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# Cohesion and Clarity

## Overview

This chapter is about achieving **cohesion** and **clarity** in your writing—that is, combining all the elements of a manuscript using a logical, cohesive style and making the language as clear, concise, and unambiguous as possible. Cohesion and clarity are essential to effective scientific writing.

Effective scientific writing has 6 characteristics:

- It is accurate.
- It is complete.
- It is linear.
- It is clear, strong, and precise.
- It is cohesive.
- It is streamlined.

This chapter focuses on the last 4 of these 6 characteristics. The first 2 are outside the scope of this workshop.

## 1. Effective scientific writing is accurate.

Scientific writing must be accurate. The authors are responsible for ensuring the accuracy of a manuscript.

*“Fastidious attention to accuracy extends beyond verifying calculations and the other steps taken to validate evidence. You must be sure that the words you choose are the right and best words for the intended meaning.”*

—Edward J. Huth, *How to Write and Publish Papers in the Medical Sciences*

## 2. Effective scientific writing is complete.

Complete writing means that you have provided your readers with all the information they need to understand your story—no more, no less. English is a writer-responsible language rather than a reader-responsible language, which means that as a writer, you are expected to explain everything that your readers need to know—all the relevant facts and procedures and all the steps in the reasoning process that led you to your hypothesis and conclusion—in language your readers can understand. Learning how much to tell comes with practice and experience.

## 3. Effective scientific writing is linear.

In *linear* writing, as the name suggests, thoughts and ideas are expressed sequentially, that is, in a line, and every new idea is connected to the previous ones. Linear style suits scientific writing because it is shorter, more direct, and easier to follow than some other writing styles.

If you think of writing as a set of directions to a certain destination, linear style would be a straight road with signs clearly marking each stage of the journey. Other styles might take a longer, less direct route to the same destination. (Such a route might allow travelers to take in more scenery along the way, but they are also more likely to get lost!)

Writing styles vary from culture to culture. According to Elaine Campbell, author of *ESL Resource Book for Engineers and Scientists*, “Japanese paragraphs tend to define by eliminating what a subject is not. French and Spanish writing may include digressive material to support a topic sentence, and Semitic languages [such as Arabic] develop paragraphs by a set of parallel constructions. Writing in English, in contrast, remains predominantly linear.”

*“In the West, we tend most often to think and write in ways that are linear. In other words, we admire writing that ‘gets to the point.’”*

—Composition Center, Dartmouth University  
([www.dartmouth.edu/~compose/tutor/problems/esl.html](http://www.dartmouth.edu/~compose/tutor/problems/esl.html))

Look at the characteristics of linear writing and nonlinear writing:

Linear writing

- Is sequential.
- States the thesis or topic first (that is, it has a hypothesis or topic sentence).
- Narrowly restricts the supporting evidence to the topic.
- Is deductive.

Nonlinear writing, on the other hand,

- Is digressive or circular.
- States the thesis or topic last or only implies it.
- Loosely connects the supporting evidence.
- Is inductive.

## Writing Linear Paragraphs

The principles of linear writing apply to paragraphs and sections of a manuscript, as well as to manuscripts as a whole. The paragraph below is an example of linear writing. The topic is stated in the first sentence (in bold), and the next sentences all support or relate back to that sentence.

**How a polyQ tract contributes to aggregate formation and how the aggregates promote disease progression are still under debate.** On the one hand, polyQ proteins either on their own or in aggregates are neurotoxic in vitro and in vivo, supporting the notion that the polyQ tract is a critical structural component of pathogenesis. On the other hand, comparison of triplet repeat diseases has not yielded a simple correlation between polyQ tract length and clinical progression, and the cells most affected in these diseases often are not the sites of maximal polyQ aggregate formation. These findings imply that the aggregates themselves may be a symptom arising from the aberrant protein rather than a primary component of the pathogenic mechanism. (From Heintz, 2003\*)

(\*References are included at the end of this chapter.)

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## *Tips for Writing Linear Paragraphs*

Follow these tips for writing linear paragraphs in your scientific manuscript:

- Begin a new paragraph for each new idea.
- Keep paragraphs short (that is, several to a page).
- Include a topic sentence, usually at the beginning, and include only those sentences that relate to or support the topic.
- Connect the ideas within a paragraph in a clearly understandable order, using transitional words when appropriate.

Each tip is discussed in detail below.

### √ **Begin a new paragraph for each new idea.**

In a unified paragraph, each sentence contributes to the discussion of the main idea. If 2 main ideas are present in a single paragraph, divide the paragraph into 2 paragraphs.

Look at the following example. *Is it unified? That is, does it have a single main idea and supporting sentences? If not, why not?*

FNA biopsy of palpable lesions has several benefits. First, it is quick. Second, it is associated with a low morbidity rate and is tolerated well by patients, most of whom do not even require local anesthesia. Third, the cells collected by FNA biopsy can not only be evaluated morphologically but also be used to perform a detailed immunophenotypic and molecular analysis. Fourth, FNA allows the pathologist to sample more than one area of the mass. The risks associated with the procedure are minimal: slight oozing of blood and a remote risk of infection. Although the risk of seeding theoretically exists, it is typically not seen. ... (From Crapanzano, 2002)

The example begins with a discussion of the benefits of FNA biopsy. The topic then changes to the risks associated with the procedure. Thus, the paragraph contains 2 main ideas and is not unified.

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In the original article, the information was divided as follows:

FNA biopsy of palpable lesions has several benefits. First, it is quick. Second, it is associated with a low morbidity rate and is tolerated well by patients, most of whom do not even require local anesthesia. Third, the cells collected by FNA biopsy can not only be evaluated morphologically but also be used to perform a detailed immunophenotypic and molecular analysis. Fourth, FNA allows the pathologist to sample more than one area of the mass.

The risks associated with the procedure are minimal: slight oozing of blood and a remote risk of infection. Although the risk of seeding theoretically exists, it is typically not seen. ...  
(From Crapanzano, 2002)

√ **Keep paragraphs short (that is, several to a page).**

Paragraphs signal important units of thought—smaller than sections and subsections but bigger than sentences. They tend to be longer in scientific writing than in other types of writing, but in general, shorter paragraphs are preferred because they are easier to read and comprehend. An excessively long paragraph can be a sign of more than 1 main idea in a single paragraph.

√ **Include a topic sentence, usually at the beginning, and include only those sentences that contribute to or support the topic.**

A topic sentence tells the reader what the paragraph is about. It is *not* a statement of all the specific details supporting a point—it *is* the point: it states the main idea.

The topic sentence can be placed at the beginning, middle, or end of a paragraph, but it is most commonly stated at the beginning to alert readers to the topic and help keep them focused on the main idea.

In this example from *The New England Journal of Medicine*, the topic sentence is highlighted. Notice how everything that follows is related to this first, topic sentence.

**The usefulness of testing for the *APOE 4* allele is also limited.** Finding one or two *APOE 4* alleles in a symptomatic person with dementia certainly increases the likelihood that one is dealing with Alzheimer's disease and might be used as an adjunct to clinical diagnosis. On the other hand, since 50 percent of patients with autopsy-proven

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Alzheimer's disease did not carry an *APOE* 4 allele, its negative predictive value in a symptomatic person is very limited. *APOE* 4 testing in asymptomatic persons has very poor positive and negative predictive values and should not be used. (From Nussbaum & Ellis, 2003)

√ **Connect the ideas within a paragraph in a clearly understandable order.**

A unified paragraph has a main idea, which is expressed in the topic sentence, and each sentence (or idea) in the paragraph should contribute to the discussion of that idea. To make the paragraph coherent and unified, however, the relationship among all the ideas must be clear, and the progression from each sentence to the next must be easy for readers to follow.

