A paper will be more readable if words are used economically. Writing concisely may be contrary to common practice in some countries where, I have been told, authors are paid by the number of words published! Always remember that your goal is to facilitate communication, which is accomplished through concise and lucid writing in a well-organized manner.

A. DELETE UNINFORMATIVE WORDS AND AVOID REDUNDANCY

Using fewer words to convey a message almost always improves readability. It also requires more effort, as the mathematician Pascal once noted to a friend: "I am writing a longer letter than usual, because there is not enough time to write a short one." The examples in the left-hand column below are unnecessarily wordy. The right-hand column displays improved versions. (This side-by-side format for displaying "before and after" examples is used throughout the book.)

<table>
<thead>
<tr>
<th>brief in duration</th>
<th>brief</th>
</tr>
</thead>
<tbody>
<tr>
<td>sufficient in number</td>
<td>sufficient</td>
</tr>
<tr>
<td>The wound was of a serious nature.</td>
<td>The wound was serious.</td>
</tr>
<tr>
<td>The solution was red in color.</td>
<td>The solution was red. (Red is understood to be a color.)</td>
</tr>
</tbody>
</table>

Some material in this chapter is from the lecture notes of Julius H. Comroe Jr., Cardiovascular Research Institute, University of California at San Francisco; excerpted by kind permission at Mrs. Julius H. Comroe.
It was precooled before use.  

We repeated the experiment again.

It was precooled. (The prefix *pre-* implies *before*.)

We repeated the experiment.

**EXERCISES.**

1. Rewrite each phrase to eliminate unnecessary and redundant words (Answers are given at the end of the chapter.)
   a. carefully investigate
   b. past history
   c. mix together
   d. human volunteers
   e. original source
   f. advance planning
   g. globular in shape
   h. more preferable than
   i. seem to appear
   j. for a period of several minutes
   k. The role of cobra toxin is still *a matter for speculation.* (Hint: replace the words in italics.)
   l. The work will be completed in *the not-too-distant future.*
   m. The reaction rate was *examined and found to vary considerably.*
   n. The results *would seem to indicate* the possibility that impurities might be present.
   o. As a result of these experiments it became quite evident that overheating of the samples had occurred.
   p. As far as my own experiments are concerned, they show ...
   q. It has been found that ...
   r. It is interesting to note that ...
   s. Needless to say, ...
B. USE ONE WORD TO REPLACE A PHRASE

Many popular expressions can be expressed as a single word, or are better omitted altogether.

at this point in time     now
the reason was because    because

EXERCISES.
2. Rewrite or eliminate the following phrases.
   a. in view of the fact that
   b. was observed to be
   c. in the near future
   d. in most cases
   e. it would appear that
   f. is suggestive of
   g. as to whether
   h. in the vicinity of
   i. it was evident that
   j. in the event that

C. AVOID GRANDILOQUENCE

The word grandiloquence is itself grandiose. It implies a pompous style that impresses no one and provokes ridicule. Recall the elegant and memorable words of Sir Winston Churchill: “Give us the tools and we will finish the job.” The greatest speeches in history were simple and to-the-point. Abraham Lincoln’s Gettysburg address was so brief that his audience was disappointed, but it has since come to be regarded as one of the most effective speeches ever delivered.

The same brevity and clarity should apply to scientific writing. On the left, below, is a sentence in which clarity is obliterated by grandiloquence; on the right, a much-improved version.
3 Paragraph Structure

In its simplest form, a lucid paragraph contains a topic sentence and clearly related supporting sentences. The topic sentence contains the main point or idea of the paragraph, while supporting sentences provide detail or ancillary information. Each paragraph should be organized for continuity. That is, a smooth flow of ideas should be maintained, not only from sentence to sentence, but from paragraph to paragraph as well.

Less experienced authors tend to format each paragraph identically, making the first sentence a summary statement, with subsequent sentences providing the detail. Such writing "by formula" is considered less polished and often lacks good transition between topics; it is, however, direct and intelligible and therefore perfectly acceptable.

It is beyond the scope of this discussion to cover paragraph composition in detail. Authors learning to write in English would be discouraged when confronted with the many fine points of paragraph design. My advice is to write your first draft with just the goal of communicating simply and clearly; otherwise, you will hesitate to start writing at all. Then gradually improve your style in subsequent drafts. With practice you will compose more "by ear" and less by studying rules.

The following are basic guidelines for paragraph design. Readers interested in further study are referred to Chapter 3 of Mimi Zeiger's book *Essentials of Writing Biomedical Research Papers*, which discusses paragraph composition and provides many examples.

1. Cover only one main point or idea in each paragraph.
2. Each sentence should establish or support the topic of the paragraph.

Sometimes the relationship of the supporting sentences and topic is unclear, as in the following:
Muscle length and changes in contractility have been reported to have overlapping effects on the components of excitation-contraction coupling. Muscle length is believed to affect the action potential, the amount of calcium released, and the rise of intracellular calcium... finally, muscle length affects the interaction between actin and myosin and hence shortening and force development. Changes in contractility are believed to affect the action potential and the level and rise of intracellular calcium.

Muscle length and contractility are discussed in separate sentences and without noting their similarities. Thus, the sentences do not directly illustrate their overlapping effects, and relationship of these sentences to the topic sentence is not immediately evident. The relationship is established by stating how effects overlap.

Muscle length and changes in contractility have been reported to have overlapping effects on the components of excitation-contraction coupling. Both affect the action potential, the amount of calcium released, and the rise of intracellular calcium. In addition, muscle length affects the interaction between actin and myosin and hence affects muscle shortening and force development.

3. Include information that explains why actions were taken.

Although you can expect your readers to have a reasonable understanding of the topic, comprehension will be facilitated if the reader is not required to "fill in the gaps."

All of the patient data were kept in paper files. The absence of even one clerk caused delays in the monthly reporting. Finally, management decided to interview some systems analysts.

The connection between the three sentences in the preceding paragraph is not clear. Although the meaning can be inferred, it is better to state it outright.

All of the patient data were kept in paper files, which took much staff time to maintain. The absence of even one clerk would delay the monthly
patient reports. Management wanted computerized recordkeeping, which would take less time and be more reliable, and finally decided to interview some systems analysts to develop the new system.

4. Keep a consistent point of view.

That is, maintain the same grammatical voice (active or passive) throughout the paragraph.

Topical applications of the drug did not improve the condition. The condition improved after small doses were delivered intravenously.

The first sentence is in the passive voice, in which the condition receives the action. The second sentence is in the active voice, in which the condition performs the action. Either voice is acceptable, but the change from one voice to the other makes the logic less clear.

Topical applications of the drug did not improve the condition. Intravenous delivery of small doses improved the condition.

Or,

Unlike topical applications of the drug, intravenous delivery of small doses improved the condition.

5. Use parallel construction to make the paragraph easier to understand.

Maintain consistent structure throughout the paragraph. In an attempt to avoid monotony, some writers vary the sentence construction and thereby hinder comprehension.

A 10 mg dose produces no effect, a 20 mg dose produces a small effect, but patients demonstrate a noticeable effect from a 30 mg dose.

A 10 mg dose produces no effect, a 20 mg dose produces a small effect, but a 30 mg dose produces a noticeable effect in patients.