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Using Scientific Literature

About this chapter

In this chapter we examine what we mean by scientific literature and the significance of peer review. We also consider why using scientific literature is essential for your essay or project work. We will examine issues concerning the sourcing of information: for example, books, academic journals, search engines and databases. We will highlight the pitfalls of using web-based information and suggest ways in which you can evaluate source material and its appropriateness to your task. We give guidance on how to read the literature critically and effectively, and how to summarize information clearly. We will take a look at plagiarism, particularly what is covered by the term, and how you can avoid it. Finally, we discuss the accepted ways in which the work of others is acknowledged, and standard styles for citing in your text and listing references or providing a bibliography.

What is scientific literature?

Scientific literature is the storehouse or archive of the history of scientific research and the techniques that researchers have developed or used. As such it is central to the development and exploitation of science itself. All scientists draw on scientific literature both to set the context of their own research and to inform fellow scientists (their peers) about the way in which their theories have developed from earlier research, and the extent to which they complement or contradict previous findings. Scientists often repeat the experiments of others, both to check that the techniques and the findings of the work reported are valid

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and to improve their own techniques. As a result the outcomes of research are constantly checked and validated and new interpretations and experimental techniques developed. It is normal for scientists to describe how a particular technique was developed and why they used it in their experiments. There is also an unwritten expectation that they will describe fully what results they obtained, how they were derived and the reasons that they have put a particular interpretation on them.

A little bit of history

Scientific literature goes back a long way. Both the Chinese and Babylonians recorded information about the eclipses of the sun and moon and other astronomical events more than two and a half thousand years ago, largely for religious reasons. It is also thought that cave paintings of animals and the like were a way of recording information for others. The Egyptians recorded the changes in the flow of the Nile for agricultural purposes. Greek and Roman authors such as Aristotle, Theophrastus and Pliny contributed significantly to the understanding and interpretation of nature and natural events. By the Middle Ages Arabic scholars were routinely undertaking experimental work and recording their results.

The development of scientific journals, as opposed to single-authored books and treatises, began in Europe in the mid-seventeenth century. An early form of peer review was introduced by the editor of the *Philosophical Transactions* of the Royal Society of London. Inevitably, as research and techniques developed, scientists found it increasingly difficult to keep up to date with the work of others, and journals began to include abstracts of current publications to inform their readers. By the beginning of the twentieth century there were formal indices or abstracts of published work and by the mid-twentieth century volumes like the *Science Citation Index* were routinely published. Scientists are constantly updating their knowledge and techniques by reading the literature in their discipline and passing on to others details of their own work. Nowadays as a result of developments in computing it is possible to bring together data from a very large range of published sources in meta-analyses. These can be important in clinical medicine, particularly when they are able to identify significant developments from the results of a large number of clinical trials that may not be entirely clear from individual case studies.

Use up-to-date sources of information

Interpretations of results do change over the years and, with hindsight, some earlier interpretations have sometimes been shown to be inaccurate or misleading. There are many such examples in the field of palaeontology, where scien-

tists have had access to a much wider range of fossil remains, and where dating techniques have become progressively more accurate. You can think of scientific literature as a dynamic entity: there will be mistakes and misinterpretations, but these will come to light as research in the field of study develops.

Nowadays many journals are available online, and subscribers are informed in advance, by email, about the contents of the latest edition. Equally, current work is often publicized through presentations at conferences or even local research meetings where draft results are made available. Unfortunately the cost of journal subscriptions can be substantial, and sometimes even major university libraries cannot afford the subscriptions to the full range of journals available. However, many scientists get round this by collaborating closely with colleagues in other institutions or research groups that have access to the publication in question. Lack of availability of journals can represent a major difficulty for distance-learning students who do not have ready access to a university library. It is worth bearing in mind that where you do find key articles that are not available in your library, or where your nearest source is a local general library, you can get books or copies of journal articles through the inter-library loans scheme.

Today scientific literature is largely written in English, even where the first language of the authors and research groups is not English. Where you do come across an article in another language that you need to read for your assignment, you will find that many libraries offer translation facilities. In addition, you may well find translations available on the web.

Different sources of scientific literature

Scientific literature is divided broadly into two categories: primary sources and secondary sources.

Primary sources include:

- research papers in peer-reviewed journals;
- research monographs;
- conference proceedings;
- doctoral theses kept in university libraries.

Secondary sources include:

- textbooks;
- edited books;
- review articles.

Primary sources

Papers published in peer-reviewed journals are primary sources of research information, because they set out research methodologies and results. The peer-review process and the date of publication of the journal will mean that an article is published several months after the original typescript was submitted.

Research monographs, which are highly detailed pieces of scholarly work, devoted to a single topic, may also be primary sources, as they bring together authors working in the area to write papers on their research. A research monograph is usually of book length (around 50,000 words), is written for a specialized audience and generally describes leading-edge research. Research monographs in science are often multi-authored, especially where they relate to the work of a major international or collaborative group such as researchers working with the Large Hadron Collider (LHC) at the Conseil Européen pour la Recherche Nucléaire (European Council for Nuclear Research), generally referred to as CERN.

Monographs often include a survey of the latest research drawn from a range of sources, including recent conference proceedings. As such they normally go beyond the author's own research, in order to set the work in the context of recent developments. They also include some kind of historical review to show how the author has built on and extended, or even contradicted, earlier work, and how the author has contributed to the development of the subject. Monographs use technical terms as a matter of course, and assume that the reader will understand them. Very often the monograph will be part of a published series that includes what are regarded as the key books in the discipline aimed at the professional scientist. Finally, a research monograph often entails a much longer period of preparation: it takes longer to write, and involves the writer in consulting the most recent journal articles and conference proceedings. Where you are designing a research project, you would normally rely much more on research monographs and draw on a wider range of journal articles and conference papers than you would for an essay.

In addition to journal articles and research monographs, conference proceedings, which contain details of the papers and posters presented at a conference, are also primary sources as they report the original work of the authors concerned. Equally, a doctoral thesis or a bound collection of papers submitted in support of an application for a higher doctorate, such as Doctor of Science (DSc), are also regarded as primary sources. These are not generally so widely available, and copies would normally only be available in the library of the university that awarded the degree, or in the department or school of the student. You may find that your tutor or supervisor has also supervised the student concerned, and that they have a copy of the thesis. The British Library also keeps copies of the abstracts of successful PhD theses across the UK.

The key features of primary sources in the sciences are that they are the original source of a set of data, or the first report of particular observations. Sometimes a report from a government department or other organization, such as a report about the decline in the population of a particular species of birds, is seen as a primary source. It may even be the case that information available on podcasts or blogs may be regarded as a primary source, especially where the researcher wants to make his or her results available quickly to the scientific community. However you need to be cautious here, as the results and techniques described may not have been subject to peer review.

Secondary sources

Secondary sources draw on the primary sources, and include textbooks, edited books and review articles. Some, such as articles in encyclopaedias, are of limited value and may only be useful when you are looking up a term that you have not come across before. A comparison of a textbook or chapter in a textbook with a research monograph or journal article highlights the key differences between primary and secondary sources. Textbooks cover broad topics and are aimed at different levels. Some will be for first-year undergraduates or students in the later stages of secondary education. Textbooks are likely to be relatively straightforward in their language, and will avoid too many technical terms. Unlike research papers and monographs, textbooks will generally include a glossary, which will give an explanation in simple language of the technical terms commonly used in your subject or discipline. Very often textbooks aimed at first-year undergraduates will contain exercises at the end of each chapter, with model answers at the end of the book. These actually form a very useful means of checking whether you have understood what the chapter covers. For these reasons, they may also appeal to the general reader who is interested in the subject.

Other textbooks are aimed at graduate students or final-year undergraduates. These are likely to include much more technical language, and assume a higher level of background knowledge.

