

Writing your Undergraduate Honors Thesis

(in Chemical Engineering at Penn State)

(Reflecting CurtisLab Experience of 40+ thesis plus secondary reader on a few hundred more)

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Logistics:

Choosing a Secondary Reader:

Typically this might be your academic honors advisor, though that person may, or may not have any experience or interest in your thesis topic. Therefore, keep them in the loop, and aware that they will have to read the thesis, but they may not be a source of intellectual feedback. If there is a faculty member that has considerable interest in the work, you could consider adding them as a technical reader of the thesis (including having them be on the signatory page of the thesis).

Interdisciplinary Honors Thesis Option:

In principle easy, in practice this means more people involved and be aware that other majors may be hesitant to allow work from another department 'qualify' as an honors thesis. This is somewhat ironic given the nature of an undergraduate thesis that most typically reflects the ideas and direction of advisor or lab mentor (i.e. graduate student), none-the-less, be aware that your bar for interdisciplinary honors may be higher than the average of what that department is producing. (Faculty seem to be more interested in policing quality from the outside ... rather than ruffling internal feathers.)

Know Your Audience:

Realize that a mere handful of people are going to read your undergraduate honors thesis; you, your advisor, a secondary reader—bearing in mind that many of these will be a quick skim over their morning coffee; where **probably the most important audience is the students that will follow-up your work.** The **Schreyers Honors College is not responsible for the quality of your thesis**; they will NOT read it. They are only there to ensure that all of the boxes have been checked; they care about you making your format deadline and submission deadlines, that an advisor signs off on it, and that's it. (No, the irony does NOT escape me that the 'honors' college subscribes, if not reinforces, the 'box-checking' paradigm of higher education). Therefore, it is key that your thesis be written for (i.e. be useful to) those that are going to use it, namely your advisor and future students. **For your advisor**, you should make sure that your thesis encapsulates anything publishable, realizing that more often than not, the publishing of your data will be after the scope of your undergraduate career. **For future students that will follow-up your work**, having the level of detail that enables your work to be reproducible is the driving motivation.

Content:

Generally, undergraduate theses are ~50 pages, however, [Amalie Tuerk](#) did [a 200-page undergraduate thesis](#). Intense! Here is the official [SHC formatting guidelines](#).

Abstract:

200 words or less...your thesis in a nutshell.

Preface:

For those who have a complex thesis, one that has 'evolved' or those who have actually worked on many different things over the duration of undergraduate research, a preface 'chapter' can be very useful 'history' to place the overall thesis document in context.

In my Freshman year I conducted work on X ... which is described in Appendix Y. The initial goal of my project was to do Z ... which was a lot of work that failed, but in since we learn a lot in failure, this is documented as Chapter ____.

Intro/Background:

This allows you to provide the buy-in for your work... the 'Why should I care?' about this work. This part should be intelligible to non-technical persons e.g. your family. It also allows you to provide the rationale for your work, noting that in the course of research, this can often be 'lost' or forgotten as learning new information reveals flaws in the original logic. However, this flawed logic and the things that do NOT work are highly valuable—sometimes even more so than the things that do work and often in unforeseeable ways so put it to paper! Remember, if it's not written, it does NOT exist!

Materials:

The key here is that the materials section is for someone that wants to reproduce your work. Be explicit; there is no such thing as too much information. [Justin Yoo](#) does a great job in his video on axenic co-culturing of algae and roots on [showing and explaining all of the associated materials](#).

Methods:

The methods section is your chance to attempt writing the methods section of a research paper; it's succinct and assumes a certain degree of technical knowledge. In other words, this is unlike the materials sections that favors explicitness. However, to provide a comprehensive methods protocol (again for reproducibility of the work), one can refer to a SOP and provide it as an Appendix (see more below).

Results/Discussion:

That last 20% of your thesis. Again, make this your best shot at the narrative (discussion) and data for a publication. Any 'tangents' can be an appendix.

Future Work:

One aspect of an **undergraduate thesis is that in the end, one almost always runs out of time**, rather than running a project to closure as for a graduate-level thesis. Therefore, it is not unusual to have a very significant amount of uncompleted work or ideas for what to do next. To increase the chances your work will be followed up and included in published research etc ... it is advisable to have extensive details of what you would do next, and associated detailed explanation of how to do that if possible. .

Appendices:

Note the above. Appendices provide explicit information for reproducibility of your experiments. Can include protocols, cookbook recipes, 'tangential' research that does NOT fit narrative of thesis, raw data (pre-compilation), protocols, media prep recipes, etc.

Pro-Tips

1. A great thing to do is to look over numerous undergraduate theses (and specifically a thesis or two from the laboratory in which you are working to have an idea of what the scope of the document is that you are undertaking
 - a. The honors college has recently been creating a [SHC database of recent theses](#). (simply type in the advisor last name or keywords to obtain PDF examples).
 - b. Some faculty link undergraduate theses to their web page page (where Dr. Curtis has a pretty extensive compilation of [recent CurtisLab Undergraduate Honors Theses](#).
 - c.
2. The **bulk of your research can be written before you have any data**. The Intro/Background, Materials & Methods, and perhaps some Appendices can be written in advance and amended as needed. Thus, ~75% of your thesis can be done before you even conduct any experiments!
3. Make a schedule in the final writing semester ... and stick to it.
 - a. Background by date _____
 - b. Methods by date _____

4. Get the references for your thesis into a citation database such as [Mendeley](#) AS YOU GO ... not only as you get to the writing phase (check what reference database your laboratory uses; dont reinvent the wheel! Note that this body of citations accessible within MS Word will make the process of writing much easier. YOU SHOULD be contributing to that database of references and documenting comments in your electronic lab notebook as well as weekly reports.

So, why write an honors thesis again?

1. If you're doing it to add one line to your resume, LAME! (And there are way more efficient ways to add lines to your resume)
2. Because UG honors thesis are low-risk; there is no requirement for 'positive results'. Therefore, counterintuitively, you can work on **high-risk projects** whereas graduate students are often hampered by the reality that they need to hit certain metrics of success (i.e. publications, 'stuff working') such that they can graduate.
3. Research is fun!
4. To get a taste of graduate school!
5. For a cool, shiny medal (Nittany Lion not included)
6. To compete for an [Outstanding Undergraduate Honors Thesis Award](#) (and win money)!

