Neuroscience Senior Thesis Guide 2025-6

Your senior thesis is a formal research report that summarizes the work you have conducted in the laboratory. Important goals of your thesis are: 1) to review the relevant background in your field; 2) to describe how your work fits into the larger scientific context; 3) to clearly describe your experimental data; and 4) to fully analyze and criticize your results. It is also important to 5) discuss how future experiments should address particular issues or build upon your work. As you write your thesis, you should keep in mind that *clarity is of the utmost importance*. In order to write very clearly, it is crucial that you always keep in mind the basic scientific question(s) that your work attempts to answer. These questions should be introduced and explained clearly in your Introduction. You should return to these driving questions in subsequent sections throughout the thesis, regularly reminding the reader how each result fits into your overall scientific goal.

Note: Thesis writers should enroll in Neuro 99 during their 8th (final) semester and typically enroll in Neuro 91 during their 7th (penultimate) semester.

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DEADLINES

1) **For all thesis writers, an 8-15 page rough draft is due at 11:59 PM on Monday, December 8, 2025**. (For students enrolled in Neuro 91 in fall, this draft serves as the required final paper for the course.) The format should be one of the following: 1) a rough draft of the thesis Introduction; or 2) a rough draft of the Results and Methods sections. To submit, this paper should be emailed to both your research director (PI) and the Neuroscience Advising Office (undergraduate_neuroscience@fas.harvard.edu). The format is designed to provide you with early feedback on your thesis: you should request comments from your lab director on this draft.

2) **Thesis Abstract**, a tentative (~250 word) abstract is due by **11:59 PM on the first day of Spring classes: Monday, January 26, 2026**. To submit, complete the Abstract Submission form found on the Neuro website: "Neuroscience Courses > "Neuro 91 and 99". Completion of this form is required to confirm your enrollment in Neuro 99. It is assumed that the abstract text may change somewhat before you turn in your final thesis.

3) **A rough draft of your entire thesis is due on Friday, February 27, 2026 at 11:59 PM**. To submit, this paper should be emailed to both your research director (PI) and the Neuroscience Advising Office (undergraduate_neuroscience@fas.harvard.edu). This draft is due two weeks before the final deadline.

4) **One complete digital copy of your thesis (in PDF format only)** is due to the Neuroscience Advising Office (undergraduate_neuroscience@fas.harvard.edu) by **5 PM on Friday, March 13, 2026**. Late theses will be penalized one grade step per day, counting weekends. These penalties will be waived only in cases of serious extenuating circumstances. Students should contact their concentration advisor and their PI **immediately** in that event. (The following are NOT considered valid excuses: faulty internet, crashed computers, malfunctioning printers, and scheduling problems at the Science Center or copy center. *You must plan in advance*.)

Off-cycle students will have corresponding deadlines and should remain in close contact with their concentration advisor.

Table of Contents STRUCTURE

STRUCTURE

In terms of how it is written and its structure (but not necessarily in terms of the quality of data), the thesis should read like a typical *Neuron* or *Journal of Neuroscience* article, but with a lengthier Introduction and Discussion sections.

Your thesis should have a clear point and there should be no doubt to the reader (or to you) what that point is. You should be able to complete the following sentence: "The goal of this thesis is to _____." To develop your goal(s), you must first clearly identify the overall and specific scientific questions that your experiments attempt to answer. *Explicitly* explain these to the reader (in the Introduction). In addition, try to frame your thesis like a good story, arranging ideas in a logical and compelling order such that the reader will follow enthusiastically from beginning to end.

You should also avoid jargon. Clearly explain things that may seem obvious to you (e.g., connexins form gap junctions). Your readers will not know as much about your specific topic as you do. Even if they did, what you don't explain in your writing may seem like a lack of understanding on your part. Take the time to explain things in concrete sentences.

The following sections should be included. See below for details on each section. Suggested page lengths are rough. Some flexibility is allowed for your thesis format so please consult with your thesis advisor before writing and formatting your thesis.

Title page
Honor Code page
Acknowledgements
List of Contributions
Abstract
Table of Contents (optional)
Introduction (~ 8-12 pages)
Materials and Methods (~ 3-5 pages)
Results (~ 7-15 pages)
Figures (each placed at the end of the paragraph/page where it is first mentioned in text)
Discussion (~ 4-8 pages)
References
Appendix (optional)

Title Page. A .docx version with the required formatting is available here. Please follow this format in centering and spacing the appropriate text and insert as the first page of your thesis.

