CHAPTER 4

Literature Sources

THIS CHAPTER PROVIDES DETAILS ABOUT:

- Locating, selecting, managing, and using references
- Formatting citations and reference lists
- How and where to cite the work of others—published in journals or on the Web—within scientific texts
- What constitutes plagiarism
- Keeping track of ideas and references
- How to paraphrase

Science builds on acquired and documented knowledge. Therefore, being able to work with references is important for two reasons: (1) to identify appropriate information of others and (2) to incorporate relevant information in your own writing. This chapter deals with both of these key aspects of scientific communication.

4.1 SEARCHING THE LITERATURE

Reading and understanding scientific literature, writing laboratory reports, composing a research paper, or preparing a review article or thesis typically requires you to be able to search for appropriate information, especially online. Using such information allows you to apply up-to-date research in your laboratory reports and to compose essays that would not normally be available in textbooks. In addition, if you submit coursework that includes references and information from relevant and recent publications, it shows that you have made an effort to research your work thoroughly and to validate it by relating it to contemporary research.

In the professional world, scientists need to be familiar with previously published findings and how to find them. They use this information to design new experiments, to cite sources of data that they use in order to

give credit and provide evidence, and to show how their interpretations integrate with published scientific knowledge overall. Scientists not familiar with this process have little credibility among their peers. It is therefore essential to familiarize yourself with the use of the scientific literature.

➤ Know where to find sources

Several sources of scientific information exist in a variety of mediums. Because of the time it takes to publish a book, books usually contain more dated information than the most recent journals and newspapers. A huge amount of information is also available online, but it may not be immediately clear what resource to use for the purpose of composing a scientific document. Internet search engines may not prove ideal for obtaining information to compose a scientific document, because you may find it difficult to distinguish relevant, reliable, and authoritative information and to obtain full-length publications. Internet sites such as Google Scholar (http://scholar.google.com) provide access to primary literature, that is, peer-reviewed research articles. Generally, however, bibliographic databases such as PubMed as well as your university library offer a more reliable and structured way of finding good-quality information. Such databases can provide links to the full text of scholarly journals, in which you can find the most up-to-date information on research in industry and academia.

➤ Distinguish between primary, secondary, and tertiary sources

Work published in peer-reviewed, scholarly journals has undergone a rigorous evaluation process by experts in the field to maintain standards and provide credibility. Such scientific journal articles are considered primary sources because they typically report results for the first time—in contrast to secondary sources, which analyze and discuss the information provided by primary sources, and tertiary sources, such as textbooks and dictionaries, which compile and reorganize information provided in mainly secondary sources (see also Table 4.1). Scientific information available in scholarly journals can be found through your library or by searching online databases such as PubMed, HighWire, MEDLINE, and the Web of Science using key words, author, source, author's affiliation, cited author, cited work, and cited year.

TABLE 4.1 Definitions and Examples of Primary, Secondary, and Tertiary Sources

SOURCE	DEFINITION	EXAMPLE
primary	original, peer-reviewed publication of a scientist's new data, results, and theories; report results for the first time	Scientific journal articles; theses, dissertations; conference proceedings; speeches
secondary	analyze and discuss the information provided by primary sources	Review articles; literary criticisms; some textbooks; commentaries
tertiary	compile and reorganize information provided in mainly secondary sources	Textbooks (some may also be secondary); dictionaries; manuals; Wikipedia

➤ Become familiar with the most important science databases

The most important science databases are:

PubMed	PubMed comprises more than 20 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text published works from PubMed Central and publisher websites. (https://www.ncbi.nlm.nih.gov/pubmed)
MEDLINE	MEDLINE is produced by the US National Library of Medicine and is part of the National Institutes of Health. This database covers more than 4,000 journal titles and is international in scope. Broad coverage includes basic biomedical research and clinical sciences. (http://clarivate.libguides.com/webofscienceplatform/bci)
Google Scholar	This free site indexes the full text of most peer-reviewed online journals of Europe and America's largest scholarly publishers. (https://scholar.google.com)
HighWire	This archive is the largest one for free full-text science articles. It hosts more than 3,500 peer-reviewed journals as well as e-books, conference proceedings, and databases. (https://www.highwirepress.com)
Web of Science	The ISI Citation Databases collectively index more than 8,000 peer-reviewed journals. They provide Web access to Science Citation Index Expanded, which covers 6,300 international science and engineering journals. (https://login.webofknowledge.com)

