

# Inheritance of poor writing habits

To improve scientific writing we must break the chain of transmission of complex writing style from senior to junior scientists

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The volume of scientific literature is enormous, but it is largely inaccessible to non-expert readers, including scientists from other fields. This is not just because the content is highly specialized but also because scientific writing itself is far from simple and clear. Generations of editors, reviewers and readers have struggled to understand complex, exaggerated and often pompous prose that does little to enhance the reader's understanding but aims to demonstrate the scholarly prowess of the author. The causes go beyond an inadequate command of the English language: they are rooted in long-standing practices that value pretentiousness over clear communication. These practices are passed down from senior to junior scientists, which explains why scientific writing remains generally poor despite regular criticism. It will take the combined efforts of scientists, research institutions and scientific journals to achieve a marked and long-lasting improvement.

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The earliest article listed in PubMed that laments the style of scientific writing was published in 1884 [1], as an editorial in *Science*. The editor reminds authors that if they wish to have the greatest impact, they should remember to write for a broad audience: "It is not against the use of fit words that this article is directed, but against the abstruse, complex, scholastic diction, which

any writer may turn, if he will, into clear and accurate English". Over 120 years later, things have not improved; a recent editorial in *Nature Cell Biology* exhorts scientists to write their research clearly [2], whilst another in *Nature Structural & Molecular Biology* has the telling title 'Scientific writing 101' [3]. It is interesting to note that I have never come across an editorial, comment or article praising the quality of scientific writing. One senior editor of *Nature* bluntly stated "most papers are badly written" [4].

The goal of writing is to communicate the thoughts and ideas of the author to the reader clearly and concisely. Only in the achievement of this goal can we call any piece of writing 'good', regardless of the complexity of the vocabulary used or the gracefulness of the prose. If a piece of writing fails to communicate clearly, it has failed. As scientific papers deal inevitably with complex subjects, the need for clarity in the language used to discuss them is greater still. Note the clear and lucid metaphor with which James Watson and Francis Crick described one of the greatest discoveries in science: "This is because all the bases are flat, and since they are stacked roughly one above another like a pile of pennies, it makes no difference which pair is neighbour to which" [5]. In reality, however, journal editors often have to "struggle through really poorly written pieces with no end in sight", or receive complaints from reviewers "about how complicated, convoluted or downright confusing a paper is" [3]. Another article that explains why students find it difficult to understand science complains that academic writing "uses sophisticated words and complex grammatical constructions that can disrupt reading comprehension and block learning" [6].

One of the best examples of awkward and convoluted writing that I have come across is the following sentence: "We adopt this broad-scale approach to determine that relationships occur both at the level of the population (and hence not confounded by [1] potential environmental variation and/or [2] statistical non-independence of individuals) and also across individuals (because [1] relatively recent colonization of the UK by rabbits [...], and [2] previous work [...] demonstrating extremely fine-scale genetic structuring in UK rabbits over short spatial scales both make it difficult to define what constitutes a 'population' for analysis)" [7]. The gist of the following sentence from another article is clearer, but the authors have constructed a pretentious way of simply saying that the measurement technique was not sensitive enough: "The answer to this question is still unclear, probably due to the limits of the techniques used to resolve temporally events that are almost coincident" [8]. It is remarkable that sentences such as those above must have passed the desks of several authors and two or three reviewers, as well as the editor(s) and copy editor(s) of reputable journals. Of course, not all academic writing is this convoluted and pompous—indeed there are examples of truly great scientific prose—but much of the scientific literature leaves a great deal to be improved.

It is important at this stage to assert that good grammar and spelling are not sufficient to make a paper well written. A paper can be a grammatical work of art and still fail to convey its message, whilst a paper with a less firm grasp of grammar, if well-written in other ways, can still do a better job of communicating with the reader. The authors of much of the scientific literature

are not native speakers of English. As such, they tend to make more grammatical mistakes than native speakers, especially when they use the artificially complex writing style favoured by the scientific community. Native speakers generally make fewer grammatical mistakes, but this does not mean that they necessarily write better prose. Leslie Sage, Senior Editor for physical sciences at *Nature* has noted that two of the worst papers he has ever seen at *Nature* were from “native English speakers based at a major UK university” [4]. The problem is therefore not rooted in the inadequate knowledge and application of the English language but from a misconception that ‘big science’ can only be described in big words.

Given the constant criticism of contemporary scientific writing, it is remarkable that so little has changed. This is despite the efforts of academic institutions and grant agencies to help scientists to improve their writing—many offer workshops and courses at both the undergraduate and graduate levels to teach students to write clearly and efficiently. This is a necessary step in the right direction but the effect might not last long. Even if students learn the principles of good writing they are, nonetheless, embedded in a culture in which they will read scores of papers written in the ‘standard’ style. Moreover, once they start writing their own thesis and papers, their supervisor or a postdoc, steeped in the art of ‘scientific’ writing, will probably insist on editing and complicating the manuscript. As long as this inheritance chain remains, the provision of writing workshops and courses will have no long-lasting effects.

Some universities have established writing centres in recognition of the necessity of writing clear and concise grant applications and scientific articles. These provide some help to scientists in crafting their prose, and examples include the Department of Surgery’s Scientific Publications Office at the University of Southern California (USA), the editorial office at the Perelman School of Medicine, University of Pennsylvania (USA), and the Grant Information, Facilitation and Training (GIFT) Centre of Arizona University (USA). St Jude Children’s Research Hospital (USA) similarly has a Scientific Editing Department, and the Mayo Clinic (USA) has the Section of Scientific Publications. NASA also provides writing and editing services

for its scientists. However, such services are available at only a few institutions, and their usefulness depends on whether or not an author is willing to accept such services and heed an editor’s advice.

