

## Airlie Rose's Short Guide to Writing a STEM thesis at Amherst College

0. What makes a good thesis? Ask your mentor. While many things (like the IMRAD format) are common to all STEM theses at Amherst, features like the audience you are addressing and the sub-structure of the sections vary significantly by discipline and lab. Ultimately, your faculty mentor decides whether what you have done is satisfactory, good, or excellent. So, if you have a question about what they think is a good organization or style, ask them. Ask them to give you models of what they consider well written sections.
1. Write-out your Research Question: You did something in the lab. What is the question that your research answers? Like a claim in an argumentative paper, the research question is the core organizer of your thesis. Write it out clearly and use it as a reference for the rest of the sections in this guide.
2. Introduction: The introduction has three parts: Opening, Literature Review, Transition. You can think of the introduction as a funnel that draws the reader into the work you did in your study. It sets the stage by explaining the broader context of the project, why the project matters to the wider world and to the research community it is a part of. It explains the concepts and background information needed to understand your project. It tells the story of what other researchers did before you that led to your particular project. The introduction concludes with a transition that usually includes the specific research question that distinguishes your project from the work that came before you followed by a summary of the work you proposed to do in your study to answer that question.
3. Methods: The purpose of the methods section is to explain what you did in enough detail that a reader could repeat your protocols if they wanted to. It is like writing a recipe book for your project. If you want to know what to include, ask: "If a student in my lab next year wanted to repeat this, what would they need to know?" It is good to use the steps you proposed to do in your introduction to organize the subsections of your methods. The written style of a methods section is peculiar and unique to this section. It is best learned by looking at examples of methods sections, a good place to start would be the methods of the articles you summarized in your literature review.
4. Results: If the Introduction answers the question, "why did I do what I did?" and the Methods section answers, "what did I do?", the Results is the answer to the question, "What happened when I did it?" This is where you put figures summarizing your data. Graphs and tables should display the data in visually clean ways. In the figure legend, describe what is present in the image, highlighting features that are important for your conclusions. Organize section headings in the Results section so that, if you just read the headings, they would tell the story of what happened when you did each step that you proposed to do at the end of your introduction. A useful pattern for structuring Results subsections is: (A) What did I anticipate would happen when I did this? (B) What happened? (C-varies) What conclusion did I draw from what happened? You will describe the conclusions you drew from each step of your project and the data you used to arrive at those conclusions somewhere in your thesis. However, disciplines and labs vary in the extent to which they include inference and conclusions in the Results. So, seek your mentor's guidance. According to Joshua Schimel's *Writing Science*, a good rule of thumb is that, no matter where you put your inferences and conclusions, you should always be able to distinguish between data and your thinking about the data (8.2.1).
5. Discussion/Conclusion: The Discussion and Conclusion are sometimes separate and sometimes lumped into a single chapter. Whatever the formal structure, the final section(s) of the thesis should: (1) Remind the reader of your research question and the broader aims of the project. Why was this a worthwhile question to try to answer? (2) Give a brief recap of what you did to answer the question and the outcome of each step. If you didn't do it in the Results section, describe your interpretation of what happened at each step and the data you used to justify your conclusions. (3) Given your understanding of what happened, what is your current answer to your research question? Are there other studies that inform your interpretation of what happened or your conclusions? (4) At the end of your study, what new questions did this study raise that are worth exploring? What remains to be done?

NOTE: For simplicity's sake, this guide assumes that the writer has completed their lab work and knows the data they will be working with.