
THE COLLEGE OF

WOOSTER

**NEUROSCIENCE
INDEPENDENT STUDY
HANDBOOK**

UPDATED: February 2012

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OVERVIEW OF IS

Prerequisites:

- **Required:** Statistics (250) and at least one 300-level Neuroscience course must be successfully completed prior to Junior IS.
 - **Recommended:** Completion of introductory courses and at least one or more upper level elective course in the major are recommended.
-

SPRING Jr Year

NEUROSCIENCE 401 – JR IS

- **Goals:** Choose a project, develop familiarity with the literature, propose appropriate experimental design and data analysis, write a research proposal
 - **Choosing a project:**
 - At the beginning of spring semester we will have descriptions of projects and faculty research interests from which may choose.
 - Some students may choose to design their own project – This is appropriate for students who already have a project in mind, have prior research experience and are especially strong and/or committed students.
 - Some students may also choose to have a co-advisor at another institution (e.g. OARDC, summer research advisor)
 - We encourage students to consider collaborative projects, in which some aspects of the project are shared with a peer or peers. This can allow for increased “n’s” and increased probability of obtaining meaningful data. Note that unique contributions are required by each student - however we do encourage sharing of data, resources, ideas, literature, etc.
 - Meet with individual faculty to discuss options and then choose an advisor and project.
 - Provide descriptions of preferences (2-3) for research project & advisor. Advisors will be assigned by Neuroscience faculty based on student preferences and attempts to equally distribute students among advisors.
 - **Write a Research Proposal :**
 - Jr IS culminates in a research proposal that includes an extensive literature review, specific aims, research design and methods – this proposal usually serves as the “game plan” for your IS project.
 - **Attend Seminars:**
 - You are required to attend all Neuroscience seminars and will be alerted to these through your Wooster email. You are required to attend at least 2 neuroscience related research seminars on or off campus each month (may include BCMB, Biology, Chemistry or Psychology, as well as Sr IS presentations).
 - **Seminar Log:** You are required to record the date and title of the seminar and summarize the major points of the seminar in the form of a short paragraph
 - **Grade:** A-F (65 % Final Research Proposal; 30% Drafts, Journal Club Participation, and Participation in Peer Review; 5% Seminar attendance and log with brief summaries)
-

SUMMER Senior Year

Helpful tips

- Some students may choose to collect data during the summer.
- Some students may choose to also do more revising on their intro.
- Some students may choose to continue reading relevant literature.
- Some students write and submit IACUC (Internal Animal Care and Use Committee) proposals
- Some students write there Copeland proposals for additional funding – usually due in Sept

FALL Senior Year

NEUROSCIENCE 451 – SR IS

- **Conduct research** (*once, twice... it'll take a few attempts!*)
 - some students may compile & analyze data
- **Start writing your theses**
- **Meet with your advisor**
 - Use these meeting to set goals and discuss progress and literature, discuss future plans, plan arrangements for additional help with data analysis, writing, or techniques, etc. Be prepared and arrive on time.
- **Attend Seminars :**
 - You are required to attend all Neuroscience seminars. You are required to attend at least 2 neuroscience related research seminars on or off campus each month (may include BCMB, Biology, Chemistry or Psychology). No log required.
- **Grade:** S-N (assigned by advisor)
- Failure to accomplish a satisfactory amount of research goals (set by you and your advisor) will result in either an Incomplete or an NC grade for 451. Assignment of an I or NC grade will necessitate that you spend at least one extra semester on campus to complete your project.

