Scientific Literature Review
Overview:

1. What is a Scientific Literature Review?
2. How to write a Scientific Literature Review
3. Structuring a Coherent Literature Review
4. Literature Review example
What is a Scientific Literature Review?
A scientific literature review is a **CRITICAL** account of what has been published on a topic by accredited researchers.

It may be:

- A stand-alone piece for publication
- An introduction to a thesis
- Part of postdoctoral research/grant proposals
A scientific literature review should:

- Provide a **clear statement** of the topical area – *scope*?

- Provide a **range of research** on the topic – and not just the “good” data!

- **Critically analyse** a selected topic using a published body of knowledge – *evidence-based arguments*

- Provide an indication of what **further research** is necessary

- Identify areas of **controversy** in the literature

- Conclude with **new insights and perspectives**
A scientific literature review is *not*:

- An English essay… use *scientific writing skills*
- A *summary* of each research article that you read
- Based on personal opinion or *biased* towards your research hypotheses
- A *chronological history* of events in your research area
Scientific Literature Review:

What is the purpose of a literature review?
What is the purpose of a literature review?

To support the advancement of scientific knowledge!

- Scientific knowledge is not static: reviews help scientists to understand how knowledge in a particular field is changing and developing over time

- There is a significant output of scientific publications – literature reviews save time for the scientific community

- Literature reviews can lead to new scientific insights and highlight gaps, conflicting results and under-examined areas of research
How To Write A Scientific Literature Review?
Scientific Writing!

...is writing about scientific topics aimed at specialists in a particular field

Assume the reader is familiar with the research/topic area but not with the specifics of your review…

i.e. your Principal Investigator
    internal/external examiners
    peer-reviewers (journal articles, research papers, book chapters, grant proposals)

Use precision, clarity and objectivity!
Scientific Writing!

1. Be precise!

Ambiguities in writing cause confusion and may prevent a reader from grasping key concepts of your review…

- Use precise concrete language, no ambiguity
  eg ‘correlated’ ≠ ‘related’

- Exclude similes/metaphors (and humour!)

- Be quantitative wherever relevant (stats, methodological details etc.)
Scientific Writing!

2. Be clear!

Concepts in the sciences can often be complex; without clarity the reader may be confused or misled

- Simple language – no unnecessary “frills” (distractions)
- Pay attention to sentence structure, grammar

Your reader will be interested based on the science only… make it easy for them to access!
Scientific Writing!

3. Be objective!

Any claims that you make need to be based on facts, not intuition or emotion

- **Passive voice** – focus is on the literature!

- Avoid **assumptions** or premature conclusions

- Be aware of **research limitations** and refer to these in the review
How to Write a Scientific Literature Review?

Reviewing the literature requires four stages:

1. **Problem formulation** – Defining your scope. Which topic is being examined and why? What aspects will be included/excluded?

2. **Literature search** - Identifying relevant research

3. **Critical analysis** – Criticise the experts; identify conflicting evidence, assumptions, errors and misconceptions

4. **Evaluation** – which authors are most convincing and provide the most significant scientific contribution? Have I conducted a fair and objective literature review?
1. Problem Formation

Ask yourself questions like these:

- What useful reviews are **missing** or not up to date in my research area?
- What new review topic would be **useful** to scientists?
- Is there a **specific aspect of this topic** that my literature review might help to define?

*eg. critically comparing different methodological approaches, contrasting evidence, assessing therapeutic potential, etc.*

- What is the **scope** of my literature review? *Be specific*
2. Literature Searching

1. Online Research (basic) – Background Information
   - Wikipedia (gasp!)
   - Relevant “background” websites (eg. university/company websites, associations eg. American Heart Association)
   - YouTube, TED Talks

2. General Literature Search – Literature Overview
   - Google Scholar/Books
   - PubMed
   - …find other relevant literature reviews in your chosen format (journal etc) for tips on structure and content

3. Specific Literature Search – The Detail
   - Library databases e.g. Web of Science
   - “Advanced search” tool in Google Scholar/PubMed

*Keep track of your references as you go!*
3. Critical Analysis

In assessing each source, consideration should be given to:

- **Provenance** - Author's credentials? Are the author's arguments supported by evidence?