Some authors who are very distinguished in their research field will write books aimed at the general reader. Professor Stephen Hawking's *A Brief History of Time* is a well-known and widely read example. Another useful series is the 'Very Short Introductions' published by the Oxford University Press. Such books tend to avoid technical language or the use of formulae, particularly where they are not readily understandable. Instead, the author will set out the concepts in simple and straightforward language. As such, they often provide a good example of the sort of language and approach that you should use in writing general essays. By contrast, a textbook will normally include the essential technical terms, and will define them where they first occur, as well as in

a glossary. This definition will describe the terms or concepts in simple language and will try to relate them to everyday ideas and language.

Where to start

The normal starting point for an essay will be your lecture notes and handouts and a recommended textbook. From these you should move to review articles, followed by research papers. A good textbook or review article will set the historical background, identify current ideas and set out where issues remain to be solved. Sometimes review articles will be derived from keynote presentations at major conferences, and will generally give an excellent overview of current research in a straightforward way.

Journals are often quite focused in the subject that they cover. Others, such as *Nature*, will cover a wide range of topics. Equally the standards of journals will vary, and there are published ratings of journals. It is likely that the researcher who uses novel and innovative techniques for his or her work, or who has come up with results that may change thinking in the subject, will try to have the article published in the most prestigious journal.

Publications in journal articles and research monographs are often used in recruitment and promotion procedures by universities for academic and research staff. In addition, in order to obtain research funding, academics must have a good record of publication in prestigious journals. Consequently academics will aim to publish regularly and therefore information about up-to-date research is now more readily available than in earlier times. For example, during his lifetime Mendel did not publish much of his research observations on hybridization and variation in plants, and where he did they were in fairly remote journals like the *Proceedings of the Natural History Society of Brünn* and, of course, were written in German. Consequently Darwin was not aware of Mendel's research, and it was not until the twentieth century that the real significance of this research was recognized.

For the most part it is relatively easy to follow up research in individual disciplines. Where multidisciplinary research is involved, following up information and results may be less straightforward. Publications are likely to be in a range of journals across the disciplines concerned. Researchers in the single disciplines may not pick up the work published by multidisciplinary groups, and in some instances may dismiss it as irrelevant. However, multidisciplinary groups may well bring a new and important approach that conventional single groups have not spotted. A clear example in the biosciences is where there is research that involves neuroscientists and immunologists; a comparable example

in the clinical sciences is where clinical psychologists have input to the management of disease.

Peer review

Peer review is generally seen as the most effective way of maintaining the standards and quality of research, as well as ensuring that the public in general have confidence in what scientists are doing. The nature of peer review has developed as the dissemination of the literature has improved. In the seventeenth century articles published in the *Philosophical Transactions* of the Royal Society of London were reviewed by the editor, who had sole responsibility for the quality of the article published. By the middle of the eighteenth century the Royal Society itself took over responsibility for the review process, and each article was sent out for review by a limited number of experts in the field. This process was adopted increasingly in the nineteenth century, and by the twentieth century it became absolutely standard. Peer-reviewed papers, such as journal articles, are seen as the gold standard of scientific literature.

Today, an original manuscript submitted to a peer-reviewed journal is reviewed by at least two independent scientists. The reviewers must not be directly involved in the research described in the article, but will be acknowledged experts in the field with wide experience of the research methodology used and the interpretation of the results derived from the experiments described. In some cases they may be members of another team that is carrying out similar research, and the work of their team may well be in direct competition with that presented in the article. Generally the reviewers have the option of remaining anonymous. They are also under an obligation to keep information about the work confidential while they are reviewing it and until it is published. It is normal for reviewers to give feedback to the author through the editor, with the aim of improving the quality of the article. Reviewers will look at the research methodologies described, the data presented and the interpretation of the data. If they do not think that it is up to scratch, they will recommend that it should not be published in its present form, or in some cases not even published at all. They will often suggest modifications that the author should incorporate before the article is published. Anonymity can help ensure that reviews that are critical of the research are provided. Equally, of course, anonymity can be abused. The editor of the journal will look at all reviewers' reports. If there are disagreements between the reviews, they will normally seek the views of another reviewer.

Over the years there have been some concerns about the peer-review process and its effects on the publication of research. For example, peer reviewers may

be reluctant to support the publication of negative results, or results that show no overall trend. One consequence of this is that the scientific literature may be skewed by the publication of largely positive results and you should bear this in mind when you are researching the literature. This can have a significant impact on the meta-analysis of the data that form the basis of the research results. There is also an additional concern that the reviewer may take a more positive view of research submitted by a prestigious university or research institute as against that of a junior academic or researcher in an institution that has a poor track record for research. However, it is worth noting that the research carried out by junior researchers, by doctoral students or by undergraduates undertaking project work can make a significant contribution to science. An undergraduate who has a peer-reviewed publication arising from project work is praiseworthy indeed, and there are even undergraduate research journals for students to publish their work. One such journal is *Bioscience Horizons*, which is a national journal for undergraduate research.

Beyond peer review

Where a new research technique has been published in a research journal, other scientists will try to reproduce the techniques and associated results, to check that both the method described is reliable and that similar results can be obtained in a different laboratory. In this way the peer-review process continues beyond the initial publication of an article in the form of post-publication replication of experiments and results by the wider research community. There have been many instances where scientists have not been able to reproduce the results. A well-known example is cold fusion, where other researchers were unable to reproduce the results described by Fleischman and Pons (1989).

Why use scientific literature for your assignments?

The development of the ability to put over ideas about your chosen area of study, either by means of oral presentation or through essays and other written work, is a vital part of your education. It is also one of those skills that can be used later in your career, whether you become a professional bioscientist or not. The writing of essays or preparation of presentations during your course is intended to help you develop a structured approach to finding and evaluating information, and setting out and communicating this information to your readers or audience. Normally the development of these skills will take time, and practice makes perfect. Moreover, the tricks and techniques acquired in the process will help you in later life to look critically at articles you may read in the press

about, say, the latest ‘miracle cure’ for some disease or other. In addition, by successfully communicating the results of your work, you will be adding to the pool of knowledge in your area of study, and what you say may very well help others in their understanding of the field.

Your department or school will have conventions and guidelines to help you to prepare your written work or your oral presentation, and you should make sure on every occasion that you find out what these are. Many of these will be concerned with the way in which your material is presented. In your presentations, whether written or oral, you will be expected to cross-refer to the literature that you have consulted during the course of your work. In all scientific and technical writing there are established conventions that you have to follow when you are reporting or acknowledging sources of information. As much as anything, these are to ensure that it is clear what your own work is, and what is the work of others. This is not intended to prevent you from drawing on and making use of the work of other people. Indeed, as we have already said, much scientific work is the result of collaborative effort, or builds upon the work that others have undertaken in the past. Citing or cross-referring to the work of others helps strengthen the perception of the quality and breadth of your work. This is particularly so when you are drawing on the primary literature in peer-reviewed academic journals or research monographs, where the authors have reported the information for the first time. As we said earlier, textbooks are regarded as secondary literature, as they reflect their authors’ views on and interpretations of the primary sources. You should remember that there may be other interpretations than those set out in the textbook you are using. However, a well-written textbook will summarize the range of interpretations and will therefore be invaluable for essays in the early years of your course. In addition, textbooks will usually provide a bibliography setting out references to the primary sources.

Newspapers and popular magazines, and to some extent encyclopaedias, are not generally useful sources. In the case of newspapers and popular magazines, the journalist responsible for the article may very well have topped and tailed a press release, which in any case has probably not been written by the original scientist.

Reading the literature

The assignments you are given during your course will inevitably require you to consult the relevant scientific literature, and without help and guidance this can seem to be quite a daunting task. As part of your A-level or comparable level work you may well have undertaken some kind of project or coursework, and

will therefore have had some experience of finding out information from the Internet or from textbooks. As you will have discovered, reading scientific literature is very different from reading a novel or a magazine article for pleasure.

