To be or not to be – Are medical and scientific writers of non-native English origin at a disadvantage?

encountered by science writers whose native language is not English. These are referred to as English-as-second-language (ESL) mistakes (Table 1). Please note that the list in Table 1 is by no means exhaustive; depending on your experience and working field, there may be other issues experienced. You may wish to consult the self-help guide titled "Mastering Scientific and Medical Writing"[1] that provides more details and helpful examples relating to most of the issues described here.

The following sections address those issues I consider to be most troublesome to scientific communicators with a language origin other than English.

Choice of correct verb tense

As pointed out in Table 1, using the correct tense is one of the most important aspects of clear scientific writing in English, in that unambiguous distinction between *new* and *old* knowledge is mandatory. This is in contrast to some other languages, e.g. German, where the tense appears to be less critical to meaning. The main tenses used in science reporting are the present tense and past tense, with other tenses, such as the perfect tenses or future tense, used rather sparingly. Essentially, we merely have to know when to use the present or past tense (Table 2).

In scientific documents, the present tense indicates known facts, general knowledge, or established findings. We usually have no problems identifying known facts and general knowledge because they concern, to all intents and purposes, information with which we tend to be familiar. Here are some examples:

Today's analytical methods differ markedly from those used 10 years ago.

Vaccination in children prevents the spread of childhood diseases.

MRSA infections are difficult to treat because they resist the effects of many common antibiotics.

However, it may be more difficult to recognise *established* findings. The textbook definition of an *established finding* is "any result that has been published in a credible primary source". But what is a primary source? And what makes it credible? Primary sources are documents that provide a full description of the original research. For example, a primary source could be a journal article reporting original research findings. A secondary source could be an article commenting, analysing, interpreting, or contradicting these research findings. A good example of a secondary source is a review paper that usually includes all current and pertinent studies in connection with the research question addressed. The definition of *credible* is, of course, somewhat more arbitrary. Within the sciences, a credible source could be a peer-reviewed journal or other recognised scholarly source, such as an article issued by a university publisher.

For describing the materials and methods applied in the study being reported, we apply the past tense since this section gives an account of how the work was conducted. Although some authors would argue that their method should be viewed as a general *recipe* and should, therefore, appear in the present tense, method description for the current study must be in the past tense even if the method used is an established procedure.

The use of the past tense to describe new findings, including our own, is perhaps the most important aspect of proper writing. By using the past tense, you indicate to the reader that these are new, previously unpublished findings. Many authors are highly enthusiastic about their findings and are tempted to use the present tense for reporting them, as in "The new method is superior to the old one." This is clearly incorrect since the finding is neither published nor a generally known fact. Here are some examples of proper use of tense when reporting results:

Method A was superior to Method B in our study.

We observed large intra- and interindividual variability.

The authors concluded that the trial population was too small and terminated the study prematurely.

When you refer to a table, figure, or other visual aid contained in your manuscript, make sure to use the present tense, e.g.

Table 2 lists the individual percentages.

Figure 1 shows the concentration versus time profile.

Appendix A contains the raw data.

It helps to use active voice in such sentences since the passive voice may encourage erroneous use of the past tense. Thus, we have two good reasons for applying the active voice here (see also below).

Finally, make sure to use the past tense when referring to other researchers or attributing previous findings to other authors:

Jones et al. reported similar findings.

Miller et al. did not use the same study design.

Some authors prefer to use the present perfect for attributions, as in: *Jones et al. have reported similar findings.*

This is not wrong by any standard, but if we want to limit the tenses to the simple present and simple past, it makes sense to use the past tense also in attributions.

Avoiding wordiness

Wordiness is a serious problem in science writing because unnecessary words obscure the message. Inexperience and language problems may be the cause of wordiness and redundant text because a more eloquent formulation may not be to hand. Uncertainty about the significance of our findings may also lead to wordiness; the author may welcome the vagueness resulting from using overly long sentences in the absence of a clear understanding of the results. Remember though that science writing is about informing, rather than confusing, the reader. Any unnecessary word may get in the way of clarity. With this in mind, wordiness must be avoided and any unnecessary word or filler discarded. Table 3 provides a few tips on how to avoid wordiness in scientific texts.

Active versus passive writing

Barely another topic is as heatedly debated as active versus passive writing. For some reason, many authors hold a strong view on the tradition of passive writing, and sometimes they can hardly be convinced of the many advantages of active writing. Proponents of passive writing claim that the *doers* (e.g. the scientists) are not of relevance, and the main emphasis should be on the outcome. Although the notion of modesty is appealing, this view no longer complies with the scientific community's expectations. These days, our peers demand to know who carried out the

work reported, and they require the transparency and clarity that comes with using the active voice. However, the active voice is more than just using the personal pronouns *I* or *we*; it also concerns the use of active verbs in place of the ubiquitous verb *to be* (see also Table 3).