SPRING Senior Year

NEUROSCIENCE 452 – SR IS

- some students may still be collecting/analyzing data early in semester
- most students will be writing & revising their theses
- written thesis due the Monday after spring break
- continue meetings with advisor
- present 15-minute research seminar (will be scheduled typically after spring break)
- schedule oral exam with advisor and 2nd reader (2nd readers are assigned by faculty after spring break)
- make contribution to campus-wide I.S. Celebration and regional/national meeting if possible
- Grade: H / G / S / NC (assigned by advisor and second reader after consultation with Neuroscience faculty)

Junior IS proposal

Your Jr IS research proposal will contain the following sections: Background and Significance, Specific Aims, Experimental Design and Methods, and References

I. Background and Significance:

You probably already have some intended research area and/or interests. Before writing your proposal, it is useful/necessary to have thoroughly researched your topic (start with step 1, the annotated bibliography). The overall goal of the Background and Significance is to provide a review of relevant literature that is clearly linked your overall research aims (as described in your specific aims section). That said, the first draft of the B&S may need to be revised after you write the Specific Aims and Experimental Design.

Step 1:

Prepare an Annotated bibliography: What is an annotated bibliography? An annotated bibliography is a list of citations (abstracts, review articles, and primary research; books are good primarily for obtaining background info before you start). Each citation should be followed by a brief evaluation. For this particular exercise, the annotation is meant to serve YOU: It is NOT meant to serve as summary of the article for someone else to read, it doesn't need to be grammatically perfect; If you find a research article that is potentially relevant simply because of the techniques that are mentioned, then that is what you describe and focus on in your annotation; It should summarize what is interesting about the citation in the context of your research. Your annotated bibliography should be saved electronically (*why?* if the citations are properly formatted, then you can use for this for your proposal and your thesis).

Web Resources:

<http://owl.english.purdue.edu/owl/resource/614/01/>

http://www.unc.edu/depts/wcweb/handouts/annotated_bibliographies.html

A Note About Citations and Bibliographic Format

Your sources should be cited in the text and listed in the Literature Cited section following the guidelines described in the Journal of Neuroscience.

Step 2: Identify Your Overall Research Question(s)

It is important to at least have a vague sense of your research question before you get too far into the lit review. This is because the lit review should be structured in a way that it leads up to your primary research question.

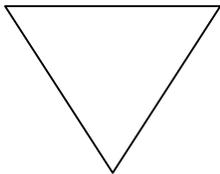
Before you develop your research question(s), consider the fact that you will be *doing* this research. What can you in reality accomplish in one to two semesters? Hopefully you have gotten a taste for this from your laboratory courses (or other experience). Although specifics regarding methodologies are not included in the lit review, if you plan to use mouse models or cell cultures in your research, etc., relevant research using these systems may be worth discussing in the B&S (in the context of your research question). When you are searching the literature, you will want to keep an eye out for methodologies/assays that you could conceivably utilize to address your research question (save these for the Experimental Design)! If the methods or assays that you use have worked for someone else (including your advisor) OR if you have at least some knowledge regarding the technique(s), this *may* save you MONTHS of trouble shooting.

Tips for developing a “good” question:

- Brain storm as you research: Write down potential questions, gaps in the literature (on a separate piece of paper) as you do your literature research!
- Extend a research finding to another population
- Extend a research finding to another situation, under different conditions, or with additional variables
- Explicitly compare two procedures/techniques/treatments that have each been compared to a control, but not to one another
- Resolve contradictions
- Combine two findings to predict a third
- For all of the above, it is very important that you are sure the research question(s) is not so complex that it can not be fully studied during the IS timeline. Though we talk about IS being a year-long project, it is actually only 20 weeks of the academic semester, with 3 more added in if you plan to spend your winter break on campus. We will expect that your IS will be complete before Spring Break and make no promise to continue to assist you during those 2 weeks.

C. Step 3: Writing the Background and Significance:

The goal of this section is to provide the reader with the background information necessary to understand the *significance* of your research question/specific aim(s) and to *summarize and integrate previous work/research* that relates to your research question/specific aim. This section should be written with the most general concepts first, progressing to be more and more detailed until you focus finally on your specific aim(s) (the specific aim can be stated as a research question, an objective, or a specific aim). A way to visualize this is by thinking of an inverted triangle with the width of the triangle being the breadth of the subject matter being discussed.



General area of study

Important details necessary to understand question

Specific aim(s) of research project.