When you read a novel, you will quite often skim-read or skip paragraphs, and you will certainly not try to analyse it in any depth. By contrast, when you read scientific literature as part of your course, you must have a very focused approach. It is important that you read critically and think about what the author says. You should also look at the way the author presents his views and the data that support it. Equally, you should aim to understand why the book or article is seen as important. With such a focused approach you can develop your own style by learning and drawing on the stylistic techniques that an author uses. This means that reading and understanding a textbook or research article will take much longer than reading a novel or magazine article of corresponding length.

Learning to read scientific literature critically is an important skill that you must acquire and develop as your course progresses. It is a skill that you need

to practise constantly. If you work on the basis that you will take two minutes to read the average page, then reading a 360-page book will take at minimum twelve hours of solid reading. If you have only, say, an average of two hours available a day for reading, it will take you the best part of a week to read the book. This, of course, does not include any time for you to take notes. You need, therefore, to focus clearly on what you have to read, and if it is obvious that an article or chapter is peripheral to your essay or project, ignore it, at least as part of your initial reading.

You should also take account of your deadlines. If you have a month to complete your essay or project, you can spend more time on reading than if you only have a week. The aim of this section is to give you some tips that will help you to develop a systematic and methodological approach to reading.

1. Check the reading list

When you start a unit or module, you will be given a reading list by your tutor. You may well be dismayed at the amount of reading suggested, especially when you realize that this is the reading list for just one small part of the course. As we said earlier, the starting point for any essay or project work is always the lecture notes and a good textbook. You should not rely just on your lecture notes and handouts. You have to read much more widely if you are going to produce a good essay, or design a good research project. Staff in your department or school will have identified the most appropriate textbook for your module or course. In some cases they may even recommend a very general textbook for your subject, for example, a standard textbook on zoology, if that is your main subject.

2. Identify your source material

Read and re-read the essay title or the subject of your project, and make sure that you understand it fully. In this way you will be able to identify the sort of source material such as notes, textbook(s), reviews or journal papers, and the information that you will need for your essay or project.

3. Think about your approach to reading

Before you start to read a book or an article, you need to think about what your approach to reading is going to be. If you are reading a textbook to get an idea of the context of your essay subject, your approach will certainly be different from that which you will use when you read a journal article as part of the background for a research project. For a research project you will need to

concentrate hard on the detailed experimental techniques and the data that form the basis of the conclusion of the article.

4. Start with the textbook and use all its facilities

Textbooks are immensely helpful for identifying the key researchers in the subject, and the best primary sources of information for you to follow up when you read further into the subject. Textbooks essentially take the form of a review and summary of the subject based on the important primary sources. They will generally reflect the opinions of their authors and sometimes their prejudices. Consult the glossary for any technical terms you have not come across before. Use the bibliography to find the important primary sources: these will form the background reading that you will need to do when you are researching information. You will often find that there is much in common between the bibliography and the reading list for your module or project and that will give you a good starting point in identifying the main authors and papers.

You should also read the textbook alongside the handouts and lecture notes. You may find it helpful to highlight the key points in your lecture notes, and where possible make a note of related passages or sections in the textbook. There will be a lot more detail in the textbook, and you will find it helpful for your later revision to summarize the important parts as bullet points to supplement your lecture notes. In this way you will get into the habit of reading around to add to the information that your lecturer or tutor gives, and gain a much more informed grasp of your subject. You will also find that reading a textbook and lecture notes will be somewhat different from reading the primary literature of your subject.

5. Read the type of literature appropriate to the assignment and use an interpretive approach

When it comes to reading as part of the background research for your essay or project, you must have a very structured and disciplined approach to ensure that you are able to recall the key points at a later date. The topic of an essay may be a broad general review, or may require you to focus on a specific topic. In general, your tutor is much more likely to be impressed by a well-argued personal interpretation than by a simple narration of the facts. You will normally have to use such an interpretative approach later for, for example, a research project.

A project will almost certainly be based around a specific topic. Here you will be required to present the data that come from your research in a clear and logical way, but also interpret the implications of the data in setting out your results.

Again, the starting point will be your lecture notes and the textbook, but now you will also be expected to read much more of the primary literature, with the aim of developing your own thoughts, rather than just regurgitating the points that you have picked up from your lecture notes or the recommended textbook.

6. When reading a textbook

Inevitably, when you are writing a general essay you will have to draw initially on a lot of basic subject information from your textbook and lecture notes. Summarize the major issues as bullet points in your notes, and then follow up each bullet point by reading the main primary sources of material, usually journal papers or reviews. You should summarize the more detailed information from the papers as sub-bullets.

7. When reading a research article

If the topic of your essay is more specific, then the focus for your research may very well be a particular research monograph by a leading scientist that deals with the topic. Again, for both a general and specific essay you will need to follow it up by reading appropriate journal articles. This is also the approach that you should adopt for project work, which is much more likely to focus on a specific topic. For example, if you are writing an essay on something as broad as the causes of disease, you will need to read a general book on the topic, and then look at a limited number of specific diseases to identify common factors, and examples of marked differences, to allow you to put forward a personal view. By contrast, if you are writing an essay or doing a project on cytokines, you would need to read one or more books that are specific to the area, and follow them up by reading the key research papers from journals.

The approach to reading journal articles will have some things in common with reading a book, but will also have some differences. A book is much longer for a start (on average around 60,000 words; a journal article may be around 5000 words), but this does not mean that reading a research article is easy. A journal article will usually have an abstract, a formal introduction, followed by a description of the experimental methods and, where appropriate, the materials, that have been used, together with the results obtained. It will also include a general discussion and a conclusion, as well as a list of references or a bibliography. An article is generally more condensed and technical in its language than a book, especially a textbook, and will not normally include a glossary of terms used.

When you have found an article or paper that you think is central to the topic of your essay or project, you will need to read it more than once to ensure

that you fully understand it. A good approach is to read it once, then to read a number of complementary articles or papers that have been mentioned in the text, particularly where they help in setting the context for the original paper. You will find that when you read the original article or paper for a second time, you will have a much better understanding of what its author is setting out to demonstrate, and of the technical terms used in it. Equally, you will gain a much better idea of the way that the author has approached the topic and how the experiments and data collected are used to support the thesis. It will also help you understand how they map on to previous interpretations and the broader context of the topic. Reading the complementary articles will also allow you to identify where there are contradictory results or interpretations. It is important that you identify where authors have conflicting views, and spell out the differences in your essay or project report. Where appropriate you should say which interpretation you prefer, and why it seems the best approach to you, using the appropriate source material to support your argument.

8. Memorize key authors' names

As far as any literature or other source material is concerned, the names of the authors and the titles are important. If the authors are those that are mentioned regularly, or identified in your reading list, then it is a fair bet that the book or paper is worth reading. When you are writing a project report or a final-year essay, you will probably have some idea of the standing of the authors and the reliability of their work. However, for a first-year essay it is always worth checking about the authors from your textbook or lecture notes. Sometimes, of course, an author is frequently cited because the results of the research are wrong or misleading. A well-known recent case is that in which a very limited study of twelve children suggested that the measles, mumps and rubella (MMR) vaccine might be involved in the development of autism (Wakefield *et al.*, 1998). A subsequent investigation by the General Medical Council (GMC) has shown that the results of the study did not match the hospitals' or general practitioners' records of the patients studied. In addition, major studies that followed have established that there is no link (NHS, 2008).

In a journal article the names of the authors are listed after the title. In some cases, particularly in those areas of physics that involve international research facilities, such as the Large Hadron Collider at CERN, the list of names of the authors may well run to seventy or more, and it is not uncommon in some areas of bioscience for the list to run to ten or more. In such cases your tutor or supervisor will know who the main author is. Normally the book or article will identify where the principal author is based. If it is a major university or institution, or a research group well known for the quality of its research, it will give you some feeling for the standing of the author.