Other key science databases include:

Current Contents	Current Contents Science Edition covers all the science editions of the Current Contents Search database in one package. (http://www.ovid.com/site/catalog/databases/862.jsp)
BIOSIS	Biosis, the online version of Biological Abstracts and Biological Abstracts, Reports, Reviews, and Meetings, contains literature references from all of the life sciences. This is the premier database for coverage of botany research. (http://clarivate.libguides.com/webofscienceplatform/bci)
Scopus	Scopus provides broad international coverage of the sciences and social sciences, indexing 14,000 journals. (https://www.elsevier.com/solutions/scopus)

Some of these databases require subscription or registration, whereas others are free (e.g., Google Scholar).

In many cases, search results link directly to journal articles, and most users will only be able to access a brief summary of the articles. In these cases, you may have to request articles through interlibrary loans or directly from the publisher. Sometimes you may have to pay a fee to access entire articles. Other journals, such as *PLOS*, provide free access to complete articles online.

A longer list of major databases and search engines for finding and accessing articles in academic journals can be found at http://en.wikipedia.org/wiki/Academic_databases_and_search_engines. Note that many societies also have lists of useful journals for their disciplines (e.g., Society of Neuroscience, Society for Conservation Biology, American Society for Cell Biology).

4.2 SOURCE MATERIAL

➤ Use appropriate search terms

If you already know the details of a journal article (authors, title, date of publication, journal name, volume number, etc.), you can use the journal search to check if the library holds the article by searching for the title of the journal in which the article is published. To identify journal articles on a particular topic, you need to use a database. Searching for an article is easier if you already know a bit about the topic, for example, from reading the course textbook, lab manual, and lecture notes. This means you will already know some of the jargon and key terms for the topic before you start. In this case, you can search for articles using key words and refine your search by changing or combining key words, and by limiting databases or time of publication.

When a topic is mentioned in your textbook or lectures, you can search for a cited reference to find out more details about the topic. Such cited references in turn might lead you to other cited sources. When reading for your essay/report, you may also find one person's research mentioned frequently in the textbook, and you can then search for works and publications of this person as an author.

Many databases have an online thesaurus that you can consult to help in your search. If needed, ask a librarian for help in best use and combination of key words or search terms or to refine your search further. You can also use wildcards such as the "*" to find words containing the same root or if you are unsure about the spelling and conjunctions such as "and" and "or" to expand or refine your search.

➤ Select the most relevant references

For most papers, you will find many references that relate to your topic. It is important to distinguish between those related to your topic and those *relevant* to your writing. Related references may discuss your topic and may be highly interesting yet not be relevant to the arguments you are trying to make. Relevant references are those that apply to the content of your writing and to the flow of thoughts most directly and elegantly. These references are the most respected by the scientific community. Thus, rather than listing any and all papers published on the topic, select the most relevant references by citing original or review articles (i.e., articles that analyze, summarize, and critique previously published studies and findings on a common topic) and choosing the most important papers on a subject to support your document's content (this will also keep the number of your references manageable.)

One indication of the importance of a paper is the number of its citations compared to other articles on the topic. The number of citations is usually provided in the results of a literature search, and—for quick reference—can also be gleaned when doing a Google search. Another measure is the impact factor of the journal in which an article has been published. The impact factor ranks the journal based on the frequency with

which average articles in it have been cited in a given year. When possible, validate specific findings. That is, use a primary source, which is the original, peer-reviewed publication of a scientist's new data, results, and theories. For a general overview of a topic, you may also use secondary sources (e.g., a review article) or certain tertiary sources (e.g., a textbook).

➤ Verify your references against the original document

References tend to have a surprisingly high rate of error. Therefore, when you use references found in other sources, you need to verify them against the original document. Make sure you have read all references you cite to prevent false representation of the reference or the information within. In addition, ensure that every reference in the text is included in the Reference List and that every reference in the Reference List is cited in the text. Ensure also that citations and references follow the format requested in any instructions for composing your document.