Here is a list of hints to aid your writing:

1. **Know your audience.** You are writing to other neuroscience majors and neuroscience faculty that have a good working knowledge of biology and neuroscience, but will not know many of the particular details of your area of research.
2. **Begin with a broad overview** of the research problem (1-2 paragraphs). Introduce the reader to the area by explaining key aspects of the research problem or field. If possible, point to concrete applications of the knowledge and the potential importance, but don't stretch the point.
3. **Prepare the reader through a description of key background information and then begin to build your argument or explanation of research goals.** Use a Chain of Logic: Start by discussing and citing previous work → link previous research to models, hypothesis, questions → link to overall goal of your study.
4. **Link discussion of previous work and background to your overall research goals and/or questions.** Explain HOW you will fill in the gaps of current knowledge. You may need to revisit your Background and Introduction to ensure the link is still effective, after planning the details of your project.
5. **Identify major points using bold or underlining.** Use sub-sections with new headings to segment information clearly and effectively.

6. **References are important.** You must demonstrate that you are an “expert” and know the literature in the proposed area of research. These citations may also be a good resource for you when you start the research design and methods section. Statements should be supported with references. An important way to demonstrate your true understanding of the empirical works you use in your B&S is to relate the articles to one another – discuss similarities, differences, points of contradiction, etc. The depth of integration between your references indicates clearly to your advisors if you understand the research or are simply summarizing the research.

II. Specific Aims

Tips for writing the Specific Aims section

- The specific aims section should serve as a succinct description of what you plan to accomplish during the project period. The Specific Aims summarizes the what, why, and how of the study or project. This is your “elevator pitch” (in which you have 2 minutes to explain your project and why it is important)
- Begin this section with a brief description of the overall short- and long-term goals, then state the specific aims in terms of measurable objectives and provide a brief overview of the general experimental prediction and approaches that will be used to accomplish your specific aims. The specific aims themselves may be presented as hypotheses, objectives, or questions that the proposed research will address. Numbering or bulleting each specific aim can be an effective way of “walking the reader through the proposal” and should also serve to organize the Experimental Design section.
- One page is recommended for this section.

An example of how you might choose to organize the specific aims.

The overall goal of the proposed research is to (e.g. evaluate the effects of caffeine consumption on). This goal will be accomplished through the following specific aims:

Specific Aim 1:

To test the hypothesis that

To test this hypothesis,describe in general terms how you will test the hypothesis. Briefly describe the specific techniques or strategies you will use (2-3 sentences).

If (this hypothesis is true), then (describe expected results).

Specific Aim 2:

III. EXPERIMENTAL DESIGN AND METHODS

The Goal is to describe HOW you will address your specific aim(s).

The overall goal of this section is to establish that the experiments you propose address the questions proposed in the Specific Aims, and that they are feasible. In writing this section, it is usually best to keep the organization similar to that of the Specific Aims: Write the description for each aim to answer the questions: WHAT? WHY? and HOW?

Be sure this section provides answers to the following:

1. What experiments will be done? Begin by discussing the overall (broad) approach for each aim. Provide justification of your approach, citing specific, previous situations in which that approach has been used successfully. The experiments should be designed to establish proof, not simply a correlation.

2. How will the experiments be carried out? Explain experimental manipulations, controls (both positive and negative), data collection and data analysis, potential problems and limitations, and state where crucial materials will be obtained (however, this is not a cookbook listing of protocols and

reagents). Common standard procedures can be described briefly and referenced, however controls should be explained thoroughly. Where appropriate, propose alternative experimental approaches.

4. How will the results be analyzed and interpreted? How will data be collected? What statistical or graphical methods will be used to examine the data? What is the reliability of your measurements or results? If possible, cite situations where similar procedures have shown the desired sensitivity.

3. What results are expected? Are the results consistent with more than one interpretation? Discuss results both consistent with your hypothesis and potential alternative, reasonable outcomes.

5. How do these activities accomplish the aims? Conclude each section with a statement that relates the results back to the stated aim. (Reminds the reader why you what you do.)

6. What future experiments might be performed to follow up these results? Ideally, each aim when accomplished should lead logically to the next aim or suggest some future line of experimentation. State this specifically and explicitly.