9. Read most recent articles first and look at their quality

It is also useful to look at the date of publication of the book or article. If it is very recent, you should read it before others that were previously published to see how the author draws on earlier published research. With textbooks or research monographs you should also check that you are using the most recent edition. It is probably fair to say that where there have been many editions, the book is likely to be a standard source in the field and can be relied upon to provide the accepted approach. You will also find that certain journals have a higher reputation than others. Also research monographs published by a university press may be more highly regarded than those published elsewhere. Very often a research monograph will be published as part of a series and this is generally seen as a mark of quality. As far as books and research monographs are concerned, it may also be helpful to look at the reviews that were written when they were published. These can give you a good feel for the standing of the authors and the quality of the book.

10. Look at the titles

A book will always have a list of chapter headings, and very often a string of sub-headings for each chapter. A book will also have an index based on key words in the text. An index is particularly helpful in indicating where specific topics are mentioned in more than one chapter. Looking at the chapter headings and the index is always a good starting point before plunging into the text of the book.

The title of a journal paper should give you a fairly precise idea of what the research covers. Most titles will include specific key words. These are important, as experienced researchers will often start their background reading with an online search of these key words. A review article will usually have a table of contents, which in many ways will resemble the sub-headings of a book chapter. Reading the chapter headings and index of a book or the table of contents of a review article will help you to identify initially where the parts relevant to your essay or project are to be found, and so help you to focus your reading. Research papers, however, will not usually have a table of contents or even subheadings in the text. Where this happens, your starting point has to be the abstract, followed by a quick reading of the conclusion.

11. Read the preface or introductory chapter

When you begin to read the main text of a book, start by reading the preface. This will set out the structure of the book and will give some indication of the audience that it is aimed at, as well as saying why it has been written. Clearly,

if it says that it is primarily aimed at graduate students, it will be more advanced than a general textbook, and is less likely to be appropriate as a starting point for a first-year essay. Sometimes, especially with research monographs, the preface will outline the contents of the chapters. Where it does not, you will generally find that the first chapter will form the introduction to the book. When you read the preface or introduction of a textbook or research monograph, you should also get into the habit of using the index to identify where the key words used in the preface or introduction crop up in the main text of the other chapters. Similarly with a journal article, you will start by reading the abstract. Very often this will include key words, and this will be especially helpful if the article is available online or published on a CD-ROM. The abstract of the article will also often be included in a published collection of abstracts, such as *Biological Abstracts*.

There are occasions when the title of the book or article does not reflect its true relevance to your essay or project, and reading the preface or introduction of the book, or abstract of the article, will help clarify this for you. It is also worth bearing in mind that the abstract part of a journal article may not summarize some important parts of the paper. An obvious case in point is where the abstract only picks out the key results of the research, and does not mention other experiments in the project that did not work. Information about these other experiments may be relevant to your essay or project. If you are in doubt about the relevance of the article, skim through the illustrations and data tables and the section describing the research methods used. These will generally show you much more clearly the relevance of the article.

It should be clear from the preface or introductory first chapter of a good book if it is relevant to your essay or project. They are obviously longer than the abstract in a journal article, and as such allow the author to be more expansive about the subject matter. A preface or introduction will also give a real feel for how readable the book is. If the author's style sends you to sleep, then you may want to think about whether it is sensible to continue, given that the following chapters may be equally unreadable or boring. In the preface or introductory chapter the main points should be clearly presented in a logical order. The language should be straightforward and easy to read.

12. Read on and take notes!

Once you have decided that the book or article is relevant, read on. It is important that you take notes that summarize the key points. Do not make long notes on sections that are not really relevant to your work. Start by summarizing the key points that the author is seeking to make in the chapter or article. These will usually be found in the opening paragraphs of the chapter, and will cer-

tainly have been identified in the preface or introduction to the book. In a journal article these will be found in the abstract and conclusion. Your summary of the paragraphs and sections of the main text will provide the supporting arguments for the author's proposition. If you find when you have reached the end of the article or chapter that there are contradictions, highlight them. Avoid copying down long quotations. There is always the danger that parts of your essay will end up as a string of unattributed passages, and this almost certainly will be seen as plagiarism.

Always summarize the key points in your own words after reading a whole paragraph or section. Summarizing a section or paragraph is the best way of learning to think about the material that you are reading. Inevitably there will be times when it will be difficult to summarize a passage, especially when, for example, in the description of the methods and materials used, the original source uses a lot of technical terms and is very dense. Nonetheless, do try to summarize it in your own words. This will help you to understand much of the technical language. If you come across any technical terms you do not understand, then note them down and look them up, for example, in the glossary or in a scientific dictionary. You can always seek the help of your tutor, though only when you have tried other sources. It is well known that we remember far more of what we find out for ourselves, than what other people have told us!

When you have summarized a paragraph or section re-read your summary to make sure that it reflects accurately the source material. Try to avoid paraphrasing, for example, by rewording a whole sentence in the original text. Avoid trying to take notes as you read, as you will be much more likely to copy out whole sentences or phrases. When you are taking notes, focus on the book chapter or journal article that you are reading. Do not be tempted to skip to another chapter or article that has been referred to in the text. Read them after you have finished reading your current text, otherwise you may end up with notes that confuse two or more sources. As far as journal articles are concerned, you will probably find it helpful to take a photocopy or a personal print-out, where it is an online journal, and use a highlighter pen when you have your first read through. Check the copyright rules for photocopying – your university library will have information on the regulations. A collection of hard copies with annotations and highlighted points will often be helpful when you are revising for your examinations, as well as for the essay or project in hand.

If you are used to working with a computer, whether a laptop or desktop, you may find it easier to key your notes in through the word-processor that you use routinely. There are advantages to this, in that you can subsequently use the word-processor to find key words in your notes. There is, however, the danger that where you are accessing an online journal, or a web-based article,

you will simply cut and paste, and potentially end up with a large number of unattributed quotations, with the risk of plagiarism, when you come to write your essay or report.

13. Reading for your research project

The introduction of a journal article will normally set out the aims of the research conducted and the key elements of the background. This is particularly important as all research builds on previous work. The introduction should explain clearly why the author undertook the experiments, what research methodology was used, and how these relate to previous work. It should also set out the key results of the experiment, and how they fit in with previously reported work. The opening chapter of a research monograph will similarly give you a good idea as to how the research or matter described fits into the wider field of the topic you are studying. The introduction or opening chapter should always be read in conjunction with the bibliography, which will give you the references to previous work and the context for the present research.

When you are doing background research for a project or laboratory experiment, look at the techniques described in the article or book. In a journal article these will be found in the section about methods and materials. This will set out the research methodology, which will describe the techniques used as well as details of the materials used. This section may well be where technical language is used much more extensively, because each term has a precise meaning that other researchers will understand. Consult your supervisor as a last resort if you do not understand fully the terms used. Nonetheless, you need to recognize that by the time you reach your final year you will be expected to understand these terms fully. The methods and materials section will obviously give you another good starting point for your own experiments, and will allow you to evaluate the quality of data found in previous research. This may also help you to identify another and possibly more effective approach. It may also give some views on possible follow-up studies or experiments. This will again help when you are designing a project involving a range of experiments.

A word of warning: where an author has repeated a method already published elsewhere, they may not give full details, and may simply refer to the previous paper. For example the author may simply state ‘the assay was performed according to Bloggs *et al.* (1999)’. This is frustrating because you may have to follow up the original reference to get the detailed method.

The discussion and conclusion sections of a research paper are clearly important because they set the research fully in context, and they will contain the detailed interpretation of the results. They will inevitably be the most subjective

part of the text. You have to remember that the author is trying to convince the reader that it is an important piece of research, and that the experimental techniques and the approach used are appropriate and valid. Equally, the author is aiming to convince the reader that the integrity of the data stands up to scrutiny. This is also where the importance of the peer-review process comes into play. Look at the data set out in the paper, and compare them with the description of the results. In a well-written paper the author will always present the data or results obtained separately from the interpretation of them.

