## Maria's Diploma and Ph.D Thesis writing suggestions

(this also applies to project proposals, papers and grant or fellowship applications).

I have put this together because in reviewing theses over the last years I have found that there are enormous gaps in the understanding among students of what the different parts of a thesis are for and how they should be written. Rather than explain it to everyone over and over again, I decided to put together a written set of suggestions or rules. These rules are not complete. I add a bit every time I review a thesis and find something I don't approve of. Some of this reflects my personal taste, but much of it is simply common standard of decent scientific writing, as taught to me a large number of excellent advisers and colleagues. Those of you who will have their theses reviewed by me can take it or leave it – if you come up with an excellent thesis that does not follow these suggestions, fine by me!

***Table of contents***

It really helps if this is easy to read. No endless subtitles, not too cramped etc.

***Intro***

Should contain an overview of the literature of the field. However, this should not be a detailed review of all known facts of the field, but should concentrate on those aspects relevant to your work. Most importantly, it should lead to the open questions that were the basis for your project.

It may also have to contain a brief section on the approaches that are available to analysing the problem, describing which one you chose and why (part of this may have to be taken up again in the discussion).

Please keep it short, but do include all important background necessary to understand your thesis.

Do not explain generally used techniques (mouse knock-outs, sequencing, P-Element transformation, PCR, yeast-2-hybrid screens, GAL4/UAS system etc.), since they should be generally known, or can be read up in textbooks.

***Aim***

What is the scientific question you are trying to answer? This is extremely important and has to be perfect. It is the part I read first in every thesis, because it tells me what the person thinks

they are trying to show, and I can then see to what degree they do or do not show this. There is no point embarking on a scientific project without a clear aim.
The aim you actually write up when you have finished your thesis may differ a bit from what you thought when you started, because the project has ultimately lead you into an unexpected direction. This means you should not write the aim you originally had in mind when you started, but the aim you had in mind when you conducted the experiments you now describe in your thesis.
Absolute maximum one half page. Better: just a few lines. In fact, the shorter the better (e.g.: the aim of this project was to determine the structure of DNA with a view to understanding the basis of heredity).

***Summary***

This should NOT be a list of all your experimental results. It should tell the reader what your discovieres are and what you conclude from them. I usually read this after reading the Aim section, to see to what degree the aim has been achieved.
Absolute maximum one page. Better: just over half a page.

***Material and Methods:***

You must know and understand exactly how all reagents you used were made (better than your supervisor does!).
If you use components of buffers etc. that you have not made yourself, you must find out how they were made.
no need for descriptions of absolutely standard methods for which generally accepted protocols (e.g. Maniatis) exist. (However: you may find it useful for yourself to have a compilation of all protocols you used in your thesis for later reference).
All modificiations of methods, or all methods for which a large variety of different protocols exist (in situs, antibody stainings, Westerns): precise protocols of what YOU did.

***Results***

If you don't know how to present results properly by the time you write up your Ph.D. thesis, it's too late anyway. As for Diploma theses, you must discuss this part in detail with your supervisor. It is their job to train you.
Just one or two remarks on figures and tables: Provide complete figure and table legends, i.e. ones that explain all details of the figure (i.e. all labels, all antibodies, probes etc.). It must be possible to understand a figure without having to refer to the main text. Conversely, the contents of the figure have to be described in the text. It has to be possible to understand the

main text without having to refer to the figures. Microscope images and other photographs should have scale bars or give the final magnification factor (including magnification by printing). There is not point in saying that the 25x magnification lens was used. An exception can of course be made for objects where the size is obvious or completely irrelevant (a whole mouse or fly, a yeast or bacterial plate etc.).
For further instructions on presentation of results check the 'instructions to authors' of the various journals. Especially the large cell biological and biochemical ones.

***Discussion:***

Do not just re-write the results.
Discuss the relevance of your new data for the whole field, or for the larger project of which your work forms a part. Problems with the data and possible solutions have to be discussed. If your project was partly unsuccessful, discuss whether this was a problem with your approach and what other approaches might have been used. What are the next open questions?
A discussion does not have to be long, and it certainly must not be boring. It should tell the reader how your findings advance the field, or how you think they fit in, and how you have dealt or will deal with problems and open questions.

***Acknowledgements:***

Soppy thanks to the whole world, or jokey references to lab life might feel appropriate to you now, but you may well feel very embarrassed when you read them in a few years' time (and think of all the other people who had to read them!). It is much nicer to keep them brief, and try and remember all the people who really helped you, not just your friends.

*General/ Style:*

if you have few data, do not try to spread them over many pages – just irritiating to the reader.
Be precise and brief. Say exactly what you mean to say, not what you think sounds good. Use as plain language as possible. The beauty of scientific writing lies in clarity and simplicity, not in poetic phrases.
Do NOT use lab jargon. This work has to be understood by scientists from other fields.
Make sure to lay out the whole logic or argument for everything you describe. Do not assume that parts of a logic chain are 'obvious'.