IV. References (as per Journal of Neuroscience)

References should be cited in the text as follows: "The procedure used has been described elsewhere (Green, 1978)," or "Our observations are in agreement with those of Brown and Black (1979) and of Fenster et al. (1999)," or with multiple references, in chronological order: "Earlier reports (Brown and Black, 1979, 1981; Fenster et al., 1997; Smith, 1982, 1984).... " In the list of references (to be typed double-spaced), papers should be given in alphabetical order according to the surname of the first author. In two-author papers with the same first author, the order is alphabetical by the second author's name. In three-or-more-author papers with the same first author, the order is chronological. The name of the author(s) should be followed by the date in parentheses, the full title of the paper as it appeared in the original together with the source of the reference, the volume number, and the first and last pages. Do not number or bullet the references. If the author list for a paper in the references exceeds 20, the paper should be cited as Author A et al. The following illustrate the format to be used:

Journal article

Hamill OP, Marty A, Neher E, Sakmann B, Sigworth F (1981) Improved patch-clamp techniques for high-resolution current recordings from cells and cell free membrane patches. *Pflugers Arch* 391:85-100.

Stoelzel CR, Stavnezer AJ, Denenberg VH, Ward M, Markus EJ (2002) The effects of aging and dorsal hippocampal lesions: performance on spatial and nonspatial comparable versions of the water maze. *Neurobiol Learn Mem.* 78:217-33.

Hodgkin AL, Huxley AF (1952a) The components of membrane conductance in the giant axon of *Loligo*. *J Physiol (Lond)* 116:473-496.

Hodgkin AL, Huxley AF (1952b) The dual effect of membrane potential on sodium conductance in the giant axon of *Loligo*. *J Physiol (Lond)* 116:497-506.

Book

Hille B (1984) *Ionic channels of excitable membranes*. Sunderland, MA: Sinauer.

Chapter in a book

Stent GS (1981) Strength and weakness of the genetic approach to the development of the nervous system. In: *Studies in developmental neurobiology: essays in honor of Viktor Hamburger* (Cowan WM, ed), pp288-321. New York: Oxford UP.

Abbreviations of journal titles should follow those listed in the Index Medicus.

Great tips for general writing: *Say it Simply: Tips for Clear Writing* Gary Westbrook, Senior Editor, The Journal of Neuroscience & Linda Cooper, McGill University

<http://www.jneurosci.org/misc/publishingpointers.dtl>

INDEPEDENT STUDY MANUSCRIPT GUIDE

Jan Pechenik has written an entire book (*A Short Guide to Writing about Biology*) on this subject and it is my understanding that all bio majors have this useful guide. Use it! Before you begin, read over chapter 1 and focus on “keys to success”. Read over *Chapter 5: Revising* before and after you complete your first draft.

What to include:

A. Title:

Provide a title that is appropriate and interesting and which conveys significant information about your manuscript.

Checklist:

- _____ Is descriptive gives a specific indication of what the study is about
- _____ is concise

B. Acknowledgments

Give *specific* thanks to those individuals who assisted you in your investigation. People are mentioned by first and last names, and their specific contributions are noted. Give specific thanks to funding sources that provided a mechanism for the project to be completed.

C. Abstract

The abstract is a summary of your report. In the abstract, include a) the primary purpose or hypothesis, b) a very brief and general methodology, c) summarize results and d) your main conclusions. Pechenik 208-209. Remember that researchers often search for key words in the title abstract and that your abstract serves to advertise your research. Scientists often skim abstract to determine if they are interested enough to read and possible SITE your paper!