As has been said before, it is always important that other scientists are able to replicate the results, and where appropriate bring their own interpretation of them. Sometimes the researcher will have overlooked a possibly important interpretation, or have laid too much emphasis on a particular aspect, by misinterpreting the statistical implications, particularly where a sample in the study is small, with little or no control comparator. You should, therefore, look at the extent to which the conclusions are based on opinions rather than the evidence of all the data presented. This can be important where the author is trying to tailor the data to a preconceived opinion. A common fault is where the author presents only a very limited set of data that support the preconceived interpretation. When experiments are conducted, all the results should be available to other scientists. Increasingly material that has been obtained, but is difficult to fit into the main report, such as very detailed data, may be included in an appendix, or separately in an online supplement to the article. This is also the approach used when the experimenters have used videos to record material, for example, in a study of animal behaviour.

When you are looking at data presented in graphic form, make sure that you understand the statistical technique used in presenting the data. Most bioscience programmes include a module on statistics and data presentation. Look at your lecture notes and handouts on statistics. You should also look at the text related to the graphics or diagram to see how the researchers collected the data and what controls they used, especially where they are basing their claims on the statistical significance of the data presented. In a good paper the presentation and interpretation of the data will very often give you a good model for your own work. Badly presented or misinterpreted data can ruin a paper or report.

14. Recheck your summary

When you are reading an article as part of the background for an essay or project report, take particular care to ensure that your summary actually reflects what is written. Again, highlight in your notes any point that you feel is not supported by the data. Equally, highlight aspects where you think that there can be further

follow up to the research described in the article. Above all, when you are writing your notes, remember that they will form the basis of your essay or report. It is clearly not sensible when you are actually writing the essay or report that you constantly have to go back to the original source material to confirm what you have written or to fill in gaps. Again, make sure that your notes include accurately the full title of the paper or book with page numbers where necessary, and the authors' names in line with the referencing conventions that you will be using. (See below for a more detailed description of the Harvard referencing system.)

Using material from the Internet

The Internet can be a helpful source, especially where the information comes from peer-reviewed journals available in electronic form. Indeed, in some disciplines the Internet may well be the first place where something is reported and the article may be the first version of a paper that will be published in hard copy later. Increasingly, too, online peer-reviewed journals are being developed. However, many of the sources on the Internet are not refereed, and may well be misleading. You should also be aware of the target audience of any article published on the Internet. For example, in biomedical or health science, an article about a disease is often aimed at the patient or the patient's relatives. Thus, the information, though correct, is not necessarily at the level required for your assignment. So, you should always be aware of **your** target audience, which is most often your tutor.

The last thing you should do is cut and paste indiscriminately from the Internet. For a start, this is easily detectable as plagiarism by the standard computer programs used by institutions. It is also possible that you may be inadvertently copying an unattributed passage from the work of your own tutor! It is always useful to seek the help and advice of your tutor or lecturer, and even fellow students, in sorting out your ideas, but in the end the words in the essay or presentation must be your own.

There are pitfalls in using the Internet as a source of information for your work. If you use Google or one of the other search engines, you will certainly be presented with a very large list of links. When the link is to a refereed academic journal, or an online peer-reviewed journal, you can be confident about the quality of the information (using Google Scholar will ensure that the links obtained are to reputable journals). Similarly, if the link is source material from a college or university, which will be identifiable by the use of. ac.uk or. edu in the URL, you can be reasonably confident about its quality. If it includes in the text or as a bibliography a range of references to original source material,

then you can regard it as reasonably reliable. Nonetheless, you should always check it against the primary source material, such as peer-reviewed journals.

When it comes to other sources, you need to be more cautious. Wikipedia is an often used source and can be very useful as a starting point, but you have to remember that it is not formally peer reviewed, and there have been instances where rogue writers have added information that is downright inaccurate. Be aware that there are groups that will take a religious or political stance against certain material, and will try to alter it when the opportunity arises. Generally Wikipedia articles will include references to original source material, and wherever possible you should follow these up. However, these articles may be highly selective, and may not represent the whole picture. If you are ever in doubt, always go back to your textbook or lecture notes, and compare the references there with those in the online article. You should always take the same cautious approach to other articles on the web, even when they have a named author or authors. You will find from time to time that the text in these articles corresponds word for word with a similar article in another source like Wikipedia. In cases like this it is not generally possible to tell what the original text is and who is the real author. You may well find that the text looks like an unattributed paraphrase of another online source. Again, it is often difficult to identify the originality or the provenance of the text. As a matter of general principle, unless the online source is from a peer-reviewed journal, or from a clearly respectable academic source with solid references, be extremely cautious about using web-based material. Nonetheless, it can provide you with an alternative or unorthodox view about the topic you are researching, and as such you may wish to comment on it in your essay or report.

Plagiarism

Institutions and examiners in particular are constantly on the lookout for plagiarism. Plagiarism is deemed to take place when you fail to acknowledge properly the work of others you have used in your assignment. More specifically it is seen as plagiarism if you quote from or paraphrase an author's work without a reference, or where you have used the laboratory results of someone else without proper acknowledgement. It also includes the copying of other students' work, or work that is written by more than one student, when it is supposed to be a solo effort. Your own institution or department/school will have specific guidelines on plagiarism and the assessment regulations will detail the penalties if you are caught plagiarizing someone else's work. Plagiarism is taken very seriously nowadays particularly because of the ease with which students can download material from the Internet.

Referencing conventions

In your essay, presentation or report you will be expected to use consistently one of the standard referencing conventions to cite the sources that you have used in your background reading. You should therefore learn to cite and reference articles and books properly. In most conventions referencing takes the form of a two-stage process. The first is a citation in the text of your essay or report to indicate that you are drawing on information from the work of another author. The second is a reference, which gives more detail of the source to which you refer in your text. The detailed references to **all** the sources that you cite should be included in a list, usually placed at the end of your essay or report. In addition, there may be circumstances in which you will also include a bibliography in your essay or presentation. The bibliography will include a list of relevant sources that you have consulted in the process of preparing your paper or presentation, but not actually cited in the text. Very often the bibliography will be headed 'Further Reading'. This is a particularly useful way of referencing textbooks, review articles and abstracts. The format of the bibliography must always be the same as that of the list of references.

Different disciplines often have different styles of referencing (academics are like that: you can rarely get them to agree on a common convention across disciplines). For example, the conventions used in the biosciences will be different from those used in chemistry. In the UK many disciplines in the sciences and humanities, including biology, use what is known as the Harvard style. However, the Council of Science Editors (CSE) in the USA produces a substantial style manual that currently runs to 680 pages in its latest edition (Council of Science Editors, 2006). It recommends two systems of documentation: one that follows the Harvard style (also known as the name-year (N-Y) system); the other that follows the Vancouver style (also known as the citation-sequence (C-S) system). As usual, life is never simple: many of the journals in the biomedical and biochemistry areas follow the Vancouver style, for example, the *British Medical Journal* (BMJ). The conventions used by chemistry are those of the Royal Society of Chemistry, or the American Chemistry Society, which are broadly similar. Many university bioscience departments, however, recommend that students use the Harvard system, where references to the literature are cited in the text, the form of the citation is: (principal author(s), year of publication), for example (Smith, 1999). In the Vancouver style, citations are indicated by a number in parentheses in the text, for example, 'In a recent study (1)'. In Chemistry citations are indicated by superscript numbers in the text, for example, 'In a recent study[1]…'. In addition, each of the styles has a different convention for the format of the reference list or bibliography. Consequently in many areas of biology you are likely to draw on sources that

use three different styles of referencing. You should always follow consistently the style recommended by your tutor. In this section we will focus on the conventions used in the Harvard style. A brief guide to the Vancouver system can be found on the British Medical Association's (BMA) website (British Medical Association, 2006).

