Writing a Literature Review

Searching the Literature

How should I look for literature that might be useful?

a. **How much literature is out there?**

The answer is - lots! Even though the large Medline database indexes around 5000 journals, this is still less than 25% of the journals in the biomedical literature.

1. **What sorts of literature are there?**

Primary and secondary literature

It is always more desirable to use primary sources whenever possible. **Primary sources** in science are usually in the form of articles published in reputable journals. **Secondary sources** include textbooks and review articles. Like your literature review, secondary sources do not contain new information. A look at secondary sources is often a good move when starting a literature review, but you never rely solely on secondary sources and always review the primary sources as a check against possible errors.

Primary literature, and most secondary literature, is subject to a strict quality-control process called **peer-review** . Papers that you will eventually produce from your research project will also be subject to this process.

Grey literature is a term used to describe such things as government reports, reports from short-term consultancies, internal planning documents etc. Conference proceedings and theses also come into this category. Grey literature is rarely peer-reviewed, is rarely found in regular academic libraries, and copies can be very difficult to obtain. It is best to avoid the grey literature. Any worthwhile information in the grey literature is likely to be published by its authors in the primary literature eventually.

Web sites other than those associated with mainstream academic literature. Huge quantities of information and mis-information can be found on the Internet.

1. **How should I look for literature?**
    - Ask your supervisor (This will be the first thing to do, but quite soon you should be independently finding literature your supervisor might be unaware of).
    - Look at a few secondary sources - recent published reviews or textbooks (does it worry you that somebody might have published a review paper that covers your topic exactly?).

- At this stage, define the scope of your literature review as clearly as you can. Expect to continually refine this as you progress with your work. You should already have enough information to come up with a series of questions or topics that can be used as tentative headings. You should also make a list of keywords that might apply to your topic, and also a list of names of relevant authors.
- Now launch into the primary literature. Nowadays, this is most easily done using online databases such as *Web of Science, Biological Abstracts* and the like. Search using appropriate keywords and names of relevant authors. **Refine your lists of keywords and authors as you go**. Examine papers that you find and note what keywords they use that could be added to your list.
- Record (see below) papers that look relevant. Scan the reference list in each of these and record papers listed there that seem important. Using *Web of Science*, you can also trace the use of published papers forward in time by looking to see what papers have cited the one you specify. As one outcome of this process, you will soon recognise that a number of highly-cited articles exist that you must read.
- Obtain copies (paper copies or pdf files or whatever) of papers you think should be important, and start reading!

2. **How far back into the past should I track the literature?**

There is no set answer. In many biomedical fields, papers written 5-10 years ago are already hopelessly out of date. In other fields, such as ecology and systematics, papers written 50 years ago might still have relevance. Be guided by the ages of references cited in recent review papers.

3. **For how long into the future should I track the literature?**

This might seem like an odd question! However, if you prepare a literature review at the start of your research project, you should not assume that you have finished with the literature for ever. You will need to follow current thought and findings in your field and bring the literature review completely up to date at the time you submit the thesis. Use resources such as Web of Science to see who is citing important papers. Various "current awareness" services are also available.

Reading and Organising the Literature

How should I approach the reading and organisation of what I have found?

You can very quickly acquire a huge pile of papers, each of which seems to be trying to point you in a different direction. You might feel confused and irritated by all of this and wonder how to make any sense of it. At this point, **getting organised** is vital. You should obtain bibliographic software such as **Endnote** (JCU has a site licence) and enter into it all the papers you find. This can be simplified by downloading records in Endnote format from online databases. However, manual entry is useful, because it forces you to take a first look at each paper. You should also decide on a storage system for physical or digital copies of papers that allows you to find them again. Some people file papers according to topic, but it is probably better to file papers alphabetically by author.

Now you are ready for the hard work, in which your bibliographic database will be a constant companion, guide and ally. Expect also to be constantly modifying keywords and phrases in your database. The three-part approach below is modified from the University of Queensland website

Making sense of the literature - first pass

At this stage there may seem to be masses of literature relevant to your research. Or you may worry that there seems to be hardly anything. As you read, think about and discuss articles and isolate the issues you're more interested in. In this way, you focus your topic more and more. The more you can close in on what your research question actually is, the more you will be able to have a basis for selecting the relevant areas of the literature. This is the only way to bring it down to a manageable size.

Very little there?

