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Bjorn Gustavii
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1 Basic rules of writing

Winston Churchill was sitting at his desk, working on his epic about World War II, when his private secretary entered the room. Churchill had reached the Blitz – the German air strikes against London. His staff of researchers had earlier produced a 150-page brief on the raids. The secretary had been asked to cut it down to about two and a half pages and, after having "worked like stink," he could now proudly hand over the condensed version.

Churchill took out his red pen and started to edit. "All my sloppy sentences were tightened up and all my useless adjectives obliterated," the secretary tells us in a documentary made about 50 years later (Bennet 1992). In the midst of it all, Churchill said gently, "I hope you don't mind me doing this?" The secretary answered, "Thank you, Sir – you are giving me a free lesson in writing plain English."

Brevity

We should emulate Churchill by excluding every nonessential word. Professional writers do it that way. Brevity is an elementary rule of all writing, not only to save valuable publication space, but also because verbose writing obscures meaning and wastes the reader's time and patience. And that is also the essence of the next basic rule.

Logic and clarity

To convey information is above all a matter of logic and clarity. What you want to say should be so arranged that the reader can follow your argumentation step by step. Moreover, your sen-

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tences should be so clear and easily understood "that the reader forgets that he is reading and knows only that he is absorbing ideas" (Baker 1955).

Now to the importance of making the manuscript physically attractive. Here is an illustrative example.

Clean typing

Paul Fogelberg, editor of a Finnish scientific journal, was one of the teachers at a course on scientific writing. Late one evening, he told us, he was perusing a manuscript in which only half of the letter "a" was legible. Page after page, that half-letter pursued him until eventually he began to feel vaguely that this must be something directed at him personally.

I didn't see Fogelberg again until 12 years later at a meeting of editors. I mentioned the damaged typeface, without really expecting that he would remember it. But he replied instantly, "It wasn't damaged. Much worse – it wasn't cleaned."

Does a dirty typeface of a mechanical typewriter, or an error related to electronic word processing, really matter? Yes, because editors know from experience that there is a close relationship between a poorly prepared manuscript and poor science. So make sure your manuscript looks carefully prepared; it may influence editors and referees in your favor.

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2 Comments on scientific language

A MEDLINE search showed that no fewer than 90 percent of papers listed in *Index Medicus* in 1999 were written in English, compared with 53 percent in 1966 (the year MEDLINE started). The saying "Publish in English or perish" must therefore be taken seriously. Regrettably, this means that many authors are obliged to write in a language other than their native tongue – with all that this can entail. Here I will share with you an episode from my own experience as a non-native writer of English.

English as a foreign language

My first paper published in English was initially written in Swedish and then translated into English by a professional translator. "Brilliant," I thought when I saw the translated version. But when my supervisor read it, he shook his head and said, "Try to write directly in English!" "Gosh," I said to myself, thinking of my poor grades in English at school, "I'll never, ever be able to do that."

But I decided to try and consulted the textbooks, which advised me to read writers of fine English, such as Gibbon and his *Decline and Fall of the Roman Empire*. I bought the book (running to 3616 pages in three volumes!) but could find neither the time nor the interest to read it.

Instead, I subscribed to the American weekly magazines *Newsweek* and *Time*. As they often cover the same topics, the reader is given the opportunity to learn twice, in different words, about the same issues. I have found this very instructive.

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Now to the correction of your English text. Ideally, correctors ought to be persons who (1) not only are native speakers of English but also live in your country and speak its language; (2) return to their native country at least once a year to refresh their English; and (3) have a knowledge of scientific writing. Correctors fulfilling these criteria are a rare species. Many authors therefore have to rely on English-speaking persons who, for instance, happen to be working in their department or laboratory. That may not be so bad, after all, because these persons are no doubt acquainted with your field of research. But you must be aware that native-English-speaking researchers do not necessarily write good English – just as not all Swedish researchers are good at Swedish.

I return to my early paper, translated from Swedish into English. On rereading it 30 years later, I found to my embarrassment that it didn't express exactly what I meant to say, though I found the style elegant. However, even clumsy writing would have been better than this, had it conveyed the information accurately.

