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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 (collected) data
   - The experimental (collected) data are valid with respect to the question
   - The experimental (collected) 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
  - The data/concepts/ideas are mine (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!

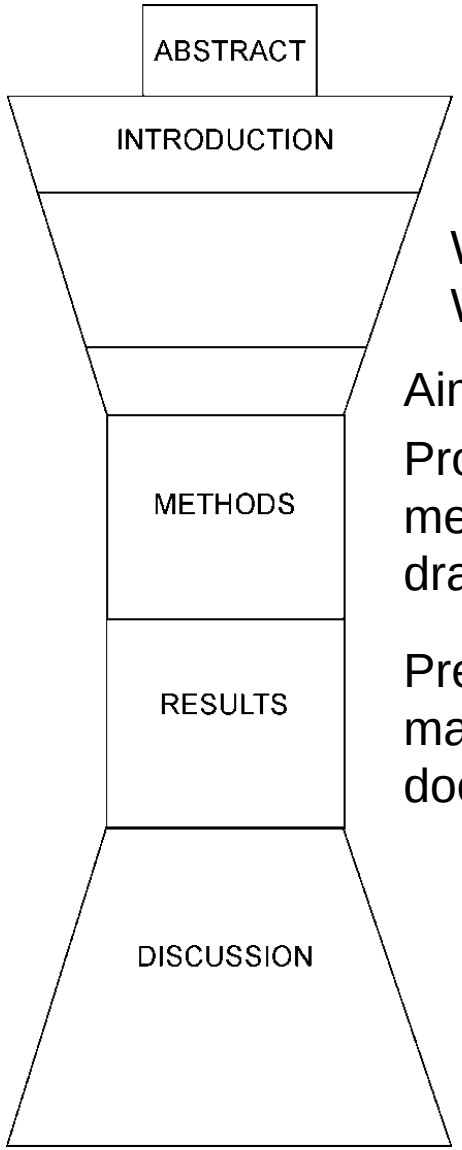
Overview

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

1. What is a good thesis?
2. Requirements
3. Choose a format
    1. Most commonly used: Introduction, Methods, Results, Discussion
4. Plan your writing and reviewing of available data
5. Common mistakes/excuses
6. Summary and discussion

Structure IMRAD



Why of interest?

What do we know?
What is missing?