➤ Evaluate Web sources before use

If you are planning on using material from the Internet, evaluate the source before you use the information. If the website is that of a peer-reviewed journal, it contains primary sources, as do open access sites, that is, organizational, societal, or library databases containing full-text research articles that have been peer-reviewed, such as BioMed Central or PubMed, which provide collections of free research articles in the biological and medical sciences. For additional open access journals, see also https://doaj.org.

Many other websites may contain informative secondary sources. You should, however, verify their content and that of their citations before you use these sources. Websites that contain reliable information often have a domain extension of ".edu" (education) or ".gov" (government) or ".ac" (academic) rather than ".com" (commercial) or ".net" (Internet). Check also who created the website. Do they have expertise or credentials? Is it a reputable organization? Is their purpose clear? Moreover, find out who the intended audience is and check whether the information is current. See if the site looks professional and uses correct spelling, punctuation, and grammar. Assess if facts are represented as facts and opinions as opinions.

The following university websites have useful advice for helping students determine whether Web sources are credible:

https://usm.maine.edu/library/checklist-evaluating-web-resources
https://www.library.kent.edu/criteria-evaluating-web-resources

4.3 CITING REFERENCES

Whenever you use the ideas and findings of others, the source needs to be cited in the text and listed in a Reference List at the end of an article or paper. Such citations give credit to researchers for their intellectual work. They can also be used to locate specific articles, show your familiarity with the field, and help fight plagiarism.

➤ Know where to place references in a lab report or scientific paper

Abstract	Do not place any citations in the Abstract. Start citing sources in your Introduction.
Introduction	Cite the most relevant references only. Although the amount of background information needed depends on the audience, do not review the literature exhaustively.
Materials and Methods	When appropriate, cite original references for methods used in your study—for example, "Growth was measured and analyzed according to Billings (1988)."
Results	Usually, statements that need to be referenced are not written in the Results section. Comparison statements are made in the Discussion section.
Discussion	Include references to compare and contrast your findings, studies that provide explanations, or those that give your findings some significance.

➤ Cite references in the requested form and order

References are listed in two formats in scientific documents: as text citations and in the Reference List (or Literature Cited section). Text citations list references within the text in short version, such as by name and year. The Reference List at the end of a document displays the full citation of the reference.

In the text as well as in the Reference List, references can be cited in different ways. Some common formats for text citations are parenthetical—(author, year) and (number)—and others are bracketed or superscript or both, as shown here: "[number]." Always check the guidelines for any document you have to complete to ensure that your citations are correctly formatted. Two examples of text citations are shown in Examples 4-1a and 4-1b.

Example 4-1

a Vit-E is a fat-soluble vitamin **(Hollander et al., 1976)**.

b Vit-E is a fat-soluble vitamin.[8]

If you cite multiple references for a point in your text, list the references in chronological order. If the references were published in the same year by the same author(s), add a lowercase letter after the year to distinguish the references (in alphabetical order), as in Example 4-1c.

Example 4-1

c Vit-E is a fat-soluble vitamin (Traber, 1998; Brigelius-Flohé & Traber, **1999a**; Brigelius-Flohé & Traber, **1999b)**.

Generally, for a publication by one author, cite that author's name.

Example 4-2a . . . described by Popi (18, 20).

For a paper by two authors, cite both authors' names.

Example 4-2b Daniles and Ebert (9) reported XYZ.

For a paper by three or more authors, cite the first author's name followed by "et al."

Example 4-2c . . . has previously been reported (Brown et al., 1999a; Brown et al., 1999b; Liu et al., 2003).

Note that there are a number of different style guides that specify citation format and styles for reference lists. Most instructors (and scientific journals) will indicate which style to use and provide examples of reference citations and lists for authors. If requested to use a specific style, you should follow the style's specifications. The most common reference styles and style guides in the sciences, such as that of the American Medical Association (AMA), Council of Scientific Editors (CSE; formerly CBE), or American Psychological Association (APA), are discussed in more detail in Section 4.4. AMA style is the preference for the medical sciences, whereas CSE style is used primarily in the biological and other sciences, and the APA style is used largely in psychology, social sciences, and general sciences.

➤ Know where to place references in a sentence

References can be incorporated into the text in two general ways. To emphasize the science, place the citation directly following a concept, idea, or finding. To emphasize the scientist, place the citation directly following the names of the author(s).

