



# Beyond style guides: Suggestions for better scientific English

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## Summary

The benefit of publishing research in English is obvious, but so is the problem: authors with a limited knowledge of English find it difficult to compete with their proficient colleagues. In this note, we offer suggestions for improving the English of papers in the biological sciences. The suggestions aim to help authors enhance writing skills, are based on our experiences as language correctors and do not appear in major guides to scientific writing. We also argue for the need for regular publication of language tips in the pages of science journals.

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## Introduction

The role of English in worldwide scientific communication has increased dramatically over the past 25 years (Jaffe, 2003). The number of international English-language scientific periodicals is constantly on the rise, and many journals issued in non-English-speaking countries are in English. The benefit of publishing research in English is obvious, but so is the problem: authors with a limited knowledge of English find it difficult to compete with their proficient colleagues.

Earlier publications have emphasized the need for good English in science reporting (Griscom, 1999; Eleftheriades, 2002; Coleman, 2003; Tychinin and Webb, 2003; Gee, 2004) and have provided specific tips for authors wishing to improve writing skills (Griscom, 1999; Tychinin and Webb, 2003; Tychinin and Mkandawire, 2004; Adams, 2004). More such tips are given in this article. These are based on our experiences as language correctors and as readers of scientific and technical literature, which unfortunately abounds with examples of incorrect English. The goal of the article is

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twofold: (i) To help authors or their translators make the language of prospective submissions more friendly to editors, referees and, ultimately, readers. (ii) To stimulate interest among bioscientists in matters of usage and style, and to encourage the exchange of advice. To achieve this goal, we look at some commonly misused words, including scientific terms. For general guidance on writing we point readers to Greenbaum and Whitcut (1988), Amis (1998), Strunk and White (2000), and Walsh (2000).

## Literature

Our examples were taken from a range of biological literature (original papers, reviews, application notes, meeting reports, editorials and announcements) in the fields of microbiology, biochemistry, ecology and the environment, and plant and soil sciences.

To check spelling and meaning, we used the fourth edition of *The American Heritage® Dictionary of the English Language* (2002), available online at <http://www.bartleby.com/61/>. To exclude overlap of material, we consulted several authoritative guidebooks on writing and editing (American Society for Microbiology, 1991; Alley, 2000; Day, 2000; Matthews et al., 1996; Dodd, 1997; University of Chicago Press, 2003). As a result we do not consider many perennial problems, such as 'amount' vs. 'number' (American Society for Microbiology, 1991; Alley, 2000; Day, 2000; University of Chicago Press, 2003), 'between' vs. 'among' (American Society for Microbiology, 1991; Dodd, 1997; Day, 2000; University of Chicago Press, 2003), 'criteria' vs. 'criterion' (Alley, 2000; Day, 2000; University of Chicago Press, 2003), 'fewer' vs. 'less' (American Society for Microbiology, 1991; Dodd, 1997; Alley, 2000; Day, 2000; University of Chicago Press, 2003), 'regime' vs. 'regimen' (American Society for Microbiology, 1991; Matthews et al., 1996), 'kill' vs. 'sacrifice' (Matthews et al., 1996; Day, 2000), 'plethora' vs. 'many' or 'excess' (Matthews et al., 1996; Alley, 2000), 'that' vs. 'which' (American Society for Microbiology, 1991; Matthews et al., 1996; Alley, 2000; University of Chicago Press, 2003), 'varying' vs. 'various' (American Society for Microbiology, 1991; Matthews et al., 1996; Day, 2000) or 'whereas' vs. 'while' (American Society for Microbiology, 1991; Matthews et al., 1996; Day, 2000; University of Chicago Press, 2003). Following the style used in the relevant sections of the guidebooks, we arranged the entries in alphabetical order.

## A mini-guide to better English

*Adenylylation, adenylation*: The inclusion of one or two *yls* depends on the biochemical process in question. 'Adenylylation' (not 'adenylation') is an established term for the attachment of an *adenylyl* (adenosine 5'-monophosphate, AMP) group to an acceptor, generally by the action of the enzyme adenylyl transferase (see <http://history.nih.gov/exhibits/stadtman/glossary.htm>). 'Adenylation', though not yet validated by any scientific reference work, would correctly describe the attachment of an *adenyl* group.

*Analogous, similar*: The words are sometimes misused in place of 'identical, the same', mostly through careless translation. "Our next experiment was performed in an analogous manner" is a misleading statement if the difference was only in the amount of substance added to the reaction mixture.

*Approach*: (i) Idiomatic English has 'approach++to+gerund'; thus, 'an approach to determining  $\Delta C_p$  for protein unfolding', not 'an approach to determine ...'. (ii) The word can lead to verbosity, as in 'in a phased approach', which means nothing more than 'by phases'.

*As well as*: 'And as well as', as in 'hazardous properties of the waste and as well as its possible effects', is a blatant redundancy and an indication of negligent proofreading. Either 'and' or 'as well as' (if the meaning is 'not only effects but also properties') would be enough. Similarly, the use of 'both' with 'as well as' instead of 'and', as in 'both a diode array detector as well as a fluorescence detector', is plainly ungrammatical. 'Both ... as well as' works only if the sentence goes something like this: "Both these references, as well as my own data, show that ..."