Honor Code Page. A .docx version of this page is available here. Please attach this right after the title page and digitally sign the form (add your electronic signature).

Acknowledgments. Acknowledgements should appear after the honor code page. This section is reserved for you to thank and acknowledge individuals who may have been helpful to you during the thesis process.

List of Contributions. In this section, you should clearly and simply state who did what portions of the project. You should explain which portions were done independently by you, which were done in collaboration with others, and what data others may have contributed. For example, if your name were "A. Student":

> "Following the initial discovery of spontaneous calcium waves by other members of the laboratory, the current research project was conceived by Dr. M. Labdirector but jointly designed by A. Student, Dr. M. Labdirector, and Dr. C. Postdoc. Behavioral assays, brain dissections, and histological analysis were done independently by A. Student. Sciatic nerve dissections were done by C. Technician. Electrophysiological recordings were done jointly by A. Student and C. Postdoc. The immunohistochemistry presented in Figure 9b was performed by P. Gradstudent. Cell counts and all statistical analyses were done independently by A. Student. Computer modeling was done jointly by A. Student with C. Postdoc. Data and results were interpreted by A. Student with assistance and guidance from both C. Postdoc and M. Labdirector."

(Please note that although this example is written in the passive voice, the majority of the thesis should be written in the active voice – see "Style" section on page 11 below.) In addition, any figures that include someone else's data should *also* be fully explained in the accompanying figure legend. See **Figures** for more information.

Abstract. The Abstract should be placed after the List of Contributions. The Abstract should be a single paragraph and should not exceed **250 words**. It should be designed to define clearly what is dealt with in the thesis and should (1) state the principal objectives and scope of the investigation, (2) describe the methods employed, (3) summarize the results, and (4) state the principal conclusions. Most of the abstract should be written in the past tense, because it refers to completed work. The abstract should never give any information or conclusion that is not stated in the thesis. References to the literature should not be cited in the abstract.

Table of Contents. (Optional) The table of contents should list every subsequent section of the thesis, as well as the abstract and other pages that precede it.

Introduction. The introduction should present an overall framework for your research by reviewing the literature, discussing what is currently known about the particular subject (as well as perhaps how this knowledge may have evolved historically), identifying relevant questions or debates that exist in the field, and detailing the specific question/s that you investigate in the thesis. The introduction often reads like a mini review article on your topic. It should be very obvious to the reader what specific scientific questions you aim to address with your work. If you introduce the background well, the reader should also understand why your specific experiments are an important and obvious next step for your particular field or laboratory.

You should end your introduction by clearly stating (or perhaps restating) your objectives and rationale for the thesis. This provides a starting point for the thesis and tells the reader what to expect in the forthcoming sections. For example, your Introduction may end with something like the following: “This thesis investigates the role of calcium waves in the development of the embryonic mammalian cortex. Specifically, we will 1) use calcium imaging techniques to characterize the morphology and frequency of calcium waves that occur spontaneously in embryonic cortical slice preparations; 2) demonstrate electrophysiologically that calcium waves can be recapitulated with extracellular stimulation; 3) demonstrate pharmacologically that calcium waves are dependent upon ATP receptors; and 4) use a cell proliferation assay in embryonic brain slices to demonstrate that calcium waves are crucial to embryonic neurogenesis.” Try your best to list these items in a logical order that walks the reader through your ‘story’. Also include here any significant components of your work that it might be important to highlight, for example If your research involves an involved statistical analysis.

Throughout the introduction, you should supply sufficient information to allow the reader to understand the forthcoming results without her/him needing to read previous publications. Assume that your audience has the background of a general neuroscientist but not necessarily one that knows your field well. (This means that you don’t have to describe what an “axon” is, but you should explain things like “presenilin”, “connexins”, “synapsin”, “iPS cells”, or “glioma”.) When in doubt, explain briefly. Include schematic figures or diagrams in your introduction that illustrate the details you are introducing, e.g., important brain regions/circuits you are discussing or a complex biochemical pathway. If it is something crucial for the reader to understand, a figure is always a good idea. It improves your overall presentation and also helps the reader to

focus on the important points they must understand for the remainder of the thesis. Many authors feel that one figure should be included for every main point in a scientific paper.

