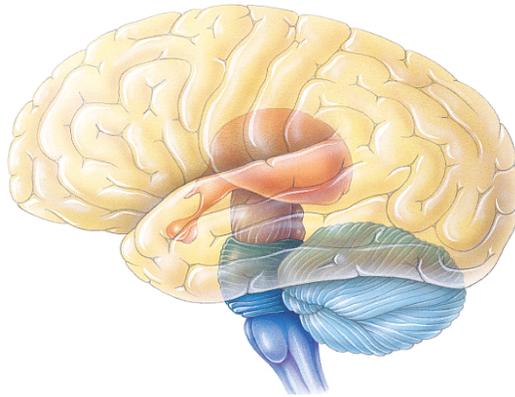


**The Neuroscience Department
Wellesley College**



**Guide for
Independent Research
Students**

2019-2020

250/250H/350/350H/360/370

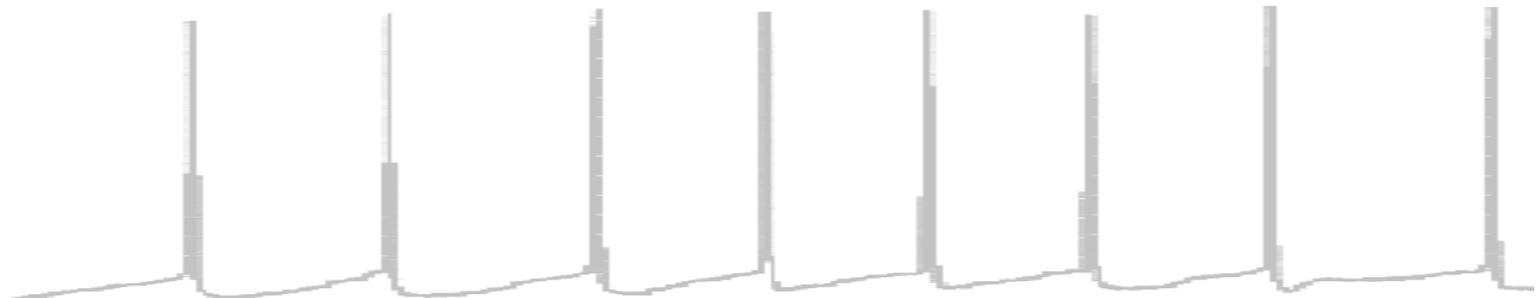
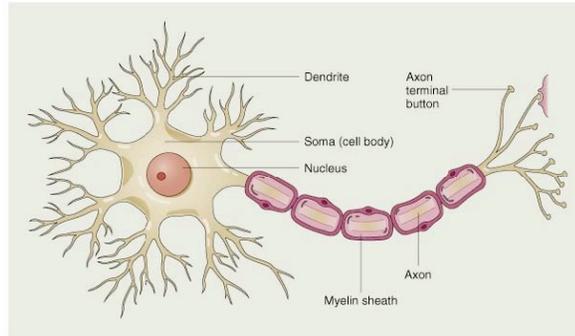


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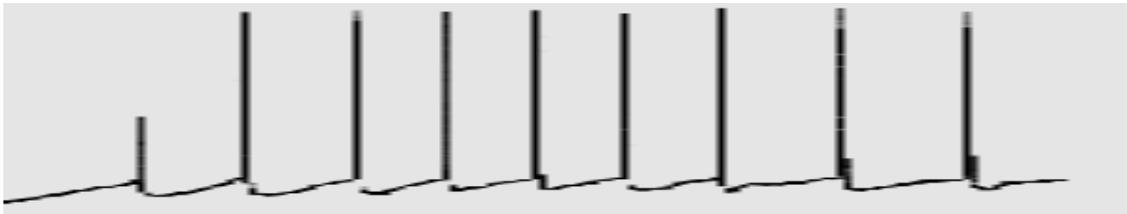
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Why do Independent Research?

