

# Writing Scientific and Medical Papers Clearly

DENYS WHEATLEY\*

*University of Aberdeen, UK (retired) and Former Editor-in-Chief, Cell Biology International, founder Cancer Cell International and Theoretical Biology and Medical Modelling, former Editor-in-Chief of Oncology News and Cancer Hypotheses, and Founder and Director of BioMedES UK (www.biomedes.biz), a biomedical editing service.*

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## ABSTRACT

My concern in this presentation is with the falling standard of papers, particularly primary research articles, in the scientific and medical literature. Few of our younger generation of scientists (and many older ones) have never had specific training in how to write a good article, and yet this is the major product of all research effort that has been done, perhaps over a year or more. This is a situation that has to be corrected by all institutions, universities, and similar bodies, who need to introduce into the curriculum a course (not just a token lecture) that deals with the complexity of writing a lucid article that is succinct and written with style. To assist in this exercise, I have now produced a manual (1) that goes step-by-step through the process of writing and publishing scientific papers in such a way that they have much greater chance of being accepted by learned journals. *Anat Rec*, 301:1493–1496, 2018. © 2018 Wiley Periodicals, Inc.

## INTRODUCTION

I wish to thank the organizers for inviting me to speak in this session. Cynthia Jensen, in particular, has done a lot of work to bring this meeting into being, and Alison Harris has also done a great job. I think it is very important to have a good session on this subject, and similar sessions should be held at future American Society for Cell Biology (ASCB) and other scientific and medical conferences, because the business of writing scientific papers and getting them published is so important to every one of us.

## EDITORIAL EXPERIENCE

I founded *Cancer Cell International* in 2000 as an independent editor for *BioMed Central*, which in the past 3 years has moved on to a new Editor. I also founded *Theoretical Biology and Medical Modelling*, later run by my colleague, Paul Agutter, which now has a Japanese Editor-in-Chief. I remain editor of *Oncology News*, am still on many editorial boards, the international advisory board of EASE (European Association of Science Editors), and advise many other organizations regarding editorial matters and all matters pertaining to the preparation and publication of scientific (and other types of) papers. I

actually was talking to somebody earlier about my getting into editing and I realized that, as a graduate student in London, I made some much needed money (at that time) to keep myself going by helping with *Biological Abstracts* in the days when everything was on printed paper, which now seems a long time back; it was indeed well over 50 years ago! I was sent many papers and had to prepare potted abstracts of them which had to fill little entries like small advertising boxes in this journal (more like a database of abstracts), sometimes down to ~50 words. And we got paid a pittance for each one, so you had to do a lot. Thus, I have been in the business a long time and have had much experience, which over the last 20 years or so I have been sharing with authors, editors, and publishers on a much bigger and wider scale.

## ON THE PRESENTATION OF PAPERS

What I want to deal with here is something quite different from what the other panelists have covered. I want to talk about the scientific paper itself. I have an outfit called BioMedES ([www.biomedes.co.uk](http://www.biomedes.co.uk)), which came into being after I became editor of *Cell Biology International* (CBI) over 20 years ago, which I have relinquished to Sergio Schenkman, who will be its new Editor-in-Chief. When I took it over, there were many manuscripts that

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\*Correspondence to: 3232dnwd@gmail.com

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the International Federation for Cell Biology (IFCB) was publishing from around the world through *CBI*, its official journal. We wanted a more level playing-field approach so that people from different countries, especially developing countries, were not so disadvantaged in having their papers published in international journals that need to be in English. Many papers come from non-native English speakers, even more so these days when you consider the deluge coming from mainland China. Consequently, we introduced a “Manuscript Presentation Service,” which for a couple of years was free of charge. As it gained momentum and needed to generate some income to keep going, it became BioMedES, which is a free-standing independent company. Its main task is to improve the presentation of scientifically sound papers—in jargon it is an editorial *polishing* service for manuscripts. In other words, after we have checked that the science is sound, we edit to make it read smoothly and clearly in idiomatic English. This applies to papers being or about to be submitted to journals, but in particular to those coming through peer review as potentially acceptable *if* their presentation can be raised to an acceptable standard. This makes it a very important service, which many people, particularly authors from mainland China and other Far East countries, now use a lot, and at a reasonable charge.

Why then is it important to think about the actual writing of a scientific paper? How many people here are graduate students, postgrads, or postdocs and how many people have been trained in writing a scientific paper? (A show of hands indicated about 20% of the audience.) How long was the course in your training, an hour or more? (A small response.) Did any of you have a 2-month course on writing a scientific paper? (Apart from one responder, none.) This training is too important to dismiss or ignore, and I will discuss the problem this creates as I go along.