If initially you can't seem to find much at all on your research area - and you are sure that you've exploited all avenues for searching that the library can present you with - then there are a few possibilities:

- You could be right at the cutting edge of something new and it's not surprising there's little around.
- You could be limiting yourself to too narrow an area and not appreciating that relevant material could be just around the corner in a closely related field.
- Unfortunately there's another possibility and this is that there's nothing in the literature because it is not a worthwhile area of research. In this case, you need to look closely, with your supervisor, at what you plan to do.

First Impressions

When first exploring a field of research new to you, it is useful to skim the literature in an intelligent way. At this stage, read only the abstract, introduction and discussion from each paper (don't worry yet about the "how" of the work). This allows you to identify the **ideas**, **theories**, **questions** and **controversies** that underlie each piece of work. Design keywords or phrases that identify each question, and enter these in your bibliographic database for each paper. This will allow you later to retrieve all papers that tackle a particular question. Details of exactly **how** the various questions were tackled, as outlined in methods and results sections, can wait for a later reading of the paper.

Quality of the Literature

This begins your first step in making sense of the literature. You are not necessarily closely evaluating it now; you are mostly learning through it. But, sometimes at this stage students want to know how they can judge the quality of the literature they're reading, as they're not yet experts.

You learn to judge, evaluate, and look critically at the literature by judging, evaluating and looking critically at it. Sound like a circular argument? Well, you learn to do so by practising. There is no quick recipe for doing this but there are some questions you could find useful and, with practice, you will develop many others:

- Is the theoretical basis transparent?
- Was the research influential in that others picked up the threads and pursued them? (i.e. has the paper been cited frequently?)
- Is the problem clearly spelled out?
- Are the results presented new?
- How large a sample was used?
- How convincing is the argument made?
- How were the results analysed?
- What perspective are they coming from?
- Are the generalisations justified by the evidence on which they are made?
- What is the significance of this research?
- What are the assumptions behind the research?
- Is the methodology well justified as the most appropriate to study the problem?

In critically evaluating, you are looking for the strengths of certain studies and the significance and contributions made by researchers. You are also looking for limitations, flaws and weaknesses of particular studies, or of whole lines of enquiry.

Make sure that your evaluation of each paper is recorded in your bibliographic database in a consistent way.

In particular, you might want to keep a list of standard keywords pinned to the wall beside your desk

Making sense of the literature - second pass

You continue the process of making sense of the literature by further reading, re-reading and digesting of what you have read. This will allow you to become more confident and much more focused on your specific research.

You're still reading and re-reading the literature. If you are already doing research towards your thesis, you're thinking about it as you are doing your experiments, conducting your studies, analysing texts or other data. You are able to talk about it easily and discuss it. In other words, it's becoming part of you.

At a deeper level than before,

- You are now not only looking at findings but are looking at how others have arrived at their findings.
- You're looking at what assumptions are leading to the way something is investigated.
- You're looking for genuine differences in theories as opposed to semantic differences.
- You also are gaining an understanding of why the field developed in the way it did.
- You have a sense of where it might be going.

First of all you probably thought something like, "I just have to get a handle on this". But now you see that this 'handle', which you discovered for yourself, turns out to be the key to what is important. You are very likely getting to this level of understanding by taking things to pieces and putting them back together.

For example, you may need to set up alongside one another four or five different definitions of the same concept, versions of the same theory, or different theories proposed to account for the same phenomenon. You may need to unpack them thoroughly, even at the very basic level of what is the implied understanding of key words (for example 'concept', 'model', 'principles' etc.), before you can confidently compare them, which you need to do before **synthesis** is possible.

Or, for example, you may be trying to sort through specific discoveries which have been variously and concurrently described by different researchers in different countries. You need to ask questions such as whether they are the same discoveries being given

different names or, if they are not the same, whether they are related. In other words, you may need to embark on very detailed analyses of parts of the literature while maintaining the general picture.

Record your views on each paper in your bibliographic database. By now you should have an idea of what headings you might use in your final review, and you could use these headings as keywords/keyphrases in your database.

Making sense of the literature - final pass

You make sense of the literature finally when you are looking back to place your own research within the field. At the final pass, you really see how your research has grown out of previous work. So now you may be able to identify points or issues that lead directly to your research. You may see points whose significance didn't strike you at first but which now you can highlight. Or you may realise that some aspect of your research has incidentally provided evidence to lend weight to one view of a controversy. Having finished your own research, you are now much better equipped to evaluate previous research in your field.