Research is the source of new knowledge and understanding, and a research experience is potentially the most exciting part of your neuroscience education at Wellesley. Students, working closely with faculty, have an opportunity to use modern research methods, make new discoveries, and present their findings orally and in written form. The process therefore sharpens technical and analytical skills, critical thinking and independent learning, and helps students develop their abilities in public speaking and scientific writing. Many students say that laboratory research was their favorite and most valuable experience while at Wellesley. Talk to students and faculty, and find out more---don't miss out!



Choosing the Right Experience:

250, 250H, 350, 350H, 360/370

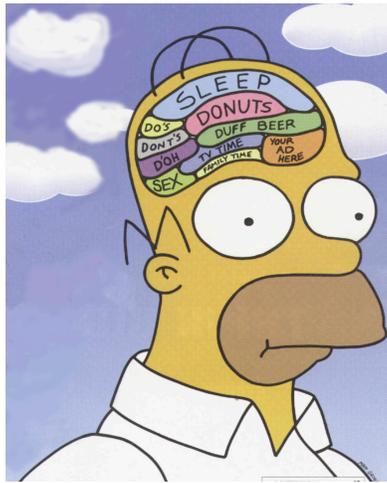
What's the "H" about?

Several "course" options are available for independent research. The 360/370 experience is defined as thesis research and this is only available to senior majors. The other designations are open to all students---majors and non-majors, from 1st-year through senior students--- and have no formal pre-requisites. The 250 and 350 options earn one unit of academic credit. 1st and 2nd-year students generally elect the 250, and more advanced students the 350, but there is no essential difference in these programs. The 250H and 350H options earn a ½ unit of academic credit. These experiences were designed to encourage students to "get their feet wet" in the lab. Students sometimes elect this option if they want to do research but do not have time in their schedule for a full unit, or if they want to give research a try but with a reduced time commitment.

Expectations: 250, 250H, 350, 350H

Students electing 250 or 350 research should anticipate spending 10-12 hours/week (on average) working on their research project; this is the same time expectation as for traditional 1-unit classroom-based courses. The expectation for the "H" options is 5-6 hours per week (on average) devoted to the research project. Note that 250, 250H, 350 and 350H research does not count towards the minimum major in neuroscience.

How to Find a Research Advisor



- ✓ think ahead
- ✓ use the web to learn about faculty research interests
- ✓ talk to other students about the research experience and about particular labs
- ✓ initiate contacts with potential faculty advisors

The first step towards a research experience is to learn about the faculty's research interests. This is most easily accomplished by reading departmental and individual faculty websites, and by using search engines to locate and read research publications written by Wellesley faculty. The reference librarians in the Science Library can teach you how to find specific journal articles. Once you have identified faculty whose research interests you, it is time to contact those faculty, talk to them about their work, and express interest in a lab project. It is best to do this well in advance of the term when the research will be conducted. For research in the fall term, make arrangements before you leave campus for the summer. On occasion, students are able to organize a 250, 250H, 350 or 350H during the add/drop period, but this is definitely not the recommended method as many labs do fill up before the semester begins.

Research in the Neuroscience Department (NEUR 250, 250H, 350, 350H, 360/370) can be conducted with any faculty member in the Biological Sciences and Chemistry Departments, and selected faculty in Computer Science, Physics and Psychology. For additional information, speak with the Chair of the Neuroscience Department.

Choosing a Research Project

Advisors and students generally discuss a variety of ideas and potential research questions before any decisions are made about specific projects. The final choice of a research topic is made after reading relevant literature and in consultation with the advisor.

Once the topic of research has been identified, a testable hypothesis is formulated. Working with the advisor, the student then designs an experimental plan and gathers the reagents and tools needed to conduct the study. The advisor is responsible for training research students in the relevant methods, until each student's skills are well enough developed to work independently. Then, you are on your way!