Checklist

- _____ Background is stated in one or two sentences
- _____ Clearly describes the major purpose, objective or hypothesis that was tested
- _____ Contains a very brief) and general description of experimental approach or methodology (i.e., Changes in PC12 morphology were observed using microscopy) (2-3 sentences, max)
- _____ Major findings and conclusions reported (2-4 sentences, max)
- _____ Concluding sentence relates to statement of specific question addressed
- _____ Abstract is a single paragraph; if not can it be rewritten as one paragraph?
- _____ No references are included in the abstract
- _____ Is less than 250 words
- _____ Written in past tense (and tense is kept consistent throughout)

D. Introduction

In the Introduction, you should provide necessary background information that will allow the reader to understand the significance of your research aims/hypotheses. The goal of your IS info is to place your research in the context of the field. The final paragraph should perhaps state the specific hypothesis or hypotheses (or question or aim or objective). It may also provide a very general description of approach that you used to investigate you hypothesis (or question or aim). You may wish to end this section by briefly stating your main observations and conclusions. Pechenik pages 199-208.

Checklist:

- _____ Provides general historical and theoretical background from the literature (sites primary references)

- _____ Selected references and background are *directly relevant* to your experiment – this is not a lit review
- _____ Citation format is correct (author, year) or (author et al., year) & citations are paraphrased (do NOT use quotations)
- _____ Objectives of experiment are clearly stated
- _____ Main observations and conclusions are briefly stated.
- _____ Clear statement of specific question or issue addressed
- _____ All statements of fact or opinion are supported with a reference or example

E. Materials and Methods

This is a description of the experiment you performed. Keep the same format as the rest of the text (not outline format); include main steps of the experimental procedure. Details of the dissection, saline solution composition, and other mundane items can be referenced by citing the lab handout (I know this is subjective, so use your own discretion). Be sure to describe variable you chose to measure and a description of your controls. Include the equipment and reagents that you used (manufacturer and model or catalogue number, if unusual), and a description of environmental conditions when applicable (temp, light, etc.). Finally, you should specify any statistical tests that were used to analyze data. Read pg 151-157 in Pechenik's guide.

Checklist:

- _____ Written in paragraph form
- _____ Written in past tense
- _____ Materials are generally not listed separately
- _____ No references to containers
- _____ No description of routine procedures (e.g. to make the dilution, a micropipettor was used to pipette 150 microliters of media into an epindorf tube and 1 microliter of the antibody into the same epindorf tube).
- _____ Contains information that could enable reader to repeat the experiment. This includes incubation times and temperatures, wavelengths, concentrations, so on.
- _____ Brief description of controls is included
- _____ Design of experiment is clear and complete
- _____ Order is similar to order of the presentation of results
- _____ Subtitles help to organize different experimental procedures
- _____ Suppliers and make or model of number of unusual materials included
- _____ Rationale for each step is self-evident or clearly indicated
- _____ Each factor mentioned is likely to have influenced the outcome of this study (i.e., we don't really care about your trouble shooting, this is not a diary)
- _____ Includes brief description of how data were analyzed (calculations made, statistical tests used)

F. Results:

Present your results in the same order that you described your experimental methods above. Just giving a table or graph of your data is not enough! Describe your results in the text **and** also show your data (in graph, figure, or table format, but **don't put the same data in more than one format**). Put a thorough legend on your figures and tables but save observations of trends, sig differences and other for the text. The figure legend should begin with a sentence stating what the figure is. Label all axes and scales. Pechenik 157-190

In your Results text, don't use a figure or table as the subject of a sentence. Example:
 BAD: Figure 1 shows that the rates of the reaction catalyzed by alkaline phosphatase increased at higher temperatures.

BETTER: Rates of the reaction catalyzed by alkaline phosphatase increased at higher temperatures (Figure 1).

Checklist:

- _____ Figures and tables are present. Figure captions/legends are below each figure.
- _____ Table captions go above tables
- _____ Legends provide enough information to interpret the figures and tables. Should include sample size info, etc.
- _____ Figure and table titles are present and can be understood apart from the text
- _____ Text is present and summarizes important trends in the data described in words.
- _____ References are made in the text to each table and figure in the order they are numbered.
- _____ Appropriate use of stats (you will probably not be using stats in your PC12 paper)
- _____ Each table or graph makes a unique and important point (don't repeat data i.e., same data in a table and a graph)
- _____ The meaning of error bars on figures is clearly indicated in the caption
- _____ Numbers of individuals/numbers of replicates are clearly indicated in the graph, table, caption, or legend
- _____ Presented in past tense
- _____ Data is described, but their implications are not discussed
- _____ Don't use the word "significant" unless you have performed statistical test!
- _____ Results are presented in the past tense
- _____ Results are presented in active voice whenever possible