Let us look at some examples:

The trial was conducted in 30 healthy subjects. (passive voice)

We conducted the trial in 30 healthy subjects. (active voice using the personal pronoun "we")

The trial involved 30 healthy subjects. (active voice using an active verb)

What are we learning from these statements? The first sentence tells us that someone had conducted a trial in 30 healthy subjects, but we do not know whether or not the authors themselves carried out the study. The second sentence makes this clear by using the personal pronoun *we*. The third sentence would actually win the top prize in a competition of word economy and clarity, although it remains unclear who carried out the study. This may become clear from the context if the authors generally use personal pronouns in the article.

It is good advice to apply the active voice wherever possible and to limit the passive voice to statements that are more *natural* in the passive than the active. Consider a sentence like this:

After the terrible accident in the mountains, he was rushed into hospital by helicopter. (passive)

Although you may be able to rephrase the sentence in the active voice, especially if you were the nurse or pilot involved, there is little sense in making a truly passive situation grammatically active. The rule usually applied in science writing states that no more than 30% of all verbs in the article should be passive.[2] In a standard research paper, we tend to use most of the (allowed) passive verbs in the section describing the methods. Here, active sentences involving *we* are sometimes stilted if used throughout.

In conclusion, the best guide is your common sense, as long as you use the active voice in the majority of your sentences.

Non-essential and essential clauses

The pronouns *which* and *that* introduce either a non-essential or essential clause. This seems easy enough – all the more surprising that erroneous use of these two pronouns causes considerable confusion in medical and scientific texts. Life used to be fairly straightforward when *which* exclusively introduced a non-essential clause and *that* was reserved for the essential clause, but this rule appears to have gone out of fashion. This, in

Table 1. The most common English-as-second-language mistakes in science writing

Trouble makers	Comments
Choice of tense	The choice of tense is critical to the meaning in English science writing, contrary to other languages (e.g. German). The present tense indicates known facts or established knowledge or both. The past tense indicates new findings, including your own.
Wordiness	The tendency to use two or three words when one would do is a common English-as-second-language (ESL) mistake. Quantity does, however, never compensate for quality, and short sentences help to make messages clear.
Passive writing	Language uncertainties may predispose to passive writing. Passive writing tends to make statements longer and vague; thus, active writing almost always conveys the message more readily.
***Which* versus *that* (non-essential and essential clauses)**	*Which* and *that* are frequently used pronouns in scientific texts. *Which* is used when the information being added is not essential to the meaning of the sentence (non-essential clause). If you use a *which clause*, be sure to separate it from the main sentence with a comma. *That* is used when the information being added is essential to the understanding of the sentence.
Use of *respectively*	Few words cause as much confusion as does the adverb *respectively*. *Respectively* should be used exclusively in sentences where there is a clear relationship between pairs of variables.
Translating terms (*lost in translation*)	Translating terms from other languages may be a problem if the target language is not our mother tongue. A thesaurus may be helpful, but it can become a problem when homonyms (words with identical spelling but different meaning) are not understood. Make sure you have a firm understanding of the definition of a word before you try to find an alternative.
Definite versus indefinite article	The only definite article in the English language (*the*) is used when referring to something known by both the writer and reader. If you discuss a specific method, you would refer to it as *the* method. In contrast, the indefinite articles (*a* or *an*) are used with nouns that are not specific. For example, you may develop *a new method* that subsequently becomes *the* method in your text. *A* is used for words that begin with a consonant sound (e.g. a method), and *an* is used for words that begin with a vowel or vowel sound (e.g. an analysis or an hour).
Transitional phrases	Over-reliance on transitional phrases gets in the way of conciseness and clarity. If two statements are logically related, do not use a transitional link. For example, "The pharmacologists determined the pharmacokinetics of the new drug. Consequently, we obtained values for the half-life." Here, *consequently* is unnecesary because the causal relationship is clear to the reader.
Positioning adjectives and adverbs (syntax)	Adjectives used in a series usually follow a specific order: 1. article, 2. judgement, 3. size, 4. age, 5. shape, 6. colour, 7. nationality, and 8. material. Thus, "a tall, 20-year old French patient" would be correct. Keep adverbs close to the verb to avoid confusion. In the past, placing an adverb between the infinitive (known as a split infinitive; e.g. to quickly determine) was not acceptable practice. Nowadays, you may split an infinitive if you have a good reason for placing the main emphasis on the nature of the action (e.g. to randomly allocate patients to treatment groups). In most situations, however, we are still on safer ground when placing the adverb after the verb.
Vague statements	Writers who are insufficiently confident in their writing skills tend to avoid definitive statements. Non-committal messages are, however, not compatible with the accuracy we apply in science and medicine. Do bear in mind that you facilitate the transfer of the intended message by using clear and definitive statements.

