, “What does this mean?” about a statement in his abstract. He had used a word that does not exist in any dictionary that I have and I could not even guess what it meant with certainty. How would non-native English speakers understand it? The paper was resubmitted a few days later with no change to the sentence. Again I asked: “What does this mean?” The author replied, a little angry I think, that if I only read the full paper I would discover what it meant, to which I replied that the point of my comment was that it should not be necessary to read the whole paper to discover what was meant in the abstract. This vital point is not understood many authors.

Titles and abstracts are much more important nowadays than they were 10 years ago. The Editor pleads with you to make sure they are accurate and can be understood in isolation. My maxim to keep them “concise and precise” applies more today than ever before.

Editor-in-Chief
Peter A. Thrower

Available online 25 July 2007