How to Write a Good Thesis

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www.bioinf.org.uk/teaching/thesiswriting/

Outline

- What do you want from this session
- Your ideas on a good thesis
- Structuring your thesis
- Writing style
- Writing well
- Writing tools

- Apart from being SMB Graduate Tutor...
- Supervised: 19
- Co-supervised: 30
- Examined: 31

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What do you want from this session?

- Your thoughts?

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- Your thoughts?

- *What, generally, is expected?*

- *"Do"s and "don't"s*

- *How is a thesis different from a paper*

- *How to reduce text (e.g. extended notes)*

- *How to spot typos/errors*

- *What is the average time to write up?*

What do you want from this session?

- What is expected?
  - See the UCL PhD examiners form.
    - https://www.ucl.ac.uk/academic-manual/sites/academic_manual/files/phd_joint_report-2018-19.docx
  - Generally around 200 pages (1.8 line spacing, 12pt font), but very variable
  - A coherant overarching story
- Dos and don'ts
  - We will address these throughout
- How is a thesis different from a paper
  - More discursive – can include what doesn't work as well as what does
- Reducing text and spotting errors
  - We will return to these later
- Average write-up time
  - Always difficult to say, but I would guess ~3 months, but can easily be 6 months and I have known it to be ~1 month. Don't forget to leave time for your supervisor(s) to read it.

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Your ideas on a good thesis

- Your thoughts?

Your ideas on a good thesis

- Your thoughts?
- *Describe all **relevant** work (you don't have to include everything. You might want to add 'extras' in an appendix or as a bound-in paper)*

- *Must be a 'distinct and original contribution' to the field*

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Structuring your thesis

https://www.ucl.ac.uk/students/exams-and-assessments/research-assessments/format-bind-and-submit-your-thesis-general-guidance

- **Title page**

- **Declaration**

- **Abstract**

- **Impact statement**

- Table of Contents, Lists of Tables and Figures, List of Abbreviations, Acknowledgements

- Introduction

- (Methodological introduction) – optional depending on your topic – see later

- (Materials and Methods) – usually replaced by a methodological introduction for bioinformatics

- Results

- Discussion and Conclusions

Structuring your thesis

Title page

- the officially-approved title of the thesis
- the candidates full name as registered
- the institution name 'UCL'
- the degree for which the thesis is submitted

Structuring your thesis

Declaration

- The title page should be followed by a signed declaration that the work presented in the thesis is the candidate's own e.g.

- *'I, [full name] confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.'*

Structuring your thesis

Abstract

- Maximum of 300 words

- Readable by a non-expert

- Summarize

  - Context

  - What was done

  - **What was discovered** (often neglected!)

Structuring your thesis

Impact statement

- https://www.grad.ucl.ac.uk/essinfo/docs/Impact-Statement-Guidance-Notes-for-Research-Students-and-Supervisors.pdf

- No more than 500 words

- Need to be able to articulate the potential impact of your work

- How could the expertise, knowledge, analysis, discovery or insight in your thesis be put to a beneficial use – both inside and outside academia

- How will you realise these benefits?

- '*How to Write an Effective Impact Statement*' workshop run by the Doctoral Skills Development Programme.

Structuring your thesis

Table of Contents

Lists of Tables and Figures

List of Abbreviations

Acknowledgements

- – Funders, supervisor(s), group, family, etc.

Structuring your thesis

Introduction (biological)

- Introduce the problem your thesis is addressing

- Literature survey

- Clear statement of overall aims of the thesis

This chapter is setting the background to the biological problem your thesis is trying to address.

Structuring your thesis –
Structural Biology

Methodological introduction

- You may need a methodological introduction as well as a normal M&M chapter.

- Describe theory behind x-ray crystallography, NMR, MassSpec, EM, etc., as appropriate to your work.

This is not needed to understand your thesis – it is there to show the examiners you know and understand what you were doing.

Structuring your thesis –
Bioinformatics

Methodological introduction

- A standard M&M isn't really appropriate as you will be developing methods

- Describe resources (e.g. databases and databanks) that you used

- Describe standard computational tools you used at a level appropriate to your work
  - e.g. If BLAST is central to some of your work then you need to describe it in detail; if you only used it for a few simple searches then you would not need this

- If you used machine learning explain the basic theory behind the method(s) and how they were implemented (SciKit Learn, Weka, etc.)
  - you don't need too much detail unless you are somehow building on existing methods.

This is not needed to understand your thesis – it is there to show the examiners you know and understand what you were doing.

Structuring your thesis –
Wet Lab

Materials and Methods

- Your thesis is (almost certainly) ***not*** a single experiment!

