Using Scientific Literature in Biology Courses

I. Types of Literature

Introduction

Scientific Literature

Citing Sources of Information

II. How to Cite Sources (Council of Biological Editors Style)

Introduction

In science, knowledge accumulates as individuals study phenomena in the natural world. These researchers base their studies on the information contributed in the past by others, and the results of the new studies provide new information or different interpretations of the subjects under investigation. Scientists share their work through the publication of the results of their original research projects. In this way, the new knowledge is available to all who have an interest in those subjects.

At Earlham, we believe it is important that you learn how to access and use this scientific literature. Our reasons for this include:

- Reading scientific literature is one of the necessary components of scientific research.
- Using scientific literature shows something about the social structure of the activity of scientists -- it illustrates the formal means by which scientists communicate with each other and with wider communities.
- By reading scientific literature, you will see examples of the writing style by which scientists communicate.
- The acquisition of library research skills will enable you to find scientific literature on subjects that interest you now and in the future.

Scientific Literature

Primary Literature

Scientific knowledge is furthered through the publication of the results of original research projects. These publications, the scientists' own reporting of their original research, are known as primary literature. Since a primary article is the report of a given study, it will include an introduction to the research, the methods used, the data and results obtained, a discussion of the results and a list of references to the literature used in the design and analysis of the research.

These publications are found in journals, government and other institutions' research reports, and occasionally in books. Before a research paper is accepted for publication in the scientific literature, it is subjected to the "peer review" process. This means that the publisher sends a copy of the submitted paper to one or more scientists working in the same field. These peer scientists read the paper and assess the quality of the research and the paper describing it. They look at such factors as whether or not the design of the experiment was appropriate for the hypothesis being tested, whether sufficient data were collected, and whether the conclusions follow logically from the results of the experiment. They also consider whether the overall topic was of sufficient importance and interest to warrant publication.

It is important to read primary literature because it provides details of how the research was conducted, includes the data that were collected, and outlines the researcher's own interpretation of the work. Because the methodology of the study is described, a primary

literature paper gives readers the opportunity to repeat the study or a variation of it. It also enables one to argue with the conclusions of the study since the data is there for all to consider.

Secondary Literature

Another important type of scientific literature is created when other scientists integrate information from the primary literature into review articles or books. These reviews are called secondary literature, and they are useful in providing a broad overview of a field or by providing a synthesis of the ideas of many people. These articles and books may present tables and figures showing data from experiments, but these have always been taken from the primary literature which originally published the results. There may be a literature cited section in which the author refers to other people's publications, but a secondary article may describe or explain things without giving specific references. Sometimes one of these articles or books provides a synthesis of a field that is sufficiently unique that it can be considered a primary source because it contributes a new understanding and shapes the future of research in that area.

Scientific literature may take a variety of physical forms: print publications such as books or journal articles, electronic documents, web sites, personal communications, etc.

You will consult a variety of types of literature when you do scientific research. In general, a good research strategy is to begin looking at secondary sources to gain an overview of the subject in question and to locate references to other secondary and primary literature that are included in the bibliographies of the secondary sources. Then you can proceed to the primary literature, using the bibliographies of these papers as well.

Comparison of Primary and Secondary Literature

The chart below summarizes some features that will help you as you learn to distinguish primary from secondary articles:

WHAT TO LOOK FOR IN JUDGING AN ARTICLE	PRIMARY LITERATURE	SECONDARY LITERATURE
Peer Review	primary literature is always peer reviewed	may or may not be peer reviewed
Title	a brief statement of a research project, usually very technical	may sound technical, but may sound broad or "cute"
Focus	very narrow and specific	a broader overview
Abstract	usually	not usually
Introduction to Topic	yes	yes
Methods Section	yes	not usually
Results Section	yes	not usually
Data in Figures and Tables	usually	not usually
Discussion Section	yes	the whole paper may be considered a discussion
Literature Cited	always	may or may not have
The Form of Publication	usually an article in a print or online journal, but may be in a book, conference report, or a report from the government or another institution	may take any form -- an article in a journal, an article in an "annual review" series, a report, a book, a part of a book, a website
Examples of Publications Which Specialize in Either Primary or Secondary Articles	Ecology, Journal of Ecology, Oecologia, Ecological Monographs	Science News, Scientific American, Annual Review of Ecology and Systematics
Journals with Both Primary and Secondary Articles	Science, Nature Primary articles may be labelled "research" or "report" and secondary articles are often labelled "review" or "news"	