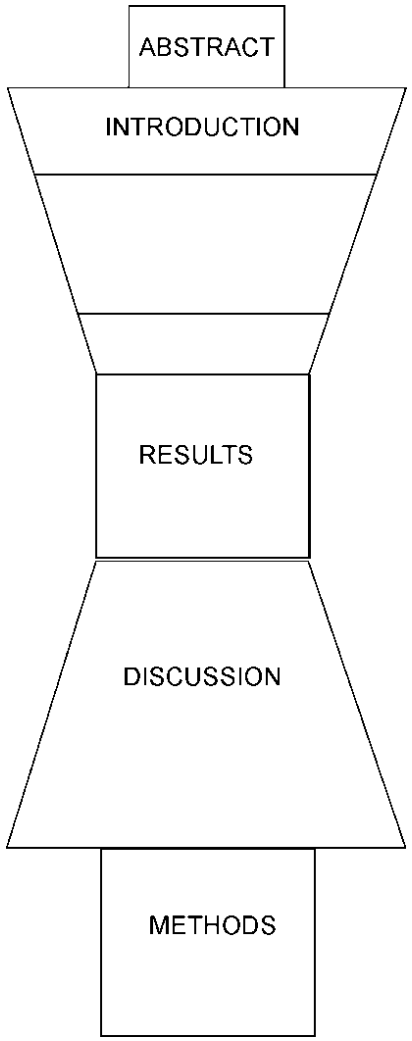
Aim

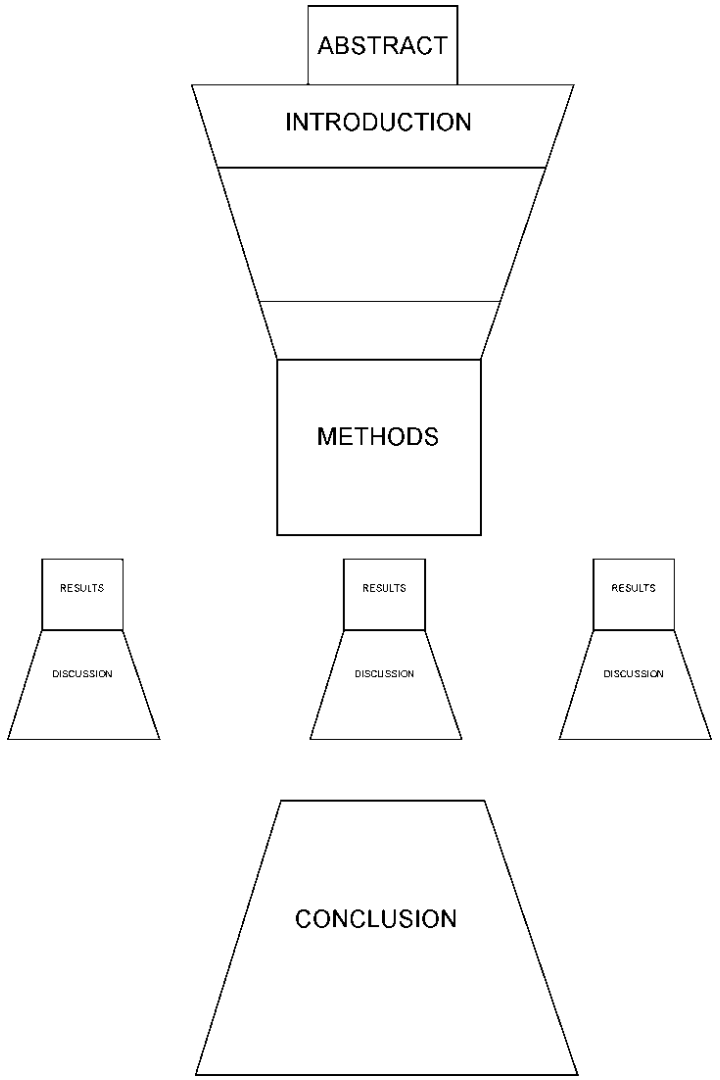
Provides information sufficient to evaluate relevance of methods, related to results reported, and conclusions drawn (a colleague should be able to replicate)

Presents observations in a logical and coherent manner; use illustrations, graphs, tables to document

Provides conclusions, interpretations and potential problems. Relates observations to what is known and extends that knowledge, if possible

Structure: alternatives





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 and content
  - Title page
  - Abstract/synopsis
  - Table of content
  - Introduction – what is the problem
  - Methodology
  - Results
  - Conclusions and discussion

Above all: check the instructions/ talk to your supervisor

Introduction

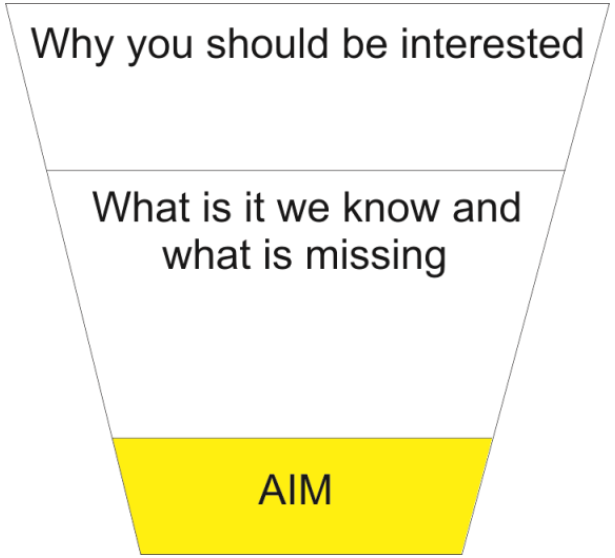
To introduce your question

- 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 or aim
- Maintain focus and write coherently
- Use appealing illustrations