Throughout the introduction and all subsequent sections, you should include in-text citations of all relevant published work. References serve multiple purposes. Beyond their most important role in giving credit to previous work, references also serve as resources for the reader to learn where s/he might find further reading on a particular subject. Be sure to include relevant reviews or even textbook chapters that you found helpful as you learned about your topic. (See "References" section below for citation format.)

Materials and Methods. This section details how you conducted the experiments. Give enough detail so that the reader has an idea of how to conduct a similar experiment, but don't include the excruciating details of full protocols. For example, include concentrations or final dilution amounts, but do not explain step-by-step how to make your buffer. Use subheadings to help guide the reader through the Material and Methods section (e.g., "Tissue preparation"; "Imaging & Analysis"; etc.).

Results. This section comprises the body of the thesis. The results section should be presented in an explicit, logical order, so that the reader will understand the purpose of each experiment. This section summarizes the data obtained from the experiments and should describe the results in a matter-of-fact manner but not overly interpret them (which would be done in the discussion). Rather than simply listing one experiment monotonously after another, walk us through your logic using key transition sentences that remind us of your underlying scientific questions. For example, instead of saying "Next, we used antibodies against Protein X at three different time points", you might say "Next, in order to determine whether autism-associated proteins are indeed localized in the striatum throughout development, we used antibodies against Protein X at various postnatal ages." If you completed two unrelated projects, you may consider separate sections or chapters within the results section. You may also include relevant experiments with negative or no results.

Figures. The visual elements in your thesis should be a mirror of the written elements such that either the figures or the text may stand alone to tell your story. In other words, you should ideally have a figure to visually represent each main result described in your text. Your figures, diagrams, and tables should be properly labeled, with descriptive figure legends and any sources acknowledged (see below). Clear, well-labeled figures help significantly to impress

readers with the overall professional presentation of your thesis. Figures and tables should be numbered in the order that they are cited in the text (for example, Figures 1-2 in the Introduction, Figure 3 in the Methods, Figures 4-11 in the Results, *etc*.). Ordinarily, figures should be presented in portrait orientation with the figure legends accompanying the appropriate figures. We encourage you to dedicate a page to each figure and insert that page into the appropriate position within the text. We suggest that you do *not* embed the figure in the document. (This can lead to a formatting nightmare for you.) You may instead choose to dedicate an entire page to each figure and place figure place just after the page where it is first mentioned in the text. Alternatively, you can put the figures together at the end of a chapter or section, although some readers prefer that figures appear within the text where they are relevant. The pages on which figures appear should be numbered in sequence with the text.

If a figure is a multi-panel plate, individual panels within the figure should be consecutively lettered, and for all images, a scale bar should be included in the figure and defined within the figure legend. Figures should be presented in a plain and unadorned style as much as possible. All text within the figure should be large enough to be read easily. Panels should not be set off by boxes or other edging, and lettering and images should not have gratuitous effects such as highlighting, three-dimensional edging, shading, etc. Where possible, figures should consist of black lines and lettering against a white background. Color should be used to differentiate or emphasize specific features of a drawing, but only if scientifically necessary (i.e., needed to differentiate the different parts of the image, such as different lines in a graph or different labels mapped against a brain section).

In order to present a complete story, it is sometimes appropriate to include some minimal data conducted by another individual in the lab. Work done in collaboration with others or even by someone else may be included in your thesis, but *this must be acknowledged in the figure legend even if the appropriate researcher is also given credit elsewhere*. The reader assumes that all figure data presented are yours unless it is explicitly stated in the figure legend. Be sure that you do not make this ambiguous to the reader; their frustration/confusion may be reflected in your thesis grade.

Discussion. The discussion section should first summarize and analyze the results that you have presented. For example: “We demonstrated in Figure 8 that cell proliferation was decreased in the presence of ATP receptor antagonists. This result could be interpreted in a number of ways…” then go on to explain that one likely interpretation would support your overall hypothesis, but a caveat might be that the pharmacological agents could have caused cell

damage. (Ideally you have done a control experiment to rule that out – explain how that control supports your hypothesis here.) In addition to this type of discussion, recapitulate your overall argument(s) presented in the introduction as well as strengths and weaknesses and address the theoretical issues that were used in approaching and analyzing the problem. You should also explain how you may have modified your view of the issues in the course of conducting the analysis. If your experiments did not produce significant or meaningful results, explain here your thoughts on why this might have occurred, and suggest how things could be done differently. Convince the reader that you have fully thought through and understand the implications of your work, no matter how individual experiments may have turned out. The discussion is an important aspect of your thesis and should place your findings into the larger perspective. It is the best section to demonstrate to the reader how carefully you have thought about your work and how sophisticated your thinking might be regarding its nuances and implications. Be sure to compare your findings to previously published results – are your data consistent with findings from other studies? Why or why not? Importantly, end with a section detailing further questions to be asked and directions for future study. Faculty readers will look specifically for a discussion of how future experiments may build upon or improve your work. If this is missing, they may feel that you have not adequately thought things through.