Transitional words and phrases, which will be discussed later in this chapter, are very useful in guiding the reader through the text and in making the connections between ideas clear.

Techniques such as using transitional phrases and repeating words are not effective, however, if the sentences being connected are not arranged in a logical order.

Consider the following paragraph. Notice how smoothly each sentence flows into the next. The first sentence, in italics, is the topic sentence. As the paragraph progresses, certain words and phrases, in bold, are repeated to keep readers from losing their way.

*When it comes to adaptive immune responses to **HIV**, antibodies have received much of the attention—and caused unparalleled frustration and confusion. Antibodies typically derail viruses by binding to specific parts of their surface proteins, preventing the invaders from locking onto receptors on cell surfaces, the first step in establishing an infection. HIV long has befuddled AIDS vaccine developers because it overcomes almost every antibody that attaches to its surface protein, gp120. The central genius of the virus is that it copies rapidly and mutates frequently, creating a staggering number of viral strains. But over the years, researchers have fished a half-dozen antibodies from infected people that are remarkably potent—and work against many strains of the virus.* (From Cohen, 2003)

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## Writing Linear Manuscripts

As previously stated, the principles of linear writing apply to paragraphs, sections of a paper, and the entire paper.

### *Tips for Linear Manuscript Writing*

The following are tips for writing a manuscript in a linear style:

- State your hypothesis early and clearly.
- Include only the information that contributes to or supports the hypothesis statement or purpose statement, and tie the discussion and conclusion directly to that statement.
- Connect ideas in adjacent paragraphs.

Each tip is discussed in detail below.

#### √ **State your hypothesis early and clearly.**

Your hypothesis or purpose statement corresponds to your paper as the topic sentence does to a paragraph: it alerts readers to the main idea and helps keep them (and you!) focused. Guidelines for writing the hypothesis or purpose statement are presented in the chapters “Preliminary Steps in Writing a Scientific Manuscript” and “Writing the Introduction Section.” Refer to these chapters for details.

#### √ **Include only the information that contributes to or supports the hypothesis statement or purpose statement, and tie the discussion and conclusion directly to that statement.**

The information in your paper should be limited to what is necessary to make the point, that is, to support your hypothesis statement, and to the experiments that form a linear and logical thought process. If you keep this principle of limiting in mind, your discussion and conclusion will naturally tie in to your hypothesis statement.

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*“I try to limit the experiments presented to those that form a linear and logical thought process... If the experiment resides outside of this linear thought process, I am more hesitant to include it; rather, its results may be noted as ‘data not shown.’ If you cannot resist including such an experiment, then work hard on trying to find a logical tie-in that disrupts the flow as little as possible.”*

—Pierre D. McCrea, PhD  
Biochemistry & Molecular Biology

√ **Connect ideas in adjacent paragraphs.**

Connecting ideas between paragraphs is another important element of linear writing. This can be done by using connecting words and phrases. It can also be done by repeating words or phrases. Notice how the second paragraph is connected to the first in the following example:

Therapy for idiopathic venous thromboembolism typically includes a 5- to 10-day course of heparin followed by 3 to 12 months of oral anticoagulation therapy with full-dose warfarin.... In observational studies, full-dose warfarin is associated with rates of major bleeding episodes ranging from 5 to 9 percent annually. Similarly, an annual rate of major hemorrhage of 3.8 percent was observed in a recent trial of full-dose warfarin despite careful on-site monitoring of anticoagulation therapy.

**In contrast**, low-intensity warfarin carries a low risk of bleeding when used on a long-term basis, and such therapy may require less frequent monitoring.... (From Ridker et al., 2003)

Another way to connect paragraphs is to lead from the final sentence in 1 to the topic sentence in the next. Look at the example below, which shows the first and last sentences of the first paragraph and the first sentence of the following paragraph. Notice how the 2 paragraphs are connected:

There has been a dramatic increase in the worldwide prevalence of obesity.... From this perspective, most weight gain represents a subtle imbalance in an otherwise tightly regulated **hormonal system**.

**Several hormones** are now known to influence the appetite-control centers located in the hypothalamus.... (From List & Habener, 2003)

## 4. Effective scientific writing is clear, strong, and precise.

For scientific writing to be most effective, the language must be clear, strong, and precise. *Why are these characteristics so important?* Readers must be able to understand an author's meaning; misunderstandings can waste time and are potentially embarrassing. Writing that is clear is easier to understand and remember.

### *Tips for Clear, Strong, Precise Writing*

Books on English writing style generally agree on certain techniques that lead to clear, strong, precise writing:

- Use words that are precise and strong rather than vague, general, or ambiguous.
- Use first-person voice rather than third-person voice.
- Use active verbs rather than passive verbs.
- Avoid vague introductory phrases and vague pronouns.
- Use *a*, *an*, and *the* appropriately.
- Introduce a term before using its acronym or abbreviation.

Each of the techniques above is discussed in detail below. (**Note:** In English, commas are commonly used to help clarify meaning within sentences. Details and examples on using commas correctly are included at the end of this chapter.)

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*“Steady movement, a quality of fluent and graceful prose, should run through an entire paper. The stopping points at ends of paragraphs and ends of sections should not really be stops but pauses that close out units of thought and signal to the reader that a new start is about to be made.”*

—Edward J. Huth, *How to Write and Publish Papers in the Medical Sciences*

√ **Use words that are precise and strong rather than vague or general.**

Precise words enable your readers to understand and visualize your message. In the examples below, notice the differences in precision between the words in italics:

*Weak:* Many older people have bone fractures each year.

*Better:* In the United States, nearly 1 million fractures occur annually in people over the age of 65 years. (From Boyden et al., 2002)

Strong, precise action verbs are more descriptive and tell the reader much more than do such vague, weak verbs as *be*, *do*, *make*, *have*, *seem*, *appear*, and *exist*.

*Weak:* The other method is dependent on DNA uptake facilitated by polyethylene glycol.

*Better:* The other method depends on DNA uptake facilitated by polyethylene glycol.

*Weak:* The results seem to suggest that the patients who were given imatinib mesylate had milder side effects than did the patients given conventional therapy.

*Better:* The results suggest that the patients who were given imatinib mesylate had milder side effects than did the patients given conventional therapy.

You can sometimes strengthen a sentence by changing a noun to a verb:

*Weak:* We conducted an investigation.

*Better:* We investigated....

*Weak:* The patient's condition *showed improvement* after the second round of BEP.

*Better:* The patient's condition *improved* after the second round of BEP.

√ **Use first-person voice rather than third-person voice.**

Many writers avoid personal pronouns like "I" and "we," thinking that *first person* is informal and less objective. However, in writing your paper, using first-person pronouns is appropriate and can be an important signal for distinguishing your work from someone else's.

*Weak:* *The authors performed* biochemical analyses.

*Better:* *We performed* biochemical analyses.

√ **Use active verbs rather than passive verbs.**

Active verbs are concise and direct. *Why is this?* In English, the natural word order is *subject-verb* and *subject-verb-object*. In both patterns, the verbs are active verbs.

*subject-verb:*

*The tumor grew.*

*subject-verb-object:*

*The mice ate* a high-calorie diet.

Passive sentences reverse the natural word order of English; in other words, the object moves forward and becomes the subject:

*original object-verb-original subject*

A high-calorie diet *was eaten* by the mice.

Notice the differences in the active and passive sentences. First, the passive sentence is longer (and as you will see later in this chapter, readers of English prefer shorter sentences). Second, the passive requires the use of the verb *to be* (*is/are, was/were*), a weak verb; thus, passive sentences are naturally weaker.

