

1 Word Choice

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.)

brief in duration

brief

sufficient in number

sufficient

The wound was of a serious nature.

The wound was serious.

The solution was red in color.

The solution was red. (Red is understood to be a color.)

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.

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It was precooled before use.

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

We repeated the experiment again.

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.

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The validity of the structural information obtained will depend on the fidelity of reconstitution of the proteolipid in a native conformation under the condition or incorporation into vesicles.

Such structural information is valid only when the reconstituted proteolipid has the native conformation.

EXERCISES.

3. Rewrite the following sentences into concise and effective English.
 - a. Computations were conducted on the data.
 - b. It may seem reasonable to suggest that the necrotic effect may possibly be due to toxins.
 - c. In studies pertaining to identification of phenolic derivatives, drying of the paper gives less satisfactory visualization.
 - d. A method, which was found to be expedient and not very difficult to accomplish and which possessed a high degree of accuracy on its results, was devised whereby ...

D. AVOID CLICHÉS AND EUPHEMISMS

These are rarely helpful and frequently cryptic.

all in all (delete)

if and when if

Some common euphemisms are simply awkward. For instance, such evasions as

The patient expired

The patient passed away

The patient succumbed

The patient breathed his last

The patient has gone to his rest

are better expressed as

The patient died.

EXERCISES.

4. Rewrite the following phrases and sentences.
 - a. unless and until
 - b. it goes without saying
 - c. within the realm of possibility
 - d. We sacrificed the animal.
 - e. We performed euthanasia on the animal.

The following terms are usually better omitted or rephrased. Answers have not been provided; the reader should be able to suggest suitable answers.

approximately

a majority of

a number of

an order of magnitude faster

are of the same opinion

as a consequence of

as a matter of fact

As seen from our study, it is evident that

based on the fact that

due to the fact that

first of all

for the reason that

has the capability of

in a satisfactory manner

in order to

in terms of

is defined as

it has been reported by Dr. Lee that
it has long been known that
It is clear that much additional work will be required before a complete
understanding.
it is worth pointing out in this context that
it may, however, be noted that
owing to the fact that
the question as to whether
there is reason to believe
with the possible exception of

E. USE SYNONYMS

A *synonym* is a word that has the same or nearly the same meaning as another word. There are two reasons to use synonyms: First, to avoid monotony from using the same term repeatedly.

The subject demonstrated a marked sensitivity to the allergen. After receiving the medication, she showed marked improvement. This is a marked medical achievement.

The repeated use of *marked* makes this passage tedious. The text can be improved by substituting different synonyms.

The subject demonstrated a marked sensitivity to the allergen. After receiving the medication, she showed extraordinary improvement. This is a noteworthy medical achievement.

The second reason for using synonyms to express the *precise* shade of meaning for a specific context. *Extraordinary* and *noteworthy* communicate a stronger sense of enthusiasm than *marked*. Goglum [*Cancer Res.* (1945) 5, 247] has given twenty-two alternatives for the word *marked*:

- | | | |
|--------------|---------|-------------|
| appreciable | extreme | signal |
| considerable | great | significant |
| conspicuous | intense | striking |

decided	large	strong
definite	notable	substantial
distinct	noteworthy	unusual
extensive	noticeable	
extraordinary	pronounced	

To this list Dr. Comroe added

advanced	excessive	important
astonishing	goodly	obvious
big	huge	profound
enormous	immense	remarkable

Synonyms for common words can be found in a *thesaurus*, a dictionary, and some word processing programs. Understanding the nuances of synonyms can admittedly be difficult for those of us with English as a second language. The best ways to improve your grasp are to read English-language authors and practice your own writing.

ANSWERS TO EXERCISES.

1. a. investigate (study) b. history c. mix d. volunteers e. source
f. planning g. globular h. preferable (to) i. seem j. for several minutes
k. speculative l. soon (before long) m. varied n. suggest (were) o. These
experiments showed that the samples had evidently been overheated. p. My
own experiments show ... q. (delete phrase) r. (delete phrase) s. (delete
entire passage)

2. a. because b. was c. soon d. mostly e. (delete) f. suggests
g. whether h. near i. evidently j. if (should)

3. a. The data were calculated. b. Necrosis may be caused by toxins.
(Toxins may cause necrosis.) c. Phenolic derivatives are easier to see if the
paper is left wet. d. An easy, accurate way to ...

4: a. (rewrite the sentence) b. (delete) c. possible d and e. We killed the
animal.