Introduction

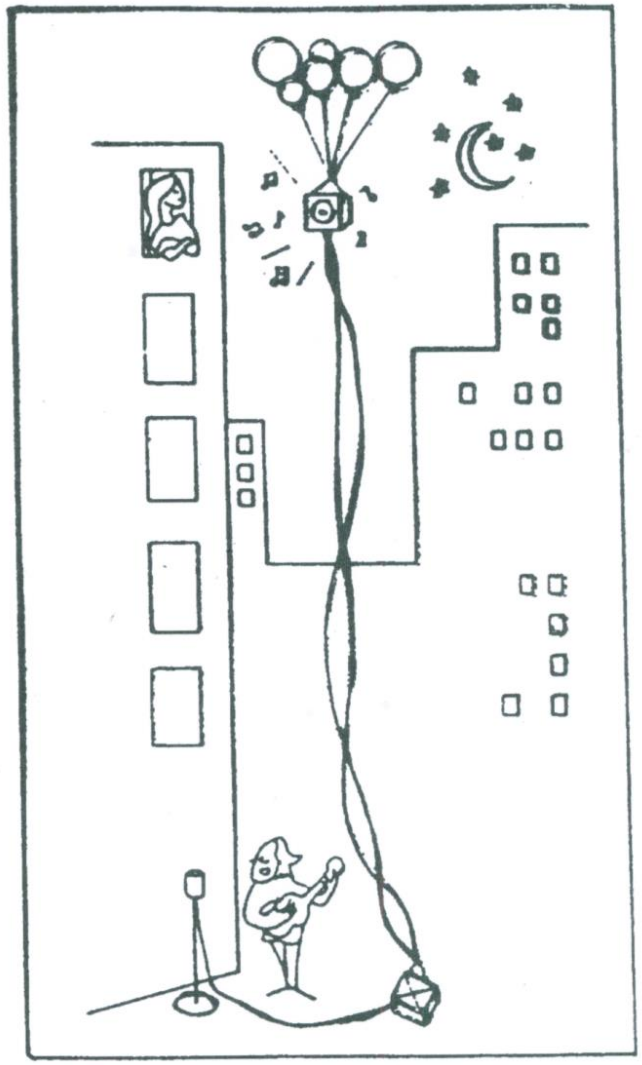
- The introduction begins with a broad focus.
  - The starting point you select for your introduction should be one that attracts the lively interest of the audience you are aiming to address.
- The introduction ends with a focus exactly parallel to that of the Results;
  - often this is a statement of the aim or purpose of the work presented in the paper.
- Between these two points, background information and previous work are woven together to logically connect the relevant problem with the approach taken in the work to be presented to address the problem.

from: M Cargill & P O'Connor (2009) "Writing scientific research articles: strategy and steps", Wiley-Blackwell.