There are times, of course, when a passive verb is appropriate. In the examples below, the doer is unknown, unimportant, or less important than the result:

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*Correct:* The sections **were incubated** with normal goat serum.

*Correct:* Although this new, structure-based approach **has not been tested** yet, other prediction tools have already begun to prove their mettle. (From Hagmann, 2000)

## Activity 1

Revise these sentences to make the verbs in bold active instead of passive:

1. Telomerase activity **was induced by** ectopic expression of BTAK/Aurora-A. (From Gritsko et al., 2003)
2. Further evidence that MC4R mutations are not so rare **was provided by** Farooqi and coworkers. (From List & Habener, 2003)

### √ Avoid vague introductory phrases and vague pronouns.

Replace *There are*, *It is*, and *This is* with expressions that get right to the point.

*Weak:* *It was* important to identify the x....

*Better:* *Identifying the x* was important....

*Weak:* *There is* an increased risk of lung cancer associated with smoking.

*Better:* *An increased risk of lung cancer is* associated with smoking.

*Best:* *Smoking increases* the risk of lung cancer.

### √ Use *a*, *an*, and *the* appropriately.

For non-native speakers of English, learning when to use articles (*a*, *an*, and *the*) in English—and when not to—can be a challenge. Because these small but important words are so critical for clear, precise writing, a review of articles is included at the end of this chapter.

*Correct:* A few mice died. (The meaning is equivalent to “Some mice died.”)

*Also correct:* Few mice died. (The meaning is equivalent to “Not many mice died.”)

√ **Introduce a term before using its acronym or abbreviation.**

In your paper, introduce an abbreviation at first mention of the term, and then use it consistently thereafter.

*Incorrect:* We then applied the model to evaluate the risk of lung cancer among smokers enrolled in a study of lung cancer screening with *CT* (*computed tomography*).

*Correct:* We then applied the model to evaluate the risk of lung cancer among smokers enrolled in a study of lung cancer screening with *computed tomography* (*CT*). (From Bach et al., 2003)

*Incorrect:* The loss of function of specific genes known as *metastasis suppressor genes* (*MSGs*) is an important event during the progression toward a malignant phenotype. *These metastasis suppressor genes* suppress the formation of overt metastases....

*Correct:* The loss of function of specific genes known as *metastasis suppressor genes* (*MSGs*) is an important event during the progression toward a malignant phenotype. *MSGs* suppress the formation of overt metastases.... (From Keller et al., 2002)

*Note:* In general, do not use an abbreviation in a manuscript unless the term is used 5 or more times.

## **Activity 2**

In the 3 sentences below, how can the sentences be made stronger by changing the words in bold?

1. The prevalence of obesity has increased **a lot** worldwide. (From List & Habener, 2003)
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2. The findings of Branson and coworkers, however, must be interpreted with caution since they **are different** from earlier findings of a prevalence of binge-eating disorder of 5 percent among carriers of *MC4R* mutations.<sup>5</sup> (From List & Habener, 2003)
  
3. **There are** three primary routes for human exposure to the carcinogen 4-aminobiphenyl (ABP): skin contact, inhalation, and ingestion. (From Tsuneoka et al., 2003)

*“Scientific writing, unfortunately, has become full of jargon and hard to understand by people who are not in that particular sub-area. We are lousy at communicating. But being an effective writer means being able to communicate to your audience clearly.”*

—Faith M. Strickland, PhD  
Immunology

## 5. Effective scientific writing is cohesive.

Cohesive writing shows **connectedness** and **consistency** in the message and details. *Why is cohesion important to scientific writing?* It ensures that ideas are connected and presented logically, and it helps readers follow the author’s line of reasoning. Many of these characteristics overlap with those of linear writing.

## ***Tips for Cohesive Writing***

Here are some tips for making your writing more cohesive:

- Use transitional words and phrases to connect ideas.
- Repeat key terms as often as needed; do not substitute new words for terms already introduced.
- Use parallel structures in writing sentences and expressing thoughts in paragraphs.

Each tip is discussed in detail below.

### √ **Use transitional words and phrases.**

A useful tool for connecting sentences and ideas, that is, for *transitioning* between them, is transitional words. Transitional, or connecting, words can help show the connection between a particular sentence and the sentences before and after it.

Transitional words can be used within sentences, between sentences, and between paragraphs. Some of the most common ones are *but, and, or, if, so, so that, first, second, last, although, however, moreover, also, in addition, for example, furthermore, therefore, thus, and finally*. Even words like *it/they* and *this/these* can be used to connect words and ideas.

In the example below, *thus* connects the 2 sentences, and *although* connects the 2 parts of the second sentence by contrasting 2 ideas:

One example of abnormal molecular physiology is the missing link between genes and behavior. *Thus, although* it is becoming clearer how hypothalamic neuropeptides control the amount of food we eat, further investigation is needed to establish the role of neuropeptides in determining the amount we eat at one sitting. (From List & Habener, 2003)

In the following example, *in fact* emphasizes or intensifies what follows:

Neurons may be particularly sensitive to free radical damage during aging. *In fact*, overexpression of Cu/Zn SOD in only motor neurons can extend *Drosophila* life-span by 48%. (From Wolkow et al., 2000)

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In the example below, *Such analyses* connects to *microarrays* in the previous sentence:

Other researchers are using microarrays to help uncover the genetic programs that cause lymphocytes to follow one developmental path instead of another or to become activated when they “see” a pathogen during normal immune responses. *Such analyses* can also provide clues to what goes wrong either in autoimmunity or in immune deficiencies. (From Hagmann, 2000)

In the example below, *These* and *they* carry the meaning of *candidate epitopes*:

But in less than a day, TEPITOPE slashed that unworkable number to 130 candidate epitopes, all predicted to bind to many different MHC alleles. *These epitopes* can now be tested to see whether *they* evoke an immune reaction. (From Hagmann, 2000)

English has a huge variety of transitional words, many with meanings that are close but not exactly the same. A list of transitional words grouped by general meaning has been included at the end of this chapter.

### **Activity 3**

Add the transitional words listed on the next page in the blanks of this paragraph:

A \_\_\_\_\_ study on ductal breast cancer showed that overexpression of BTAK/Aurora-A protein was independent of tumor histopathological type and was not correlated with tumor size and lymph node metastases.<sup>16</sup> \_\_\_\_\_ studies showed that alterations in BTAK/Aurora-A are associated with poor prognosis in gastric cancers and with high grade/late stage in breast and bladder cancer.<sup>25-27</sup> In the present study, \_\_\_\_\_, BTAK/Aurora-A protein kinase was preferentially activated/overexpressed in low-grade and early-stage ovarian cancer, as well as LMP, \_\_\_\_\_ there was no statistical

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significance at the kinase level between low-grade/early-stage and high-grade/late-stage tumors. (Adapted from Gritsko et al., 2003)

*although*      *however*      *other*      *previous*

√ **Repeat key terms as often as needed; do not substitute new words for terms already introduced.**

Although monotonous repetition of a word or group of words can be avoided by the use of pronouns, some repetition is good. Repeating key terms makes it clear to readers that a topic has not changed; on the other hand, varying key terms (for example, *radical surgical resection*, *complete surgical resection*, and *surgical extirpation*) can confuse readers and may lead them to think the topic has changed when it has not.