Example 4-3

a Starfish fertilization is species-specific **(17)**.

b Peterson **(17)** reported that starfish fertilization is species-specific.

Do not place references in the middle of an idea or after general information of a study, such as after "in a recent study" or "has been reported." Also note that references for different points in one sentence have to be cited after the appropriate point rather than grouping all the references together at the end of the sentence.

Example 4-4 Compound A can be separated from the mixture by two methods: distillation **(Ramos et al., 2011; Smith et al., 2013)** and HPLC **(Koehler et al., 2004)**.

4.4 COMMON REFERENCE STYLES

➤ List references in the requested style in the reference list

Your Reference List at the end of your paper (commonly also referred to as "Literature Cited") should contain a list of the literature cited in the text. Many different reference styles have been developed by various scientific societies and publishing houses over the years to provide a uniform appearance of references within a field or related fields and within their respective publications. Styles differ on where to place and what to include in terms of first name initials, year of publication, journal volume, page numbers, and so on. Depending for whom your document is intended or where it is published, you will have to use the requested reference style. Often examples of the desired style are provided. Be sure to check and follow the provided reference style requirements and citation instructions carefully. Aside from determining which elements to include, check on which elements to italicize, and check on spacing and punctuation between and following elements. Follow ALL the rules to the letter.

Typically, if you have used the "(author, year)" system in the text, references are listed in alphabetical order and are not numbered in the Reference List.

Example 4-5a

1. Bailey, S.E., Olin, T.J., Bricka, R.M., and Adrian, D.D. (1999). A review of potentially low-cost sorbents for heavy metals. *Water Res.* **33:**2469–2479.
2. Das, N.C. and Bandyopadhyay, M. (1992). Removal of copper(II) using vermiculite. *Water Environ. Res.* **64:**852–857.
3. Hani, H. (1990). The analysis of inorganic pollutants in soil with special regard to their bioavailability. *J. Environ. Anal. Chem.* **39:**197–208.
4. Lackovic, K., Angove, M.J., Wells, J.D., and Johnson, B.B. (2004). Modelling the adsorption of Cd(II) onto goethite in the presence of citric acid. *J. Colloid Interface Sci.* **269:**37–45.

If you have used the number system in the text, references in the list are numbered in the order in which each reference is first cited in the text.

Example 4-5b

1. Lackovic, K., Angove, M.J., Wells, J.D., and Johnson, B.B. (2004). Modelling the adsorption of Cd(II) onto goethite in the presence of citric acid. *J. Colloid Interface Sci.* **269:**37–45.
2. Bailey, S.E., Olin, T.J., Bricka, R.M., and Adrian, D.D. (1999). A review of potentially low-cost sorbents for heavy metals. *Water Res.* **33:**2469–2479.

3. Hani, H. (1990). The analysis of inorganic pollutants in soil with special regard to their bioavailability. *J. Environ. Anal. Chem.* **39:**197–208.

4. Das, N.C., and Bandyopadhyay, M. (1992). Removal of copper(II) using vermiculite. *Water Environ. Res.* **64:**852–857.

References to books or book chapters also require great attention to detail. Here, too, there are various formats, and you may have to adjust yours to the one requested in class.

Example 4-6 Ege, Seyhan N. (1984). *Organic Chemistry*. D.C. Heath and Company, Lexington, MA/Toronto, pp. 203–229.

If no citation instructions are given, consider using one of the more commonly accepted formats, such as the AMA (http://www.amamanualofstyle.com), CSE (https://writing.wisc.edu/Handbook/DocCSE.html), or APA (http://www.apastyle.org) style. Another option is to select a pertinent journal in that field and then use the format of that journal in your write-up.

Example 4-7 **AMA style**

In Text . . . as reported previously.[13]

Bibliography ***Book:***

Okuda M and Okuda D. *Star Trek Chronology: The History of the Future*. New York: Pocket, 1993.

Journal article:

Jefferson TA, Stacey PJ, and Baird RW. A review of Killer Whale interactions with other marine mammals: predation to co-existence. *Mammal Review* 2008; 21(4):151–80.

Example 4-8 **CSE style**

In Text . . . observed by Hinter (2008).