Why are papers in biomedicine often almost unintelligible? Maybe an editorial in *The Lancet* (1995) had the answer when it claimed that authors of scientific papers often write more to please the editor than to inform the reader. They dare not depart from the traditional style for fear of having their work rejected.

Another mistake commonly committed by beginners is the compulsion to be "complete." Charlie Chaplin had something to say about that.

Follow the "leitmotif"

The video film *Unknown Chaplin* (Brownlow and Gill 1983) shows unused sequences from Chaplin's productions. Some of them are far funnier than those actually included in the final versions of his films. Why were they excluded? Chaplin gives the answer in his autobiography (Chaplin 1973). "If a gag interfered

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with the logic of events, no matter how funny it was, I would not use it." You are thus recommended to do as Chaplin did and resist the urge to include every item of evidence obtained. In other words, do not include observations that depart from the main theme – no matter how interesting these may seem to be (you will probably find space for them elsewhere, or they could give rise to hypotheses to be tested in future studies). However, if such information cries out to be mentioned, you can insert it parenthetically – as I did in the previous sentence.

Researchers are often short of time. I once heard of a scientist who only had time to read papers while driving to work! That is one reason for keeping a paper short; another is that superfluous words obscure the meaning.

Verbosity

In the following paragraph, adapted from Kesling (1958), 40 of the 55 words can be omitted:

> Our research, designed to test the fatal effects of PGF2α on dogs, was carried out by intravenously introducing the drug. In the experiments, a relatively small quantity, 30 mg, was administered to each animal. In each case, PGF2α proved fatal; all 10 dogs expiring before a lapse of five minutes after the injection.

15 words are enough:

> Intravenous injection of 30 mg prostaglandin PGF2α to each of ten dogs killed them within five minutes.

"Omit needless words!" is Rule 17 in Strunk and White's *The Elements of Style* (2000). In the introduction to the third edition of the book, E.B. White, a pupil of Strunk, tells us that his teacher omitted so many needless words in his course in English that he would have been left with nothing more to say at the end of his lesson if he had not used a simple trick: he uttered every sentence three times, "Omit needless words! Omit needless words! Omit needless words!"

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But do not go too far. The telegraphic style of the following sentence taken from *Contraception* must be a riddle to a non-specialist:

> Young mature Sprague Dawley rats (200 g) (Charles River Italia) were [used].

What do "young" and "mature" mean? What do "Sprague Dawley" and "Charles River Italia" stand for? And did all the rats weigh exactly 200 g? The average reader is probably better served by this:

> The rats used in this experiment were obtained from Charles River Breeding Laboratories and were derived from the Sprague Dawley strain. The animals were sexually mature, 100 days old, and weighed 190 to 215 g.

He/she

Most writers no longer use male pronouns (*he*, *his*, *him*) to denote both males and females. Does this mean that our language is less sexist now? No. Instead, we have got constructions such as *he/she* or *s/he*, which hardly solve the problem, but rather emphasize it. Here is an example from a manuscript:

> Each patient was interviewed at the out-patient unit that s/he belonged to.

How to avoid constructions like this? The simplest way is often to use the plural:

> All *patients* were interviewed at the out-patient unit *they* belonged to.

On the odd occasion where the use of the plural seems impossible, reword the sentence or try to remove the pronoun. For example, in the following, the pronoun *their* could be removed.

> I submitted the manuscript to the editor for their consideration.

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Only when all else fails, use the less awkward form *he or she*. Finally, I must relate an anecdote by Sheila McNab (1993).

> In a serious road accident a father was killed and his son seriously injured. When the boy was later brought into the hospital operating theatre, the surgeon blanched and exclaimed, "I can't operate on this boy, he is my son!"

If you were unable to realize immediately that the surgeon was the boy's mother, you may have something to think about. When I tested this anecdote on my graduate students, one male student could find only one answer: the man who had died was the stepfather!

Active or passive voice

Previously, scientists were obliged by tradition to use the passive voice. The use of first-person pronouns (*I* or *we*) was seen as pretentious, even impolite. Not so now. Scientists of today dare do what Watson and Crick, back in 1953, had the courage to do in the opening phrase of their classic on the structure of DNA – and say *we*:

> We wish to suggest . . . ,

which is more direct, easier to read, and shorter than the passive:

> In this letter a suggestion is made . . .