Introduction provides context

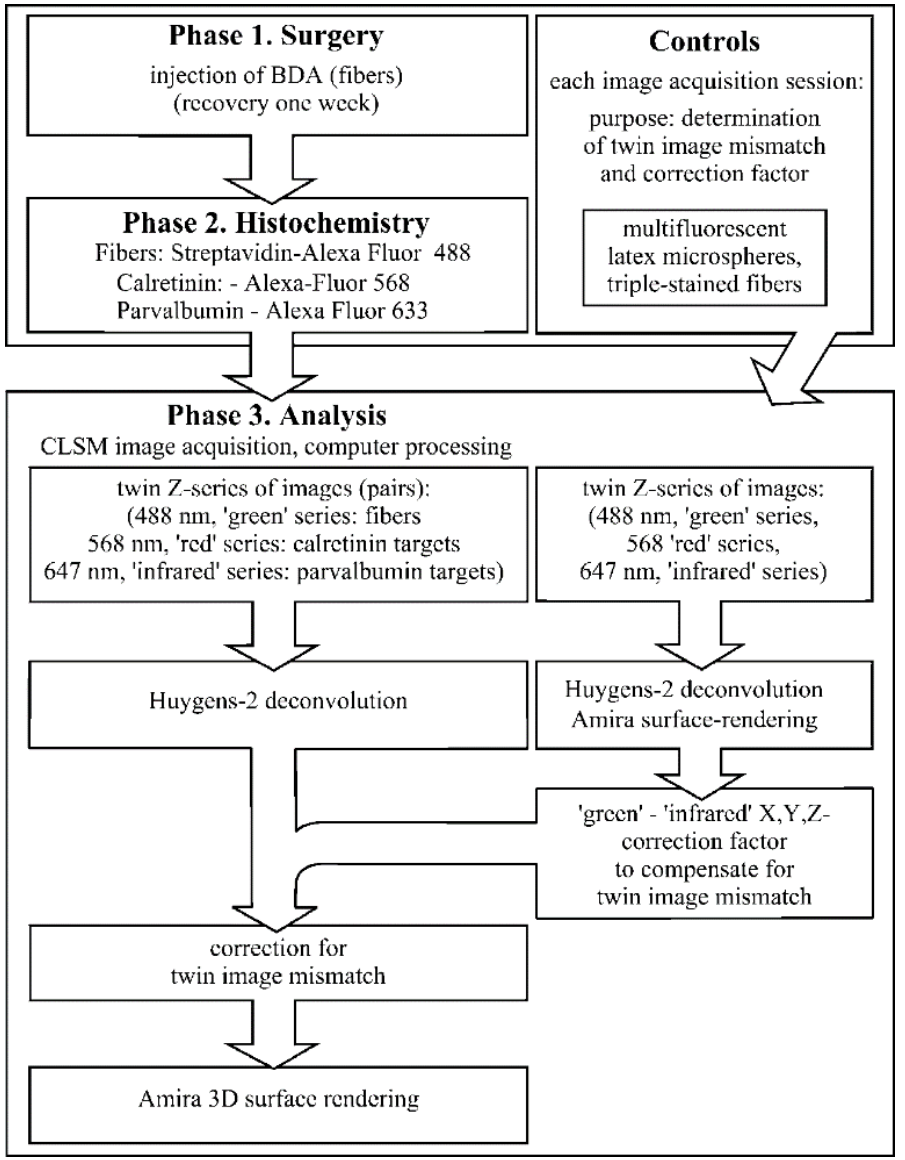
If the balloons popped, the sound would not be able to carry, since everything would be away from the floor. A closed window would also prevent the sound from carrying since most buildings tend to be well insulated. Since the whole operation depends on a steady flow of electriciy, a break in the middle of the wire would also cause problems. Of course, the fellow could shout but the human voice is not loud enough to carry that far. An additional problem is that a string could break on the instrument then there could be no accompaniment to the message. It is clear that the best situation would involve less distance then there would be fewer potential problems. With face to face contact the least number of things could go wrong (From Maguire et al 1999 Brain 122:1839).



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



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
  - Qualitative or quantitative
  - Statistical analysis
  - Graphical representations
- 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-entorhinal connectivity across ages is provided. 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 the entorhinal cortex. 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 entorhinal cortex, preferentially in the medial part, 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 injections in different ages have gradually become successful, a more specific goal has been to try to limit injections to entorhinal superficial and deep layers.

Write results as results; what is the parameter you observe

Example: better

In order 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 postnatal day 0 (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 20 hours with that of an animal injected with the same tracer, in the same area but now with a survival time of 24 or 48 hours. From this we concluded that using a survival time between 20- 24 hours is sufficient to provide a reliable overview of established connections.

Discussion

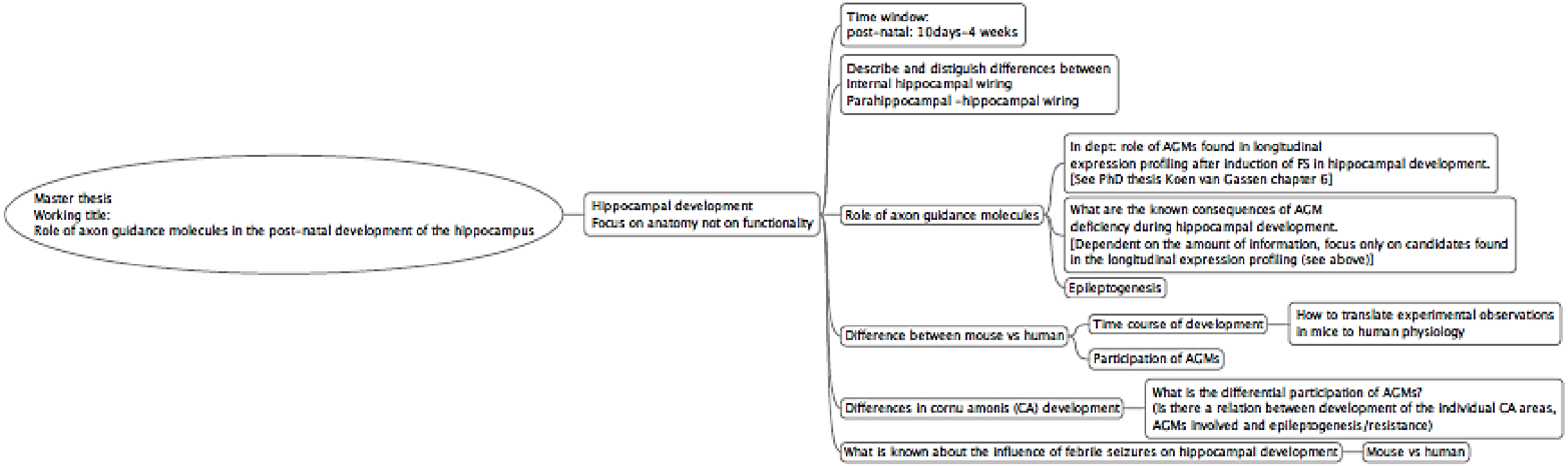
To put your results into context and reach conclusions