Abbreviation: ESL, English-as-second-language.

Table 2. The* tense *rules

Part of paper	Tense
Established knowledge, previous results, generally known facts	Reported in the present tense
Methods applied, materials used in the current study	Reported in the past tense
Description of results	Reported strictly in the past tense
Description of tables, figures, and other displays	Referred to in the present tense because they are part of the actual report or manuscript
Attribution	Given in the past tense, but the present perfect may also be used

turn, leads to the liberal use of *which* in essential as well as non-essential clauses. The distinction is, however, important because of the commas that are needed in case of a non-essential clause. Let us look at an example:

The cells sedimented to the bottom of the tube which was associated with a change of colour.

Does *which* introduce an essential or non-essential clause? The statement is ambiguous because it is not entirely clear whether *which* refers to the bottom of the tube or the process of cell sedimentation. A useful test is to replace *which* with *that*; if the message of the sentence remains unchanged, *which* introduces an essential clause.

The cells sedimented to the bottom of the tube that was associated with a change of colour.

From a grammatical point of view, this sentence makes it absolutely clear that the bottom of the tube changed its colour. But is this what the author intended to say? It is highly unlikely that a glass tube changes its colour simply because cells in the mixture sedimented to the bottom of the vial. Thus, *which* in the original sentence most likely introduces a non-essential clause that must be separated from the main sentence by a comma. If we place a comma before *which*, the reader knows that the colour change was the result of cell sedimentation.

The cells sedimented to the bottom of the tube, which was associated with a change of colour.

If there is any doubt about such a sentence, rephrase it completely. The above sentence could be rewritten as follows:

Cells sedimented to the bottom of the tube, resulting in a change of colour.

Table 3. Strategies for eliminating wordiness

Tip	Examples
Avoid *there is*, *there was*, or *this is* etc., at the beginning of the sentence. Use action verbs rather than forms of the verb *to be*.	It was our intention to study the in vitro mechanism of gastrointestinal absorption. (wordy) We intended to study the in vitro mechanism of gastrointestinal absorption. (revised)
Use active rather than passive voice because active sentences are clearer and usually shorter.	The results were analysed using several statistical tests. (unclear because passive) We analysed the results using several statistical tests. (revised)
Make the real subject the actual subject of the sentence; make the real verb the actual verb.	In their review, there is ample evidence of the discrepancy in findings reported by the various institutions. (wordy) Their review clearly documents the discrepancy in findings reported by the various institutions. (revised)
Limit multiple adjectives and adverbs	The stain we observed was large, red in colour, irregularly shaped, and very extended. (wordy) We observed a large red stain of irregular shape. (revised) The effect was very highly statistically significantly more pronounced in the second experiment than the first. (wordy) The effect was significantly greater in the second than the first experiment ($p = 0.001$). (revised; actual p-value given)
Avoid redundancies, e.g. *in my personal opinion*, *for the purpose of*, *in an attempt to*, *at the present time*, etc.	At the present time, there are no guidelines with regard to quality assurance of these proteins as far as we know. (wordy) Currently, no guidelines exist for the quality assurance of these proteins. (revised)
Delete unnecessary phrases and clauses, e.g. *in the event that*, *due to the fact that*, *the reason why is that*, etc.	Because of the fact that there were many leaking cells in the event when they were incubated overnight, the incubation times were adjusted by means of shortening them for subsequent experiments. (wordy) Because many cells leaked in overnight incubations, we shortened the incubation times in subsequent experiments. (revised)

Or: Cell sedimentation to the bottom of the tube led to a change of colour.

Here is another example:

Our laboratory, which has two dark rooms, is located in the city centre. (non-essential clause)

Our laboratory that has two dark rooms is located in the city centre. (essential clause)

The first sentence tells us that the laboratory is located in the city centre, and that it possesses two dark rooms. The latter information is, however, not essential to the main message. The main sentence simply says that the laboratory is located in the city centre. In contrast, the second sentence implies that there are several laboratories, and the one that has two dark rooms is located in the city centre. If you were to replace *that* in this sentence with *which*, make sure not to use a comma before *which*. If you use a comma nonetheless, your sentence is misread as to imply the meaning of the first example above.