Guidelines for deciding when to use primary literature and when to use secondary literature:

Use primary literature for:	For most biology course assignments, you are expected to base your work on the primary scientific literature. Whenever possible, read these original sources of information.
	You may be tempted to refer to a study that you are reading ABOUT in a primary source, but that you have not read yourself personally. This is NOT acceptable procedure. You should make all efforts to read the additional study itself, either in our library or by getting the additional study through interlibrary loan.
Use secondary literature for:	Secondary literature is useful for gaining a broad perspective on a topic or a synthesis of ideas about a topic and to find a bibliography of relevant sources.
	Secondary literature can be used in addition to primary literature, but not in place of it. For instance, if you are reading a review article which refers to information in a primary research article, you should find that primary article and read it yourself.

Citing Sources of Information

You, like other scholars, must cite the sources of information you use. Citing others' work fulfills a number of purposes:

- it can be a way of recognizing the contributions of pioneers in a field
- it identifies the original publications in which an idea or concept was first presented
- it provides access to other readings on the topic of the work at hand
- it can be used to identify a methodology
- it is a way to refer to work of one's own or others that is being critiqued or corrected

Guidelines for deciding when to cite:

You don't need to cite if:	you use information that seems to be common, background knowledge (Example: *The vast majority of birds have functional wings.*)
You DO need to cite if:	you refer to or describe specific information that you have taken from a source (*The Galapagos flightless cormorant has rudimentary, non-functional wings.*)
	you refer to a theory or idea from a source
	you want to incorporate a figure, table, or photograph from another source

Avoid plagiarism in scholarly writing:

Never	do NOT cut and paste text from an electronic source with the intention of paraphrasing the text after copying it -- this practice makes it easy to accidentally plagiarize by following the original text too closely
Never	do NOT use direct quotations; in scientific writing, you express the information and ideas you have taken from other sources IN YOUR OWN WORDS, rather than how the author says it
Always	THINK about the information that you're using from another source and when you understand it sufficiently, you'll be able to say it IN YOUR OWN WORDS

II. How to Cite Sources (Council of Biological Editor's Style)

The Name-Year System

In the text of your paper, refer to a source of information by the name of the author and the publication year.

- Put name and year in parentheses at the end of the sentence (before the period)
- Or use the author's name as part of the sentence and the year in parentheses just after the name.
- For example: *Bird nests located in vegetation are protected from adverse weather conditions (Montevcchi 1979). Dunn and Davis (1976) note that chick survival is increased when there is shrub coverage around the nest. The coverage can result from dense leaf cover (Wininger 1987a) or from a thick pattern of branching (Hagberg and Perrera 1989).*

Variations

IF...	Do this...	For example...
An author has written more than one article in the same year	Distinguish the articles from each other by adding a letter to the year (a, b, c, etc.)	(McCarthy 1996a) or (McCarthy 1996b)
There are two authors	Use both names in the citation	(Denton and Lee 1997)
There are three or more authors	Use the first author's name followed by "et al."	(Strauss et al. 1997)
There are several sources to cite on a given topic	List them in chronological order from oldest to the newest. If some of the articles have been published in the same year, then list those alphabetically by the author	(Aldington and Fry 1993, Jackson 1993, Kiesecker and Blaustein 1997)
If you didn't read a source yourself, but read about it in another source (always try to avoid this by reading that additional source)	Refer to both sources in a form similar to the example to the right	Birds were once thought to be reptiles (Jones 1924, as cited in Anderson 1987)
If the information isn't published in print or electronic form (interview, letter, conversation, etc.) and can't be accessed by another person	In the text of your paper, refer to the source of information, the type of communication, and the date. Because this source is only available to you, omit from the Literature Cited list.	(Smith R., personal communication, 2004 Nov 15)

Creating a *Literature Cited* List

Create a list of references to all the documents that you have cited in your work.