- Formulate conclusions and interpret them 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!
   - Have a vision
5. Common mistakes/excuses
6. Summary and discussion

Different types of plan: content



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 sequence that may work

1. Summarize main knowlegde – state of the art – the aim
2. Do your experiments and continue to work on your review of current knowledge
3. Write methods section
4. Outline your introduction in general terms
5. Summarize your results in figures/tables and legends
6. Formulate main conclusions
7. Write results section
8. Write introduction and discussion
9. Write abstract and formulate the title

Title checklist

- Attract target readership to your paper
- Indicate content of paper clearly
- Keywords prominently - near the front
- Chose title type: noun, statement or question
  - ✓Noun (combination of nouns): ambiguity in noun phrases
  - ✓Statement (includes a verb): only if the paper provides an answer to a specific question.
  - ✓Question: only if the paper aims to give the answer
- Informative, specific and concise
- As much relevant information as possible, as short as possible
- Waste words, woolly phrases, non-sensationalist
- Unnecessary abbreviations
- Typing errors and correct use of capitals (matter of style)

Title examples

- **NOUN-TITLE**
- Neural Activity with Modulation of Photolysis of Caged Compounds using Microelectrode Arrays in Rats with Seizures
- The impact of pathological high-frequency oscillations on hippocampal network activity in rats with chronic epilepsy
- Visual statistical learning deficits in memory-impaired individuals.
- **STATEMENT-TITLE**
- GABA(A)R isoform and subunit structural motifs determine synaptic and extrasynaptic receptor localization
- Treatment with the glutamate modulator riluzole prevents early life stress-induced cognitive deficits and impairments in synaptic plasticity in APPswe/PS1dE9 mice
- DKL5 deficiency predisposes neurons to cell death through the deregulation of SMAD3 signaling
- **QUESTION-TITLE**
- What is new about the hippocampus?
- How to define medial entorhinal cortex in the human brain?
- Do multiple system atrophy and Parkinson's disease show distinct patterns of volumetric alterations across hippocampal subfields? An exploratory study

Have a vision

- What is it you are after?
- Analyze your experimental data and develop a concept
- Be creative and original
- Do not be afraid, but do not make a fool of yourself

Overview

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4. Plan your writing and reviewing of available data
5. Common mistakes/excuses
   - Start with the wrong piece of writing (see ‘a sequence that might work’)
   - Postponing making figures and tables
   - Not assuring that you have all the skills to write your thesis
   - Postponing the review and summary of available information
   - 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!

AVOID

Combining own data with the available body of knowledge

- Data should be in result-section (use data-derived language)
  - Experimental data
  - Meta-data
  - Observations/descriptive data
- Data are interpreted in the discussion-section (change language)
  - 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
  - Do not end the discussion with a sentence, quote, statement that could begin another paper.

Citation principles

- 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

Example 1

Can I cite data without a reference? No except:

- Common knowledge
  - Factual: the president of the US is Donald Trump
  - The earth circles around the sun
  - The CNS of vertebrates 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.

Example 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:
    - X is more often present than Y (author a as referenced in author b)
  - It is incorrect to cite a paper if you have not read the paper

Citation principles

- Ethics
  - Do not cite textbooks; if necessary be precise (chapter/page); may be better as a note than a 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 ……