(McCormac and Kennedy 2004)

(Meise et al. 2003)

(Hinter 2008)

Bibliography ***Book:***

McCormac JS, Kennedy G. 2004. *Birds of Ohio*. Auburn (WA): Lone Pine. p. 77–78.

Journal article:

Meise CJ, Johnson DL, Stehlik LL, Manderson J, Shaheen P. 2003. Growth rates of juvenile Winter Flounder under varying environmental conditions. *Trans Am Fish Soc* 132(2):225–345.

Example 4-9 **APA style**

In Text

. . . as reported by Juls (1999).

Research by Wegener and Petty (1994) supports . . .

(Juls, 1999)

(Wegener & Petty, 1994)

(Kernis et al., 1993)

Bibliography

Book:

Calfee, R. C. & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication.* Washington, DC: American Psychological Association.

Journal article:

Scruton, R. (1996). The eclipse of listening. *The New Criterion, 15*(30), 5–13.

➤ Know how to cite and list references from the Internet

Use of Web citations is not always accepted, but this is a developing area (see also Section 4.2 and Chapter 1, Section 1.4). Generally, as the author, you can decide which style to choose. However, make sure that the style does not conflict with that asked for by your instructor.

To cite and list a reference from the Internet or the World Wide Web, use one of the following forms:

Example 4-10 Author's name (last name first). Title. Available from URL: http://Internet address or World Wide Web address.

Example 4-11 **AMA style**

Online document:

Author's name (last name first, then first and middle initial). Document title. Name of journal, if appropriate, year, volume: pages. Available at <URL>. Accessed [date]

Book:

Bryant PJ. The Age of Mammals. *Biodiversity and Conservation*. 28 Aug. 1999. Available at <http://darwin.bio.uci.edu/~sustain/bio65/lec02/ b65lec02.htm>. Accessed September 30, 2017.

Article in an electronic journal (e-journal):

Joyce M. On the Birthday of the Stranger (in Memory of John Hawkes). *Evergreen Review* 5 Mar. 1999. Available at <http://www.evergreenreview.com/102/evexcite/joyce/nojoyce.html>. Accessed November 26, 2017.

Example 4-12 **CSE style**

Online document:

Author's or organization's name. Date of publication or last revision [year month]. Document title. Title of complete work (if relevant). <URL>. Accessed [year month].

Book:

Bryant P. 1999 Aug 28. Biodiversity and conservation. <http://darwin.bio.uci.edu/~sustain/bio65/index.html>. Accessed 2017 Sep 30.

Article in an electronic journal (e-journal):

Browning T. 1997. Embedded visuals: student design in Web spaces. *Kairos: A Journal for Teachers of Writing in Webbed Environments* 3(1). <http://english.ttu.edu/kairos/2.1/features/browning/bridge.html>. Accessed 2015 Oct 21.

Example 4-13 **Chicago style**

Online document:

Author's name. "Title of document." Title of complete work (if relevant). Date of publication or last revision. Accessed [month year] (if required), DOI or <URL>. *(Note: A DOI, or Digital Object Identifier, is a code that identifies and organizes electronic information, including scientific literature; it can usually be found in the article information after a literature search. For more information, see http://www.biosciencewriters.com/Digital-identifiers-of-scientific-literature-PMID-PMCID-NIHMS-DOI-and-how-to-use-them.aspx)*

Book:

Bryant, Peter J. "The Age of Mammals," in *Biodiversity and Conservation* August 1999. <http://darwin.bio.uci.edu/~sustain/bio65/index.html> (September 30, 2017).

Article in an electronic journal (e-journal):

Browning, Tonya. "Embedded Visuals: Student Design in Web Spaces," *Kairos: A Journal for Teachers of Writing in Webbed Environments* 3, no. 1 (1997), <http://english.ttu.edu/kairos/2.1/features/browning /index.html> (October 21, 2015).

4.5 MANAGING SOURCES

➤ Manage your references well

Keep a list of references to help organize and keep track of them. There are few aspects of preparing a manuscript that are more irritating than painstakingly typing, changing, or correcting the Reference List. You can save yourself much time and much frustration if you manage your references from the start, using a reference managing computer program right when you download your references from the library or Internet. If you have many references in your list, such as when you are writing an article for publication, programs that put references in various formats (EndNote, Mendeley, or Zotero) are very useful. If you are unfamiliar with such a program, inquire at your library. Most libraries offer short classes on reference programs.