The following paragraph would be clearer if the same term were used for each item in bold:

The association of a family history of **prostate adenocarcinoma** with a number of clinical and pathological features has been investigated in several studies,<sup>7-19</sup> but no specific characteristics have been identified to distinguish familial **prostate cancer** cases from sporadic cases. Therefore, we have also examined whether reporting of a family history of **prostate carcinoma** varied with the grade of disease in the cases. (Adapted from Staples et al., 2003)

√ **Use parallel structures in writing sentences and expressing thoughts in paragraphs.**

Bruce Ross-Larson, author of *Edit Yourself*, writes, “Words and groups of words that do the same work are easier to read if they are similar (parallel) in grammatical constructions.... The construction of sentences presenting similar facts or ideas should be parallel, too, as should any recurring sentence parts.”

Look at these 2 sentences joined by *however*. Notice how parallel, that is, how similar in structure, the 2 sentences are:

Studies of *daf-2* genetic mosaic animals showed that animals lacking *daf-2* activity from the entire AB cell lineage, which generates nearly all of the hypodermis and nervous system and half of the pharynx, have extended life-spans. *However*, mosaic animals lacking *daf-2* activity from blastomere

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daughters of AB, which generate about half of the hypodermis, nervous system, and pharynx, did not have extended life-spans. (From Wolkow et al., 2000)

Sentence 1:  Studies of daf-2 genetic mosaic animals showed that	Sentence 2:  However,			
animals lacking daf-2 activity from the entire AB cell lineage,	mosaic animals lacking daf-2 activity from blastomere daughters of AB,			
which generates	which generate			
<table border="0"> <tr> <td style="border-left: 1px solid black; padding-left: 10px;">nearly all of the hypodermis and nervous system</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 10px;">and half of the pharynx,</td> </tr> </table>	nearly all of the hypodermis and nervous system	and half of the pharynx,	<table border="0"> <tr> <td style="border-left: 1px solid black; padding-left: 10px;">about half of the hypodermis, nervous system, and pharynx,</td> </tr> </table>	about half of the hypodermis, nervous system, and pharynx,
nearly all of the hypodermis and nervous system				
and half of the pharynx,				
about half of the hypodermis, nervous system, and pharynx,				
have extended life-spans.	did not have extended life-spans.			

Be especially careful after *either...or*, *both...and*, and *not only...but also*. The words or phrases that follow must be grammatically parallel:

These MHC proteins with their antigen fragments act like red flags, drawing the attention of the immune system's T cells, which *either kill* cells carrying the antigens outright *or orchestrate* an attack by various other immune players. (From Hagmann, 2000)

<p>These MHC proteins with their antigen fragments act like red flags, drawing the attention of the immune system's T cells,</p> <p>which</p> <table border="0"> <tr> <td style="border-left: 1px solid black; padding-left: 10px;"><i>either</i></td> <td style="border-left: 1px solid black; padding-left: 10px;"><i>kill</i> cells carrying the antigens outright</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 10px;"><i>or</i></td> <td style="border-left: 1px solid black; padding-left: 10px;"><i>orchestrate</i> an attack by various other immune players.</td> </tr> </table>	<i>either</i>	<i>kill</i> cells carrying the antigens outright	<i>or</i>	<i>orchestrate</i> an attack by various other immune players.
<i>either</i>	<i>kill</i> cells carrying the antigens outright			
<i>or</i>	<i>orchestrate</i> an attack by various other immune players.			

## Activity 4

Reword the phrases in bold to make them more parallel:

1. Specifically, bone provides **chemotactic factors, factors for adhesion, and growth factors** that allow the cancer cells to target and proliferate in the skeleton. (From Keller et al., 2002)
2. The activity of FPGS is **high in the liver** and **in bone marrow stem cells may also be high**.
3. It was observed that BTAK/Aurora-A protein kinase is preferentially activated/overexpressed in **low-grade and early-stage** ovarian cancer, although there was no statistical significance at the kinase level between **low-grade/early-stage** and **late-stage/high-grade** tumors. (From Gritsko et al., 2003)

## 6. Effective scientific writing is streamlined.

According to the author instructions of the journal *Biochemistry*, “Manuscripts should be written in clear, concise English and should be condensed to [the extent] most compatible with clarity. Editors, reviewers, and readers may tend to be biased against results reported in complex or excessively verbose language.” Fortunately, complex science does not require complex language.

In her *ESL Resource Book for Engineers and Scientists*, Elaine Campbell writes, “Technical writing style in the United States is quite standardized.... It emphasizes plain prose and simple word choice. Whenever possible, it favors brevity of expression, although brevity must never take priority over clarity.”

*“In English, we like sentences that are lean and mean. We like nouns and verbs and are suspicious of other parts of speech....”*

—Composition Center, Dartmouth University  
([www.dartmouth.edu/~compose/tutor/problems/esl.html](http://www.dartmouth.edu/~compose/tutor/problems/esl.html))

Brevity of expression is achieved through streamlining, which is eliminating unnecessary words and expressions that clutter language and interrupt the flow of thought. Thus, an important task for you as a scientific writer is to streamline your writing. Streamlining primarily involves making paragraphs and sentences a reasonable length, reducing wordiness, and using short words instead of longer ones when possible.

### ***Tips for Streamlined Writing***

- Break long sentences into shorter ones.
- Eliminate wordiness.
- Use shorter words rather than long ones when possible.

Each tip is discussed in detail below.

#### √ **Break long sentences into shorter ones.**

One requirement of writer-responsible writing is that as the writer, you must help readers understand what you write. One easy way to make your writing more easily understood is to break your long sentences into shorter ones. *Why?* The shorter a sentence is, the fewer words readers must store in their short-term memory. Scientific writing in English allows longer sentences than other types of writing do, but the fact remains that shorter sentences are more easily understood. Use your own judgment as to what is too long, but as a guideline, keep your sentences to about 15 to 20 words.

In the sentences below, which example is easier to follow?

*58-word sentence:*

The daf-2 pathway-mediated regulation of dauer arrest and of metabolism, which can be decoupled from life-span regulation, involves distinct outputs of the daf-2 insulinlike signaling pathway, which in neurons may produce a senescence-inducing neuroendocrine output that is not produced in muscle or intestine, the cells of which may contribute dauer and metabolic regulatory signals. (From Wolkow et al., 2000)

*3 shorter sentences:*

The daf-2 pathway-mediated regulation of dauer arrest and of metabolism, which can be decoupled from life-span regulation, involves distinct outputs of the daf-2 insulinlike signaling pathway. Daf-2 pathway signaling in neurons may

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produce a senescence-inducing neuroendocrine output that is not produced in muscle or intestine. Muscle or intestine cells may contribute dauer and metabolic regulatory signals.

Of course, sentences can also be too short, making the writing seem choppy or abrupt. Very short sentences can be combined using transitional words. (See the list of transitional words at the end of this chapter.) A mix of longer and shorter sentences — the best case — will lend a touch of sophistication to your writing.

### **Activity 5**

Cut each long sentence into 2 sentences at the word in bold. Begin the second sentence with a word or phrase that links the 2 sentences.

1. To date, only a handful of metastasis suppressor genes have been identified, **and** the mechanisms through which these genes and their protein products suppress metastasis *in vivo* are not well defined. (From Keller et al., 2002)
  
2. The bone provides a unique environment, compared with soft tissue, for the establishment of metastases, **which** includes aspects unique to bone, including the sinusoidal characteristics of the marrow, the mineralized matrix in the bone, and the extracellular matrix, which is rich in growth factors. (From Keller et al., 2002)

#### √ **Eliminate wordiness.**

“Lean” language is language that has the minimum number of words necessary to clearly state the message. Extra words tend to clutter a sentence and get in the way of the meaning.

Inexperienced writers, especially, often use more words than necessary. With practice, though, you can develop a clean, lean style of writing that supports your message.