2 Sentence Structure

The reader of this book is presumed to be familiar with basic English grammar: parts of speech, tenses, plurals, and so forth. Here we will discuss a few of the more complex rules that sometimes prove troublesome even for those with English as their native language.

A. AGREEMENT OF SUBJECT AND VERB

1. *The number of the verb must agree with the number of the subject.* A singular subject has a singular verb, and a plural subject a plural verb. It follows that you must correctly identify the subject, which is not necessarily the first or only noun in the sentence.

From this work has come improved antibiotic drugs.

From this work have come improved antibiotic drugs.

An evaluation of the experimental results, as well as the clinical findings, are described.

An evaluation of the experimental results, as well as the clinical findings, is described.

The first example illustrates inverted structure, in which the subject of the sentence, *drugs*, comes after the verb. In the second example, the subject is *evaluation*, not *results* or *findings*.

An easy way to identify the correct subject and verb form is to examine the briefest form of the sentence: Remove prepositional phrases, modifiers,

Most of the examples in this chapter are from the lecture notes of JuliusSome 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.

and so forth, until the sentence is reduced to just its subject, verb, and complement (if any). It usually becomes clear which verb form should be used—especially if the sentence is spoken aloud. Using the preceding example:

An evaluation ... are described.

An evaluation ... is described.

Speaking sentences aloud is a useful check of your writing style. Often the ear will detect what the eye misses, although you cannot always rely on the sound of a sentence, as the next rule shows.

2. *Recognize irregular plurals.* A common mistake is to use a singular verb with *data*, *formulae*, and *radii*, which are plural nouns (their singular forms are *datum*, *formula*, and *radius*, respectively). The error results from failure to recognize irregular plurals, i.e., plural forms that do not end with an *s*.

This data is significant.

These data are significant. (Also note the use of the plural article *these*.)

3. *When singular and plural subjects are joined by either ... or and neither ... nor*, the verb must agree with the nearest subject.

Neither the physical behavior of these substances nor their half-life data was known.

Neither the physical behavior of these substances nor their half-life data were known.

Either the samples or the apparatus were contaminated.

Either the samples or the apparatus was contaminated.

Do not confuse *either ... or* and *neither ... nor* with *either* and *neither*, both of which always take a singular verb.

Either of the explanations is acceptable.

Neither of the samples is large.

A compound sentence with more than one dependent clause must include all verbs, unless they are the same in each clause. That is, if one clause contains a singular subject and another clause a plural subject, both the singular and plural verbs are required.

The tissue was minced and samples incubated.

The tissue was minced and samples were incubated.

All auxiliaries verbs (such as *to be* and *have*) must likewise be included, unless they are the same.

Blood samples have been drawn and measurements have been taken.

Blood samples have been drawn and measurements taken.

Dissimilar auxiliaries cannot be omitted, however.

Blood samples have been drawn and urine collected.

Blood samples have been drawn and urine has been collected.

B. PRONOUN REFERENCE

An *antecedent* is the word, phrase, or clause to which a pronoun refers. A sentence may be confusing if the pronoun and its antecedent are not clearly identifiable. A missing antecedent cannot be assumed to be “obvious from context,” and an ambiguous reference should always be corrected. In the statement

The monkey was operated on by the surgeon when he was six weeks old

the reader cannot tell whether it was the surgeon or the monkey who was six weeks old at the time of the surgery. The ambiguity is removed by

positioning the pronoun closer to its antecedent.

The monkey, when he was six weeks old, was operated on by the surgeon.

Better still is to move the relative clause to the beginning, where it will not separate the subject from the principal verb.

When he was six weeks old, the monkey was operated on by the surgeon.

If the ambiguity cannot be removed by rearranging words, the entire sentence should be rewritten.

Sera were prepared by immunizing rabbits and drying and using them in powdered form for blood grouping.

Sera from immunized rabbits were dried, powdered, and used for blood grouping.

The left-hand version evokes unfortunate images of rabbits being dried and powdered, while the revised version conveys the intended meaning.

C. ACTIVE AND PASSIVE VOICE

English verbs have two voices: *active* and *passive*. In the active voice, the subject performs the action, while in the passive voice, the subject receives the action.

Frances always wins the award. [Active voice]

The award is always won by Frances. [Passive voice]

Note the change of the verb from *win* for the active voice to *is won* for the passive. The passive voice always combines some form of the verb *to be* with a past participle.