Writing the review

This section is based on material gathered from:
State University of New York Institute of Technology
Calvary University
University of Queensland

Now for the hard part - the writing!

From this point when you have finished your own research and you look back and fill in the picture, it is not only that you understand the literature and can handle it better, but you could also see how it motivates your own research. When you conceptualise the literature in this way, it becomes an integral part of your research.

It is a purposeful kind of writing which should be

- Well argued.
- Well supported by evidence.
- Well documented.

A straightforward style - neither informal and chatty, nor stuffy and pompous - is what to aim for. Use clear and unadorned English appropriate for your audience. Therefore, use the jargon of your discipline only when it is necessary. **Don't** build a smokescreen of impressive sounding phrases to mask what it is you are saying.

You know from your own experience that very complex ideas in your own field can be and are expressed very clearly by good scholars in your discipline. While you are reading for your research, take note of particularly well-written articles. But also be aware of the kind of writing which frustrates you as a reader and obscures the point.

You need to be aware of who it is you are writing for. **You are not writing for your supervisor**, who should know what you are doing, but for someone who may need to be reminded of some background and who, at the very least, needs you to signpost the importance of the various parts.

You also need to think about what it is you are actually doing; are you describing something, analysing something, explaining something, arguing the point, giving examples, evaluating or assessing the value of other arguments or the sufficiency of evidence? What you are doing affects the language you use. In particular, the verbs you use need attention because they convey your attitude. Very often students don't exploit verbs fully, relying on just one or two favourites (for example 'mentions', 'states', 'suggests', 'discusses') or overworking the weaker verbs ('have', 'be'). However, verbs such as 'judges', 'postulates', 'excludes', 'convinces', 'confuses', 'questions', 'advances (the argument)', 'verifies', provide a stronger interpretation of your reading, understanding, and opinion of the research.

Apart from questions of who your reader is and what it is you are doing, matters of style need to be considered. Here are the three most commonly asked about:

Use of the personal pronoun

Some people frown on the use of 'I'. Acceptance of its use has become more common in some disciplines. Even if 'I' is acceptable, however, its use has to be controlled, as you are not the subject of the literature review or thesis. Therefore, regardless of the practice, there will necessarily be large parts of the text in which the problem never arises. Check with your department or supervisor and take your cue from publications and theses in your academic area. If you do decide to avoid the use of 'I' at all, don't substitute 'we' and don't move into pompous circumlocutions such as 'the author' or the 'present writer'. Whatever your decision about this issue, be consistent in your usage.

Active vs passive voice

Both active and passive voice should be used - where appropriate. As a general rule, use active voice unless there is good reason not to. For example, if "The results support the theory" is the active, and the passive is "The theory is supported by the results", then we would select one or the other version depending on whether we were stressing the results or the theory. Alternatively we might choose one or the other phrasing to finish the sentence in such a way as to link it to what followed. Otherwise, choose the active as more direct. This is a very simple example, of course, and the distancing effect

of the passive here is not great. However, in more complex examples, and also where a series of passives piles up, the reader fights unnecessary obstacles.

The use of tenses

Many students cling to an absolute dictum about what tense to use. Their beliefs seem to divide equally between total dedication to the use of the present and total dedication to the use of the past. The tense that suits your purpose is the tense you use. Clearly, an event , be it a survey, an experiment, a study of some kind, done by other researchers or by you, has to be in the past and it is usual to use the past tense to describe it. However, the interpretations or ideas arising from this might still hold and it is usual to talk about them in the present. Even though someone has written an article a decade ago, the article still exists, is currently part of the living knowledge of your discipline, and your reaction to it is happening now. There is even the possibility that you could be predicting something for the future, so the manipulation of time changes again to fit the situation. For example,

Smith (1965) reports/reported [which do you prefer?] a study conducted on bees which used White's (1953) radical artificial insemination technique. These data are still the most convincing to support Brown's (1996) hypothesis that bees would respond well to intensive bee husbandry.

Shades of meaning conveyed by different tenses can be very subtle. Compare the following:

Darwin (1858) calculated that earthworms turn over x tonnes of soil per hectare. **Or**,

Darwin (1858) calculated that earthworms turned over x tonnes of soil per hectare.

