How to write a good master thesis

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Overview

1. What is a good thesis?
2. Requirements
3. Choose a format
4. Plan your writing and reviewing of available data
5. Common mistakes/excuses
6. Summary and discussion
Overview

1. What is a good thesis?
   - Aims – why do you write a thesis/why do scientists publish?

2. Requirements

3. Choose a format

4. Plan your writing and reviewing of available data

5. Common mistakes/excuses
   - Start in time

6. Summary and discussion
What is a good thesis?

1. Has a good question
2. Has an answer to that question
3. Shows that you, as the author, made a significant and original contribution to our knowledge database
   - The question and answer are relevant
   - The answer is logically derived from experimental data
   - The experimental data are clearly described and documented
   - The experimental (collected) data are interpreted in a logically coherent way, using relevant work of others and giving complete reference to that previous work
Why do you write a thesis
Why do scientists write papers

• I need/want my Master degree (egoistic)
• To make your/their findings public/available to peers
  – I own the data/concepts/ideas (egoistic)
  – Someone else may make good use of them (altruistic)
  – I have to show that I am productive (control from outside)

!You want to communicate and convince!
Overview

1. What is a good thesis?
2. Requirements
   - Have a question
   - Find the appropriate supervisor and experimental tools to answer the question
   - Write a good, convincing story
3. Choose a format
4. Plan your writing and reviewing of available data
5. Common mistakes/excuses
6. Summary and discussion
Overview

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Is a thesis different from a journal publication?

• Likely with respect to format and/or weight on different aspects
• Not likely with respect to overall aim
  – Title page
  – Abstract/synopsis
  – Table of content
  – Introduction – what is the problem
  – Methodology
  – Results
  – Conclusions and discussion

Above all: check the instructions
Format

- Introduction: to introduce your question
  - Identify the problem and why it is important
  - Write in simple understandable language, do not overestimate the information/knowledge available to the reader
  - Give sufficient background information to make the question interesting, to argue the relevance of and logic behind the question
    - Summary of recognized facts and information in relevant scientific literature (reference attitude).
    - Summary of relevant obtained experimental results and the methods used and how these are interpreted
    - Explain/argue why you choose to use a particular publication to be incorporated in your introduction.
  - If possible give a clearly formulated hypothesis
  - Maintain focus and write coherently
  - Use appealing illustrations
Examples

• Not good (too condensed)
  – Grid cells have been proven to be present during first exploration of environment in 2½-week pre-weaning pups with a strong increase in number and quality from 16 days of age (p16). This increase coincides with an increase in synchronous inhibitory network activity in stellate cells (Langston et al., 2010). Nothing is reported about either grid cell or stellate cell activity before this age. Synchronous intracellular patch clamp recordings on groups of stellates will be performed in p10 to p16 pre-weaning rat pups to get insight into cellular development of stellate cells in this range of age. The same sets of stellate cells will as well be used for connectivity testing to establish a possible time-line of increase or decrease of interconnectivity.
Examples

• Better:

Data suggests (Langston et al, 2010) that grid cells are already present during first exploration of the environment in 2 ½-week old pre-weaning pups. But the observed pattern is not adult like yet. Less grid cells are found and the grids are not as regular as in adults yet. During development the grid pattern becomes more stable and presumably so does the spatial representation.

Understanding how grid properties arise depends strongly on our understanding of the architecture and physiological properties of the network (ref). Virtually all spatially modulated cells found in layer II of the entorhinal cortex are grid cells. Their firing properties indicate that they are principal neurons, not interneurons (ref). Since the most abundant principal cell type in layer II are the stellate cells, it is likely that they are the in vitro correlates of what is called a grid cell in vivo.

To test the prediction derived from continuous attractor modeling that the cells underlying grid cell firing are interconnected and to increase our understanding of the emergence of grid cell properties during development, we will study the interconnectivity of stellate cells in a restricted number of developmental stages. Our results indicate that.........
Format

- **Methods**: provide a description sufficient to allow replication
  - Give details as much as needed, but do not overdo
  - All additional details can go into appendices
  - Give references to established protocols in the literature – or provide in appendix
  - Consider using a flowchart or figure to explain your experimental design
Format

• Results: provide a description of your observations
  – Organize in a logical way and introduce briefly what the section/paragraph is about
  – Describe and illustrate main observations; additional details can go into appendices/suppl. material
  – Do not interpret/discuss data unless absolutely necessary for a logical flow of thought (but check with your supervisor about preferences/customs in the lab).
Example: don’t

• At the end of this chapter a brief comparative summary (figure/table) of hippocampal-EC connectivity across ages is extracted. In general, the majority of the brains presented below are cut with a horizontal orientation to aid the determination of injection site and layer specificity in MEC. All brains have been cut into 50 µm thick sections and distributed into 6 series (so sections within one series are 0.3 mm apart, also described in Methods chapter).

• !Do not repeat methods in results!
Example: don’t

• In the initial phase of this project a very general goal has been to 1) inject any tracer into any part of the EC, preferentially MEC, 2) see if the tracer uptake and transport works/is effective in young pups, and 3) try to limit survival times to a relatively short developmental time frame while allowing enough time for tracer uptake and transport. As MEC injections in different ages have gradually become successful, a more specific goal has been to try to limit injections to MEC superficial and deep layers.