The rule then would be to be sensitive to the change of meaning that occurs by using or omitting a comma. To make things easier, at least for you as a writer, stick to *that* in essential clauses and reserve *which* for non-essential ones.

Use of *respectively*

The word *respectively* is frequently misused by native and non-native English-speaking authors alike, and, as with the other elements described above, its misuse can lead to confusion and ambiguities. The main reason for such misuse is the fact that other languages have a word that resembles *respectively* but may mean something else. For example, the German *respektive* usually simply means *or* in English, and *respectively* is thus inappropriate.

A sentence without *respectively* is often clearer, but if we wish to economise on words in sentences containing two corresponding lists, the term *respectively* may be useful. Here is an example:

The mean time to disease progression in groups 1 and 2 was 5 weeks and 9 weeks, respectively.

This means that the patients in group 1 experienced disease progression after a mean of 5 weeks, while those in group 2 had a mean time to progression of 9 weeks. When describing a term that is shorter than *the time to disease progression*, such as average weights for example, *respectively* is not necessary.

Mean body weight was 72 kg in group 1 and 83 kg in group 2.

This is preferable to a construction with *respectively* because the sentence without *respectively* is shorter and is readily understood anyhow. Thus, the rule would be to use *respectively* sparingly, i.e. only in those situations where the word helps to clarify the relationships. In sentences that are clear without the additional *respectively*, do not use the term.

Lost in translation

Nowadays, most biomedical and other scientific publications are written in English. Authors who are insufficiently acquainted with the English language sometimes opt for their native language when drafting a manuscript. In a second step, the text is translated into English, usually by a professional translator or colleague whose native language *is* English.

Clearly, the quality of the final manuscript depends substantially on the language skills of the translator. You may have written an impressive paper in your own language whose beauty may be lost in translation. Thus, translators should be selected with the greatest possible care. In most cases, it does not suffice to know the language well; for the translation to be accurate and precise, the translator must fully understand the science and concepts described. Many terms may be correctly translated but may be inappropriate for the intended meaning. In this way, ridiculous, if not dangerous, confusion may arise. An example that springs to mind is the frequently used phrase *not statistically significant*. In a translation from German to English, the translator had used the term *statistically insignificant*, which is linguistically correct but scientifically inappropriate. If statistical testing revealed the absence of a statistically significant difference between groups, the result is said to be *not statistically significant*. To call this finding *insignificant* is incorrect because the result may be of considerable meaning and significance although it was not statistically significant.

In short, *correctness* and meaning are two different things, and the professional who transfers your reasoning into another language must be able to fully understand the meaning that you have intended. Much confusion in medical and scientific papers originates from careless, incomplete, or even incorrect translation. Authors sometimes have an insufficient understanding of a term even in their own language; thus, when translating it with the help of a dictionary or thesaurus, they may pick the wrong translation for the term. In addition, words may have the same spelling and pronunciation, but their use may vary considerably. Writers with a language origin other than English have a disadvantage here because correct usage of terms clearly comes from experience. Moreover, not being familiar with the proper use of terms can predispose to rather exotic translations involving fancy words and uncommon formulations. Remember, we do not show off our scientific writing skill by using words that no one knows; rather we impress readers if we succeed in conveying the message with few (well-known) words and short sentences.

Literal translation of scientific texts often results in complicated, long, and obscure sentences. English is a highly precise and powerful language requiring fewer words than others to express informative contents. At any rate, every manuscript written by non-native speakers of English should be scrutinised for spelling and grammar mistakes, and an experienced writer or editor with a sound knowledge of English should edit the article before submitting it for publication.

In conclusion, are medical and scientific writers of non-native English origin really at a disadvantage? It seems reasonable to conclude that the drawbacks these writers may have is compensated by their vigilance and awareness of potential pitfalls. Finally, good writing comes from fully understanding the subject you write about, coupled with the willingness and ability to apply the principles of clear writing.

References

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Author information

Silvia M. Rogers, BSc Hons., PhD, has been running a medical writing agency in Basel for some 20 years. She writes for the pharmaceutical industry and leads workshops on writing for medical and scientific professionals. She holds a permanent lectureship at the University of Basel, teaching scientific writing for students of pharmacy and other biomedical sciences. Before starting her career as a medical writer, she worked in the research and development departments of two major pharmaceutical companies. Silvia is a pharmacologist who trained at the University of Liverpool, in the UK. She has authored two books on medical and scientific writing published by Springer, Heidelberg.

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