- Give the detailed protocols that you use in one or more chapters of your thesis. Most of your methods will appear **in your results chapters**

- Describe resources and any computational tools you used.

The reader doesn't need to read this chapter to understand what you have done – only to be able to reproduce the work.

Structuring your thesis

Results

- Your thoughts?

Structuring your thesis

Results

- *Probably 2–4 results chapters*
- *Each must tell a self-contained story*
- *You shouldn't have to look back at the methods chapter to understand the results*
- *Include an introduction and discussion*

Structuring your thesis

Results

- You need to tell a story

- You don't want the reader to have to go back to a separate chapter (or section) to understand the experiment that lead to a particular result.

- Generally you should organize each chapter by experiment and integrate a (brief) description of the methods with the results and a brief discussion of what those results mean

Structuring your thesis

Results

- Mix the actual results with some explanation / discussion to make it easier to read

- Rather than:

  - *"The value went up by 5%."*
    say:

  - *"The value went up by 5% (significant at p<0.01) which suggests that..."*

Structuring your thesis

Results – structure of results Chapter x

Publication statement – if this work has been published open with a statement saying something like:

Some of the work presented in this chapter has been published in Author et al., Title. Journal vol(year)pages

If you are not the first author you should add a statement to say what your contribution was.

Structuring your thesis

Results – structure of results Chapter x

x.1 Introduction

Usually only a couple of paragraphs setting out (if appropriate) how this follows on from the previous chapter, what you are trying to achieve in this chapter etc.

Structuring your thesis

Results – structure of results Chapter x

x.2 My first amazing experiment

Describe what you did, what the results were and what you conclude from those results. Details of the methods (especially for wet-lab work) will be in the earlier M&M chapter. However this section should include any deviations from the standard protocol or anything specific for this experiment (e.g. the number of PCR cycles, the particular machine learning algorithm, split of data, etc.)

Structuring your thesis

Results – structure of results Chapter x

x.3 My second amazing experiment

Often you will start with an introductory sentence saying something like "In the light of the results obtained in the previous experiment, it was decided to…"

As x.2, describe what you did, what the results were and what you conclude from those results.

Structuring your thesis

Results – structure of results Chapter x

x.12 Conclusion

You will have discussed the results as you go along. You now need a brief conclusion of the overall findings from the chapter.

Structuring your thesis

Conclusions

- Generally fairly short

- Should bring together conclusions from the results chapters

- Overall conclusions

- Perhaps some new hypothesis, or framework of ideas, that has been supported by the results

- Future work

Structuring your thesis

Supporting data and code

- Attach a CD/DVD containing data and/or code
  - Ideally include copies of any open-source programs used, so the work can be reproduced

–or–

- Links to code/data on GitHub
  - Tag with a version number so the exact version used can be identified.
  - Data might be on another web site such as the UCL Research Data Store or a group website.
- Indicate version numbers of all **software used to generate results** (whether your own or from other sources) – probably in an appendix.
  - You don't need to do this for software used merely to visualize or analyze results using standard techniques.

Structuring your thesis

Appendices

- You can use appendices for supporting information or data.

- In general it is anything that you think may help the reader to get a very detailed picture of your results and methods

- For example:
    - a list of software version numbers
    - instructions for running code that you have written
    - large tables of data from a set of experiments (e.g. repeats) where the results just contain a summary table or graph that highlights the key information – perhaps the average result and standard deviation from repeats. (Particularly large datasets may be better on a CD/DVD or on a web site.)

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Writing style

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Writing style

- Your thoughts?
- *Must flow well and tell a story*
- *Formal language*

Writing style

- Tone – scientific
  - Read lots of papers and reviews to see what this means!
- Tell a story
  - You can be much more discursive than a scientific paper
  - You can describe what didn't work as well as what did if it helps tell the story
- Generally use passive voice
  - e.g. *"Samples were amplified by PCR"*
    rather than
    "I used PCR to amplify the samples"
- If you do use first person, use *"I"*, not *"we"*
  - If you use *"we"* it implies other people were involved, so what was your contribution?

Writing style

- Do not repeat content between a graph and a table or graph/table and text
  - though you might want to include raw data on a CD/DVD, on a web site or in an appendix, if you have just shown the data in a graph.

- Use detailed figure legends and table captions
  - should be sufficient to allow you to understand the figure/table without resorting to the text. If you can't explain it all add a '*See text, Section x.y.z*'

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Writing well

- How to piss off an examiner
  - Your thoughts?

