

Advanced Professional Development Course.

Preparing a Thesis

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This document is accompanied by two very different but complimentary documents on preparing a thesis and I recommend you read them both. This document is a starting point only to get the concept of the Thesis and defense expectations clear before you even begin. In this way you can fully understand the relevance of the points raised in the following documents.

1) What is a thesis and what is the difference between PhD and MS/Mphil?

Both of the terms PhD and MPhil refer to philosophy, i.e. original thought. In the USA, MS is widely used but in most other countries the term used more appropriately is MPhil. The reason is any degree that concludes with a Thesis is philosophical in nature while those requiring coursework and exams only is an MS or MSc.

The point here is the *philosophical* nature of the Thesis. It takes a question about the unknown, investigates it, and reports the findings and the meaning of the findings.

Both a Masters and PhD require formulation of a question, investigation of the question, reporting of the results and a discussion of the immediate implications. The difference between the two degrees (Masters vs PhD) is the extent of the investigation and, most importantly, the extent to which the findings are discussed beyond the immediate objective/conclusions.

Put another way a **Masters** is exactly that, Mastery of science ie excellence of investigative technique/ability in an ongoing project, knowledge and understanding of Methods including principles, quality of data collection, appropriate analysis of data and an understanding of the meaning of the outcome. The background knowledge of the literature and the discussion of the data is more in relationship to that needed to undertake the work and publish the data. As a rule the successful completion of the study and publication of the data is largely sufficient in itself and as such the Masters thesis could quickly be prepared around a shell of say two manuscripts. The final chapter should include some more general discussion but the extent to which this is undertaken is not that great in most cases. Most commonly this is actually drawn out from the student in the thesis exam.

A **PhD** is all this but much more. First of all a more thorough knowledge of the background to the question is expected and a fair representation of all side of any possible disagreement in the field should never be overlooked. In such a case a clear description of why you start where you do should be stated. Knowledge of the literature should go beyond the immediate papers in the field- examples include a knowledge of possible differences in cell signaling in a number of cells and not just your chosen cell.

Beyond the Introduction and background there is a choice to be made.

Traditionally a PhD thesis is written as :

Abstract	
Introduction	
Background	
Methods	Detailed methods commonly used
Data chapters 1,2,3,4	Brief Intro, Methods including unique methods or variants, Results, Immediate conclusions only/ as needed to set up the next chapter.
Conclusions	More general conclusions- what the implications are and how the data/findings have changed our appreciation of the problem as well as answered the hypothesis.
Future Directions	Speculation way beyond what you are normally allowed in the form of a paper but a chance to also show how you think and how well you think.
Acknowledgements	

However there is an increasing trend to prepare a thesis as a supplemented collection of papers:

Abstract
Introduction
Paper 1
Paper 2
Paper 3
Conclusions
Future Directions
Acknowledgements.

The problem with this is the fact that the preparation of papers and the preparation of a thesis creates a conflict. It also potentially misses an opportunity (see last point). These can be resolved but it takes careful consideration. These are the conflicting issues:

- 1) Originality: Often a paper will need to be submitted revised and resubmitted. While the paper benefits from this there is the question of who wrote it. In the rush to publish the paper may be written by the student but have to be revised by someone more experienced. It is normal for this to occur in the first paper but it is hoped by the examiners the second and certainly third will be authored by the student with input from the co-authors/advisor, not written by the advisor. If the Thesis is simply the paper reproduced we will never know but if the traditional style is used the chapter must be the students own words even if reiterated. The paper can be bound in the back of the thesis if already published, for comparison.
- 2) Introduction: I have seen students submit a thesis of bound papers where the introduction to each paper is nearly identical, i.e. a modular approach is used for paper generation. This is

hardly appropriate. You can handle this by appropriately preparing the paper in the first place but if you don't then expect a longer thesis defense

- 2) Methods: A journal may want you to minimize methods to save costs but a thesis requires demonstration of understanding of methods as well as information needed for critical evaluation of the methods used. Again if it is absent expect a long defense.
- 3) Results: Not much of an issue but some data may be relevant yet missing for publication purposes (a big array table for instance, or method validation). Consider the use of appendices for this purpose.
- 4) Conclusions: The problem with papers format in a thesis is the need to speculate in the discussion of every paper, so the thesis will end up with a lot of repetition in the final general discussion of what was said in each chapter. So you basically fail to 'build' towards your finale since you have already given much of the final conclusions away. Perhaps more seriously you may conclude one thing at the beginning of the thesis studies but have to reverse that decision at a later date in the light of new evidence. This in itself is neither uncommon nor unacceptable- we all do it through our careers but you cannot go back and change what was said if it was published and you reproduced that paper as is. You can only readily modify the conclusions without a lot of obvious backtracking /apologies if you write a traditional thesis.
- 5) Lost opportunity: Data collected early in a study should rightly be published in a timely manner. However, many students will rush to submit a paper just in time for the thesis defense but it may well be of benefit to get the thesis committees input first on these and then submit the final papers. You may well have missed something but you can be sure the referees of the submitted paper will not.

So for a PhD in particular, I would urge all candidates to not just abandon the traditional format - it actually allows a much better representation and consideration of the work and in the days of computer editing, is not as hard a transition as you would think.

Regardless of the choice made the *final discussion* should be a demonstration of your understanding of the results and their implications with reference to both the immediate question but also the broader literature. Remember, regardless of why you undertook the study (reproductive efficiency in agriculture, signaling mechanisms in mouse tumor cells etc) RELATE TO THE BIGGER PICTURE! Does your data from mice relate to human health? Could data from tumors help with stem cell research? Think wider. Use this opportunity to set up the *future directions* part of your thesis conclusions as well as demonstrate your scientific maturity.

Common Mistakes:

I am sure I have not got half of them but some common mistakes I have seen are:

- 1) Pasting methods from the proposal but failing to update and/or correct the tense. This shows a poor focus/rushed approach. Also incomplete methods or sources information.
- 2) Lack of any abstract at all.
- 3) Inconsistent abbreviations due to changes between 'papers'.
- 4) Conclusions in a 'paper' style results chapter that are ignored or contradictory to the final conclusions and not explained or discussed further
- 5) Completely ignoring any opposed view from another lab even if they are 'obviously wrong'.
- 6) Graphs or tables which are incompletely titled/labeled and no mention of n values in legends.
- 7) Failure to acknowledge other peoples work/data. The fact the student may not have collected all the data is not the issue but integrity is.
- 8) Use of wooly language - the most common of all is saying two things were different or one increased but then showing a lack of significance. So what is meant by 'different'?
- 9) Use of pages of text when one good diagram would work a lot better.

The Bottom Line

The bottom line is the same as for the prelim- the better you prepare and check your thesis with input from your advisor and other students/postdocs the easier the final exam will be. Remember however that the thesis is your- you can get input but no-one else can write it for you. What you fail to address before hand will be addressed in the final defense. So you can go in prepared and enjoy the experience of a dialogue between equals, or you can rush it and have a rough defense or worse. There are plenty of resources to help you do the former. Make full use of them.

A Final point: In addition to all of this the thesis must comply to the university guidelines for layout etc- be sure to comply because refusal to meet the guidelines (available on the web) means you cannot graduate. Also to gain a Masters in ERP you **MUST** deposit your thesis in the library (see student handbook), just as we do for a PhD.