---

*“All men are really attracted by the beauty of plain speech [but they] write in a florid style in imitation of this.”*

—Henry David Thoreau (1817–1862)

There are several categories of wordiness that you can learn to recognize and minimize: unnecessary words, redundancies (unnecessary repetition in meaning), and metadiscourse (talking to readers about the content and suggesting how they should react).

Look at the examples below of wordy expressions and how they can be shortened or cut. (A longer list can be found at the end of this chapter.)

*Unnecessary words:*

in regards to → regarding/about  
a greater number of → more  
is indicative of → indicates  
prior to → before  
for the purpose of → to

*Redundancies:*

an integral part of → part of  
prior experience → experience  
white in color → white  
decision-making process → decision-making

*Metadiscourse:*

It is important to note → [delete phrase]  
Interestingly → [delete phrase]

---

**Activity 6**

Remove any unnecessary words from the phrases in bold, or replace the phrases with shorter phrases:

1. Although strong formal proof of this hypothesis **has not been published at this time**, the observation that inhibiting bone remodeling diminishes tumor growth in bone **is supportive of** this possibility. (From Keller et al., 2002)
  2. The mechanism accounting for this tissue selectivity has received **a great deal of attention** in the cancer research field. (From Keller et al., 2002)
  3. Moreover, immunohistochemical staining showed that BTAK/Aurora-A is expressed **in a preferential way** in tumors **that are less invasive** and declines once a tumor becomes invasive. (From Gritsko et al., 2003)
  4. Therefore, **it is possible** that activation and overexpression of BTAK/Aurora-A protein kinase may be early changes and play an important role in the development of a subset of human ovarian cancers. (From Gritsko et al., 2003)
  5. Regardless of the **organ being targeted**, the complexity of the **cascade of metastasis** suggests that there are many factors that control the ability of a cancer cell to reach **where it wants to go**. (From Keller et al., 2002)
-

√ **Use shorter words rather than long ones when possible.**

English is an extremely absorbent language that over time has added words from most of the world's languages, especially Latin and German. The added words have tended to be longer than the original English words. As a result, the English language is full of word choices: for example, *perform* (added) versus *do* (original).

Technical English, however, favors shorter English words when there is a choice. Unfortunately, when English-speaking scientists first began publishing their work more than 100 years ago, they tended to sprinkle their writing with words from Latin and French—to show off their education and knowledge of languages. This practice evolved into a writing tradition that persists today. However, it is enough for you to know that you should choose shorter words when you have a choice. (Of course, there are many long technical words that you cannot avoid using.)

Here are some examples of words that can be made shorter:

assistance → help

desire → want

facilitate → help

instituted → set up/started

optimum → best

*“Once you know the principles involved, ... writing is easier.”*

—Mien-Chie Hung, PhD  
Molecular & Cellular Oncology

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**Activity 7**

Replace these words and phrases with shorter ones:

- |                          |                      |
|--------------------------|----------------------|
| 1. lengthy               | 6. necessitate       |
| 2. has the capability of | 7. firstly           |
| 3. in the near future    | 8. subsequently      |
| 4. for this reason       | 9. as compared with  |
| 5. following             | 10. has an effect on |

**Conclusion**

When your manuscript has all the characteristics described in this chapter, you will have fulfilled your responsibilities to your readers by making your message easy to understand.

Tip: To continue to polish the skills you have learned in this chapter and become a more sophisticated science writer, read as much as you can from well-edited journals, such as *The New England Journal of Medicine* and *Molecular and Cellular Biology*.

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## Supplemental Materials

The following supplemental materials are also included in this chapter.

- Review of the English Article System
  - Transitional Words
  - Wordy Phrases to Avoid
  - Avoiding Common Comma Errors
  - References for This Chapter
  - Solutions to Activities
  - Article Practice Answer Key
-

## Review of the English Article System

Articles (*a*, *an*, and *the*)—like adjectives (*small*, *surgical*, etc.)—are words that modify nouns. Words that *modify* nouns change the meaning of the nouns. Articles can change a noun’s meaning from singular to plural and from general to specific.

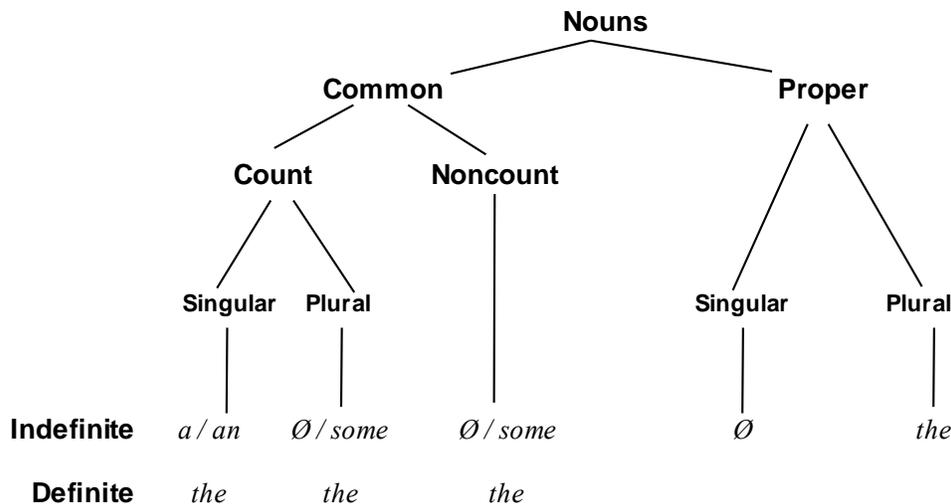
In general, the English article system includes the words *a*, *an*, *the*, and the absence of these words (represented in this review by “ $\emptyset$ ”). The patterns of article usage, however, are complex and often depend on the particular context.

As anyone learning English knows, this system has *many* exceptions. Moreover, scientific writing, like other types of specialized writing, has developed many patterns of article usage that differ from those of “textbook” English.

*The best way to learn how to use articles correctly is to become very familiar with the usage patterns described in this review and then to pay close attention to what you read and hear.*

There are many different ways to describe the English article system. The chart that follows shows how this review is organized.

### English Article System\*



\* Some minor differences exist in American and British English. This chart is based on American English. (Adapted from Campbell E. ESL Resource Book for Engineers and Scientists. New York, John Wiley & Sons, 1995.)

## Review of Nouns

**Nouns** are names of people, places, things, and ideas. In English, nouns are either **common** or **proper**. Most nouns are **common** nouns.

**Common:** *mouse, hospitals*

**Proper:** *Mickey Mouse*  
*Memorial Sloan-Kettering Cancer Center*

## Common Nouns

**Common** nouns name things, conditions, ideas, etc. They have two main features: they can be **count** (**singular** and **plural**) or **noncount**, and they can be **indefinite** (general) or **definite** (specific).

*injection, response, cell, efficacy*

## Count and Noncount

### Count

**Count** nouns can be counted—that is, they can be **singular** or **plural**.

**Plural** nouns in English generally end in *s*, *es*, or *ies*.  
*array/arrays, class/classes, antibody/antibodies*

Some nouns have an irregular **plural** form:

*mouse/mice, hypothesis/hypotheses, datum/data, phenomenon/phenomena, bacterium/bacteria*

A few nouns that end in *s*, *es*, or *ies* are **singular** or **noncount**, not **plural**:

*measles* *Measles is a serious disease.*  
*series* *The series of tests was completed.*

Some words are **plural** only:

*scissors* *The scissors are broken.*  
*pants* *His pants were clean.*

### Noncount

**Noncount** nouns (also called mass nouns) cannot be counted and thus do not have singular and plural forms.

*pain, air, time, physics, neutropenia, oncology, scanning*

**Noncount** nouns typically fall into certain categories:

**Fields of study:** *physics, oncology, medicine*

**Diseases and conditions:** *measles, diabetes, nausea*

**Drugs:** *lorazepam/Ativan, doxorubicin/Adriamycin*

**Note:** Drugs often have both generic and trade names. (The trade, or proprietary, name could be considered a proper noun, but for the purposes of this review, it is categorized with the generic name.) Only the trade names are capitalized.