G. Discussion:

Systematically explain each of your results in the same order presented in the Results section. Here is where you need to go into greater detail in your explanations. Do not, however, include in your discussion details which are not directly relevant to your results. Compare your results with those of other researchers and attempt to account for any differences. This is where you might want to use other studies to help explain mechanisms of the phenomena you observed, but don't go overboard and talk about complexities beyond the scope of your study. Be thorough in documenting (referencing) the sources of your information. End with an overall conclusion that answers the questions you pose in your original objectives. Pechenick 191- 208

Checklist:

- _____ Results are briefly restated
- _____ Results are related to the objectives as stated in intro
- _____ Explanations for results are provided; implications are considered (in the context of primary literature)
- _____ Errors and inconsistencies are pointed out
- _____ Often suggests future studies that should be conducted, additional questions that stem from the current study

H. Literature Cited

Make sure each citation in the text is properly referenced in this section and that each reference has a citation in the text. Lecture notes are not appropriate as a reference source. Use additional readings. If you read about a paper in your text, cite your text but include the original reference of the paper as well. Please reference any ideas not your own. My laboratory instruction can be referenced for technique methodology but are not to be used as a source of scientific knowledge. In the text of the report, cite your lab guide as (see Pechenik pg74)

Checklist:

- _____ Citations are provided for every reference cited in the report and are in the correct format

_____ Section includes no references that are not cited in the report

_____ Each citation includes names of all authors, title of paper, year of publication, volume number, and page

OTHER ADVICE

I. ORGANIZATION IS KEY!

Remember, each paragraph should have a topic sentence. All sentences should relate to or support the topic sentence (if not, maybe they don't belong there). The topic sentences of each paragraph should provide a logical outline of your paper.

II. YOUR GOAL IS TO WRITE CLEARLY AND SUCCIENCTLY!

REVISIONS!!!!!!!!!!!!!! Read your paper over again. See Pechnick's chapter on Revising for clarity!

Is it clearly written? Could a friend that is not in this class understand your manuscript? Clarity is extremely important. If your advisors can't understand what you have written, you will not receive a grade higher than a C. See chapter 5 in Pechnik's *A Short Guide to Writing About Biology*.

III. Keep the verb tense of the entire paper consistent. Using present person in active voice is usually clearer and less wordy than passive voice past tense. Use simple words and less jargon when at all possible. It is most helpful for a second party (in addition to your computer's spell checker) to proofread your paper not only for typos but also for clarity of text and grammatical errors. You should proofread it several times (each time looking for something different, e.g. spelling, grammar, organization, logic, readability). Read your report as if you were evaluating it, looking for things you might have missed. *Use the evaluation form, the handout on common lab report mistakes, and this handout while doing so.*

Format for the Senior I.S. Thesis

The I.S. thesis should be prepared in the form of a scientific paper (see below for the required sections). For all issues related to appropriate style, grammar, content and presentation in the thesis, please refer to “A Short Guide to Writing About Biology” by Jan Pechenik. This book was required in some of your previous courses in biology at the College and we regard it as the final word on scientific writing for undergraduates. Refer to it frequently!

I. TITLE PAGE (SEE EXAMPLE BELOW)

II. TABLE OF CONTENTS

III. ABSTRACT

IV. ACKNOWLEDGEMENTS

V. INTRODUCTION

VI. MATERIALS AND METHODS

VII. RESULTS

VIII. DISCUSSION

IX. LITERATURE CITED

X. APPENDIX (Additional tables or figures may be appended to give details that are extra information, not suitably placed in the body of the thesis. The pages are numbered consecutively with the preceding pages.)