- **Objectivity** - Is the author's perspective fair? Is contrary data considered? Is information ignored to prove the author's point? (bias)

- **Persuasiveness** – Is the author’s data convincing?

- **Value** - Does the work contribute in a significant way to an understanding of the field?

...this involves CRITICAL THINKING!
What is critical thinking?

Cottrell (2016):
“The process of looking at ideas and information critically, taking nothing for granted, but questioning accuracy, motivation and inferences, and seeking new understanding, connections and insights.”

i.e. weighing up the evidence and arguments for or against something, and coming up with your own informed opinion.
Ask questions!

- “Is that really true?”
- How do you know?
- Show me the evidence.
- Is that evidence reliable?”

“There is evidence on both sides”

Red Model based on the Watson-Glaser™ Critical Thinking Appraisal at www.ThinkWatson.com
Critical Thinking…

Move from Description to Analysis!

Description – reproducing information
• Summarising texts - accepting details, results etc.

Analysis – deconstructing information in order to:
• Challenge assumptions; perspectives
• Show limitations in studies, exceptions to cases
• Highlight under-examined aspects of research
Key aspects of critical thinking

• Identify evidence to back-up AND challenge key points

• Detecting inconsistencies and mistakes in authors’ reasoning

• Detecting bias, premature conclusions, lacking evidence

• Distinguishing between fact and opinion

• Evaluating conflicting opinions/research

• Suggesting new or different solutions

• Constructing your own arguments and opinions
What should I be asking?

• Why is the author choosing to use the evidence presented?
• Is there a hidden agenda? *(eg. financial gain)*
• Are the sources reliable and objective?
• Is there bias present?
• Have all of the points been cited?
• Is there information missing?
• Are there conflicting opinions/conclusions?

And most importantly….

• *Do I agree with these opinions/conclusions?*
Critical Thinking…

This is the most important aspect of a good literature review!

Critical thinking is what elevates your writing from a simple summary of the literature to a contributory piece of scientific knowledge…

…your analyses of the literature is valuable!!!
4. Evaluation and Interpretation

- What **conclusions** can I make from the most convincing literature? What are my opinions/arguments?

  **Also evaluate your own interpretations…**

- Have I made a well-informed decision? How good was my **information seeking**? Has my search been **wide** enough to ensure all relevant material is included? Has it been **narrow** enough to exclude irrelevant material?

- Have I **critically analysed** the literature I use?
- **Instead of just listing and summarizing research, do I assess them, discussing strengths and weaknesses?**

- Have I cited and discussed studies **contrary** to my perspective to form a well-balanced argument?
Structuring Coherent Literature Reviews
Coherent Scientific Literature Reviews

Aim for:

• **Clear and cohesive** communication and analyses

• Tackle **one key point** at a time

• Use **subheadings**, especially in long reviews

• Check the **flow** of your argument for coherence (logical order?)

…it is all about **STRUCTURE**!
How to structure a scientific literature review?

- **Introduction**: An overview of the topic under consideration, along with the objectives of the literature review.

- **Main body**: Critical analysis and evaluation of topically relevant research/data

- **Conclusion**: Summarise the key points and conclusions from your review

**Word count:**

- Introduction = 10%
- Main Body = 80-85%
- Conclusion = 5-10%
Before you start writing…

1. **Brainstorm your review topics**
   What aspects of your topic do you want to focus on? *(Problem formulation)*

2. **Decide on the number of “topics” you will address based on your remaining word count (80%)**
   Set aside 15-20% word count for Intro/Conclusion
   Of the most interesting/relevant topics… how many can you address in the allocated word count? Prioritise!

3. **Choose your topics**
   Scan the literature, make sure there is enough information out there for you to complete a coherent, critical summary of each chosen topic… *reassess step 2 if necessary*
It is usually easier to write this after the main body…

Introduce your topic by highlighting the **core scientific facts** that are well backed up and widely accepted.