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**Fluids, solids, gases, particles:** *oil, water*

**Abstractions:** *knowledge, time, help, advice, care*

**Activities, procedures, processes:** *smoking, cloning, binding, detection*

**Groupings of items:** *money, equipment*

**Languages:** *English, Spanish, Chinese*

**Weather and other natural phenomena:** *rain, lightning, thunder*

**Note:** Some nouns can be either **count** or **noncount**, depending on their meaning in a particular context. Such words follow the pattern for either **count** nouns or **noncount** nouns, depending on how they are used.

**Count:** *protein/proteins (the shape of a protein, the shape of proteins)*

**Noncount:** *protein (Protein is critical for a healthy diet.)*

**Count:** *papers (How many papers have you written?)*

**Noncount:** *paper (How much paper do you need?)*

The concept of **count** and **noncount** exists in many languages. However, what is **count** in one language may be **noncount** in another language. For example:

In English, the word *information* is **noncount**.

In French and Spanish, it is **count**: *les informations, las informaciones*.

## Indefinite and Definite

**Common** nouns can refer to something **indefinite** or **definite**, depending on the article used.

*A/an* and the absence of *a/an* ( $\emptyset$ ) are used to make nouns **indefinite**.

*a gel / gels / some gels*

*decay / some decay*

*The* is used to make nouns **definite**.

*the gel / the gels*

*the decay*

This pattern is true for **count** nouns (**singular** and **plural** forms) and for **noncount** nouns.

### Indefinite

Nouns that refer to something general or something not identified are preceded by **indefinite** articles.

These nouns can be **count** (singular, plural) and **noncount**.

*a gene/genes*

*genetics*

### **Definite**

Nouns that refer to the following are preceded by **definite** articles:

- something specific (including ordinal numbers [*first*, etc.] and superlatives [*most*, etc.] )
- something already mentioned
- something identified by a word, phrase, or clause that follows
- something unique
- something known (understood) by both the speaker and the listener or reader

These nouns can be **count** (singular or plural) and **noncount**.

*the erb-B gene*

*...expression of erb-B. The gene...*

*the study supporting our hypothesis* [the only study]

But: *a study supporting our hypothesis* [one of several studies]

*the sun*

*the phone* (*Can you please answer the phone?*)

**Note:** Organs of the body are usually preceded by *the*.

*He was hit in the stomach.*

*Damage eventually occurs to the liver.*

**Note:** **Count** nouns that refer to a class of items can use the **indefinite** article (*a/an* or  $\emptyset$ ) or the **definite** article (*the*)—without changing the meaning of the statement.

Indefinite, singular and plural: *a rodent, rodents*

*A rodent develops cancer relatively easily in response to chemical carcinogens.*

*Rodents develop cancer relatively easily in response to chemical carcinogens.*

*A human body is like a sophisticated computer.*

*Human bodies are like sophisticated computers.*

Definite, singular only: *the rodent*

*The rodent develops cancer relatively easily in response to chemical carcinogens.*

*The human body is like a sophisticated computer.*

### **Proper Nouns**

**Proper** nouns are the names of particular people, places, journals, organizations, etc.

*George Washington, Houston, American Cancer Society*

## Patterns of Article Usage

### **Pattern 1. Singular Nouns – Indefinite (a/an)**

A **singular** noun that refers to something **indefinite** is preceded by *a* or *an*.

*a diet*  
*an anesthetic*

Intervening adjectives usually do not change the pattern.

*a diet / a low-fat diet / an unappetizing diet*

**Singular** count nouns that can be preceded by *a/an* or *the* can instead be preceded by *one*, *this*, *that*, *my*, *his*, *either*, *every*, *each*, *no*, *another*, etc.

*a patient / the patient / this patient / each patient / no patient*

A **singular** noun requires *a* if it begins with a consonant sound (*d*, *s*, *ch*, etc.); a **singular** noun requires *an* if it begins with a vowel sound (*a*, *e*, *i*, *o*, *u*, etc.).

*a stem cell*  
*an enzyme*

Before **singular** acronyms (*AIDS*, *NCI*, etc.), choose *a* or *an*, depending on the pronunciation of the first letter.

*a DNA molecule, an RNA molecule (“ar”)*  
*an NCI grant (“en”)*

### **Pattern 2. Plural Nouns – Indefinite (∅ or some)**

A **plural** noun that refers to something **indefinite** is preceded by nothing ( $\emptyset$ ) or *some*.

*diseases*  
*some diseases*

Intervening adjectives usually do not change the pattern.

*infectious diseases / some infectious diseases*

### **Pattern 3. Noncount Nouns – Indefinite (∅ or some)**

**Noncount** nouns that are **indefinite** are preceded by nothing ( $\emptyset$ ) or *some*.

*Pain is an important consideration in palliative care.*  
*Some pain is worse than other pain.*

Many **noncount** nouns have special expressions for quantity. (These unit expressions can be **singular** or **plural**.)

*a liter of oil / liters of oil*  
*a piece of paper / pieces of paper*  
*a cup of coffee / cups of coffee*  
*a breath of fresh air*  
*(also some oil, some paper, some coffee, some air)*

### ***Pattern 4. Singular, Plural, and Noncount Noun – Definite (the)***

All nouns (singular, plural, noncount) that are **definite** are preceded by *the*. These nouns refer to...

- something specific (including ordinal numbers and superlatives):  
*the pathology report*  
*the last chance*  
*the best assays*
- something already mentioned:  
...in a phase III clinical trial. The trial...
- something unique:  
the human genome, the ozone  
Did you see the moon last night?
- something identified by a word, phrase, or clause that follows:  
the goal of early detection  
HBV is the virus that causes hepatitis B.
- something known (understood) by both the speaker and the listener or reader:  
*I'll meet you in the lab after lunch.*

**Note:** **Count** nouns that refer to something **definite** can be preceded by words such as *this/these, that/those, three, many, such, his/her, its/their*, etc., instead of *the*.

singular: *one country, his country, this country*

plural: *three countries, these countries, such countries*

### ***Pattern 5. Proper Nouns***

**Proper** nouns are preceded by nothing ( $\emptyset$ ) or by *the*, but never by *a/an*. These nouns are usually capitalized.

*Abraham Lincoln*

*Mount Everest*

*The Johns Hopkins Hospital*

*American Cancer Society*

*National Institutes of Health*

Journal of the American Medical Association

The New England Journal of Medicine

**Note:** Capitalize *the* in the middle of a sentence only when it is part of the formal name.

*She volunteers at the American Cancer Society.*

*He submitted an article to The New England Journal of Medicine.*

**Note:** Avoid overcapitalizing nouns that are *not* proper nouns.

- Professions and academic positions are *not* proper nouns and are usually not capitalized in sentences.  
*professor of diagnostic radiology*

- Academic departments are proper nouns (and are capitalized) *only* when the official name is used.  
*the Department of Diagnostic Radiology*  
*the diagnostic radiology department*
  
  - Diseases are proper nouns (and are capitalized) *only* when a person's name is included in the disease name.  
*Hodgkin's disease*  
*lymphoma*
-

## Article Practice

Fill in the blanks with *a*, *an*, *the*, or  $\emptyset$ . Solutions can be found at the end of the chapter.