The Harvard style of referencing

Up to the end of the nineteenth century there were no conventions for referring to the work or views of other authors in a book or article. For example, in his *Origin of Species* Darwin (1859) uses phrases like 'Professor Ramsay has given me …'; 'from information given to me by Mr Watson …' However, in the early 1880s Professor Edward Mark, who was Hersey Professor of Anatomy at Harvard University, and a very distinguished zoologist, used a name-year citation system, with a footnote to explain its purpose. The system was increasingly adopted in scientific articles. It seems, however, that the use of 'Harvard system' to describe it came much later and may have originated in the UK (see Chernin, 1988).

General principles

There are certain general principles that should be followed. Please note that the 'citation' refers to the detail given in the text, while the 'reference' refers to the item in the reference list at the end of the piece.

1. In the citation you should use only the author's surname without initials, unless you are citing another author with the same surname who has published an article in the same year as another.
2. The form of the citation will depend on whether you are emphasizing the name of the author, for example: 'King (1998) reported …' or emphasizing the topic or research, for example: 'The aetiology of disease is … (Ahmed *et al.*, 2007).
3. In the reference list the author's initials are used rather than the full first name(s). Do not give a mix of initials and full first name(s). The initial should come after the name. For example: Watson, J.D. and Crick, F.H.C.
4. In the citation give both names if there are two authors. For example: 'Watson and Crick (1953) proposed a structure for DNA'. If there are three or more authors, cite the first author and use *et al.* (which is a shortened Latin form for 'and others').

5. When a government department/agency or other public organization is referred to, the organization's name is generally used in the citation, unless there is a named author.
6. Where a book is part of a series, the series title and series number should be given after the book title in the reference.
7. Where more than one place of publication is listed (for example, Cambridge, London, New York), include only the first named in the reference.
8. The reference list should be in alphabetical order, based on the name of the first author, or name of organization.
9. With multiple-authored works, always list the names in the reference in the order in which they appear in the source material.
10. Where a book has been reprinted, only enter the first published date as the year of publication. However, if a new edition has been published, reference the latest edition, unless you are actually using an earlier edition.
11. Where an article has no date, put 'no date' where you would normally cite or reference the year. This is relatively unusual in printed works, but may occur on websites where an organization is referring to an earlier publication.
12. You need to distinguish between chapters in an edited book, and chapters in a multi-authored book. In an edited book, the citation will be author of the chapter and date, and the reference will make it explicit that it is a chapter in an edited book, as well as giving the name of the editor(s). In a multi-authored book the citation will take the form '(Jones *et al.*, 2003)' or 'Jones *et al.* (2003)' and the reference will give the full list of authors.
13. Where the author has not been identified, as is generally the case with government White Papers, the accepted practice is to give the name of the organization where you would give the name of the author. If the name of the chair of the report committee is usually added to the title (for example, 'the Leitch Report'), cite the organization and date.
14. For electronic copies of books or journals on disk, it is normal to reference them in the same way as the printed versions. However, it is increasingly the case that primary sources, particularly journals, are

being made available through the Internet. Where the Internet version has been consulted, it is now quite normal to reference the URL.

15. Where material is available on the Internet it is the established practice to give the full URL, rather than the general URL for the publisher or organization followed by an instruction 'and follow the link to …'. However, this can be a problem when the material is on a password protected site. In addition you should also give the date that you accessed the source in the reference. There are slightly different conventions for the order of the date of accession and the URL. Some institutions use the form 'Available from: URL …' followed by '[date of access]'; others use the form '[date of access], URL'. You should always follow one convention consistently throughout your reference list or bibliography. This will normally be the convention recommended by your institution, but remember, if your report or presentation is going to be published, then you should follow the convention of the publisher concerned.
16. Where you refer to papers in journal articles or given at conferences that have been published online, the normal practice is to reference them in the same way as the printed version, but with '[online]' inserted after the tile of the journal or conference. In addition you should also give the date that you accessed the source in the reference and the URL in line with one of the conventions listed above.
17. Where a PDF version of a paper or report is available, in the reference this should be given explicitly as the URL. However, sometimes the URL of the PDF version is not given. In such cases reference the URL of the page that you accessed, and indicate 'available as a PDF' at the end of the reference. You must remember that the page numbering of a PDF file source is likely to be different from that of an HTML or other file source, so it is important that you reference accurately the source that you used.

Quotations and how to cite and reference them

When you are using a direct quotation from an author or organization, you should always cite the author's or organization's name in the form: name, year of publication: page number (for example, Ahmed *et al.*, 2007:203). If you are quoting an online source, substitute 'online' for the page number. The quotation should always illustrate a point that you wish to make, and should always use the exact words of the original. If you quote only part of a sentence use three

dots (…) for the part that you have omitted. If you want to add a couple of words to the quotation, for example, to help clarify the quotation, put the addition in square brackets (for example, 'The Director [Professor John Smith] indicated …'). Only add to the quotation where it is necessary for clarification.

Where a quotation is less than a line of text, enclose it in single quotation marks. Where you give a quotation within a quotation, always use double quotation marks to identify the internal quotation.

If the quotation extends to more than a single line of text, begin a new paragraph and indent it. The part of the sentence that you have written before the quotation should end with a colon. The actual quotation in the indented paragraph should not have quotation marks.

When you do quote directly, as well as citing the author in the text you should always give a full reference in your reference list or bibliography.

Using software to generate your references

There are software programs, like Endnote, and word-processing programs, such as Microsoft Word 2007, that will allow you to create references in different styles. The range of styles that Word 2007 will allow you to use is limited, and does not include the Harvard system. It does, however, include the American Psychological Association (APA) style, that is very similar. Endnote includes a much wider range of options. There are, of course, advantages in using a word-processor that has an embedded citation and referencing system. Word 2007 has a specific tab labelled 'References'.

Examples of citations and references

The principal formats for citations and reference lists (including bibliographies) are set out in Tables 2.1–2.3. There are formats for printed works, such as books and journal articles, and for electronic and multimedia material, though you should remember that references to electronic versions of books and journal articles will follow the conventions used for print versions. Examples are given to indicate how you should use the conventions. The list of examples is not exhaustive: there are, for example, ways of referencing blogs, email sources or personal interviews. In some disciplines these will be used both as primary and secondary sources. There are useful and easily accessible online guides that will give you details of how to cite and reference these other sources (Leeds Metropolitan University, 2009; Patel *et al.*, 2009; Anglia Ruskin University, 2008; Imperial College Library, 2008).

Table 2.1 How to reference: books, including textbooks, research monographs and edited volumes

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
Work with a single author or two authors	Surname(s) (year) ***or*** (surname(s), year)	As King (1998) reports … It has been reported that … (King, 1988) As Price and Newman (2001) report … From a recent experiment … (Price and Newman, 2001)	Surname(s), initial(s) (year of publication) *Book title*. Series title and number, edition [*where applicable*]. Place of publication: publisher.	King, D.J. (1998) *Applications and Engineering of Monoclonal Antibodies*. London: Taylor & Francis. Price, C.P. and Newman, D.J. (2001) *Principles and Practice of Immunoassay*. London: Macmillan.
Work with three or more authors	Surname of first named author *et al.* (year) ***or*** (Surname of first named author *et al.*, year)	Ahmed *et al.* (2007) show that … The aetiology of disease is … (Ahmed *et al.,* 2007)	All authors' surnames, initial(s) (year of publication) *Book title*. Series title and number, edition [*where applicable*]. Place of publication: publisher.	Ahmed, N., Dawson, M., Smith, C. and Wood, E. (2007) *Biology of Disease*. Abingdon: Taylor & Francis.
Two authors with the same surname; different publications	Initial, surname (year) ***[for each]*** ***or*** (initial, surname, year ***[for each]***) ***[Shown in chronological order]***	J. Smith (2005) and A. Smith (2008) have both … There is evidence that … (J. Smith, 2005, A. Smith, 2008)	*[As for single-authored work* ***but listed in alphabetical order, not chronological order]***	

