

Whole books, of course, are devoted to principles of scientific writing. The following is a condensation of some principles that I think are particularly important and frequently violated. Numbers 1-4 and 10 are the most important.

1) *Write paragraphs with a single subject and a topic sentence that conveys that subject.* In scientific writing, paragraphs usually begin with the topic sentence. This sentence tells readers the subject of the paragraph. Asking someone to read a paragraph in a scientific paper that does not have a topic sentence is like asking a weary hiker to start up a steep, rugged trail without a destination in mind. The reader is likely to stop halfway, exhausted and wondering why he ever started. When you're finished with a paragraph, ask yourself whether all of the sentences of the paragraph contribute to its subject. Sentences that don't belong should be moved to another paragraph. Just as all of the components of a machine contribute to its function, all of the sentences of a paragraph should contribute to its subject. There is no rule regarding paragraph length, as long as the subject of the paragraph does not wander. Many long paragraphs strung together, however, can become onerous for readers. Often after scrutinizing a paragraph, you will find that it can be split into two or more paragraphs with more focused subjects. Finally, if you begin writing a paragraph without a reasonably clear notion of its subject, stop writing and think harder: fuzzy thinking will likely lead to an ill-focused paragraph.

2) *Strive for concise, lean sentences.* Beginning scientific writers commonly include seemingly sophisticated, unnecessary words with the goal of "sounding scientific." If you think you have written a sentence that sounds scientific, you are likely conveying the opposite impression. When considering a simple word and a complicated one, always chose the simple one. When considering a simple sentence structure and a complicated one, always chose the simple one. After you have written a sentence for the first time, ask yourself whether your point can be made with fewer words. It almost always can be. Nine times out of ten, the shorter sentence will be more effective. Apply this test to every sentence you write.

3) *Use specific, concrete language.* Avoid words that are general, vague, or abstract. For example, replace "An unfavorable period of weather plagued the glacial environment for a number of days" with "Rain fell for eight days on the glacier."

4) *Avoid redundancy.* A point in a paper should be made only once. An exception to this rule would be fundamental conclusions, which might appear for emphasis both in the body and concluding section of a paper. Otherwise, making the same point two or more times is an indicator of poorly organized writing. Also, once modifiers have been used once (e.g., the long, sharp-crested esker), there is no need to keep applying those modifiers later in the paragraph (readers will know you are alluding to that particular esker without repeating the two adjectives again and again).

5) *Use lists sparingly or not at all.* Bulleted or numbered lists can sometimes be useful but lose their impact when used more than once or twice in a paper. When used too frequently, they begin to seem like a crutch for writers who are either unable or unwilling to write a coherent paragraph. Use a list only as a last resort.

6) *Avoid long strings of modifiers.* Using more than two modifiers before a noun or verb usually results in an awkward sentence. For example, replace “The primary, esker, formational process involves rapid, turbulent, subglacial water flow” with “the primary process of esker formation involves subglacial water flow that is rapid and turbulent.”

7) *Avoid self-congratulatory statements.* Never refer to your own work with highly complimentary modifiers (novel, powerful, insightful, etc.). Let readers make that judgment. Your goal should be to project yourself as a scientist who is impartial, not arrogant and pretentious.

8) *Avoid long strings of “loose” sentences.* A loose sentence consists of two or more clauses connected by words such as *and*, *but*, *who*, *when*, *where*, *while*, *whereas*, *which*, etc. Many such sentences in succession become exhausting for readers. A good but challenging practice is to consciously vary sentence length, to avoid the monotonous singsong that can put a reader to sleep.

9) *Avoid participial phrases with unclear subjects.* For example, “Dragging the radar equipment across the ice with decreasing speed, we noticed that the snowmobile eventually came to a halt.” The authors intend for the participial phrase (the phrase at the beginning of the sentence) to modify “snowmobile,” but the sentence is structured so that it modifies “we.” The result is a weak, confusing sentence.

10) *Rewrite obsessively.* As you begin writing for the day, make it a habit to always read and modify what you have written previously. You’ll find that each time you read your work with fresh eyes, flaws become apparent. The longer you wait between writing sessions, the more conspicuous these flaws become, because as time passes you become more like your poor reader: completely unaware of your thought processes during the previous writing session. By the time you subject someone else to your writing, you should have read and modified the text of your paper at least 10 times. Papers littered with typographical errors indicate definitively that this process has not been followed. Such papers don’t merit reading beyond the first page.

Following these rules is difficult, and thus writing is time-consuming work that requires sustained concentration. Don’t underestimate the difficulty of the process by leaving yourself inadequate time or disrupting your thinking with televisions, stereos, headphones, etc. Take your writing very seriously, and the product will be a statement of your ideas that you’re proud of (by the way, never end a sentence with a preposition!).