1. \_\_\_\_\_ M/mutations are \_\_\_\_\_ flaws that occur in \_\_\_\_\_ genes.
2. Many scientists believe that \_\_\_\_\_ release of \_\_\_\_\_ chlorofluorocarbons into \_\_\_\_\_ atmosphere has caused \_\_\_\_\_ earth's ozone layer to thin.
3. \_\_\_\_\_ L/long exposure to \_\_\_\_\_ UV-A light will damage \_\_\_\_\_ skin and cause \_\_\_\_\_ cancer.
4. \_\_\_\_\_ R/radiation therapy is \_\_\_\_\_ use of ionizing radiation to treat cancer.
5. \_\_\_\_\_ C/clinical trial can be conducted at \_\_\_\_\_ single hospital or in dozens of \_\_\_\_\_ health centers in \_\_\_\_\_ several countries.
6. In 1984, \_\_\_\_\_ first strain of \_\_\_\_\_ transgenic mice was developed. \_\_\_\_\_ T/transgenic mouse—a mouse that contains \_\_\_\_\_ gene from another animal—is produced by introducing \_\_\_\_\_ foreign gene into \_\_\_\_\_ egg that produces \_\_\_\_\_ mouse. \_\_\_\_\_ T/transplanted gene then becomes a permanent part of \_\_\_\_\_ animal's genetic makeup. In this way, \_\_\_\_\_ scientists can study \_\_\_\_\_ influence of a particular gene on \_\_\_\_\_ tumor development.

Exercise and some examples adapted from Ward DE. *The Cancer Handbook: A Guide for the Nonspecialist*. Columbus, OH, Ohio State University Press, 1995.

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## Transitional Words

English has a huge variety of transitional words. The categories and examples below, adapted from Purdue University's Online Writing Lab,\* are grouped according to *general* meaning. Words within the same group are *not* usually interchangeable: their grammar may vary, and there may be slight differences in meaning. If you are at all unsure about how to use a particular word, check its meaning and usage in a good dictionary.

**To add**—and, again, and then, besides, equally important, finally, furthermore, too, next, last, moreover, in addition, first (second, etc.), not only...but also

**To compare**—similarly, likewise, as before

**To contrast**—in contrast, whereas

**To show a condition**—if, whether, in such a case

**To show purpose**—to, in order to, so that

**To prove**—because, for the same reason, furthermore, moreover, indeed, in fact, thus

**To show exception**—yet, still, however, nevertheless, in spite of, despite, sometimes, although

**To show time**—soon, after a few hours, finally, then, later, previously, first/second, next, immediately

**To repeat**—as noted previously, in brief, as mentioned before

**To emphasize**—obviously, in fact, indeed, naturally, without a doubt, certainly, that is

**To show sequence**—first/second/last, next, then, after, afterward, subsequently, finally, previously, before this, simultaneously, hence, soon

**To give an example**—for example, for instance, in this case, in another case, in this situation, to illustrate, specifically

**To summarize or conclude**—to conclude, therefore, thus, accordingly, as a result, to summarize, in conclusion, in summary

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\*Adapted from the Purdue University Online Writing Lab: [www.owl.english.purdue.edu/handouts/general/gl\\_transition.html](http://www.owl.english.purdue.edu/handouts/general/gl_transition.html)

## Wordy Phrases to Avoid

The following is a transcribed list of words, expressions, and jargon to avoid in scientific and technical writing and was taken from Robert A. Day's outstanding books on technical writing:

Day, Robert A. *How to Write and Publish a Scientific Paper*. Philadelphia, ISI Press, 1979.

Day, Robert A. *Scientific English: A Guide for Scientists and Other Professionals*. Phoenix, Oryx Press, 1992.

<b>Avoid</b>	<b>Use instead</b>	<b>Avoid</b>	<b>Use instead</b>
a considerable amount of	much	be advised that	(omit)
a considerable number of	many	by means of	by, with
a great number of times	often	capability	ability
a majority of	most	causal factor	cause
a number of	some	caveat	warning
a small number of	a few	completely full	full
absolutely essential	essential	consensus of opinion	consensus
accounted for by the fact that	because	considerable amount of	much
adjacent to	near	deem	think
afford an opportunity	let	definitely proved	proved
along the lines of	like	despite the fact that	although
an example of this fact is that	for example	due to the fact that	because
an order of magnitude faster	10 times faster	during the course of	during, while
apparent	clear	during the time that	while
are of the same opinion	agree	echelons	levels
as a consequence of	because	elucidate	explain
as a matter of fact	in fact (or omit)	employ	use
as a means of	to	enclosed herewith	enclosed
as is the case	as happens	encounter	meet
as of this date	today	end result	result
as to	about (or omit)	endeavor	try
as to whether	whether	entirely eliminate	eliminate
at a rapid rate	rapidly	equivalent	equal
at an early date	soon	eventuate	happen
at an earlier date	previously	evidenced	showed
at some future time	later	fabricate	make
at the conclusion of	after	fatal outcome	death
at the present time	now	fewer in number	fewer
at this point in time	now	finalize	end
based on the fact that	because	first of all	first
		following	after
		for a period of	for
		for the purpose of	for
		for the reason that	since, because
		from the point of view	for
		future plans	plans
		give an account of	describe

<b>Avoid</b>	<b>Use instead</b>	<b>Avoid</b>	<b>Use instead</b>
give consideration to	consider	incline to the view	think
give rise to	cause	incumbent upon	must
has been engaged in a study of	has studied	initiate	begin, start
has the capability of	can	is defined as	is
have the appearance of	look like	it goes without saying that I	I
having regard to	about	it has been reported by Smith	Smith reported
impact (verb)	affect	it has long been known that	(the author hasn't bothered to look up the reference)
important essentials	essentials	it is apparent that	apparently
in a number of cases	some	it is believed that	I think
in a position to	can, may	it is clear that	clearly
in a satisfactory manner	satisfactorily	it is clear that much additional work will be required before a complete understanding	(the author doesn't understand it)
in a timely manner	promptly	it is doubtful that	possibly
in a very real sense	in a sense (or omit)	it is evident that A produced B	A produced B
in almost all instances	nearly always	it is generally believed	many think
in case	if	it is my understanding that	I understand that
in close proximity to	close, near	it is of interest to note that	(omit)
in connection with	about, concerning	it is often the case that	often
in lieu of	instead of	it is recommended that	we recommend
in many cases	often	it is worth pointing out in this context that	note that
in my opinion it is not an unjustifiable assumption that	I think	it may be that	I think
in order to	to	it may, however, be noted that	but
in respect to	about	it should be noted that	note that (or omit)
in some cases	sometimes	it was observed in the course of these experiments that	we observed
in spite of the fact that	although	join together	join
in terms of	about	lacked the ability to	could not
in the absence of	without		
in the amount of	for		
in the event that	if		
in the first place	first		
in the not-too-distant future	soon		
in the possession of	has, have		
in view of the fact that	because, since		
inasmuch as	because		
inception	start		