Table 2.1 (*Continued*)

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
More than one publication of a single author in different years	Surname (year, year) ***or*** (surname, year, year) ***[Shown In chronological order]***	The findings of Smith (1999, 2006) … There is evidence that … (Smith, 1999, 2008)	*[As for single-authored work* ***but listed in chronological order within surname****]*	
In the same year	Surname (yeara, yearb) ***or*** Surname (yeara) and Surname (yearb) ***[when cited on different pages or in different paragraphs]*** ***or*** (surname, yeara, yearb) ***[the a, b, c, suffixes are assigned in the order that they appear in the essay]***	The findings of Smith (2006a, 2006b) … Smith (2006a) reported … [*cited in paragraph 1 or page 1 of your essay*] Smith (2006b) has shown … [*cited in paragraph 2 or page 12 of your essay*] There is evidence that … (Smith 2006a, 2006b)	*[As for single-authored work* ***but listed by the a, b, c, date suffix that they appear in the essay or report and not in chronological order,*** *for example, a book published in April may be listed before one published in January]*	
More than one source referring to similar techniques or outcomes	Surname (year) and surname (year) ***or*** (surname, year; surname, year) ***[in alphabetic order]***	Chapel (1999) states … This view is backed by Goldsby *et al.* (2003) and Todd *et al.* (2005) It is generally accepted that … (Chapel, 1999; Goldsby *et al.*, 2003; Todd *et al.*, 2005)	*[As for single-authored/ multiple-authored work* ***and incorporated in alphabetical order in the reference list****]*	

More than one source, but including more than one paper by the same author	Surname (year, year), surname (year) and surname (year), ***or*** Surname (year), surname (year) and surname (year) ***or*** (surname, year, year; surname, year; surname, year) ***[In alphabetic order but with the works of the same author listed chronologically.*** ***If the works of the same author are in the same year, use the a, b, c, year suffix as appropriate]***	The findings of Allen (2001, 2003), Smith *et al.* (2001) and Williams and Jones (2004) all suggest … The findings of Allen (2001) suggest that … Other research conducted later by Allen (2003), supported by the work of Smith *et al.* (2001) and Williams and Jones (2004) suggest that … There is general agreement among the main researchers (Allen, 2001, 2003; Smith *et al.,* 2001; Williams and Jones, 2004) …	*[As for single-authored/ multiple-authored work* ***and incorporated in alphabetical order, in the reference list, but with the papers of the same author listed in chronological order within surname****]*
Where an author is cited as a single author in one publication and as the first author in a second one	Surname (year) [*for the single-authored publication*], surname *et al.* (year) or surnames (year) for the multi-authored publication ***or*** (surname, year [*single-author publication*]; surnames, year [*multi-authored publication*]	The findings of Allen (2001) suggest that …, while other research conducted later by Allen *et al.* (2003) … There is general agreement (Allen, 2001; Allen *et al.,* 2003)	*[As for single-authored/ multi-authored work* ***but with the single-authored publication listed before the multi-authored one****]*

Table 2.1 (*Continued*)

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
Where another author is cited by the source you have read, but you have not read the cited source ***[If you have read both the main article and the cited source cite both in the normal way.]***	Surname (year, cited in surname, year) ***or*** (surname, year, cited in surname, year)	The findings of Allen (2001, cited in Jones and Williams, 2003) suggest that … There is general agreement (Allen, 2001, cited in Jones and Williams, 2003) …	*[List the main source as for single- authored/ multi-authored work, in this case the Jones and Williams' publication]*	
Chapter in an edited book, but the author is not one of the editors	Surname(s) of the chapter author(s) (year) ***or*** (surname(s), year) of the chapter author(s)	Dawson and Moore (1989) identified … A major issue (Dawson and Moore, 1989) is … ***[Do not list it as if it were a secondary citation, or simply by citing the editor's surname]***	Surname(s), initial(s) (year of publication) Chapter title. In initial(s) and surname(s) of editor(s), *Book title,* series title and number, edition [*where applicable*] (chapter pages). Place of publication: Publisher.	Dawson, M.M. and Moore, M. (1989) Immunity to tumours. In I. Roitt, J. Brostoff and D. Male (eds), *Immunology*, 2nd edn (pp. 1–18). London: Gower.

Table 2.2 How to reference: other printed sources

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
Journal articles where the names of the authors are given	Surname(s) (year) ***or*** (surname(s), year) [*In multi-authored papers, the standard Smith* et al. *format is followed*]	Etzioni (2003) emphasizes … There is clear evidence (Etzioni, 2003) that … Ismail and Snowden (1999) set out very clearly … It has been established that … (Ismail and Snowden, 1999)	Surname(s), initial(s) (year of publication) Article title. *Journal name,* **volume number** (issue number) [*as available*], page numbers of article. *[Very often the titles of the journals are abbreviated in line with established conventions]*	Etzioni, A. (2003) Immune deficiency and auto-immunity. *Autoimmun. Rev.*, **2**, 364–369. Ismail, A.A. and Snowden, N. (1999) Autoantibodies and specific serum proteins in the diagnosis of rheumatological disorders. *Ann. Clin. Biochem.*, **36**, 565–578.
Journal articles where the name of the author is not given *[for example, editorial comment or review, or in popular journals]*	(Author unknown, year)	In a recent article in *The Railway Magazine* (author unknown, 2009)	Publication name (year of publication) Article Title. *Journal name,* **volume number** (issue number) [*as available*], page numbers of article.	*The Railway Magazine* (2009) £1bn electrification plan for Scotland. *The Railway Magazine*, **155**(1302), 6.
Newspapers (named author)	Author(s) (year) ***or*** (Author(s), year)	Boseley (2009) in a recent report in the press … As recently reported in the press (Boseley, 2009) …	Surname(s), initial(s) (year of publication) Article title. *Newspaper name,* supplement title [*where applicable*], date of publication, page numbers of article.	Boseley, S. (2009) Doctor to go before medical council over claims of 'ghost writing' for US drug company. *The Guardian*, 19th September, p.8.
(unknown author)	(Author unknown, year)	A recent press report (author unknown, 2009)	*Newspaper name* (year of publication) Article title. *Newspaper name,* supplement title [*where applicable*], date of publication, page numbers of article.	*Manchester Evening News* (2009) Fears over 'deadly' herbal remedy. *Manchester Evening News*, 6th October, main edition, p.30.

Table 2.2 (*Continued*)

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
Paper delivered at conference (published)	Surname of author (year of publication) ***or*** (surname of presenter, year of publication)	In a report of research delivered recently, Dawson and Overfield (2005) … The conference report included details of a recent study (Dawson *et al*., 2009) …	Surname(s), initial(s) (year of publication) Conference paper title. In name of organisation. Conference title [*including annual conference number, if stated*], volume number [*where applicable*], Location of conference [*including venue and city*], date of conference. Editor's (or chair's) surname, initial [*where available*]. Place of publication: publisher, page number(s) of article.	Dawson, M.M. and Overfield, J.A (2005) Plagiarism: do students know what it is? In Proceedings of the Science Learning and Teaching Conference 2005, University of Warwick. Published jointly by the Higher Education Academy Subject Centres for Bioscience, Materials and Physical Sciences, pp. 166–167.
Paper delivered at conference (not published)	Surname of author (year of conference) ***or*** (surname of presenter, year of conference)	In a paper detailing research delivered recently at a conference, Dawson *et al.* (2009) … A recent conference report included details of a study (Dawson *et al.*, 2009) …	Surname(s), initial(s) (year of conference) Conference paper title. Paper presented at Conference title. Location of conference [*including venue and city*], date of conference.	Dawson, M.M., Forsyth, R. and Ready, R. (2009) *Developing cross-institutional communities of academic practice – from Groundhog Day to The Wizard of Oz*. Paper presented at HEA Annual Conference, Manchester, 30th June, 2009.