A primary research article is the final product of your investigation. You spent a lot of money from your granting agency getting to this point in doing the research work after a very thorough training in your discipline over many years. And yet the vast majority of you hardly received any training in how to present that data to the world in its best-possible form at the end of it. This is simply not good enough. You all need very good training to do this and yet it is lacking in almost all quarters of the world. I go around the globe giving courses on how to write and publish scientific papers. It is very important because it is so neglected; and you also need to know both sides of the story, not just the writing of a paper, but what goes on at submission and thereafter in the editorial and publication procedures. As your scientific reputation, status, career, grants, and fund-raising activities all depend on your output, this lack of training in producing *the final product* of your efforts is frankly a disgrace. Unfortunately, it seems to be a tacit assumption that you will learn how to write papers by osmosis from your supervisors or other more experienced colleagues (who themselves probably had no good training!).

## WRITING A SCIENTIFIC PAPER

The art of writing a scientific paper is a skill that does not come easily. There are two main tasks:

(i) To present original data (research results) and their context in a conventional manner with which all are

familiar (Title, Abstract, Introduction, and so on). I have, like a number of other people, written extensively about the business of putting together a scientific paper. You can find an introduction to this in my Manual (Wheatley, n.d.) by going to the BioMedES website ([www.biomedes.biz](http://www.biomedes.biz)). When you read such a detailed work on this art, you will find to your surprise that a paper is best constructed in a way that will be quite different from the approach that most take. On this account, you will find the whole business (usually seen as a chore) of preparing a paper can become quite different—yes, an art that should be fostered.

(ii) The second task is to write so that your reader has no difficulty in understanding what you are saying and/or implying. Science depends on communication; language must be clear, and the connotation of the words and phrases should never be ambiguous. Science requires *precision* in what you have been doing in experimentation; this applies to the written product, as it must be precise in what the words mean so that they can be properly understood in their context. This side of the business is concerned with effective communication by using English accurately and properly, which is difficult enough for anyone born in the UK, but orders of magnitude more difficult for those who are non-native speakers, who nevertheless have to comply if they hope to publish their papers in most international journals.

First, let me tell you what I think of a modern scientific paper; today it has become almost completely stereotyped. Each one looks like any other. In general, the present state of the scientific paper is bad; no, it is dreadful; no, I think it is even worse; I think it is appalling, and we have to do something about it. Lacking adequate training, the result is that we tend to copy others and perpetuate poor research papers, with bad habits getting progressively worse; this is taking the easy road. Style, well, as a consequence of what I have just said, it is almost completely gone. If an editor gets a paper with style, is succinct, clear, and smoothly flowing in its presentation of sound scientific original information, this constitutes a memorable occasion.

We find in current scientific papers that the same words and phrases are used across the board. And the language, in its connotation, is getting increasingly abstruse. Traveling here by air, an announcement was made in the cabin—Would you please make the aisles clear as we are going to *expedite our rehydration service*—for which read, we are bringing around some water. That is quite like the way that scientific papers are being written, with the use of highfalutin words and phrases, making things more difficult to comprehend. This does not help science progress. You probably remember Crick’s remark made quite a number of years ago: it is out of context, but it is true enough: There’s nothing more difficult to understand, more tedious to read than the average scientific paper.

So why is language so important; why do we need to write clearly and succinctly? For you, as author, it helps to refine your ideas so that they can be communicated more effectively. It reduces redundancy, tautology, and wadding/padding—words that do not need to be there. An example is where something is implicit: the sample was spun at 100,000g in an ultracentrifuge. You cannot spin something at this speed if you do not use an ultracentrifuge. Another simple example is the start of many

sentences referring to other people's work—It was recently reported by Fox et al. (2016)...—which should read Fox et al. (2016) found that... (so it is recent, anyway, if the paper being written is read around 2016, but not if it is 2040!).”

### TALKING TO EXPERTS

Much of what I do relates to cancer research. The very first line of almost all papers that come in to my editorial office that is about some aspect of cancer, let us say it is pancreatic cancer for which the authors have found a new biomarker, often reads as follows: Pancreatic carcinoma is well-known to be one of the most highly malignant forms of cancer in the world. The authors are going to deal with one specialized aspect of cancer, and they start by putting down an opener that is so general it has no relevance to the readership *who will, almost all, be experts in the field*. In brief, authors need to stop waffling and get to the specific information they wish to impart. If something is well known, there is absolutely no need to point it out.