As fashions change with time, so does the style of scientific writing. Prior to 1900, scientists routinely used the active voice and personal pronouns in their reports, making such statements as, "I made the following

experiment,” “I cannot say,” “I have seen,” and “I would point out, however, that” The passive voice gradually gained popularity, perhaps from a belief that its impersonal style denoted greater professionalism. *“The consistent overuse and misuse of the passive voice devitalized scientific writing. It became torpid, evasive, and dull, qualities that the writers mistakenly equated with dispassionate objectivity Today, the trend is once again toward clarity of expression and the freer, more concise writing that results from habitual use of the active voice”* (Comroe). Style experts now prefer the active voice, which is more direct, sounds more natural, and usually saves words. It clearly identifies who performs the action, and does not necessarily require the use of pronouns *I, we, she*, and so forth.

It was suggested by Dr. Smith that the test be postponed.

Dr. Smith suggested postponing the test.

In these experiments exercise was carried out by the subjects.

In these experiments the subjects exercised.

A detailed description of the apparatus is presented in this Report.

This report presents a detailed description of the apparatus.

This is not to say that you must entirely avoid using the passive voice, which can be quite effective if used sparingly. By placing the receiver of the action as the subject of the sentence, it receives subtle emphasis.

The relationship $F = ma$ was discovered by Newton.

Newton discovered the relationship $F = ma$.

The first version would be appropriate in a text on the history of physics, while the second version could be used in a biography of Sir Isaac Newton.

The passive voice is also used to avoid mentioning the performer of the action when the performer is unimportant, indefinite, unknown, or obvious from context.

Bovine serum albumin was purchased from Sigma.

Eighteen minutes of the tape had been erased.

In the first example, the passive voice is used to focus more on the material than on the purchaser. In the second example, by not mentioning the person who erased the tape, the writer focuses on the erasure—and perhaps avoids a lawsuit as well!

Dr. Comroe illustrated the economy and clarity of the active voice in the following passage, presented first in the passive voice, then in the active voice.

PASSIVE VOICE.

In early studies of longitudinal sections of cardiac muscle by light microscopy, a pattern of cross striations was observed (1-5). The striations were noted to be similar to those seen in skeletal muscle, except that at irregular intervals along the length of the fibers the thin Z-lines were replaced by thick transverse bands. According to Witte (6), the thick bands, or intercalated discs, could not be detected in cardiac muscle in embryonic or early fetal life; the discs were concluded to be of physiologic importance, although precisely what role was played by these discs was conjectural. Later, electron microscopic studies of thin sections of cardiac muscle were performed (7-14). At each intercalated disc there were seen to be present two membranes and a narrow interspace traversing the muscle fibers. The cleft between the transverse membrane was clearly seen to be part of the extracellular space. Thus, it was established that cardiac muscle consists of individual cells with the intercalated discs being sites of cell-to-cell attachment.

ACTIVE VOICE.

Early studies of longitudinal sections of cardiac muscle by light microscopy showed a pattern of cross striations (1-5). The striations resembled those of skeletal muscle, except that at irregular intervals along the fibers, thick transverse bands replaced the thin Z lines. Witte (6) was unable to detect these thick bands, or intercalated discs, in cardiac muscle in embryonic or early fetal life. [He concluded that] the discs were of physiologic

importance, but [that] their precise role was conjectural. Later, studies of thin sections of cardiac muscle by electron microscopy (7-14) showed two membranes at each intercalated disc and a narrow interspace traversing the muscle fibers. The cleft between the transverse membranes was clearly part of the extracellular space. [These studies established that] cardiac muscle consists of individual cells and [that] the intercalated discs are sites of cell-to-cell attachment.

Changing the voice from passive to active reduces 165 words to 137. Further, the bracketed words can be deleted without materially affecting the content, a total saving of 22%.

D. NOUNS FROM VERBS

Verbs can express action. For many action verbs there are nouns of similar derivation that expresses the result of the action, for example, *examine/examination* and *perform/performance*. Using the noun form expresses the action indirectly. Your writing will be more vigorous if such nouns are replaced by the verb forms.

By analysis of the data

By analyzing the data

An evaluation of the data was done.

The data were evaluated.

The installation of the new equipment has been carried out.

The new equipment has been installed.

EXERCISES.

Rewrite the following sentences to use the active voice and eliminate unnecessary words (answers follow).

1. He made an examination of the patient.
2. His performance of the tests was adequate.
3. These agents exert their action by inhibition of synthesis of cholesterol by the liver.
4. We made at least two analyses on each specimen.