Mechanics of the Thesis

Margins

- 1 inch margin at the top and left of the page.
- 1 inch margin at the bottom and the right.
- Major Heading and Subheadings
- Center all major headings and subheadings.
- The major headings should be in capital letters; subheadings in small letters except for the first letter.

Spacing

- Double space throughout the body of the text.
- Between space between references in the literature cited, but single space within each reference.
- If using subheadings, triple space just before the subheading, but double space after it.

Numbering Pages

- Numbers are placed at the top right of the page.
- The page on which the table of contents begins is the first page of the paper, and should be numbered. All pages should be numbered consecutively from there. This includes pages containing illustrations exclusively.
- Page numbers should include an abbreviated running head for the document.
- The document can be printed double-sided.

Illustrations

- Place figures and tables as close as possible to the place where you first note them – but DO NOT interrupt the paragraph when you insert the figure.
- Figures and legends should be on the same page

Binding

- The two spiral bound copies of the thesis should be submitted to the Registrar.

Other style tips

- Do not (don't) use contractions.
- Do not use footnotes.

SAMPLE TITLE PAGE

Note that the title page is not numbered, it does not have a short title on the top of the page, and it does not have a running head across the bottom of the page.

The College of Wooster

The Effects of Background Music on the
Remembering of Short Stories

by

Jane Doe

Presented in Partial Fulfillment of the
Requirements of Independent Study Thesis Research

Supervised by

Amy Jo Stavnezer

Neuroscience Program

2011-2012

SAMPLE TABLE OF CONTENTS

The second page of your I.S. is typically the table of contents page. The Running Head and page numbering begin on this page.

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 General Theories of Motivation..... 8

 Societal Motivation.....12

 Development of McClelland’s Approach to Motivation13

 Criticism of the TAT.....20

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 The Job Choice Exercise.....24

 The Direction of This Study.....30

Method.....31

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Appendix B Student Demographic Survey.....75

SAMPLE ACKNOWLEDGEMENTS

The third page of your I.S. is the acknowledgements page. This page is optional, but if you want to thank anyone this is the place to do it. Copeland Funds, if you received them, should be acknowledged here.

Leadership 3

Acknowledgements

Thanks mom and dad.

Be sure to acknowledge funding sources.

SAMPLE ABSTRACT

The forth page of your I.S. is the abstract page. Your abstract should be between 150 – 250 words.

Leadership 4

Abstract

Indent the first line and write as a regular paragraph of text.

The remainder of the paper should be in basic APA format (this is not very different from Biology formatting). The lone exception is that the introduction should be given the title Introduction rather than the title of the paper as is normally the case.

SAMPLE REFERENCES

Beginning on at the top of next page immediately following the end of the Discussion section, you should list your references in Journal of Neuroscience format.

Leadership p#

References

In the list of references (to be typed double-spaced), papers should be given in alphabetical order according to the surname of the first author. In two-author papers with the same first author, the order is alphabetical by the second author's name. The name of the author(s) should be followed by the date in parentheses, the full title of the paper as it appeared in the original together with the source of the reference, the volume number, and the first and last pages. Do not number or bullet the references. If the author list for a paper in the references exceeds 20, the paper should be cited as Author A et al. See earlier sections of this handbook for examples.

Evaluation of the Thesis

The Second Reader

Each thesis is read by your faculty advisor (the first reader) and another member of the Neuroscience program, Biology, Chemistry or Psychology faculty (the second reader). Soon after I.S. Monday, the second reader will be assigned to you by the program. Your second reader will be chosen based on their expertise and on the need to spread readerships equally among faculty members. Your second reader will probably not be an expert in your area of research, therefore endeavor to write your thesis with such clarity that it will be understandable by someone who is not directly acquainted with your area of research.

If your project was co-advised, we will consider bringing in a third reader to avoid bias in the evaluation of your exam or written thesis.