The Thesis Program: NEUR 360/370¹

Like any independent research experience, the primary goal of the thesis program is the development of independent research capabilities, and emphasizes creativity and initiative on the part of the student. Unlike other research experiences, however, the 360/370 is open only to majors. In addition to the research advisor, a faculty committee formed early in the senior year helps to direct the project. Thesis research culminates in the writing of a major research paper (thesis) and an oral defense of the work. The primary goal is not necessarily for the student to obtain positive conclusive results in a given project, but to develop skills that enable her to design and execute an experiment, analyze results, propose future experiments, complete a thorough literature search, and compose a high-quality research paper. Students who complete the thesis program are eligible for honors in the major. However, the designation of "honors" is not automatic with the completion of the 360/370, but is contingent on the quality of the research effort, the thesis and the oral exam.

NEUR 360 is elected for one unit of credit (normally in the fall of the senior year) followed by a unit of 370. Students are encouraged to begin the research project in the summer preceding the senior year. As with other 1-unit courses and research experiences, it is expected that the thesis work will require an average of 10-12 hours per week.

¹ Most of the guidelines for the thesis program are determined by the College, and additional information can be found at http://www.wellesley.edu/registrar/honors/thesis_process

Qualifications for NEUR 360/370

All junior neuroscience majors will be invited to consider the thesis program by means of a letter sent in the winter/spring prior to their senior year. Interested students should talk to faculty members whose research interests them, preferably even in advance of receiving this letter. Typically, enrollment in the 360/370 is contingent upon a grade point of 3.5 or higher in the major courses above the 100 level, and on a vote of the Neuroscience Department faculty. Students with a GPA of 3.0 - 3.5 can be approved for the thesis program by the Wellesley College Committee on Curriculum and Instruction (CCI), if the department faculty endorse their candidacy for the thesis program. If a student is accepted into the thesis program with a GPA lower than 3.5, it is generally recommended that the student elect a reduced course load during the thesis research semesters.

In order to continue thesis research for a second semester (NEUR 370) the following requirements must be fulfilled:

- 1) A complete draft of the thesis Introduction must be turned in by the January option date.
- 2) The Thesis Committee must have had at least one formal meeting/discussion.
- 3) The student's course grades must be maintained during NEUR 360 research. If a student receives grades below the level achieved at the time her thesis project was approved, the Department will review the situation and determine whether the student will be allowed to enroll in the NEUR 370.

Hot Tips

- ✓✓ **Plan to work on the thesis project over winter term in January and during Spring Break.**
- ✓✓ **Start writing early! 1st draft of the Introduction is due by the January option date in order to continue research in the second term.**
- ✓✓ **Evaluate data as they are collected, and begin to compile figures and tables as you go.**
- ✓✓ **Backup your data and thesis frequently and keep copies in several places.**

Composition of The Thesis Committee

The thesis committee is composed of:

- The student's research advisor
- Two other faculty members invited by the student in the fall. One of these should be chosen from the Neuroscience Department faculty (Deborah Bauer, Barb Beltz, Sharon Gobes, Marc Tetel, Sara Wasserman or Mike Wiest) or Neuroscience Advisory Committee (James Battat [Physics], Maggie Keane [Psychology], David Ellerby [Biological Sciences], or Ellen Hildreth [Computer Science]). The second committee member can be from any of the departments (listed above), and someone who would be closest to the area of the thesis research.
- One Wellesley faculty member in a field outside the department, who represents the Committee on Curriculum and Instruction (CCI). This outside member of the thesis committee needs to be tenured and not a member of the Neuroscience faculty. The Registrar provides a list of faculty who have volunteered to serve as outside members. This person is chosen by the student in the spring and only attends the oral examination in May.
- The Department Chair or representative (usually only attends the oral examination).