- Only include the sources that you directly cited in the text of your paper; do not include background reading you didn't specifically cite.
- List references by the last name of the author, in alphabetical order.

Variations

If there are several works by the same author	List in order of the oldest to the most recent. Iverson, JB. 2001. Reproduction of the river cooter, *Pseudemys concinna*, in Arkansas and across its range. Southwest. Nat. 46 (3): 364-370. Iverson, JB. 2002. Reproduction in female razorback musk turtles (*Sternotherus carinatus* : Kinosternidae) Southwest. Nat. 47 (2): 215-224.
If an author has written more than one work in the same year	Distinguish the works from each other by using letters. For example, Iverson, J. B. 1995a. Natural History Notes: *Heterodon nasicus* (Western Hognose Snake): Reproduction. Herp. Review 26(4):206. Iverson, J. B. 1995b. *Podocnemis lewyana*. Cat. American Amphib. Rept. 605:1-3.
Author writes alone and also with other authors	List all works written by an author alone before listing articles that the author has co-written with others. List the additional works alphabetically by the name of the second author. For example: Iverson, J. B. 2002. Reproduction in female razorback musk turtles (Sternotherus carinatus: Kinosternidae). Southwestern Naturalist 47(2):215-224. Iverson, J. B., and E. O. Moll. 2002. Turtles. In: Halliday, T. R. and K. Adler (Eds.). The New Encyclopedia of Reptiles and Amphibians. Oxford University Press, Oxford, England. Iverson, J. B., and R. C. Vogt. 2002. Peltocephalus tracaxa. Cat. American Amphib. Rept. 744:1-4.

Formatting References

A correctly formatted reference begins with the author(s), followed by the publication date, then the title of the reference, and finally further publishing information about the reference.

Each of these elements of information is separated from the others by periods.
Commas and colons are used to make further separations.

Variations

No author	Use **Anonymous** as the name for an article lacking an author
More than 10 authors	For an article with multiple authors, include the first 10 names. For more than 10, list the first 10 followed by **and others**.
Names and initials	Only the first author's name is written in the form: last name followed by initials. All the other names start with initials followed by the last name.

Types of Publications

Print Publications

Journal Article	Shine, R., T. R. L. Madsen, M. J. Elphick, and P. S. Harlow. 1997. The influence of nest temperatures and maternal brooding on hatchling phenotypes in water pythons. Ecology 78:1713-1721. Note how the initials come after the first author, but before the subsequent authors. Only the first word of article title is capitalized. After the name of the journal comes the volume number and then a colon and the page numbers. Only capitalize the first word of the title. Italicize genus and species names.
Article in an Annual Review of... or Advances in...	Herberman, R. B. 1986. Natural killer cells. Annual Review of Medicine 37:347-352. McFadden, G. I. 1993. Second-hand chloroplasts: evolution of cryptomonad algae. Advances in Botanical Research 19:90-231.
Encyclopedia	Grzimek, B., editor. 1974. Grzimek's animal life encyclopedia. Van Nostrand Reinhold Company, New York, New York, USA. Only capitalize the first word of the title unless there is a proper noun. List the publisher followed by the city, state, and country of publication (all separated by commas).
Book with authors	Phillips, M. K. and D. W. Smith. 1996. The wolves of Yellowstone. Voyageur Press, Stillwater, Minnesota, USA.
Book with editors	Scriver, C. R., A. L. Beaudet, W. S. Sly and D. Valle, editors. 1989. The metabolic basis of inherited disease. 6th ed. McGraw-Hill, New York, New York, USA.
Chapter or part of a book	Newton, I. 1988. Age and reproduction in the sparrowhawk. Pages 201-219 *in* T. H. Clutton-Brock, editor. Reproductive success. University of Chicago Press, Chicago, Illinois, USA.
Magazine or newspapers or journals that do not number pages continuously between issues	Packer, C and A. E. Pusey. 1997. Divided we fall: cooperation among lions. Scientific American 276(5):52-59. Kolata, G. 1997 July 27. Some scientists ask: how do we know Dolly is a clone? New York Times;Section C:3. In some publications, each issue starts with page number one. Thus for a given volume or year, several articles may start on the same page number. To avoid confusion, supply an issue number as well as a volume number and/or include the year, month, and day of publication.