4.6 PLAGIARISM AND PARAPHRASING

➤ Ensure that you are not plagiarizing

In scientific writing, direct quotations are rarely used. Instead, information is commonly summarized and paraphrased. In all cases, the source has to be cited. Failing to indicate the source of information in scholarly scientific work is called plagiarism and is a form of academic misconduct. To give credit to the work and ideas of others, you need to acknowledge your sources, even if the writing is not absolutely identical. This rule is usually also pointed out in a school's honor code of conduct and covered during orientation.

To avoid plagiarism, you need to know what constitutes it. Plagiarism includes:

- Using material without acknowledging the source. (This is the most obvious kind of plagiarism.)
- Borrowing someone else's ideas, concepts, results, and conclusions and passing them off as your own without acknowledging them—even if these ideas have been substantially reworded.
- Summarizing and paraphrasing another's work without acknowledging the source.

The rules apply to both textual and visual information. If you are using the Internet as a source of information, you must also cite that source (see Section 4.4).

Note that you do not have to document facts that are considered common knowledge. Common knowledge is information that can be found in numerous places and is likely to be known by a lot of people, such as the information found in Example 4-14.

Example 4-14 Many endemic species exist on the Galapagos Islands.

However, information that is not generally known (i.e., information readers outside your discipline would need to look up) and ideas that interpret facts have to be referenced as in Example 4-15 so that they are verifiable.

Example 4-15 Based on a recent study, the blue iguanas of the Grand Cayman Islands are an endangered species (9).

The finding that "blue iguanas of the Grand Cayman Islands are an endangered species" is not a fact but an *interpretation*. Consequently, you need to cite your source to show that an actual study has been done and that this study has been accepted as fact in science. If you are uncertain whether something falls into the common knowledge category or if you have to look it up, it is best to document it.

Following are some other examples of common knowledge that do not require a citation:

Example 4-16

a As phosphorus is a key element for plant growth and is essential for many cell functions, the cycling of phosphorous in the soil has been studied widely.

b Volcanic eruptions are often preceded and accompanied by "volcanic unrest," providing early warning of a possible impending eruption.

Statements that contain information and interpretations that need to be cited are shown in the next examples.

Example 4-17

a Although low concentrations of phosphorus are often a limiting factor in plant growth, excess phosphorous in the soil is correlated with decreased plant health (19).

b The eruption of Mount Pinatubo in 1991 was preceded by a relatively short progression of precursory activity before its full-blown eruption (22).

Writing about the ideas and conclusions of others is a given in science. It is not considered plagiarism to do so as long as you acknowledge the source

in your document. If you cannot verify an original source, the information should not be stated or should be clearly identified as unverified, unpublished, or an opinion (see also Chapter 1, Section 1.4).

It is easy for authors to lose track of cited and verbatim text in a larger work or document, particularly one composed over a longer period. In some cultures, the concept of plagiarism may also not exist or may be much looser than in the Western world. To verify that text is plagiarism-free, software such as Turnitin and PlagScan and apps such as Plagiarisma by Plagiarisma.net are available. These tools allow you to screen your papers for plagiarism. Be aware, though, that aside from plagiarism, other forms of ethics violations may also arise. Such ethics violations may include fabrication of data and results, fudging findings, stealing data, and being asked to include an author on a publication although the researcher did not contribute to the project. For more information on research ethics, see Chapter 1, Section 1.4.

➤ Know how to paraphrase

To paraphrase is to express someone else's words, thoughts, or ideas in your own words. Learning how to paraphrase is probably one of the most important skills in scientific writing. In science, you usually have to build on the work and ideas of others, but you need to paraphrase them and reference their work.

It is important that you distinguish between paraphrasing and plagiarizing. Changing a word or two in someone else's sentence or changing the sentence structure while using the original words is not paraphrasing but plagiarizing.

Example 4-18 **Plagiarized sentence**

Original:

Grizzly bears (*Ursus arctos* ssp.) encompass all living North American subspecies of the brown bear: the mainland grizzly (*Ursus arctos horribilis*), the Kodiak (*Ursus arctos middendorffi*), and the peninsular grizzly (*Ursus arctos gyas*), but none of the giant brown bear subspecies found in Russia, Northern China, and Korea.