2019-2020 Calendar for the Thesis Program

Ginny Quinan, Thesis Coordinator

September- Ask faculty to serve on the thesis committee

You will need 2 committee members, 1 from the Neuroscience Department faculty (Barb Beltz, Marc Tetel, Sara Wasserman, Mike Wiest, Sharon Gobes, or Deborah Bauer) or Neuroscience Advisory committee (James Battat [Physics], Maggie Keane [Psychology], David Ellerby [Biological Sciences], or Ellen Hildreth [Computer Science]). The second committee member can be from any of the departments (listed above), and someone who would be closest to the area of your thesis research. Your research advisor is also a member of your committee. ***Please have your committee organized by the first meeting (below) of the neuroscience thesis students.***

September - Meeting with Neuroscience Department faculty

Throughout the year, we will be having occasional group meetings for the neuroscience thesis students. At this first meeting we will review the requirements and expectations for the NEUR 360/370, and will answer any questions you may have. ***Please have your committee members organized before this meeting, as we will be recording the names of all faculty participating in the thesis committees.***

October/November - 1st Thesis Committee meeting

You will organize your committee members (2 faculty and your advisor) for a meeting, at a convenient date/time for all members. For this meeting you should prepare a 1-2 page description of your thesis project, which you should distribute to your committee members at least 3 days prior to the meeting. Also, you should be prepared to provide a brief (10-15 minute) and informal introduction to the work at the beginning of the meeting, focusing in particular on progress to that point and any technical problems you are encountering or anticipate in the future. Your committee members are there to provide advice and support, and you should therefore be completely open with them about both successes and challenges.

January deadline for thesis introduction

Before you can register for NEUR 370, you are required to turn in a draft of the introduction for your thesis, to your research advisor.

January/February – 2nd Committee Meeting

As for the first committee meeting, find a suitable date and time, and gather your committee members together to discuss your project and progress. At this meeting, your committee will help you plan the remaining weeks to maximize your experimental and writing efforts, in preparation for the thesis deadline.

April 6th (Monday) – Names of reviewers due

Students must submit thesis reviewers through the Registrar's [thesis reviewer form](#) with a clear indication of which role each faculty member will serve:

1. honors advisor
2. honors visitor
3. department chair or Chair's designee
4. additional member of the department

More information can be found at the Registrar's current website, http://www.wellesley.edu/registrar/honors/thesis_process

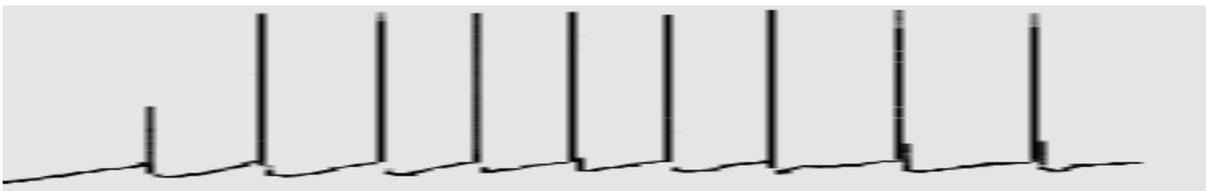
April 24th (Friday) -Thesis due!!

By 12:00PM on this day, the official copy of the thesis should be deposited into the College's repository. Information from the Registrar's Office will be sent closer to this time. More information can be found at the Registrar's current website, http://www.wellesley.edu/registrar/honors/thesis_process

April 28th (Tuesday) Ruhlman Conference.

Present your thesis research!

May (during reading period) – The Oral Exam



Writing the Thesis

The 360/370 research project culminates in the writing of a formal thesis. Rough drafts should be read by the advisor several times before the final draft is delivered to the Registrar's Office. The thesis should be well written, neat in appearance and carefully proofread. There is no set length for the thesis. It should be as concise as possible while being a complete report of the research project, and consists of the following:

- Title Page
- Abstract
- Introduction
- Materials and Methods
- Results
- Discussion
- Literature Cited

The page lengths of each section are highly variable depending upon the project, and it is best to consult the research advisor for guidance on this issue. Remember that it is important to be thorough, while also filtering the information so that extraneous details do not distract from the flow of the story.