The goal is to achieve a clear, logical style. Clear writing, however, is usually the result of lots of rewriting and careful attention to what it is you really want to say. Clear writing is not the result of obedience to prescriptive rules. **Seldom does clear writing come about in the first or even the second draft**. It takes work to remove clutter and to fill missing links but the results make the work worthwhile.

Discipline-specific terminology

Don't be ashamed to use such terminology, but remember its purpose is to help you to avoid long and complicated explanations where a technical term exists that can shorten the text.

Plagiarism

Plagiarism is the use of another person's work **without acknowledgment**. Examples include:

- Direct duplication, by copying (or allowing to be copied) another's work. This includes copying from a book article, web site, or another student's assignment (whatever - you should rarely or never quote directly).
- Paraphrasing another person's work with minor changes, but keeping the meaning, form and/or progression of ideas of the original.
- Piecing together sections of the work of others into a new whole.
- Submitting an assignment that has already been submitted for assessment in another subject.
- Presenting an assignment as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor.

How can you avoid the charge of plagiarism? Basically, whenever you make a statement or present a fact or idea that you have obtained from the literature, you should cite the relevant paper(s). Citations appear in the body of the text usually in the following form:

Smith and Jones (1997) said clearly that ..
Some authors (e.g. Smith and Jones, 1997) are of the opinion that ...

The bibliography at the end of your literature review then provides full details so that others can find and read the original papers. Look at "Instructions to Authors" on the website for your favourite journal for an indication of typical bibliographic style for your field.

Compare:

Reyes, A., Gissi, C., Pesole, G. & Saccone, C. (1998). Asymmetrical directional mutation pressure in the mitochondrial genome of mammals. *Molecular Biology & Evolution* 15, 957-966.

With:

Reyes, A et al . (1998). *Mol Biol Evol* 15, 957.

Don't write a list, write a synthesis and a critique.

Compare:

Smith (1970) reported that bilbies come out at night and eat chocolates. Jones (1972) described the variety of beetles eaten by bilbies on their daytime trips. Wheeler (1974) claimed that bilbies eat only apples.

With:

There has been considerable disagreement over the diurnal activity rhythms and food of bilbies. Smith (1970) found them to be nocturnal whereas Jones (1972) reported that they are daytime foragers. Smith (1970) also reported a fondness for chocolate, a finding rejected by Jones (1972) and Wheeler (1974) who however disagreed with each other, Jones describing beetles and Wheeler apples as the preferred food. Given findings from related animals it is hard to believe that either daytime foraging or feeding on chocolates or apples (neither of which is indigenous to the area) could be correct interpretations. The questions of foraging times and the food sought thus remain to be adequately investigated.

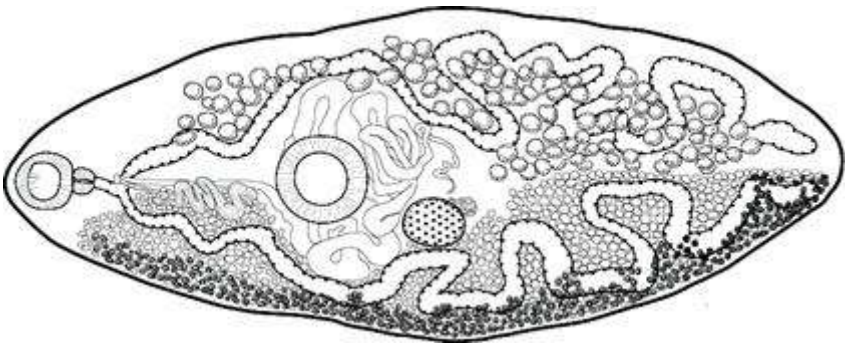
Be clear about what is important

It is easy for students to "hide" important information when writing. This may be a result of lack of confidence ("I think this point is important, but I won't emphasise it in case it's not") or of failure to recognise what is important through inexperience. If you feel a point really is important, then tell the reader so. Refer forwards and backwards to important points ("see previous section").

If your literature review is part of a thesis, or is being written before tackling a specific research question, make sure it is organised in a relevant manner.

Use of figures and tables

One picture is worth a thousand words? Sometimes it is. How many words would you need to describe the figure below?



Figures and graphs are also good ways of presenting data from a wide range of papers without having to write pages of boring text.