• Write results as results; what is the parameter you observe
Example: better

- In order to be able to visualize the development of connectivity in the developing brain, all tracing methods had to be developed, aiming to determine optimal injection and survival parameters as well as establishing surgical procedures and stereotaxic coordinates. Relevant for this study is that we ascertained that successful tracing with anterograde and retrograde tracing is feasible in pups, starting at P0 and that a survival time between 20-24 hours yields sufficient transport of injected tracers to label all central projections, i.e. those restricted to the fore- and midbrain. This is illustrated when comparing the pattern of labeling seen following a retrograde injection in area X at Px with a survival period of 24 hours with that of an animal injected with the same tracer, in the same area but now with a survival time of X days. From this we concluded that using a survival time between 20- 24 hours is sufficient to provide a reliable overview of established connections.
Format

• Discussion
  – Formulate conclusions and interpret in the light of known information
  – Generalize conclusions into what is it we learned
  – Make sure that what you have learned is indeed an answer to the question posed in the introduction
  – Thoughts on applied relevance/the future
Overview

1. What is a good thesis?
2. Requirements
3. Choose a format
4. Plan your writing and reviewing of available data
   - Plan
   - Have discipline, perseverance, work hard
   - Use your supervisor, make sure he/she tells you what it is you need to do!
   - But above all, have a vision
5. Common mistakes/excuses
6. Summary and discussion
Different types of plan: content

Master thesis
Working title:
Role of axon guidance molecules in the post-natal development of the hippocampus

Hippocampal development
Focus on anatomy not on functionality

Time window:
post-natal: 10 days - 4 weeks

Describe and distinguish differences between internal hippocampal wiring
Parahippocampal - hippocampal wiring

Role of axon guidance molecules

In dept: role of ACBs found in longitudinal expression profiling after induction of Fs in hippocampal development.
(See PND thesis Koen van Gassen chapter 6)

What are the known consequences of ACM deficiency during hippocampal development.
Dependent on the amount of information, focus only on candidates found in the longitudinal expression profiling (see above)

Epileptogenesis

Difference between mouse vs human

Time course of development
Participation of ACM

What is the differential participation of ACMs? What is the differential variation of ACMs?
Is there a relation between development of the individual CA areas, AGMs involved and epileptogenesis (resistance)

Differences in cornu ammonis (CA) development

What is known about the influence of febrile seizures on hippocampal development
Mouse vs human
Different types of plan: time

Week 1: defining subject of master thesis, collect and read publications (keypapers), design writing plan (chapters, keymessages, references)
Week 2: discuss and adjust writing plan, start writing
   **Due date writing plan: Tuesday 1 September**
Week 3: writing
Week 4: Finishing the first version
   **Due date first version: Thursday 17 September**
Week 5: discuss and adjust first version, end of the week: hand-in the final version for evaluation/appraisal of the thesis
   **Due date final version: Friday 25 September**
A good plan

• Summarize main knowledge – state of the art
• Do your experiments and continue to work on your review of current knowledge
• Write methods section
• Outline your introduction in general terms
• Summarize your results in figures/tables etc
• Formulate main conclusions
• Write results section
• Write introduction and discussion
• Write abstract
Have a vision

- What is it you are after?
- Analyze your experimental data and develop a concept/vision
- Be creative and original
- Do not be afraid, but do not make a fool of yourself
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5. Common mistakes/excuses
   - Start with the wrong piece of writing (see a good plan)
   - Postponing the review and summary of available information
   - Postponing making figures and tables
   - Not assuring that you have all the skills to write your thesis
   - Inappropriate integration of own data with what is known
   - Illegal use of known and owned information – citation rules
6. Summary and discussion
Mistakes – how to crash your plan

• Postponing making figures/tables/histograms etc
  – Murphy’s law: if things can go wrong, they will and always at the most inconvenient time

• Do you have the skills to write your thesis
  – Word processing
  – Graphics
  – Statistical expertise
  – Working with and managing reference databases

• If you don’t know: ASK!
Combining own data with the available body of knowledge

• Data should be in result-section
  – Experimental data
  – Meta-data
  – Observations/descriptive data

• Data are interpreted in the discussion-section
  – How do my data relate to other published data
  – What do my data reveal, explain
  – Why are my data/findings/conclusions relevant
  – Put your data in a larger context
  – Never end the discussion with a sentence, quote, statement that could begin another paper.
Citation principles: rules

- Each statement should have a clear reference
- A reference should be relevant to the statement
- Can I cite data without a reference? No except:
  • Public knowledge
- Cite preferentially based on full original publication
  • What if original publication is not immediately available
  • What if original publication is not accessible (language; too old)
- No references in conclusion
- No references in aim of a paper
- Do not use non-scholarly sources
Examples 1

Can I cite data without a reference? No except:

– Common knowledge
  • Factual: the president of the US is Obama
  • The earth circles around the sun
  • The CNS is bilaterally symmetric
    – In all these cases you might use a general source for reference such as a newspaper or a textbook, no need for a specific article.

– However, try to avoid:
  • it is generally known that .......... without a reference
  • Citation to text books without specifically mentioning page numbers. Preferred format might be to put textbooks in a note.
  • Citation of one or more textbook(s) for each and every statement.
Examples 2

• What if original publication is not immediately available
  – Try to find another relevant paper
  – Make sure you get it
• What if original publication is not accessible (language; too old)
  – Cite from the original source where you found the reference:
Citation principles

• Ethics
  – Do not cite textbooks; if necessary be precise (chapter/page); may be better as a note than citation
  – Plagiarism (don’t)
    • Risk of copy & paste habits
  – Random citing – selection criteria (you need to select with arguments or be complete)
  – Citing without reading
  – Do not use data from someone else as if they are your own; always give reference

http://www.adressa.no/nyheter/trondheim/article1441447.ece
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Summary

• Stay in close contact with your supervisor
• Make sure that you know the rules
• Practice (makes perfect)
• Be critical
• Make a fair and robust time schedule for writing
• Terrible research will never make a good thesis
• Above all: enjoy
Questions?

- What if I only have negative results
- What if I ........