References. Factual statements and claims that you make throughout your Introduction, Methods, Results, and Discussion sections should be backed up by providing citations to relevant published work. For example, even a basic statement such as the following should include a citation (to a review article or textbook chapter, for example):

> In the motor system, motor neurons whose cell bodies reside within the ventral horn of the spinal cord project a long axon toward the muscle and make a synaptic contact called the neuromuscular junction (Sanes & Lichtman, 1999).

For references, you should use the bibliographic notation style of the *Journal of Neuroscience* or *Journal of Comparative Neurology*. For example:

> Sanes JR, Lichtman JW (1999) Development of the vertebrate neuromuscular junction. Ann Rev Nsci 22:389-442.

Regarding in-text citation, please use the author-year method as shown in the first sample above. Do not use footnote or numbered format. Here are two examples:

Watson and Crick (1953) proposed that DNA formed a double-helix.

- or -

The nucleotide bases are on the inside of the double helix and the phosphates on the outside (Watson & Crick, 1953).

To simplify the citation process, we urge you to use an in-text citation program such as Endnote or Refworks, Zotero, or Mendeley To read more about these programs and download through Harvard, visit Citation Management Tools.

All thesis writers should read this brief guide regarding citations: *Guide to Using and Citing Sources When Writing in the Life Sciences*.

Appendix. If there is essential supplementary information you want included with your thesis, but which will not be read by the reviewers, you can add an appendix. Most theses do not need or benefit from an appendix; talk to your concentration advisor if you are considering it.

DEADLINES FORMATTING AND STYLE

FORMATTING AND STYLE

Length: Senior theses usually range from 30 to 50 pages in length with figures and diagrams. ***Although this number is not a hard and fast rule***, you should be wary of exceeding these limits in either direction. Long, verbose theses are often too wordy or poorly written, edited, and argued. On the other hand, the reader may criticize a shorter work; they may not be able to discern whether you understand the material and see the larger picture. **No thesis may be longer than 100 pages.**

Style: Your thesis should read like a professional scientific journal article. It is not appropriate to describe your personal experience (outside of the Acknowledgements) or to demonstrate your creative writing style. Use this opportunity to develop your own writing style – but write *clearly* and *concisely*. Committee members scrutinize the quality of the writing and editing. The thesis will be graded on the basis of content and writing effectiveness. Your grade will be undercut by inattentiveness to style, form, grammar, punctuation, spelling, and citations.

Active or passive voice? In all sections except for the Methods, the active voice is preferable to the passive voice. *"I" versus "we"?* Since your List of Contributions page specifies what parts of the work you did independently, many students choose to use "we" throughout the thesis. If you are comfortable using "I", it is also appropriate in a senior thesis. Beware however that it can become confusing if you are constantly going back and forth between "I" and "we", depending upon the particular experiment or method.

Resources: For examples of structure and format, previous theses are located on the shelves in the advising office (BioLabs 1082). We also maintain a searchable database of previous thesis on the Neuroscience website (https://coda.io/@kpenikis/thesis-database). We will put on 2-3 thesis-writing workshops for Neuroscience concentrators this year. You may also wish to consult with counselors at the Writing Center (https://writingcenter.fas.harvard.edu/). The counselors go over drafts of your writing. They also have a number of hand-outs on format, style, and other aspects of writing. We will also try to post resources for thesis writers on the Neuro website.

You should begin writing the thesis while experiments are still in progress (i.e., now!) while everything is fresh in your mind. You may identify inconsistencies in the data or interesting avenues that may be followed up while writing up the results section. At the latest, **you should aim to write a complete draft of your thesis by mid-late February** to allow two weeks for

revisions, printing, proofreading, etc. Give a copy to your mentor/s in lab as early as possible so that you can incorporate their feedback. Realize in advance that people will take longer to read and edit the thesis that you expect!