Title Page

The title page should include title, author, faculty advisor's name, department, Wellesley College and date. It should also include a copyright statement including the student's name, faculty advisor's name and the year:

This material is copyrighted by student and advisor, date.

Note: If students utilize drawings, etc. from copyrighted books or journals, these copies cannot come under the student's copyright. The source of each such figure must be acknowledged.

After the oral examination, if the thesis committee recommends approval of the thesis for the degree with honors, the following statement should be added to the title page in the final copies of the thesis:

This material is submitted as partial fulfillment of a B.A. degree with honors in Neuroscience.

Abstract

The Abstract describes the research project “in a nutshell”. In no more than 300 words, the research questions, methodologies, data and conclusions should be described. A reader therefore should be able to gain a general idea about the project goals and findings, just by reading the abstract.

Introduction

The introduction should present the major questions/hypotheses being addressed, and should include enough background information so that an uninformed reader can appreciate the development of the problem and understand the motivation for the research. The thesis may later be used as a reference for others working in this area, and the Introduction therefore should provide a thorough foundation for the project.

Materials and Methods

The materials (chemicals, biochemicals, animals, cell types, etc.) used in the research should be described with their sources (often including catalogue number, name and location of vendor²). Isotopes should include specific activity, and animals should be identified by their genus and species names (e.g., American lobster, *Homarus americanus*; mouse, *Mus musculus*, etc.). Methods should be written

² Discuss the specific format with your research advisor.

clearly and with enough detail so that a reader could repeat the experiment based on the information provided. However, these should be presented as text, not as an itemized list or flow diagram.³ A specific step-by-step, more detailed description can be included as an appendix if necessary.

Results

The “Results” describe your experimental findings/data, and accompanying figures display these data in whatever form of presentation is most appropriate (e.g., tables, graphs or images). The results should be described in whatever order is most logical for clarity, and this need not be the historical sequence in which the experiments were done. Each figure should be cited (e.g., Fig. 1, Fig. 2, etc.) and the content described/discussed in the text. All graph axes must be labeled and each table, graph, and image must have a legend that contains sufficient information so that the reader does not need to consult the text in order to understand the basic message. Tables and figures are generally inserted directly in the text pages as close to the relevant text as possible, and should be presented in a form and quality (i.e., >300 dpi) that would be acceptable to a major journal in the field. Raw data, if these need to be included, should be placed in appendices following the body of the thesis.

³ The best way to get a feel for writing this section is to look at theses on file in the library, or to read journal articles.

Discussion

This section of the thesis places the data in the context of the field, and should include a comparison of the author's results with the data of related studies found in the literature. Similarities and differences between published data and thesis results should be discussed. The author should state the conclusions that can be drawn from the results and explain how this information fits into presently held hypotheses. Alternate interpretations and hypotheses are also important to include. Possible future directions suggested by the thesis work are also part of the discussion.

Literature Cited

There are several possible formats for referencing the literature cited in the thesis. You should follow the format used by one of the major journals in the field, chosen in consultation with your advisor. Some journals, such as *Nature*, cite references in the text numerically, and then list the complete reference at the back of the article according to the sequence in which they were cited. Others, such as the *Journal of Neuroscience*, cite authors and year of publication in the text, and the complete references are listed alphabetically by first author at the back of the article. Whichever format you choose, each reference in "Literature Cited" in the thesis should include:

- all authors (surname and first initial)
- the year of publication
- the complete title of the article
- the name of the journal with volume and page numbers

Thesis Submission Process

On Friday, April 24th, the official copy of your thesis should be deposited into the College's repository. Information from the Registrar's Office will be sent closer to this time. More information can be found at the Registrar's current website, http://www.wellesley.edu/registrar/honors/thesis_process

Submission of the final version of the thesis. At the time of the oral examination, suggestions for thesis revisions will be made and a due date for the final version determined. Once these revisions are complete, the student is responsible for depositing the final version into the Registrar's office repository and working with the Neuroscience Department Administrative Assistants to coordinate printing and binding.