<b>Avoid</b>	<b>Use instead</b>	<b>Avoid</b>	<b>Use instead</b>
large in size	large	quite a large	much
liaise with	coordinate with	quantity of	
majority of	most	quite unique	unique
make preparations for	prepare	rather interesting	interesting
make reference to	refer to	red in color	red
methodology	method	referred to as	called
militate against	prohibit	relative to	about
month of	(omit)	remuneration	pay, payment
needless to say	(omit, and consider leaving out whatever follows it)	rendered	broken
		completely	
new initiatives	initiatives	inoperative	
not later than	by	resultant effect	result
of great	useful	root cause	cause
theoretical and practical importance		serious crisis	crisis
of long standing	old	shortfall	shortage
of the opinion that	think that	smaller in size	smaller
on account of	because	so as to	to
on a daily basis	daily	subject matter	subject
on behalf of	for	subsequent to	after
on no occasion	never	sufficient	enough
on the basis of	by	take into	consider
on the grounds that	since, because	consideration	
on the part of	by, among, for	terminate	end
optimum	best	the great majority of	most
our attention has been called to the fact that	(we belatedly discovered)	the opinion is advanced that	I think
owing to the fact that	since, because	the predominant number	most
parameters	limits	the question as to whether	whether
penultimate	next to the last	there is a reason to believe	I think
perform	do	this result would seem to indicate	this result indicates
permit	let	through the use of	by, with
place a major emphasis on	stress	ultimate	last
pooled together	pooled	utilize	use
practicable	practical	was of the opinion that	believed
presents a picture similar to	resembles	ways and means	ways, means (not both)
prior to	before	we wish to thank	we thank
prioritize	rank	whether or not	whether
protein	proteins were determined	with a view to	to
determinations were performed		with reference to	about (or omit)
provided that	if	with regard to	about
quantity	measure	with the possible exception of	except
quite	(omit)	with the result that	so that

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## Avoiding Common Comma Errors

### When to Use Commas

Use commas between independent clauses that are linked with a coordinating conjunction—and, but, or, nor, so, for, yet (an independent clause has a subject and a verb and could stand alone as a sentence):

*Not:* Most patients tolerated the drug regimen well but three patients required hospitalization for grade 4 toxic effects.

*Correct:* Most patients tolerated the drug regimen well, but three patients required hospitalization for grade 4 toxic effects.

Use commas between items in a series if there are 3 or more items:

*Correct:* The patient received fluorouracil, doxorubicin, and cyclophosphamide.

*But:* The patient received doxorubicin and cyclophosphamide.

Use commas to set off nonrestrictive clauses or phrases (nonrestrictive clauses or phrases provide information that is relevant to the topic but not essential to the meaning of the sentence):

*Correct:* Dr. John Smith, an associate professor in the Department of Experimental Biology, is building a database of epigenetic changes in acute lymphoblastic leukemia.

*But:* The Dr. John Smith who works in New York City must not be confused with the Dr. John Smith who was recently arrested for fraud. (*The clauses beginning with “who” tell you which of two John Smiths is meant.*)

*Correct:* Many types of cancer, such as breast cancer and colon cancer, can be cured if diagnosed at an early stage.

*But:* Only breast cancers that are diagnosed at an early stage can be cured. (*The clause beginning with “that” indicates which cancers are potentially curable.*)

Use commas before and after a nonrestrictive appositive (an appositive renames or defines a noun; degrees, years in dates, and many geographical names are often treated like nonrestrictive appositives):

*Correct:* DNA methylation, the addition of a methyl group to one of the bases of DNA, is a fundamental part of gene expression.

*Not:* The diagnosis was Refsum’s disease or phytanic acid storage disease. (*Without a comma, the sentence says that the patient had one of two diseases.*)

*Correct:* The diagnosis was Refsum’s disease, or phytanic acid storage disease. (*With a comma, the sentence says the patient had Refsum’s disease, which is also known by another name. The word “or” is often used before nonrestrictive appositives.*)

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*Not:* The study was conducted from May 1, 2002 to July 31, 2002.

*Correct:* The study was conducted from May 1, 2002, to July 31, 2002.

*But:* The study was conducted from 1 May 2002 to 31 July 2002.

*But:* The study was conducted from May 2002 to July 2002.

*Not:* Paris, France is an interesting place to visit.

*Correct:* Paris, France, is an interesting place to visit.

*Correct:* Houston, Texas, is unbearably hot and humid in the summer.

*Correct:* Edgardo Hidalgo, PhD, has been nominated for the Cranton Prize.

Use commas after introductory words, phrases, or clauses:

*Correct:* To be eligible for the study, patients must not have received any prior radiation therapy.

*Correct:* In contrast to previous studies, our study demonstrates that the therapy is ineffective.

Use commas to set off contrasted elements:

*Correct:* The therapy cured the underlying disease, not just improved the symptoms.

*Correct:* Patients younger than 60 years, but not those older, have a favorable prognosis.

Use commas after “e.g.” or “for example” and after “i.e.” or “that is”:

*Correct:* There are many treatment choices (e.g., morphine, oxycodone, and propoxyphene).

*Correct:* In linear writing, thoughts and ideas are expressed sequentially, that is, in a line.

## **When *Not* to Use Commas**

Do not use commas between two verbs that share the same subject:

*Not:* The samples were paraffin-embedded, and stained with hematoxylin-eosin stain.

*Correct:* The samples were paraffin-embedded and stained with hematoxylin-eosin stain.

*But:* The samples were paraffin-embedded, and half were stained with hematoxylin-eosin stain. (*This sentence has two independent clauses.*)

Do not use commas between independent clauses that are not linked by a coordinating conjunction:

*Not:* The records of all 313 patients were reviewed, the 212 who met the inclusion criteria were included in this retrospective study.

*Correct:* The records of all 313 patients were reviewed, and the 212 who met the inclusion criteria were included in this retrospective study.

*Correct:* The records of all 313 patients were reviewed; the 212 who met the inclusion criteria were included in this retrospective study.

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*Not:* The 5-year overall survival rate was higher in the high-dose group than in the low-dose group, however, this difference was not statistically significant.

*Correct:* The 5-year overall survival rate was higher in the high-dose group than in the low-dose group; however, this difference was not statistically significant.

*Correct:* The 5-year overall survival rate was higher in the high-dose group than in the low-dose group, but this difference was not statistically significant.

Do not use commas around restrictive clauses or phrases (restrictive clauses or phrases are essential to the meaning of the sentence):

*Not:* The only patient, who experienced a grade 4 toxic effect, was an 87-year-old woman.

*Correct:* The only patient who experienced a grade 4 toxic effect was an 87-year-old woman.

*But:* The patient, who was 87 years old, recovered from the toxic effects of the drug and was discharged from the hospital after 3 days. (*The clause beginning with “who” is nonrestrictive.*)

*Correct:* Researchers are investigating drugs that may inhibit angiogenesis.

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## References for This Chapter

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## Article Practice Answer Key

Fill in the blanks with *a*, *an*, *the*, or  $\emptyset$ .

1.  $\emptyset$  Mutations are  $\emptyset$  flaws that occur in  $\emptyset$  genes.
2. Many scientists believe that the release of  $\emptyset$  chlorofluorocarbons into the atmosphere has caused the earth's ozone layer to thin.
3.  $\emptyset$  Long exposure to  $\emptyset$  UV-A light will damage the skin and cause  $\emptyset$  cancer.
4.  $\emptyset$  Radiation therapy is the use of ionizing radiation to treat cancer.
5. A clinical trial can be conducted at a single hospital or in dozens of  $\emptyset$  health centers in  $\emptyset$  several countries.
6. In 1984, the first strain of  $\emptyset$  transgenic mice was developed. A transgenic mouse—a mouse that contains a gene from another animal—is produced by introducing a foreign gene into the egg that produces the mouse. The transplanted gene then becomes a permanent part of the animal's genetic makeup. In this way,  $\emptyset$  scientists can study the influence of a particular gene on  $\emptyset$  tumor development.