5. Our preliminary report included a description of the techniques used for the infusion of fluids into the cerebral ventricles of rats.
6. Evaporation of ethanol from the mixture takes place rapidly.
7. With the occurrence of increase in the metabolic rate during exercise, there is also an increase in the rate of gas exchange in the lungs.
8. Clarity in writing is my intention.

ANSWERS.

1. He examined the patient.
2. He performed the tests adequately.
3. These agents act by inhibiting the synthesis of cholesterol by the liver.
4. We analyzed each specimen at least twice.
5. Our preliminary report described the techniques used to infuse fluids into the cerebral ventricles of rats.
6. Ethanol evaporates rapidly from the mixture.
7. When the metabolic rate increases during exercise, the rate of gas exchange in the lungs also increases.
8. I intend to write clearly.

E. MODIFIERS

Modifiers can be words, phrases, or clauses. They fall into one of two categories: adjectives or adverbs. Adjectives qualify nouns and pronouns, the words that serve as subjects and objects of sentences. Adverbs mainly modify verbs, but they can also modify adjectives, other adverbs, and even whole sentences. Because their position can alter the intended meaning, it is important to place modifiers properly.

Adjectives. Adjectival modifiers are easy to place and usually modify the nearest noun. One or more adjectives precede the noun, while adjective phrases follow the noun.

a little red house

a child in jeans

a child in blue jeans

a child in jeans the color of the sky

Adverbs. Adverbs behave less conventionally than adjectives and are not as easy to place. Since an adverb can modify a verb, an adjective, an adverb, and even an entire sentence, the positioning of an adverb can sometimes perplex even the most practiced writer.

Most single-word adverbs end in *-ly*, such as *lightly* and *evenly*, and usually precede the words that they modify.

We usually centrifuge samples for ten minutes.

He noted a relatively large increase in blood flow.

An exception is when the adverb modifies an intransitive verb, which is a verb without a direct object. The adverb usually follows the intransitive verb that it modifies.

He walked quickly.

The machine runs efficiently.

An adverbial modifier that modifies the entire sentence can usually be placed at either the beginning or end.

As soon as my replacement arrived, I left for my sabbatical year.

I left for my sabbatical year as soon as my replacement arrived.

If the modifier makes up a large portion of the sentence, it should follow the verb for better balance.

As soon as my replacement
arrived, I left.

I left as soon as my replacement
arrived.

With only one hand on the wheel, he drove.

He drove with only one hand on the wheel.

Compound verbs. Compound verbs consist of one or more helping verbs (*have, be, do,* and the like) and a participle (a verb given an *-ing, -ed,* or *-en* ending). A single adverb modifying a compound verb should immediately follow the first helping verb.

He is probably writing his thesis now.

He will probably have completed his thesis by then.

If only the participle is being modified, the number of words in the adverbial determines its placement in the sentence. If the adverbial is a single word, it immediately precedes the participle; otherwise, it follows the verb.

He is probably writing his thesis now.

His thesis has been carefully written.

The procedure has been tried time after time.

Sometimes a single adverb can take one of several positions in the sentence, depending on where you wish to place emphasis. An adverb should never, however, separate a verb from its object.

Slowly, he drew the blood into the syringe

He slowly drew the blood into the syringe

He drew the blood slowly into the syringe

He drew the blood into the syringe slowly

but never

He drew slowly the blood into the syringe.

An adverbial can have more than one logical position in the sentence, each of which gives a different meaning. The sentence

He said when the experiment was finished he would leave

could be interpreted two ways, and should be rearranged to convey the correct meaning.

He said he would leave when the experiment was finished

depicts a man announcing his future departure. If rewritten as

When the experiment was finished he said he would leave

it could apply to a man who, after watching the completion of an experiment, suddenly realizes that it is time to go home.

A misplaced modifier (sometimes known as a *dangling modifier*) appears to modify the wrong element of the sentence, making the sentence confusing or illogical.

We purchased rats from a dealer weighing about 250 g.

We purchased rats weighing about 250 g from a dealer.

While at the lecture, Dr. Smith took the records from my laboratory.

While I was at the lecture, Dr. Smith took the records from my laboratory.

Oxygen content was determined immediately after collecting the samples.

Oxygen content was determined immediately after the samples were collected.

In each of the preceding examples the modifier appears to apply to the wrong word and must be moved. The first example states that the dealer weighed only 250 g. The second example implies that Dr. Smith had the

ability to be in two places at once, the lecture hall and the laboratory. Finally, the third example says that oxygen collected the samples.