Guest presentation	Surname of presenter (year of presentation) ***or*** (surname of presenter, year of presentation)	In a presentation of research delivered recently, Dawson and Overfield (2008) … A recent presentation lecture included details of a new study (Dawson and Overfield, 2008)	Surname(s), initial(s) (year of presentation) Lecture title. Paper presented at Conference title. Name of institution where the presentation took place, city, date of presentation.	Dawson, M.M. and Overfield, J.A. (2008) Teaching students what plagiarism is. Paper presented at the HEA Centre for Bioscience event 'Preventing and Designing out Plagiarism', University of Leicester, 8th April 2008.
Government papers and other official sources both in the UK and elsewhere (such as WHO and UNESCO)	Department/ Organization name in full [*on first use*], followed by abbreviation and year of publication. Sometimes the report will generally be known by the name of the enquiry's chair.	In a recently published review, Leitch (2006) …	Government Department/ Organization (year of publication) *Title*. Cmnd. Official reference number [*where available*]. Place of publication: publisher (name of chair, and 'Report' or 'Review' [*as appropriate*].	HM Treasury (2006) *Review of Skills: Prosperity for all in the Global Economy – World-Class Skills*. London: HMSO (Leitch Review).
Government department notes or information papers	Department/ Organization name in full [*on first use*], followed by abbreviation and year of publication.	In a note published by the Parliamentary Office of Science and Technology (POST) (2002) …	Government department/ organization (year of publication) Article title. Series title [*where appropriate*], Volume number/Issue number) [*where applicable*], page number(s) of article. Place of publication: publisher.	Parliamentary Office of Science and Technology (POST) (2002) Peer review. Postnote, No. 182. London: POST.
Thesis/Dissertation	Author's surname (year of submission)	Recent research undertaken by Dawson (1976) …	Surname(s), initial(s) (year of submission) Thesis title. Degree submitted for. Name of awarding institution.	Dawson, M.M. (1976) *Humoral Immunity in Human Neoplasms*. PhD. University of Manchester.

Table 2.3 How to reference: electronic and multimedia sources

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
Electronic books on disk	*As for printed books*	*As for printed books*	*As for printed books*	*As for printed books*
Consulted through the web	Surname(s) (year) ***or*** (surname(s), year)	The advice of Barass (1984) … Students are generally advised that … (Barass, 1984)	Surname(s), initial(s) (year of publication) *Title*. Series title and number, edition [*where applicable*] [e-book]. Place of publication: publisher. Available from: URL [date of access]. ***or*** [date of access] URL.	Barass, R. (1984) *Study! A Guide to Effective Study, Revision and Examination Techniques* [e-book]. London: Chapman & Hall. Available from: http://books.google.co.uk/books?id=FIg9AAAAIAAJ&dq=Barrass+Study!+a+guide&printsec=frontcover&source=bl&ots=JZhYnyLMn4&sig=jZ4rqt607tsellyhNAHWMuUVRHw&hl=en&ei=pkO3SuGnNIef4gammYx9&sa=X&oi=book_result&ct=result&resnum=3#v=onepage&q=&f=false [Accessed September 2009].
Electronic journals on disk	*As for printed journals*	*As for printed journals*	*As for printed journals*	*As for printed journals*
Consulted through the web	Surname(s) (year) ***or*** (surname(s), year)	Chernin (1988) gives a brief history … The history of the Harvard style … (Chernin, 1988)	Surname(s), initial(s) (year of publication) Article title. *Journal name* [online], **volume number** (issue number) [*as available*], first and last pages. Available from: URL [date of access]. ***or*** [date of access] URL.	Chernin, E. (1988) The 'Harvard system': a mystery dispelled. *BMJ* [online], **297**, 1062–1063. Available from: http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1834803&blobtype=pdf [Accessed September 2009]. Also available from: http://www.bmj.com/cgi/pdf_extract/297/6655/1062 [Accessed October 2009].

Newspapers	*As for printed version*	Corrigan (2009) in a recent report in the press … In a report of academic plagiarism (Corrigan, 2009) …	Surname(s), initial(s) (year of publication) Article title. *Newspaper name* [online], Supplement name [*where applicable*], publication date, page numbers of article. Available from: URL [date of access]. ***or*** [date of access] URL.	Corrigan, C. (2009) Is academic plagiarism being hidden'*The Guardian* [online], Education Guardian, 28th July, p.3. Available from: http://www.guardian.co.uk/education/2009/jul/28/academic-plagiarism [Accessed August 2009].
Articles from websites (where the author is named)	Surname(s) (year) ***or*** (surname(s), year)	Loy (2002) gives a brief account of the dispute between Newton and Leibnitz … The dispute between Newton and Leibnitz (Loy, 2002) …	Surname(s), initial(s) (year of publication) *Title* [online]. Available from: URL [date of access]. ***or*** [date of access] URL.	Loy, J. (2002) *Newton vs. Leibnitz* [online]. Available from: http://www.jimloy.com/calc/newtleib.htm [Accessed August 2009].
(where the author is not named)	Organization (year) ***or*** (organization, Year)	The NHS (2008) has dismissed claims that autism is linked to the MMR vaccine … Claims that autism is linked to the MMR vaccine have been dismissed (NHS, 2008) …	Organization (year of publication) *Title* [online]. Available from: URL [date of access]. ***or*** [date of access] URL.	NHS (2008) *MMR vaccine 'does not cause autism'* [online]. Available from: http://www.nhs.uk/news/2007/january08/pages/mmrvaccinedoesnotcauseautism.aspx [Accessed August 2009].

Table 2.3 (*Continued*)

Type of source referred to in text	Citation format	Citation example	Reference format	Reference example
Databases	Organization that has the database (year) ***or*** (Organization that has the database, year)	Data from the European Bioinformatics Institute (part of the European Molecular Biology Laboratory) (EMBL-EBI) (2009), newly released … Data from EnsemblPlants, a recently launched a web resource (EMBL-EBI, 2009), …	Organization (year of publication) Database title [online]. Available from: URL [date of access] ***or*** [date of access] URL.	The European Bioinformatics Institute (EMBL-EBI) (2009) EnsemblPlants [online]. Available from: http://plants.ensembl.org/index.html.
DVDs/ Videocassettes	Title (*abbreviated if necessary*) (year of distribution)		*Title of DVD/Videocassette* (year of distribution). Directed by [DVD] or [Videocassette]. Place of distribution: distributing company. *[If it has been saved from a TV programme give the name of the TV channel (for example, BBC4) and date of broadcast]*	*Testament of Youth*. (1996) Directed by Armstrong, M. [Videocassette]. London: Acorn Video.
Online images or photographs	Surname/ organization (year of publication)	Firefly Luciferase degradation slowed by inhibitor compound (see illustration: Ades and Auld, 2009)	Surname(s), initial(s) (year of publication) *Image title or description* [online image]. Available from: URL [date of access]. ***or*** [date of access] URL.	Ades, J. and Auld, D. (date unknown) *Firefly Luciferase Degradation Slowed by Inhibitor Compound* [Online Image]. Available from: http://www.genome.gov/Images/press_photos/highres/20149-300.jpg [Accessed October 2009].

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Watson, J.D. and Crick, F.H.C. (1953) A structure for Deoxyribose Nucleic Acid. *Nature*, **171**, 737–738.

Further reading

Bioscience Horizons, a national e-journal for the publication of undergraduate research. Available from: http://biohorizons.oxfordjournals.org/.

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The Vision Learning Website, which is supported by the US Department of Education, has a number of very useful articles. Available from: http://www.visionlearning.com/).