Journals also try to promote good writing practices. They periodically publish editorials and articles about scientific writing, and provide helpful resources and services on their web sites, sometimes at a cost. When editors and reviewers feel that a manuscript requires editing to improve the language, they usually point this out to the authors. Yet, without further details about what is wrong with the manuscript, the authors are often at a loss to know what to do. For them, the manuscript submitted represents their best attempt to explain their work in language that they feel is fully appropriate for the task. Some journals provide editing support to improve the quality of the writing but most publications provide only basic copy-editing that fixes grammatical errors and spelling mistakes, rather than complex or pretentious prose.

The problem with these efforts—which do not seem to have had much impact on the quality and style of scientific writing—is that they are too piecemeal. What is needed is a proper, cooperative, concerted effort from all parties involved—authors, institutions and journals—to break up a century-old tradition of writing badly.

## **To improve the quality of scientific communication, scientists must first acknowledge the problem and understand its nature**

Native English speakers and others who are fluent in the English language will not find it particularly difficult to improve their writing, but there are two main impediments. First, many scientists do not have a clear idea of what could be wrong with their writing or how to improve it. Scientists should therefore become more familiar with the principles of good writing. There are a multitude of books, manuals, articles and other resources, many of them freely available on the internet, to help with this. George Orwell’s 1946 essay, ‘Politics and the English Language’, is a good starting point, as is *The Elements of Style* by William Strunk and E.B. White. However, inertia compounded

by lack of time will probably push such ventures to the back burner. Second, some scientists are in a state of denial about the quality of their writing. Although many good scientists are also good writers, excellence in science does not necessarily translate into excellence in writing.

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Academic and research institutions should provide in-house editing services or use independent editors to improve the quality of their publications. The editors can work directly on the manuscripts themselves, guide authors to improve their manuscripts and teach scientists the art of good writing. This might be seen as an additional burden on research budgets but the investment is justified in my view. First, the cost is minimal compared with the expense of doing research, and the value of research is in its communication. Second, scientists—frequently senior scientists—would not have to spend a considerable amount of time trying to correct and improve manuscript drafts, often ineffectively. Whilst the writing or editing professional works on a manuscript, the scientist can go about his or her research activities.

In addition to professional editing services, universities should also provide scientific writing courses as part of their graduate and undergraduate curricula. However, unless the transmission of bad writing habits is interrupted, these courses will not be as effective as they could be. Each year, some of my students ask me whether their thesis advisors will accept a simple and direct writing style; they have already begun to learn that the scientific community views complex prose as denoting scientific importance. In general, students taking such courses probably follow the safer path by emulating their advisor’s writing habits. Once they write their Master’s thesis, they are past the point of no return. As a remedy, graduate schools should annually screen some Master’s and PhD theses for clarity and readability and provide feedback to thesis advisors. A few minutes spent reading parts of the results and discussion sections at random should give a good idea of readability.

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However, institutions without writing or editing facilities will probably hesitate to recruit new personnel for this job, and thesis advisors might see it as an intrusion into their territory.

An alternative approach is to involve thesis advisors and mentors in promoting better writing among their students, even if they themselves continue to do otherwise out of habit. Students will gain more from writing courses if their mentors reinforce what they learn. As such, the first step that institutions should take is to convince thesis advisors of the value of changing 'scientific writing' for the better. Supervisors should promote clear writing by contributing to science writing lectures and seminars, and by directly instructing their students to apply what they learn in these courses. The message they should give students and young scientists is that writing habits must change, and that because it is notoriously hard to teach an old dog new tricks, it is up to the young to change them.

Journals can also have a much more active role in educating scientists and motivating them to improve their writing practices. For example, instructions about the need for clear and direct language should not be buried within the guide to authors. Rather, these statements and links to editing services and resources should be given more prominence on the journal website. Repeating them on the manuscript submission page could also have a greater effect, perhaps with a reminder that poor writing will probably slow down

the submission-to-publication process, as poorly written manuscripts take longer to understand, review and copy-edit.

However, because many manuscripts suffer from several writing problems—grammatical errors, awkward syntax, over-long sentences, excessive use of the passive voice, verbosity and repetition—general instructions do not really enable authors to identify the problems with their own manuscripts. As such, it would help if journal editors and reviewers could provide more specific feedback about poor writing. Of course, this is an extra burden on their time, but it would enable the authors to revise their manuscripts in a more focused way. The benefit to a journal would be that revised manuscripts are better written and more easily understood by their readers.

A more direct and effective approach would require authors of manuscripts that are accepted, but which require considerable developmental editing beyond what is commonly done by copy-editors, to have their manuscripts edited by a professional editor of their choice and to provide proof of that. Applying such a policy would certainly improve the quality of the writing in a journal, and it could serve as a sufficient inducement for authors and their institutions to be more diligent about their manuscripts before they submit.

Science has made huge advances during the past century, but the quality of scientific writing has remained more or less abysmally bad. To improve the quality of scientific communication, scientists must first acknowledge the problem and understand its nature. Once we all agree that scientific writing can be improved, then individual scientists, institutions and journals can begin to bring about change. As a community, we need to overcome deeply ingrained bad writing habits and practices, to make the scientific literature

more accessible and understandable, and ultimately more enjoyable for readers.

**CONFLICT OF INTEREST**

The author declares that he has no conflict of interest.

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