Writing well

- How to piss off an examiner
  - *Typos and spelling mistakes*
  - *Sloppy presentation*
  - *Inconsistency*

Writing well

- Your examiner is not a proof reader!
  - Typos
    - carelessness suggests the science may be careless too
  - Spelling
  - Grammar
  - Punctuation
    - Can completely change the meaning of a sentence
    - If you use ':' and ';' make sure you use them correctly!
      ':' introduces a list,
      ';' can separate long list items, or is used as a silent conjunction (you could use 'and' or 'or' instead)
  - Articles
    - (a, an, the – or nothing) – see my document on the web site

Writing well

- Sloppy presentation / Inconsistency
  - Fig. vs. Figure, etc.
  - Full stop after '*etc.*', 'Fig.', '*et al.*'
  - Use 'do not' rather than 'don't'
  - Do not over-user abbreviations; never abbreviate single words
  - Be consistent with bulleted or numbered lists with punctuation at the end of each item
    - you can use no punctuation, or a full stop at the end of each item, or a comma (or semi-colon) at the end of each item except the last one where you use a full stop

Writing well

Typography

- It is generally preferred to use a serif font (like Times) for body text in long documents.
  - Serif fonts are generally regarded as easier to read
  - A sans-serif font (like Arial or Helvetica) can be used for things like headings, figure/table legends/captions or titles
- Use orphan/widow control so you do not have a single line of a paragraph at the bottom or top of a page
- Do not underline headings (or other text) – use a different or larger font, bold and/or italics.
  - For headings, do it using styles, not by manual changes!
  - Underlining is poor typographic style only used for hand-writing or mechanical typewriters
- Do not use all-capitals for titles
  - All-caps removes the 'bouma' (the shape of the word) making it more difficult to read. https://en.wikipedia.org/wiki/Bouma
- Figures and Tables should either be at the top of a page or as part of a full page of figures and tables
  - In Word, make sure you anchor them to the page not to a paragraph or letter.
- Use an unbreakable space between '*Figure*' (or '*Table*') and the figure/table number
- Use italics for '*et al.*', '*in vitro*' (etc.), and species names

Writing well

- Avoid '*significantly*' unless you have statistics to back it up
- Sentence construction
    - Passive voice, subject noun and verbs must be present and must agree – singular/plural
- Paragraph construction
    - Avoid 1-sentence paragraphs
    - Clear links between sentences in a paragraph
    - Often an introductory sentence for each paragraph

Writing well

Resources

- '*Eats, Shoots and Leaves*' (Liz Truss)
  - Easy-to-read book on the importance of grammar and punctuation
- '*Usage and Abusage: A Guide to Good English*' (Eric Partridge)
  - A classic book on writing well
- Use of articles
  - https://dictionary.cambridge.org/grammar/british-grammar/a-an-and-the
  - https://dictionaryblog.cambridge.org/2015/08/19/a-an-and-the-how-to-use-articles-in-english/
  - https://owl.purdue.edu/owl/general_writing/grammar/using_articles.html

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Writing tools

Word

- Learn to use it properly!
  - Styles
    - Headings, etc. – do **not** highlight, set font, font-size and use bold or italics. **Use the heading styles** and adjust them for the presentation you want
  - Figure/Table legends
    - Attach them properly to a figure – they will stay with the figure and will be numbered automatically
  - Cross-references
    - Use cross-references to refer to other sections, figures, tables, etc., so that if you add other sections, figures, tables the numbering of the cross-reference will be automatically updated

Writing tools

LaTeX

- Non-WYSIWYG
- You ignore presentation – LaTeX will get it right
- Excellent maths typesetting, cross-referencing, citations, ToC, LoT, LoF
- Separate chapters in separate files
- Slightly steep learning curve
- Graphical editors available
  - LyX, TeXMaker, etc. (https://beebom.com/best-latex-editors/)
  - Don't use them – you lose the advantages!

Writing tools

Reference managers

- Make sure you use one!!!
  - e.g. Endnote, Mendeley, etc. for Word
  - BibTeX for LaTeX

Reducing text and spotting errors

Reducing text (e.g. from copious notes)

- Read through the text, identify the key topics covered and make a list of them.

- Make sure you now place them in a logical order

- Use them as (temporary) section headings and move the appropriate bits of text under each heading

- Now you have organized the text, you can go through each of the sections you have created and remove redundancy from the text.

- Finally check each sentence to try to rephrase to reduce the word count.

Reducing text and spotting errors

Spotting errors (typos, spelling, grammar)

The problem is that you read what you expect you wrote rather than what you actually wrote!

- Often easier on paper than it is on screen

- Try reading it out loud

- Ask someone else to read through your writing

- Leave a chapter for a couple of weeks while you work on the next chapter, then come back to it.

Any other thoughts?

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