Below is another example, drawn from *New Scientist* (1993). Its former editor, Bernard Dixon, found the following sentence in a manuscript submitted:

> The mode of action of anti-lymphocytic serum has not yet been determined by research workers in this country or abroad.

Dixon replaced it with:

> We don't know how anti-lymphocytic serum works.

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"He was quick to telephone me," Dixon recalls, "complaining about editorial interference. [. . .] How could a magazine as prestigious as *New Scientist* change an author's meaning in such a cavalier fashion? But, I replied, we had not altered his meaning. We had simply made a sentence more readable and direct – and cut it to a third of its original length."

However, in methods and results sections the passive voice is generally more effective. It emphasizes the action rather than the person performing the action. Thus, the active form:

I stopped cell growth with colchicine

has no real advantage over the passive:

Cell growth was stopped with colchicine

since nobody cares who performed the act. And further, when there are several authors, the *we* in:

We stopped cell growth with colchicine

is probably not true – unless the authors each added a portion! Thus active and passive voices both have their place in scientific writing.

Noun clusters and modifiers

In *USA TODAY* (October 13, 1992), I saw this:

Pig liver transplant woman dies.

As a newspaper headline this phrase is acceptable. It is intelligible and unambiguous; and the cramped space makes it necessary. But in a scientific paper, such a sentence would have looked ridiculous. Here, it has been written out in full:

The woman with a transplanted pig liver has died.

The following phrase, quoted from *Contraception*, may be entirely and immediately intelligible to an expert in the field:

Rabbit anti-mouse spleen cell serum . . .

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But researchers not working in that field might wonder to which animal the spleen had belonged. The writer could have saved some readers a little trouble if he had written:

> Anti-mouse serum of rabbits immunized with cells of mouse spleen . . .

However, it is quite acceptable to couple a few nouns and modifiers as long as it is crystal-clear what you mean and as long as the reader can grasp the string of words, as in this example from a methods section (Mehrotra et al. 1973):

> Colony bred female albino rats . . .

and this used as a subheading (Gardiner et al 1980):

> Anaesthetized spontaneously breathing guinea pig.

Prevalence and incidence

The words *prevalence* and *incidence* are said to be among the most misused terms in biomedical reports. *Prevalence* refers to the total number of cases of a disease or condition existing at a specific time. *Incidence* refers to the number of new cases that develop over a specific time. In the following example from *Newsweek* (Begley 1996), the prevalence is 200 000 and the incidence 12 000.

> Each year as many as 12 000 Americans join the more than 200 000 who already live with paralyzing spinal-cord injuries.

Avoid the use of "respectively"

Respectively obliges the reader to stop and reread the sentence, as in the following, seen in a manuscript under preparation:

> Phytate reduction in wheat, rye, barley with and without hulls incubated with 40 g water/100 g cereal for 24 hours at 55°C was 45, 56, 48 and 77%, respectively.

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The version below is direct and permits the reader to proceed (revised text in boldfaced italics):

> After incubation with 40 g water/100 g cereal for 24 hours at 55°C, ***phytate reduction in wheat was 45%; in rye, 56%; in barley with hulls, 48%; and in barley without hulls, 77%***.

The "and/or" construction

The expression *and/or* disrupts the textual flow, as in this example:

> The effect of intravenous streptokinase and/or oral aspirin . . .

which the reader would have found easier if it had read:

> The effect of intravenous streptokinase, oral aspirin, or both . . .

A closer look at the text often reveals that *and/or* can be replaced by *and* (*The ACS Style Guide* 1977):

> Our goal was to confirm the presence of the alkaloid in the leaves and/or roots,

or by *or* (de Looze 2002):

> Confidential information can only be given to the patients and/or close relatives.

The construction *and/or* has no place in scientific writing.

Unnecessary hedging

Hedging is a way of saying "maybe" more than once. Two or more hedges can drain all force from a sentence. The eminent writer in the cartoon replaced seven hedges ("seems," "not inconceivable," "suggest," "may," "indicate," "possible," "probably") with just one: "think." One hedge is always enough.

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