Highlight the **importance** of the review – are you assessing potential clinical relevance? A new research perspective?

What is the **core aim** of this review? To compare and contrast conflicting evidence? To identify under-examined aspects of the topic?

Tell the reader **what you are going to talk about… list your topics in order!**
2. Writing the Main Body

- Start with the **most broad** topic and increase **specificity** as you work through.
- Focus on **recent** data where possible – scientific fact changes/develops over time!
- Summarize individual studies or articles with as much or as little detail as is relevant – detail denotes significance!
- Tackle **one key point per paragraph** so as not to overwhelm the reader.
- Use **sub-headings** to group similar/related topics.
- Use diagrams, figures, tables where appropriate.
## INTRO
10% of word count
Go from the broad to the specific. Introduce the general topic, why it is an important area, then state what you will specifically do to investigate it further.

<table>
<thead>
<tr>
<th>Section 1</th>
<th>Sub-point 1</th>
<th>Sub-point 2</th>
<th>Sub-point 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 2</td>
<td>Sub-point 1</td>
<td>Sub-point 2</td>
<td>Sub-point 3</td>
</tr>
<tr>
<td>Section 3</td>
<td>Sub-point 1</td>
<td>Sub-point 2</td>
<td>Sub-point 3</td>
</tr>
</tbody>
</table>

## CONCLUSION
10% of word count
Go from the specific to the broad. State the conclusions you can draw from the points you’ve made in the essay, and connect this learning to the general topic. End by posing a question for future research in the field.

You may need to prioritise topics… you can’t cover everything!
...one key point per paragraph!

1. Topic Sentence
   - Start with a strong “umbrella” sentence introducing your key point

2. Supporting Sentences
   - Provide context, examples or data
   - Each point backed up with a source/reference
   - Opposing data should also be considered
   - Use “linker” words to introduce similar points

3. Concluding Sentence
   - Include summary sentence at end of paragraphs… why this information is relevant
   - May include link to following paragraph
1. Writing the Main Body

www.smart-words.org

Agreement / Addition / Similarity

The transition words like also, in addition, and, likewise, add information, reinforce ideas, and express agreement with preceding material.

- in the first place
- not only ... but also
- as a matter of fact
- in like manner
- in addition
- coupled with
- in the same fashion / way
- first, second, third
- in the light of
- not to mention
- to say nothing of
- equally important
- by the same token
- again
- to
- and
- also
- then
- equally
- identically
- uniquely
- like
- as
- too
- moreover
- as well as
- together with
- of course
- likewise
- comparatively
- correspondingly
- similarly
- furthermore
- additionally
- although this may be true
- in contrast
- different from
- of course ..., but
- on the other hand
- on the contrary
- at the same time
- in spite of
- even so / though
- be that as it may
- then again
- above all
- in reality
- after all

Opposition / Limitation / Contradiction

Transition phrases like but, rather and or, express that there is evidence to the contrary or point out alternatives, and thus introduce a change the line of reasoning (contrast).

- but
- (and) still
- unlike
- or
- (and) yet
- while
- albeit
- besides
- as much as
- even though

- although
- instead
- whereas
- despite
- conversely
- otherwise
- however
- rather
- nevertheless
- nonetheless
- regardless
- notwithstanding
Critical Phrases…

http://www.phrasebank.manchester.ac.uk/

Introducing questions, problems and limitations: theory or argument

The main weakness with this theory is that ...
The key problem with this explanation is that ...
However, this theory does not fully explain why ...
One criticism of much of the literature on X is that ...
However, there is an inconsistency with this argument.
A serious weakness with this argument, however, is that ...
One question that needs to be asked, however, is whether ...
Smith’s argument relies too heavily on qualitative analysis of ...
Smith’s interpretation overlooks much of the historical research ...
Many writers have challenged Smith’s claim on the grounds that ...
Smith’s analysis does not take account of X, nor does he examine ...
It seems that Jones’ understanding of the X framework is questionable.
The existing accounts fail to resolve the contradiction between X and Y.
One of the limitations with this explanation is that it does not explain why...