Page Formatting: Leave at least 1-inch margins on all sides of 8 1/2 x 11" paper. All textual material should be double-spaced and printed on one side of the page only. Use regular white copy paper; acid-free thesis paper is not necessary.

Font: Use a 12-point font, preferably Times or Arial.

Pagination: Page numbers (Arabic) should appear centered at the bottom of the page, separated from the text by approximately 0.5 inch. Every sheet of paper in the document should be counted in the numbering sequence. The title page is the only page not physically numbered, but it is still counted as page one. (So, your physical page numbering will begin with page “2” at the bottom of the Honor Code page.) Do not use letter suffixes (e.g., 10a) for page numbering. As specified earlier, pages with figures should be numbered in sequence with the rest of the document.

Optional: *If you’d like to print your own personal copy of your thesis (not required):*
The printed copy is most commonly bound in spiral (or coil) binding, which Kinkos, Staples, Gnomon, or Flash Print can do for a nominal fee. Also, beware: copy centers like Staples etc. may charge you for color printing the entire document, even if it only contains a handful of color pages. You may prefer to ask them to print the whole document in black and white, then specify the few pages that need to be reprinted in color and inserted.

 STRUCTURE

NEUROBIOLOGY CONTENT 

NEUROBIOLOGY CONTENT REQUIREMENTS

Note for students working in behavioral science, cognitive science, computer science, sleep, and immunology labs:

One of the core Neuro Thesis Requirements is that it must provide mechanistic insight into how the nervous system works. As a Neuroscience concentrator, your thesis must integrate your knowledge of the brain with your research topic. You may find, however, that your lab mentors do not have expertise in the neurobiology underlying or related to your study. Therefore, the onus is on you to find the appropriate literature/background materials and to think about how they relate to your work. If you have any difficulty identifying relevant material to include, please contact your advisor (Dr. Draft, Magnotti, or Penikis) and they will help you find an auxiliary 'Neuroscience' mentor to guide this aspect of your writing.

Your thesis must satisfy the following requirements to receive full credit:

1) The Introduction should provide 2-3 pages of neurobiological context and background for your study. For example:

- activity patterns of the cell populations or individual cells in the areas you study (fMRI, EEG, electrophysiology studies) and how the activity relates to specific behaviors or information processing, etc.
- connectivity/organization of the cell populations in the areas you study (layers, columns, maps; connections among regions/relationship to function; etc.)
- cellular/molecular mechanisms involved in your study (neurobiological models of: learning/plasticity, addiction; cell/neurite growth/survival or signaling; etc.)

2) The Discussion should include 1-2 pages speculating on how the neurobiology described in the introduction might have influenced the results of your study.

FORMATTING AND STYLE EVALUATION

EVALUATION

As an undergraduate, you may need to stop doing experiments before you have definitive results or a complete story because of thesis deadlines. The completeness of the experiments is a major difference between the undergraduate thesis and a doctoral thesis, and it is understood that undergraduates often cannot fully complete their intended story. **How well the thesis is written, presented, and analyzed is the major determinant of its quality.**

You will receive two separate evaluations for your thesis work:

1) The letter grade that appears on your transcript for Neuro 99 is assigned independently by your research mentor. They will also write a short letter to the thesis evaluation committee on your behalf.

2) Your overall thesis "designation" (see below) is determined by a separate faculty committee. This designation does not get recorded on any official document and it is merely a subjective assessment by two independent members of the faculty. You will present your research to these faculty during your thesis conference (~30 minutes, late March/early April). A committee will then examine all evaluations to produce your overall thesis designation. This evaluation is not meant to provide feedback on your work (that comes from your lab and PI) nor is it meant to be a measure of the value of your work (that comes from the experience across many semesters). Your thesis designation will be available to you by the end of the final exam period.

Thesis Designations from Neuroscience faculty committee:

The percent of theses awarded to each category varies year to year. The numbers below are approximations.

With Highest Distinction (~5-10%): This mark distinguishes beautifully written theses that report scientific research of high quality. The thesis should be without flaw in both the design and the execution of the project. (Mastery of difficult techniques alone is not an adequate criterion for earning the summa distinction, nor is the judgment that a particular thesis is publishable.)

With High Distinction (~50%): This designation distinguishes clear, very well-written theses that reflect an excellent effort both in lab work and in analysis that goes beyond what is expected in undergraduate work.