Padding is not just superfluous words and phrases, but whole sections of papers are unnecessarily peripheral to the main message to be communicated. Keeping the subject matter relevant and to the point also helps your reader; this includes editors, peer reviewers, proof readers, copy editors, and the publishers. Members of the scientific fraternity that take a particular interest in published articles are busy people who do not want to waste time. They want you to communicate briefly and unambiguously the main purpose of it. The longer the paper, the more tedious it becomes.

Most importantly, a short and clear paper has a far greater chance at peer review than a tedious one. If it is exciting, clear, succinct, and right-on-the-button, reviewers, editors, and publishers will act quickly; otherwise, it could be shelved sometimes for months. I like Mark Twain's remark on writing in general: Don't let fluff and flowers and verbosity creep in.

### IMPROVING MANUSCRIPTS

At BioMedES, we frequently see that a paper needs to be reduced to make it clear and read well (fluently). You get this sort of thing coming in where somebody wants their paper improved, and below (see Appendix) I show as an example the Introduction to an original article in which the first paragraph is full of strikethroughs. These are the words that can and have been eliminated without affecting the sense, the message, of the whole passage. The second paragraph is left as it was because I do not want to bore you. The last paragraph I have highlighted in red font the words that just have no relevance in that context. This introduction was originally 644 words, which was reduced to 373 words, a 47% reduction. It now flows easily and reads easily with no loss of meaning.

Would that everyone could write lucidly; my experience is that even native English speakers, including well-educated UK citizens, fail to write papers and reports lucidly. We can do the hard work for you, but personally I would prefer that authors do it for themselves. That brings us back to another part of the problem, that of good training in preparing good papers in *idiomatic* English.

In post-war times, Ernest Gowers was head of civil service in London; he received daily across his desk so many memoranda that were difficult to understand. He asked for plain English to be used. His book, *Plain Words*, is still available from Amazon, with Rebecca Gowers now continuing to produce new editions (Gowers, 2015). There is a new book *For Who the Bell Tolls* by David Marsh of *The Guardian* in London (Marsh, 2014), a wonderful and amusing book about how to write plain English. Another is *Plain English* by Martin Cutts from Oxford University (Cutts, 2013). Most books that are available on “how to write a scientific paper” will not cover how to write in plain English; even my own Modules on this subject do not (work in progress!); but it is important to turn to ones like those mentioned above in your own training. Returning to scientific writing in this vein, there are other sources you can turn to for coverage of the art, but many do not set out to write a clear handbook (a manual or *vade mecum*) on the practicalities as well. They can have chapters dealing with choice of words, different tenses, much as you would find in books specifically devoted to learning the English language *per se*. However, the one that might be singled out that can help is by Vogel (Zeiger, n.d.).

I should also point out that the US government has also been begging for plain English to be used in communications. In 1978, President Carter asked (order 12044) that regulations should be written in plain English. President Clinton in 1998 issued a similar memorandum—*Plain Language in Government Writing*—much like Ernest Gowers. The Securities and Exchange Commission demanded that stocks and bond prospectuses be written in plain English. In 2010, both Houses of the US government passed the *Plain Writing Act*. Other countries and other organizations, including doctors, have put out similar edicts but how many have stuck? If there had been any movement following such a succession of demands, matters ought to have improved, but they have not. They should be enforced; surely, but how, is the 64,000 dollar question.

### SCIENTIFIC WRITING WITH A BETTER COMMAND OF THE ENGLISH LANGUAGE

We have the same problem with science and technology, and in many other disciplines. If others have tried to do something about it, then surely it is time for science and technology *editors and publishers* to demand good plain English of their authors. They have a responsibility and are in positions that could start to put things right, because under the present education of our scientists and doctors, authors *untrained* in scientific presentation in English are not going to submit better papers even if they have an immaculate command of English. The responsibility lies with everybody, but today much of that burden is in fact on the authors as—for ease of publication—it is better for papers to be submitted as close to copy-ready as possible. One factor in particular that makes matters worse is that the internet now allows authors almost unlimited scope—their papers do not have a word limit. The ease of publishing online means that some journals can now handle hundreds if not thousands of papers a year. Less time will be spent on each, and under these circumstances, *quality* will suffer at the hands of quantity, which is why the standard of papers is rapidly in decline.

**AN INTERNATIONAL CONVENTION?**

Do we need an international convention? If we can have orders from governments telling us that we have to write communications of all sorts in plain English, then in science and medicine we should have some convention as soon as possible, because the rot set in quite a number of years back. I find that DORA goes a little way toward this objective, but it does not deal with the issues I have been covering. If we do not do something about it *now*, the writing of scientific papers is just going to get even worse, which is of no help to any of us.

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