Plagiarized sentence:

Grizzly bears (*Ursus arctos* ssp.) consist of the North American subspecies of the brown bear, including the mainland grizzly (*Ursus arctos horribilis*), the Kodiak (*Ursus arctos middendorffi*), and the peninsular grizzly (*Ursus arctos gyas*), but not the subspecies found in Russia, Northern China, and Korea.

Paraphrased sentence:

Only the three North American brown bear subspecies *Ursus arctos horribilis, middendorffi*, and *gyas* are considered to belong to the grizzly bears. (Brown bears inhabiting Siberia and Northeast Asia are another subspecies.)

In the plagiarized sentence of Example 4-18, only a few words have been changed, omitted, or included. In the paraphrased sentence of the example, the same general idea is presented in an entirely different sentence from the original one.

Following is an example of a paragraph that instead of being paraphrased has been plagiarized:

Example 4-19 Plagiarized paragraph

Original:

Healthy older adults often experience mild decline in some areas of cognition. The most prominent cognitive deficits of normal aging include forgetfulness, vulnerability to distraction and other types of interference, as well as impairments in multitasking and mental flexibility (Albert, 1997; Bimonte, 2003). These cognitive functions are the domain of the prefrontal cortex, the most highly evolved part of the human brain. Prefrontal cortical cognitive abilities begin to weaken even in middle age, and are especially impaired when we are stressed. Understanding how the prefrontal cortex changes with age is a top priority for rescuing the memory and attention functions we need to survive in our fast-paced, complex culture.

Plagiarized sample:

In healthy older adults, often some areas of cognition decline. The most noticeable cognitive declines of normal aging include forgetfulness, vulnerability to distraction, and problems in multitasking. These cognitive tasks are localized in the prefrontal cortex, which is the most highly evolved portion of the brain. In middle age, prefrontal cortical cognitive functions already start to decrease. Such functions are also particularly affected during any type of stress. Studying memory and attention is important to understand how the prefrontal cortex changes with age. It is particularly important to understand these changes in our current fast-paced lifestyle.

In the plagiarized sample of Example 4-19, no sources are cited. Furthermore, only a few words have been changed in any given sentence. In addition, the

sequence of sentences has been reordered, but the sentences have essentially remained the same. For each of these reasons, the derived paragraph is considered to be plagiarized.

An acceptable way of paraphrasing the preceding sample paragraph would be the following:

Revised Example 4-19

Paraphrased sample:

Studies show that the process of aging is accompanied by a decline in cognitive abilities, deficits in working memory, and compromised integrity of neural circuitry in the brain (Albert, 1997; Bimonte, 2003). If these functions of the prefrontal cortex decline, they affect our thinking and eventually our quality of life. To find ways and potential therapies to counteract this process, it is important to understand the underlying mechanisms of aging on neural circuitry.

This is acceptable paraphrasing because the writer accurately relays the information in the original using his or her own words. The writer also lets the reader know the source of the information. Following is another example of an acceptably paraphrased paragraph:

Example 4-20

Original:

Zika virus was first discovered in 1947 in the Zika Forest of Uganda.[4] It is spread largely by mosquitoes. Initially, it occurred along the equatorial belt from Africa to Asia. Starting in 2007, the virus spread to the Americas, eventually causing the 2015–16 Zika virus epidemic in South and Central America. In most adults, infection by the virus causes no or only mild symptoms. However, the virus can also be transferred from the mother to her unborn child. In these fetuses, infection by the virus can result in severe brain malformations, known as microcephaly, and other birth defects.

Revised Example 4-20

Paraphrased sample:

Zika virus is transmitted to humans mainly through mosquitoes. Its name derives from the Zika Forest of Uganda, where it was first identified in the 1940s. The virus' spread from Africa and Asia to South America led to the 2015/16 Zika virus epidemic. Although most infected adults experience comparatively mild symptoms, when the virus is transferred from mother to child *in utero*, infection can lead to microcephaly.