With Distinction (~40%): This designation signifies that a quality and substantial effort was made in the lab and that the rationale, methods, and results are well described in the thesis at the expected level for a Harvard College student.

Acceptable (~0-5%): This designation is reserved for theses that are adequate but not deemed worthy of receiving a distinction. The rationale, methods, and results are described but not in a manner sufficient for any kind of distinction.

No Credit: This designation is reserved for theses that do not meet the standards expected of a Neuro undergraduate thesis.

NEUROBIOLOGY CONTENT THESIS CONFERENCE

THESIS CONFERENCE

Prior to submission of your thesis, we expect that you will be focused on your written thesis. After spring break (i.e., late March/early April), you will have a chance to present your work in person to the two Harvard Neuroscience faculty who are reviewing your thesis. This is not only a chance for the reviewers to gauge how well you can speak and answer questions about your project, but also a chance for you to get practice presenting and communicating your research.

This conference will last 30 minutes. You should plan for a 15-minute presentation and 15 minutes of questions, although it's highly likely that the faculty will interrupt with questions interspersed throughout your talk. You may not reach the end of your presentation: that is perfectly fine. The faculty want to take a deep dive as questions arise; the focus is not to cover every aspect of your work. We recommend preparing ~10-15 slides (roughly 1 slide per minute, keeping in mind that some points may take longer to explain). You should briefly address the key background of your project (1-2 slides), key results (not necessarily every single figure in your thesis), and major conclusions (1-2 slides; including limitations and future hypotheses).

Your evaluators will ask you questions specifically related to the content of your thesis, likely involving the background literature, rationale, research methodology, and interpretation of results. Be prepared for any level of questions - the faculty may ask some questions that seem naïve or basic and others that challenge you to think more deeply about your research. It's okay to not know every answer! We have posted a list of questions you should be able to answer about your project below. (*Not all questions apply to every thesis project.)*

Methods

- Do you understand how the methods that you are using work (what does the data that you collect mean biologically)? What does the raw data look like? Was it altered/processed; if so, why and how?
- Why did you choose to use the methods you did (what are the advantages/disadvantages)?
- What are other methods/approaches could answer or address the same question?

Experimental Design

- What are your positive and negative controls?
- Are there other variables that might influence your results, complicate the interpretation, or make your data less reliable (for example: sex, age, strain, timing, background/history

differences, etc.)?

- Are there other ways to interpret your results?
- If you could do a more ideal experiment, what would it be? What would you do to improve the quality of your results (or your confidence in your interpretation)?
- What would the next step in the analysis be?

Statistical Analysis

- What statistical tests are most appropriate for your data (can you justify why you used the particular test you did?)
- How did you determine what *n number* to use? What is the 'right' number?
- If your data is significant, what is the 'effect size' (magnitude of difference) in your groups? Is it meaningful?
- Does your result seek to establish causality or correlation?

Some additional general tips to keep in mind as you prepare for your thesis conference:

1) **Remember your audience:** You will present your work to two Harvard faculty members in the field of Neuroscience. Assume they are infinitely intelligent but not experts in your field. They might work on anything from ion channels to EEG. They will know everything in NEURO 80, but not necessarily anything more specific about your work.

2) **Pay attention to slide design**: Slide titles should be concise and deliver the take home message for each slide. Slides should not have a lot of text. It is difficult for the audience to read the text and listen to your voice simultaneously; moreover, it will be boring if you just read the text on the slide aloud. Therefore, use text sparingly and to emphasize important conclusions and take-home messages. Use images, cartoons, tables, charts, etc. to illustrate and support your ideas. Explain every piece of data/information you put on a slide; do not put data/information on your slides that you do not or cannot explain.

3) If you want to cite where you obtained a graphic/figure/schematic on your slide, add a succinct citation on the bottom of your slide (smaller font than your main text, maybe in grey to be less obtrusive). You do not need to cite text/bullet points on your slides. If you do wish to do this, put the first author's last name and year of publication in parenthesis after the text (ie, in-line citation).

4) **Practice, practice, practice!** Practice is crucial: including saying the words out loud, not just in your head! Practice your presentation so you know the information on each slide, and, importantly, how to link/transition between two slides and to make sure your narrative structure is coherent. Practice speaking clearly, loudly enough for all to hear, and not too fast. Practice maintaining eye contact with the audience; don't just read from your notes. **Ask your lab members to be your audience for a practice talk**, and most importantly, ask them to interrupt you with questions along the way! This will help simulate the format you will experience at the thesis conference.