The following two versions of a report illustrate the importance of careful sentence construction. The first version is filled with misplaced modifiers (italicized) that make the text awkward and ambiguous. These errors are corrected in the second version, which is much easier to read. (Courtesy of M. Zeiger.)

VERSION 1:

Residual lung volumes were determined in 20 normal subjects, *using* a modified Collins spirometer with a 9-liter capacity. The following procedure was used. Before *testing* each subject, the water level of the spirometer *was checked* and if necessary restored to a predetermined level to maintain a constant dead space. After *checking* for leaks in the system, the spirometer, tubing, and breathing valve were flushed repeatedly with oxygen until the nitrogen was cleared from the system. Nitrogen clearance was monitored *using* a nitrogen analyzer. When completely *cleared* of nitrogen, 5.915 liters of oxygen were introduced into the spirometer. *Combining* this oxygen with the 1.085 liters of oxygen in the dead space, the total effective spirometer volume was 7 liters.

All tests were conducted *in the sitting position*. After *explaining* the purpose of the test and *describing* the procedure, the noseclip *was secured* firmly on the subject's nose and the mouthpiece was positioned comfortably in his mouth. Next, *turning* the breathing valve to the outside air, the subject was instructed to inhale deeply and then to exhale as fully as possible.

VERSION 2:

To determine the residual lung volumes in 20 normal subjects, *we used* modified Collins spirometer that had a 9-liter capacity. Before *testing* each subject, *we checked* the water level of the spirometer and, if necessary, restored it to a previously determined level in order to maintain a constant dead space. *We then checked* the system for leaks and flushed the spirometer, tubing, and breathing valve repeatedly with oxygen until the nitrogen was cleared from the system. Nitrogen clearance was monitored *by* a nitrogen analyzer. When the system was completely *cleared* of

nitrogen, *we introduced* 5.915 liters of oxygen into the spirometer. This *oxygen combined* with the 1.085 liters of oxygen in the dead space to yield a total effective spirometer volume of 7 liters.

All tests were conducted on *seated subjects*. After *explaining* the purpose of the test and *describing* the procedure, *we secured* the noseclip firmly on the subject's nose and positioned the mouthpiece comfortably in his mouth. *We then turned* the valve to the outside air and instructed the subject first to inhale deeply and then to exhale as fully as possible.

F. GERMANIC CONSTRUCTION

Sentences containing several adjectives in sequence are difficult to understand. These sequences are sometimes called Germanic constructions, after the German practice of concatenating several adjectives and nouns to form a single, very long word. They are no easier to understand in English than they are in German! This is a case where the most concise sentence is not the clearest; a few extra words and punctuation marks will make the sentence easier to understand.

Simian virus transformed fetal mammalian heart fibroblast

Simian virus-transformed fibroblast from fetal mammalian heart

Whole rat liver homogenates were used for preparing the antigen.

The antigen was prepared from the homogenized whole liver from rats.

The gas analyzer sampling tube is then connected to the calibrator mixing chamber.

The sampling tube of the gas analyzer is then connected to the mixing chamber of the calibrator.

Respiratory rates were measured with a Yellow Spring Instrument Co. oxygen monitor system.

Respiratory rates were measured with an oxygen-monitoring system (Yellow Spring instruments Co.).

The samples contained high molecular weight complement-fixing serum antibodies.

The serum samples contained complement-fixing antibodies of high molecular weight.

The oxygen-inhalation arterial blood oxygen tensions of the neonates were consistent with this hypothesis.

The measurements of oxygen tension of arterial blood taken while the neonates breathed oxygen were consistent with this hypothesis.

G. PUNCTUATION

Remember that punctuation and spacing are important, too. Sometimes the omission of a single mark of punctuation can cause confusion. For instance, in the book title,

The Physical Chemistry of Poly(γ -benzyl-L-glutamate) and Glutamic Acid Containing Polypeptides

a reader might erroneously infer that polypeptides are sometimes found in glutamic acid. The author is actually discussing poly(g-benzyl-L-glutamate) and other polypeptides that contain glutamic acid. A hyphen is needed between *glutamic acid* and *containing* to indicate this.