Unlike elsewhere in a scientific research paper, many portions of the Materials and Methods section will sound extremely similar to each other, mainly because there are only so many ways one can describe procedures

whose technique and setup is essentially identical with the exception of the variables. Using very similar phrases in such passages, along with substituting your variables, would not be considered plagiarism. Therefore, do not desperately try to invent new wordings to describe the same procedure. Here are some examples of passages that would not be considered plagiarized:

Example 4-21

Method description in paper A:

Real-time fluorescence quantitative PCR was performed in an Applied Biosystems Prism 7000 instrument in the reactions containing an Applied Biosystems SYBR green master mix reagent and oligonucleotide pairs to the endogenous control gene 'A' and cDNA of 'B'. The reagents were denatured at 95°C for 10 min, followed by 40 cycles of 15 s at 95°C and 60 s at 60°C. The primer sequences (5'–3') were 'A' forward, 5'-GACACCTATGCCGAACCGTGAA-3'; 'A' reverse, 5'-CTGAGTATCAGTCGGCCTTGAA-3'; 'B' forward, 5'-GTTCGACGACATCAACATCA-3'; 'B' reverse, 5'-TGATGACGTCCTTCTCCATG-3'.

Method description in paper B:

PCR amplification of 'X' sequences was done using the GC RICH PCR System (Roche, Mannheim, Germany). All non-'X' sequences were amplified using Taq DNA polymerase (Promega, Madison, WI). Primers were designed using published sequences for 'X-1' (GenBank: Xxxxxx) and 'x-13' (GenBank: Xxxxxx) (Table 1). PCR thermal cycling conditions were: 2 min at 50°C, 10 min at 95°C, followed by 40 cycles of 15 s at 95°C and 1 min at 60°C. PCR reactions were run with molecular weight standards on 0.8% agarose gels containing ethidium bromide and visualized by UV light. The primers used were: 5'-GGCTCACCAGCATCATATACG-3' and 5'-GGCTACAATGACGACGTCA-3'.

Method description in paper C:

Real-time PCR was performed using the TaKaRa SYBR PCR kit and ABI Prism 7000 sequence detection system according to the manufacturer's specifications. The primers for amplification were *abc* (5'-CGCTCCTCTGCATCTAATCAG-3' and 5'-GACACTTAGCACGCACTCA-3') and *def* (5'-GCATCTTCAAGTAAGGACTATC-3' and 5'-GACTTTCACAGTACCAGATT-3'). Total reaction volume was 50 µl including 25 µl SYBR Premix Ex Taq with SYBR Green I, 300 nM forward and reverse primers, and 2 µl cDNA. The thermal cycler program was 1 cycle at 95°C for 10 s, followed by 40 cycles at 95°C for 5 s and 60°C for 30 s. The PCR products were detected by electrophoresis through a 2% agarose gel stained with ethidium bromide.

For these passages and for similar ones that occur mainly in the Materials and Methods section of a research paper, it may not be a bad idea to collect sample phrases from other articles for your reference. Know, however, that I am not advising you to copy entire passages to be placed into your manuscript—only individual sample phrases and expressions that can be applied to writing your research article.

➤ Keep track of ideas and references

When you compose a document, you can save yourself much time and confusion if you keep track of the sources of information from the start. There is nothing more frustrating than having to identify the origin of ideas and information when you are done writing. Thus, keep a list of sources.

The best way to avoid plagiarism is to do the following when you collect and use information in scientific writing:

- Keep track of references and save the information you intend to use whenever you come across a passage that you think may be useful for your document.
- Keep a detailed list of sources.
- If you copy something word for word, put it in quotation marks, but know that writing in the sciences uses direct quotations only rarely. When you want to use details from the original but not necessarily all of them and not necessarily in the same order as the original, you need to paraphrase.
- Write the most important ideas in your own words using bullet points.
- Take notes with the book closed and without looking at the original passage on the Web. This way you are forced to put the ideas into your own words.
- Double-check that the reference and information is correct by going back to the original when you compose your document.

SUMMARY

REFERENCE GUIDELINES

1. Know where to find sources.
2. Distinguish between primary, secondary, and tertiary sources.
3. Become familiar with the most important science databases.
4. Use appropriate search terms.
5. Select the most relevant references.
6. Verify your references against the original document.
7. Evaluate Web sources before use.
8. Know where to place references in a lab report or scientific paper.
9. Cite references in the requested form and order.