 EVALUATION

TIPS FROM STUDENTS 

TIPS FROM FORMER STUDENTS

- Read this guide carefully!
- Write the thesis you wish you could have read on your first day in the lab to understand your project.
- Create a document for each major section on your computer now to start formalizing early notes. Title the documents as follows:

  "Introduction" – Use this document to start jotting down ideas/main points that you want to cover in your intro. In bullet format, write out the specific questions your research is aiming to address. Fine-tune those questions over time.

  "Methods" – Use this document to start jotting down notes about your experimental methods, protocols, concentrations, stimulus intensities, etc. It is much easier to write down these details now while you're still doing the experiments.

  "Results" – Use this document to list some of the experiments you've done in bullet format and how you interpret the data. You probably already keep this info in a lab notebook, but the earlier you transfer it to a typed up document, the better.

  "References" – Keep a list of journal articles you want to include in your thesis as you remember them.

More advice from former students…

- Use literally any citation program (like Endnote). Don't be me and do it by hand.
- Speak up if your mentor is overworking you! Sometimes they forget you have other classes.
- Reach out and don't be afraid to ask for help.
- Communicate with your PI and mentors and ask for feedback.
- No pressure to write a perfect rough draft. Write (even if the words don't sound great) and revise later! Good writing is mostly revision. Don't be afraid to write!
- Take a class related to your topic.
- Talk to your friends about things other than your thesis.
- Set and stick to early deadlines. You will thank yourself.

THESIS CONFERENCE COMMON MISTAKES

COMMON MISTAKES

Abbreviation soup. Don't use too many abbreviations. It can be cumbersome for a reader who may not be familiar with your abbreviations, and it may detract from their judgment of your writing. For example, if you are discussing proteins with abbreviations, don't also abbreviate motor neuron (MN) and motor nucleus (MNu). Just spell out motor neuron and motor nucleus. Try to avoid using an abbreviation at all unless 1) it is usually abbreviated by most others in the field; 2) the abbreviation significantly shortens the phrase (e.g. a 4-word phrase shortened to 4 letters); AND 3) the abbreviation will significantly streamline your text (i.e., you use the abbreviation more than 20 times). If you use the word/phrase fewer than five times in your thesis, do not abbreviate no matter how long the phrase.

Scientific jargon. Just because a phrase is used commonly in your lab/field does not mean that someone outside of your field is familiar with it. The thesis is written for a much more general audience, and readers can feel insulted if you are not explaining your terms. Be sure to adequately introduce and explain any scientific jargon that is not common knowledge (for example, “sequence task”; “calcium dye”). Once you describe it the first time, it is appropriate to then use your shortened terminology throughout the rest of the thesis.

Too many headings. Headings can be useful landmarks in a long document, particularly the thesis Introduction, which may cover a lot of material. Be careful, however, that you do not use too many headings. They break up the flow of your writing. Don’t use a new heading as a crutch or substitute for a key segue sentence that transitions smoothly to the next paragraph.

Trying too hard to impress the reader. While it is important to be proud of your achievements and sound strong and ambitious in your writing, it is also easy to sound overly naïve or arrogant about what you have done. If your data is novel or important, you should say so, but don’t mention it more than once or twice. Avoid referring to your work in a grandiose way or saying that it has “proven” a theory or led to saving future lives, etc. Instead of saying that your results “elucidate the mechanism”, say that they “help to elucidate the mechanism”. Readers are most impressed by a confident student who not only presents the strengths of his/her work but also points out its weaknesses, addressing them before the reader can criticize. This is best done in the Discussion. Identify what are the strengths of the experiments (e.g., good behavioral paradigm, excellent expression of proteins) and what are the weaknesses (e.g., too much variability in the data, not a large enough sample size, animals were not healthy after

expression, etc.) Then talk about how each of those weaknesses could be improved, for example by running a larger number of experiments to increase statistical power.

Figures are too small. Don't waste your efforts on your figures by making them too small. Use the whole page. It will be easier for the reader.

If you need further guidance on any aspect of the thesis, from page numbering to data woes, please come and talk to Dr. Draft, Magnotti, or Penikis.

Finally, remember that you have worked hard to get to this point. The thesis is your chance to share the knowledge you've generated!

Good luck!!!

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