The Oral Examination

An oral examination based on your thesis will take place in the weeks following the submission of the thesis. You are responsible for arranging a specific time and place for the exam that is acceptable to you, your advisor, and the second reader. The oral defense will typically last an hour or two and is best thought of as a conversation among scientists about a topic of shared interest (i.e., your I.S. thesis). If you have done your work off campus, you should consider inviting your off-campus advisor to attend the oral examination. At the end of the oral examination, you will be asked to leave the room, so that your advisor and the other participant(s) can discuss your performance. You will then be asked back into the room and informed whether you passed I.S. or not. You will not receive an I.S. grade at this time. Your I.S. grade ('honors', 'good', 'satisfactory' or 'no credit') is determined by your first and second readers based on the criteria detailed later in this handbook. Final grades are available only after *all* the oral examinations are completed, and the faculty have met as a group to discuss and assign grades.

Corrections to the Thesis

It is likely that the oral examination will uncover minor problems that will require some final modification of the written thesis. These might be simple typographical errors or something more substantial. In any case, you are likely to leave the oral exam with a list of changes to be made, and with the admonition that you will not receive a grade until (1) the corrected thesis has been re-submitted, and (2) your work area has been cleaned up and all equipment and supplies have been returned to their proper place. You should prepare a copy of the corrected thesis, and turn it in directly to your IS advisor. She/he may request that you permanently bind this copy, for their archives.

Criteria Used for the Evaluation of Independent Study in Neuroscience

Your advisor will evaluate the following components of your performance in Independent Study. This evaluation will be used by your advisor, in consultation with the other faculty members, in assigning a grade for Neuroscience 452 (Honors, Good, Satisfactory, or No Credit (not passing)). This is meant to give you a sense of what components are used for evaluation purposes. Note, however, that the components listed below are not necessarily weighted equally.

1. RESEARCH PROCESS

RESEARCH

- Competence with/understanding of techniques
- Independence in the lab or field and analysis of data
- Ability to troubleshoot (independently or by seeking appropriate guidance)
- Demonstration of consistent work ethic

THESIS DEVELOPMENT

- Level of independence of writing and editing
- Finding and reading relevant primary research articles
- Ability to interpret results in the context of the literature
- Establishing & meeting goals and deadlines

- Attitude & willingness to go beyond minimum requirements

2. WRITTEN THESIS

INTRODUCTION

- Organization
- Description of motivation for research
- Clarity of hypotheses/goals/specific aims
- Relevance and adequacy of background information

MATERIALS AND METHODS

- Organization
- Appropriate level of detail
- Description of data analysis
- Suitability of experimental design

RESULTS

- Organization
- Clarity and relevance of figures/tables
- Data analysis

DISCUSSION

- Organization
- Explanation of results in context of literature
- Integration of results with goals/hypotheses/specific aims
- Suggestion for future work

STYLE

- Mechanics and grammar
- Formatting
- Use of citations (e.g. was everything cited appropriately?)
- Clarity
- Professionalism/maturity of writing
- Understanding of target audience

3. ORAL EXAMINATION

KNOWLEDGE OF SUBJECT MATTER

- Breadth and depth of knowledge
- Clarity of explanations
- Ability to respond to questions and discuss research
- Demonstration of critical thinking

UNDERSTANDING AND EXPLANATION OF PROJECT

- Understanding of techniques used in project
- Understanding of significance of results
- Understanding of project in the context of the area of study
- In the eyes of the examining committee, has the I.S. been a productive experience for the student?
- Did the student take ownership of his/her project, and demonstrate interest and enthusiasm in what was done and learned?

STUDENT OBLIGATIONS AT THE END OF I.S.

Name _____

Date _____

Signature of appropriate person

Turn in a corrected copy of your thesis to the electronic Registrar database.

Return all borrowed equipment, chemicals, supplies or books to the appropriate locations. All chemicals and solutions made must be labeled with your name, date, and contents.

Give to your advisor all items which she/he wants including a CD copy of your thesis and poster, all raw data in organized the clearly labeled file and satisfy your advisor that your work space is in good order.

Turn in room or desk keys that were issued to you (if any).

Clean your work space(s) to the satisfaction of the laboratory technician/department administrator.

Your I.S. grade will not be determined until this sheet is completed and turned into your advisor.