Writer's block

The phrase 'writer's block' covers a variety of situations. Absolute writer's block - that is, where someone literally can't write anything at all, not even a note to a friend or a shopping list, for example - is very rare. If this is the case, then possibly you need to

work individually with someone like a counsellor or learning adviser. However, 'writer's block' usually means something less extreme. The way to overcome it is to look at what is causing it. It could be that:

- *Considering the whole finished literature review paralyses you*. If this is the case, just think of the review as a series of short exercises. You then work on these smaller, identified parts. Often when you come across complex ideas and need to make them clear and linked to your argument, you should be working seriously just on a single paragraph.
- *Working on specific small parts has fragmented the whole and has caused you to lose the thread of what you want to say*. This can manifest itself in trying to rearrange the pieces in several ways, cutting and pasting, and, although being very busy, never feeling satisfied with the result. It is important to stop being busy and spend time to recover the plot or story and rebuild the logical framework. You could write down the main points in your argument - for example the aims, what you did, what you found, what it means - and then fill in from this, as it were, adding the detail to each part, feeding your content more and more into a structure without losing the bigger picture.
- *You are searching for the 'right way', the formula, and are overawed by writing rules*. There is no right way or formula: grammar, punctuation and style can take their turn much later. Don't try to juggle worrying about what it is you are going to say, what the reader's needs might be, the best word to choose, whether you have the tense right, and when to use the semi-colon - all in the first draft. Accept the fact that you will be writing several drafts and take the pressure off the first one by **concentrating only on your ideas**. Rewriting is a major part of writing. Allow the time for this.

Writing is a complex and slow process. Expecting it to flow effortlessly because you are writing about something you know and understand well is a mistake that can rob you of confidence. Here are two suggestions. If you are 'blocked', have a cup of coffee or walk around the room/campus/whatever. Then try again. If that doesn't work, then just write anyway. Force yourself to put words on paper for, say, 30 minutes without worrying about getting it perfect. Sometimes, at the end of 30 minutes, you might find words are flowing again and you can continue. If not, re-read what you have just written and score out the trash. Keep the few good phrases or ideas for inclusion in the final product.

A Final Checklist

This section is based on material from

University of Melbourne

UCE Birmingham

Selection of Sources

- Have you indicated the purpose of the review?
- Are the parameters of the review reasonable?
- Why did you include some of the literature and exclude others?
- Have you emphasised recent developments?
- Have you focused on primary sources with only selective use of secondary sources?
- Is the literature you have selected relevant?
- Is your bibliographic data complete?

Critical Evaluation of the Literature

- Have you organised your material according to issues?
- Is there a logic to the way you organised the material?
- Does the amount of detail included on an issue relate to its importance?
- Have you been sufficiently critical of design and methodological issues?
- Have you indicated when results were conflicting or inconclusive and discussed possible reasons?
- Have you indicated the relevance of each reference to your research?

Interpretation

- Has your summary of the current literature contributed to the reader's understanding of the problems?
- Does the design of your research reflect the methodological implications of the literature review?

Note

- The literature review will be judged in the context of your completed research.
- The review needs to further the reader's understanding of the problem and whether it provides a rationale for your research.

Useful links:

Conducting a Literature Review from the University of Melbourne
http://www.lib.unimelb.edu.au/postgrad/litreview/home.html

Guide to Doing a Literature Review from James Cook University School of medicine and Dentistry
http://www.jcu.edu.au/medicine/idc/groups/public/documents/guide/jcudev_011820.pdf

Preparing Scholarly Reviews of the Literature: A Webtorial from George Washington University
http://www.gwu.edu/~litrev/

Review of Literature from University of Wisconsin-Madison
http://www.wisc.edu/writing/Handbook/ReviewofLiterature.html

Writing a Literature Review from the University of Canberra
http://www.canberra.edu.au/studyskills/writing/literature

Writing Literature Reviews from Monash University
http://www.monash.edu.au/lls/llonline/writing/general/lit-reviews/index.xml

All sorts of stuff about writing - mainly of theses
http://www.learnerassociates.net/dissthes/

Word usage in scientific writing
http://www.ag.iastate.edu/aginfo/checklist.php

Information about Endnote from the JCU library

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See Also:

http://www.canberra.edu.au/studyskills/writing/literature

https://www.dlsweb.rmit.edu.au/lsu/content/2_AssessmentTasks/assess_tuts/lit_review_LL/writing.html