Identifying a study’s weakness

Smith fails to fully define what ...
Jones fails to acknowledge the significance of ...
the author overlooks the fact that X contributes to Y.
what Smith fails to do is to draw a distinction between ...
the paper would appear to be over-ambitious in its claims.
another weakness is that we are given no explanation of how ...
no attempt was made to quantify the association between X and Y.
the main weakness of the study is the failure to address how ...
the study fails to consider the differing categories of damage that ...
the research does not take into account pre-existing ... such as ...
the author offers no explanation for the distinction between X and Y.
Smith makes no attempt to differentiate between different types of X.
2. Main Body: Figures/Tables

• Aim for one key figure/table per section; this can be to:
  - illustrate a complex concept
  - summarise a large body of relevant data
  - describe the order of a process (flow diagrams)

• Legend below image/figure and above table

• Always refer to figures/tables in text… direct the reader to them (as seen in Figure 1; as summarised in Table 1)

• Provide a detailed legend… each figure + legend should stand in its own right without the review text

• Figures and tables provide a break for the reader and a chance to understand and reflect on key concepts!
Writing the Conclusion

- Maintain the focus established in the introduction

- Summarise major research contributions to the scientific field (most convincing data) and make your point of view clear

- Point out major flaws/gaps/inconsistencies in research

- Highlight potential future studies

- Provide closure so that the path of the argument ends with a conclusion of some kind

NOTE: A literature review conclusion in a thesis will lead to the research questions that will be addressed.
Additional Sections….

• Usually, a short **ABSTRACT** (approx. 200 words) is required before your literature text to summarise the topics, main findings and conclusions from your review

• *This tells the reader exactly what your review contains so that they can make an informed decision - if it is relevant or not - before reading the full text*

• **TABLE OF CONTENTS** – show the reader where to find the relevant information

• **ACKNOWLEDGEMENTS** – acknowledge any funding bodies/research groups that contributed to the review writing process

• **CONFLICT OF INTEREST** – you must declare if the *primary interest* of your review may be affected by any *secondary interests* (personal benefit)
Referencing

It is essential to credit published papers for work mentioned in your manuscript…

• In-text
• Reference List/Bibliography – *what is the difference?*

“atherosclerosis has been claimed to be an independent risk factor for cardiovascular death (Detrano *et al.*, 2008)”.


Harvard referencing guide…

*CiteThemRight*…

Zotero referencing manager…

Mendeley/RefWorks – other options

All available from DCU Library website
Referencing

Figures/Tables:

• In-text citation in the figure legend after description
• May need to ask for permission from the publisher – be careful! *(is the image copyrighted?)*
• If figure is adjusted: “image adapted from [source]”

MAKE SURE YOU REFERECE THE SOURCE MATERIAL (original research paper) and NOT A REVIEW OF THE RESEARCH!

Except when you are referencing another reviewer’s opinion/critique etc.

If submitting for publication, check the requirements of the journal… may have a specific referencing format *(eg. Elsevier merge numbering/Harvard systems)*
Concise, informative title

Short abstract – 200 word summary

Table of Contents

Good paragraph length to clearly analyse key topics
Example: Published Review...

Informative/relevant image and figure legend

Clear summary table and table legend
Example: Published Review...

Concluding with key points and future work

Relevant acknowledgements

Lengthy reference list
QUESTIONS

???
Acknowledgements

This presentation was prepared based on the resources kindly made available online by:

• University of Santa Cruz
  http://guides.library.ucsc.edu/c.php?g=119714&p=780881
• University of Toronto
  http://www.writing.utoronto.ca/advice/specific-types-of-writing/literature-review
• University of Minnesota Duluth
  http://www.duluth.umn.edu/~hrallis/guides/researching/litreview.html
• The University of Wisconsin - Madison Writing Centre
  http://writing.wisc.edu/Handbook/ReviewofLiterature.html
• Monash University