The Physical Chemistry of Poly(g-benzyl-L-glutamate) and Glutamic Acid-containing Polypeptides

The following newspaper excerpt illustrates the importance of proper spacing:

In August 1993, a dam in a remote western province of China burst and killed 257 people. However, the U.N. disaster relief agency misread a Chinese document and reported the death figure at 1,257. The error resulted from a misplaced space in the English translation of the document, which read “as of September 1,257 people were dead,” instead of “as of September 1, 257 people were dead.”

H. AMERICAN AND BRITISH STYLES

British writing is different from American writing in certain forms of punctuation and spelling. Whatever style is used will not normally affect the reader's understanding of the text, but you should be consistent and employ the same style throughout a work. If you submit a manuscript to an English journal, its editorial office will automatically convert the punctuation and spelling to British style. Similarly, an American journal will impose the American style.

1. *Spelling.* Some American words ending with *-ction*, *-ense*, *-er*, *-ll*, *-log*, or *-yze* are spelled differently in British usage.

Ending	American	British
<i>-ction</i>	connection	connexion
	inflection	inflexion
<i>-ense</i>	defense	defence
	practice	practice (noun) practise (verb)
<i>-er</i>	center	centre
	liter	litre
	meter	metre (unit of measure) meter (instrument)
<i>-or</i>	behavior	behaviour
	color	colour
<i>-l</i>	distill	distil
<i>-log</i>	catalog	catalogue
<i>-yze</i>	analyze	analyse
	catalyze	catalyse

For some verbs ending with *-e*, the American style is to drop the silent *e* when a suffix is added, while British style retains the *e*.

Verb	American	British
<i>acknowledge</i>	acknowledgment	acknowledgement
<i>age</i>	aging	ageing
<i>judge</i>	judgment	judgement

The digraphs *ae* and *oe* in words of Latin or Greek derivation are retained in British style.

Digraph	American	British
<i>ae</i>	anesthesia	anaesthesia
	cesium	caesium
	diarrhea	diarrhoea
	etiolate	aetiolate
	hematology	haematology
	leukemia	leukaemia
<i>oe</i>	edema	oedema
	esophagus	oesophagus
	estrogen	oestrogen
	fetus	foetus

2. *Punctuation with quoted material.* The British rule for placing a comma, an ellipsis, an exclamation point, a period, or a question mark is: If it belongs with the quoted material, it goes inside the quotation marks; otherwise, it goes outside. If the quotation appears at the end of a larger sentence, the punctuation mark serves to terminate both.

Lincoln started with, “Fourscore and seven years ago,” then paused before continuing.

“Fourscore and seven years ago”

He shouted, "Have a safe trip!" as we drove away.

She closed with, "This meeting is now adjourned."

Why did she say, "Call me when you get home"?

Colons and semicolons are placed outside the quotation marks. If the quotation ends with a colon or semicolon, it is dropped.

It was clear that everyone had read "Treatment of Tumors"; the ensuing discussion was brisk and informed.

The American rules for placing colons, ellipses, exclamation points, question marks, or semicolons are the same as the British rules. A comma or period, however, is always placed inside the closing quotation mark. If the quote is included within another sentence, a terminal period is omitted or replaced by a comma, unless the quote comes at the end of the sentence. If the quotation appears at the end of a larger sentence, the period is placed inside the closing quotation mark and serves to terminate both quote and sentence.

"This meeting is now adjourned," were her closing words.

"The pen is mightier than the sword" is his favorite maxim.

Finally, the American practice is to use a comma after *e.g.* and *i.e.*, while the British style omits the comma.

AMERICAN

Please bring some form of identification, e.g., a driver's license or passport.

BRITISH

Please bring some form of identification, e.g. a driver's license or passport.

She had the credentials, i.e., a degree from a top-tier school and extensive experience.

She had the credentials, i.e. a degree from a top-tier school and extensive experience.

Note that scholarly Latin such as *e.g.*, *i.e.*, *et al.*, and so forth can be set in roman type; italics are unnecessary.

3. Block quotations Quotations that are displayed separately from the main text are called *block quotes*. Typically, a block quote starts on a new line, is indented, and may be in a smaller typesize. Because they are clearly separate from the main text, quotation marks are unnecessary.

Every child who was educated in America is familiar with the address that Abraham Lincoln delivered at Gettysburg, Pennsylvania and began:

Fourscore and seven years ago, our fathers brought forth on this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived, can long endure.

A quotation that is not displayed separately must be enclosed in quotation marks. If the quotation contains more than one paragraph, quotation marks are used at the beginning of each paragraph and at the end of the last paragraph. They are not used at the ends of any paragraph except the last one.

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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.