

Finding and Using References

*The most erroneous stories are those we think we know best—
and therefore never scrutinize or question.*

Stephen Jay Gould

Finding References

If you have tried your hand at any form of scientific writing, you know that it makes use of many kinds of references. Therefore, knowing how to find and cite these references is key and warrants attention. In addition to this chapter, a very useful guide to the use of references is a publication called *Writing with Sources*, which provides a more complete treatment of the issues that are touched upon here.

There are two general kinds of sources that you will come across in scientific writing: primary sources and secondary sources. Primary sources report original experiments, data, and ideas. They usually take the form of research articles and can be found in scientific journals, such as *Science*, *Nature*, *Cell*, *Genetics*, *Animal Behaviour*, and *Evolution*. Other primary sources that show up less frequently include dissertations, technical reports, and conference abstracts and papers. Secondary sources, as the name suggests, are one step away from the primary data. They include such sources as textbooks, review papers, and articles in popular science magazines, such as *Scientific American*, *Natural History*, and *Discover*. These are generally written for a general audience and summarize many experiments and papers. Most websites on a scientific topic that you will encounter summarize experiments and data, and are therefore considered secondary sources. However, primary data are sometimes reported on the web, in which case that website would be considered a primary source. For example, DNA sequence data are now frequently found on the web.

As you write your own papers, you will want to turn increasingly to primary sources. Primary papers describe experimental methodology and report original data. Learning how to evaluate an experiment critically and interpret data for yourself is an important aspect of being a scientist. While the secondary literature is often a great place to start, you will want to seek out and read the primary literature on which the secondary sources are based.

So how do you go about finding sources for your papers? There are two general ways. The first is to follow a paper trail. Start with the secondary sources, such as your textbook or a scientific review. These are often heavily cited and highlight major works in a particular field. From there, read the primary papers that are referenced. Again, the literature cited section of these primary works will be filled with additional papers that are relevant to the area you are exploring. In a short amount of time, you will start seeing the same reviews and primary articles showing up again and again, and this will give you an indication that you have found most of the important or key references on a given topic.

A second, complementary approach is to use on-line searchable databases. There are several excellent internet-based databases of science references and you should begin to familiarize yourself with them, such as PubMed. These are readily searchable, allowing you to type in a subject, key word, author, or other search term and pull up hundreds, if not thousands, of references. The challenge of using these databases, then, is not finding references, but identifying which ones from the list are most useful to you. Knowing how to narrow your search is often key in the effective use of these databases. The most widely used databases in the biological sciences include Medline, Science

Citation Index, Current Contents, PubMed, and Biological Abstracts. These are best accessed through the Brandeis University Library website, as Brandeis has licensing agreements that give you access to those that are otherwise restricted.

When to Cite

At this point in your education, you are probably familiar with the basic rules of citation. You know you are supposed to provide a reference following a direct quotation or when you borrow or make use of another author's idea. While these two rules certainly apply to writing in the sciences, they actually do not come up very often. Direct quotations are seldom seen in scientific writing. If you use a direct quotation, you should think very carefully whether the exact words are really required, or whether paraphrasing might be sufficient. In either case, you will need to provide a reference for the idea or thought. However, a direct quotation in student writing in the sciences often indicates that the writer did not fully understand what was written. After all, it takes understanding to be able to paraphrase someone else's work. Only use a direct quotation if the particular words carry significance that cannot be conveyed by paraphrasing.

Citing comes up most often in scientific writing in two other scenarios. The first is when you report the results or conclusions of a particular study. In this case, you can cite the study as, "Darwin (1859) suggested that evolution occurs by means of natural selection" or as, "Evolution occurs by means of natural selection (Darwin, 1859)."

The second, often overlooked instance where citing is important is when you want to direct the reader to additional reading. For example, if you write, "T cells are known to be important in the immune system," it is helpful to cite a recent review on the topic or

several key recent papers or even an older, original reference if it is not cited in a recent review. This kind of citation directs the reader to additional sources if he/she is interested in pursuing the topic further.

When you cite references in either of these situations, it is useful to provide the reference or references upfront, at the first mention of the study or idea. In other forms of writing, the citation is often held to the end of the paragraph in which you talk about someone else's ideas or thoughts, as a way to signal that the entire paragraph relies on that work. In science, however, the citation is provided early, following the first sentence, so that a reader familiar with the study or idea will instantly know what work you are discussing. Even if the rest of the paragraph continues to refer to the same study, you do not need to keep repeating the citation. It is understood that the early citation is the source under discussion.

How to Cite

References are cited in two places in scientific writing, in the text and at the end of the document in a dedicated "References" section. The format of the citations in these two places is very important. Different journals, funding agencies, and classes follow different and often idiosyncratic formatting styles. The task is simply to follow the format that you are provided. So, if you are submitting a paper to the journal *Behavioral Ecology*, you should follow the format of that journal. Most journals have a special "Instructions to Authors" section on their website that spells out in detail how to format references. Another approach is simply to follow the format of the references in a recent article from that journal. Similarly, if you are submitting a grant to the National Science

Foundation, you should find and follow those formatting guidelines. Most writing assignments for your college classes will also specify a particular style, either from a journal or another source.

Whatever style you are asked to follow, it is important to follow it. While this sounds simple, it apparently is not, as instructors constantly receive incorrectly formatted references even when explicit directions are given. A comma does not mean a semicolon, and bold type is not the same as plain type. For example, the American Psychological Association (APA) provides specific formatting guidelines for references. A student who was asked to follow APA guidelines came up with the following incorrect reference:

A. E. Newsome, 1965. "The abundance of red kangaroos in central Australia."
Australian Journal of Zoology. **13**: 269-287.

Can you spot all of the formatting errors above?

The correctly formatted APA citation is provided here:

Newsome, A. E. (1965). The abundance of red kangaroos in central Australia.
Australian Journal of Zoology, 13, 269-287.

At this point, you might think that this level of detail is trivial at best. However, there are several reasons why citation format is important. First, as a scientist or physician, a journal article submission or grant will be returned unread if the specified format is not followed. Second, following a particular style will ensure that your references are consistently formatted. Finally, different formatting styles convey different kinds of information. For instance, the (author, year) style for in-text citations of APA or *Cell* provides information to a reader familiar with a field that a particular study or work is under discussion. Alternatively, use of footnotes for in-text citations, as is required for

papers in *Science* or *Nature*, saves space and allows for multiple references to be grouped together.

In summary, while there is no specific format that should be followed for all of your writing assignments in the sciences, a few general guidelines apply. First, always follow the format that is suggested in a given writing assignment. The format is usually specified or spelled out in detail; if so, it is not meant as a vague suggestion, but instead is intended as an explicit direction. Second, watch details. Different formats and style sometimes differ in small ways – a comma here, a semicolon there – and part of the task of following a particular format is just that, to follow the format. While this might seem like a trivial exercise, the work of a scientist in part involves writing papers for publication or grants for funding, where following proper format is crucial. Third, unless otherwise stated, in-text citations should normally be in the form of (author(s), year), rather than in the form of a footnote, as the former conveys a lot of information to a reader familiar with the topic. Footnotes are generally only used in scientific writing when space is severely limited, which is typically not the case in student writing assignments.