*Bacterial, microbial*: (i) Because no one has discovered plant or animal cells in bacteria, specifying that a study used 'bacterial/microbial cells of *Pseudomonas putida*' borders on the ridiculous. (ii) 'Bacterial' and 'microbial' require editing in such awkward phrases as 'bacterial-based biosensor' (repair tips: 'bacterial biosensor' or 'bacteria-based biosensor') or 'microbial-produced indoleacetic acid (IAA)' (repair tips: 'IAA produced by (the) microbes' or 'microbial IAA').

*Chromato-mass-spectrometer, chromato-mass-spectrometry*: These Slavic-English terms have the advantage of being compact and handy, but they also have the disadvantage of being non-standard (Tychinin and Mkandawire, 2004). Our search of the Medline (<http://www.ncbi.nlm.nih.gov/entrez/>) database for 'chromato-mass-spectrometry' returned 20 documents, 19 of which were of Russian

origin and one was from a Japanese university. A Medline search for 'chromato-mass-spectrometer' returned a single document, of Russian origin, and a Google Scholar (<http://www.scholar.google.com/>) search yielded none. An international audience, therefore, would be more comfortable with familiar replacements – for example, 'chromatography with mass spectrometric detection' or 'chromatography in combination/in conjunction with mass spectrometry' for the technique and 'chromatograph-mass spectrometer' or 'chromatograph in conjunction with/coupled to/together with a mass spectrometer' for the instrument.

*Degrader, destructor:* The word 'destructor' means 'an incinerator for refuse'. It does not apply to biological organisms capable of degrading harmful waste, which are correctly termed 'degraders' or 'degradative organisms'.

*Diapason, range:* Nothing is ever 'linear in the concentration diapason 0.14–1.4 mM'. 'Diapason' is a musical term; unlike 'range', it does not mean 'set of values'.

*Distil, distill, distillate:* 'Distillate' is a noun, sometimes functioning as an adjective (e.g. 'distillate fuels'). It must not be turned into a verb or past participle, as in 'distilled reaction masses'. The verb is 'distil' (British spelling) or 'distill' (American spelling). The present tense is 'distils' or 'distills', not 'distillates'; the past tense is 'distilled', not 'distillated'.

*Entire, whole:* These words are the source of tautology in combinations with 'across', 'along' and 'throughout', as in 'across the whole range', 'along the entire length' or 'throughout the whole period'.

*Example, exemplify:* A problem may be considered *with* an example, but not 'in', 'on' or 'at' it. And to give an example, or to serve as one, is to 'exemplify', not 'exemplify'.

*Exploit:* This is not equivalent to 'use'. To exploit something is to use it either selfishly (a meaning rarely needed in scientific contexts) or to the best advantage.

*In detail, in more detail, in some detail, in sufficient detail:* All these expressions require 'detail' in the singular. This detail is of particular relevance to authors and editors having a different idiom in their mother tongue (e.g. the Russian *detalyakh* 'in details').

*Paucity:* In plainer English, 'a paucity of data' is few (or insufficient) data and 'a paucity of information' is little (or insufficient) information.

*Scale:* The word can give rise to scientific bureauspeak, as in 'increased on a worldwide scale' (what is wrong with 'increased worldwide?').

*Specialize:* One does not 'specialize' at an institute or a university; rather one receives specialized (or special) training there.

*Species:* Most writers know that the plural of 'species' is also 'species' and that the singular form is abbreviated as 'sp.' and the plural form as 'spp.' What some of them overlook, though, is that 'sp.' calls for an indefinite article just as the unabbreviated singular 'species' does (e.g. 'a *Moraxella* sp.', not '*Moraxella* sp.').

*The surrounding environment:* 'Environment' already means 'circumstances surrounding', so there is no need for another 'surrounding'. It is also possible to use 'the surroundings', without 'environment'.

*Toward(s):* The word gives sticklers for conciseness a good chance to take a step forward because it can often be safely reduced to 'to', as in 'steps to success', 'effort directed to studying the effects of drugs' or 'antibody specific to Nef C-terminus'.

*Usage, use:* These words are not real synonyms. 'Usage' refers mostly to the conventions of a language (e.g. 'English usage'), whereas 'use' refers to the condition of being used (e.g. 'fertilizer use'). There are no such things as 'antibiotic usage', 'e-mail usage', 'the usage of electrophoresis' or 'common usage of the keyboard, mouse, games console and touch screen'.

## Final thoughts

- (i) Although native-speaker writing or revision is no guarantee of absolute correctness (Norman, 2003; Tychinin and Webb, 2003), we recommend that non-native-English speakers should always have their manuscripts checked and edited by a native-English speaker before submission. That will clear their styles of unidiomatic usages, esoteric coinages and awkward translations.
- (ii) We urge all our English-loving colleagues – native and non-native speakers alike – to publish experience-based suggestions for better writing in science. We also urge copy editors working for the major scientific publishers to contribute articles on usage and style topics, with real-world examples, and possibly even to introduce a journal section that might be headed 'Copy Editor's Corner'. Such advice will no doubt be of greater help to the writing scientists than will the standard advice to get a guidebook or take a writing course. It will be especially valuable to under- and postgraduate students beginning to prepare research manuscripts, as well as to non-anglophones, faced

with the lack of relevant manuals and courses in their home countries. There has been enough complaint about the 'poor' language quality of modern scientific prose; the challenge is to actually demonstrate better ways. The result will be well worth the effort.

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