Electronic Resources

Website: basic format	Websites vary tremendously in terms of the "bibliographic information" that they provide: for examples, authors or dates may or may not be noted. You may have to hunt for this information. Due to this variability, it is difficult to exactly define the proper format for a reference. Your goal should try to fulfill the two-fold goals of providing a reference: giving credit to the author of the source and enabling another person to locate the source. These are the basic elements and the order in which to provide them. Author's name (if known) Date of publication or last revision Title of document Title of complete work (if relevant) URL, in angle brackets Date of access Use period to separate the elements. If some of the information is missing (no author, no date...), omit those elements from your reference.
Professional Website	Curtis, R. 1998 February 25. Princeton environmental reform committee (PERC) home page. <http://www.princeton.edu/~perc/> Accessed 2004 November 1.
Personal Website	McLarnan, T. 2004 September 23. Tim McLarnan's home page.<http://www.cs.earlham.edu/~timm/> Accessed 2004 October 12.
Website with no author or no date	World wide recycling sites.<http://www.recycling.org> Accessed 2004 November 1. Title becomes the first element and no publication/revision date is included. When citing this in the text of your paper, use an abbreviated title to direct the reader to this source, for instance: (World wide recycling)
Part of a website	Schiro, S. 2002 December 8. Hymenoptera: Formicidae. *In* Senior seminar 2002. Introduced species in Hawaii. <http://www.earlham.edu/~biol/hawaii/> Accessed 2003 June 30. HGCI Programs Green Campus Loan Fund. 2002. In Harvard Green Campus Initiative. <http://www.greencampus.harvard.edu/programs/GCLF.shtml> Accessed 2003 May 27. When there is no author, use page title in place of author:

Electronic version of print journal article **Retrieved from an online database**	Emerson, D. 2004. In composting and recycling, WSU gets "A" for effort. BioCycle 45(9):22-24. From Academic Search Premier. <http://search.epnet.com/login.aspx?direct=true&AuthType=cookie,ip,url,uid&db=aph&an=14437592> Accessed 2004 November 1.
Electronic version of print journal article **Retrieved from the online version of the journal**	Petracco, M . Our everyday cup of coffee. The chemistry behind its magic. Journal of Chemical Education 82:1161-1168. Available from Journal of Chemical Education Website <http://jchemed.chem.wisc.edu/Journal/Issues/2005/Aug/PlusSub/V82N08/p1161.pdf> Accessed 2005 August 9. Put a reference in the style for a print journal, then put the "persistent URL," if one is given (otherwise URL for journal website) and date when retrieved.
Part of an electronic journal article, such as figure or table	Bluhm, C.K. and P.A. Gowaty. 2004. Social constraints on female mate preferences in mallards, *Anas platyrhynchos*, decrease offspring viability and mother productivity. Animal Behaviour 68:977-983 . Available from Animal Behaviour Website <http://www.animalbehaviour.org> Table 1. Fitness components of successful mothers. Accessed 2004 November 19.
Article from journal ONLY online, not in print	Gilchrist, G. , M. Mallory, and F. Merkel. 2005. Can local ecological knowledge contribute to wildlife management? Case studies of migratory birds. Ecology and Society. 10(1): 20. <http://www.ecologyandsociety.org/vol10/iss1/> Accessed 2005 August 3.

Sources Not Existing either in Print or Online

Interview, e-mail or other personal communication	Because this source is unavailable to anyone else but you, omit from the Literature Cited list. In the text of your paper, however, refer who, the way in which the information was obtained, and the date. For example: (Smith, R., personal communication, November 15, 2004)