The Oral Examination

The thesis discussion (i.e., "oral exam") will take place during reading period, on dates determined by the Committee on Curriculum and Instruction. The research advisor is responsible for scheduling the discussion and for making sure that committee members can come at that time. After a date and time when all participants are able to attend has been agreed upon, the advisor sends email confirmations to all participants. Individuals other than those on the Committee may attend the oral discussion at the invitation of the advisor.

The discussion is approximately one hour in length. All participants will be introduced by the research advisor. The student will then present a 10 minute review of the thesis work, often in the form of a PowerPoint presentation. This is followed by a question and answer period. Near the end of the hour, the student will be excused from the room to allow for a brief discussion among the committee members. The committee decision regarding the granting of honors for the thesis will be shared with the student immediately following this discussion.



The oral exam is intended to be an exciting dialogue between the student and her committee members, a time when the student has the opportunity to share her research discoveries, the depth of her knowledge on the topic, and her insights about future directions the project could take. Most students find the process fun and exhilarating ---the culmination of an intense year of research, and a moment to shine!

Financial Support for Research

Each student has a budget of \$500 per term to support NEUR 250/350/360/370 research. Students electing 250H and 350H have \$250 per term. These funds are intended to cover research costs such as:

- Animals
- Laboratory chemicals and supplies
- Photocopying
- Instrumentation charges

Students doing off-campus research may also use these funds to defray the cost of transportation and parking. An account number for accessing these funds will be issued to the research advisor (or in the case of off-campus research, the on-campus advisor).

Off-Campus Independent Research

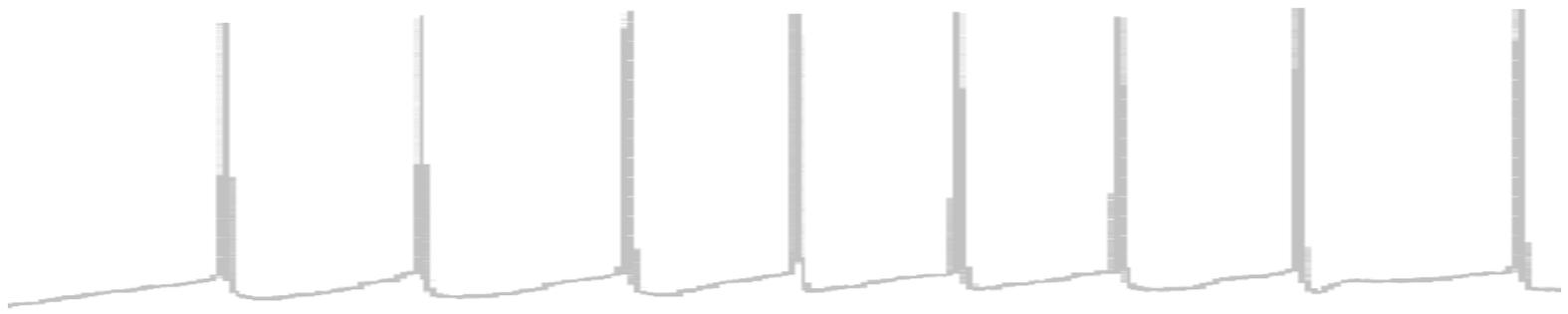
Many students do non-thesis laboratory research in a lab off campus. The first step in arranging an off-campus NEUR 250/250H/350/350H is to find a faculty member who will serve as your on-campus advisor. This individual should have some knowledge of the research area. It is expected that the on-campus advisor and research student will have regular meetings throughout the term where research progress, data and challenges will be discussed. The on-campus advisor will evaluate the term paper based on the semester's research and will assign a grade for the work, usually in consultation with the off-campus advisor. Because the thesis program has multiple curricular goals that can best be attained working with faculty on campus, off-campus thesis work is generally not approved. Grants are available from the Provost Office for students doing 250, 350, 360, or 370 work. More details and the [application form](#) are available on their site: <https://www.wellesley.edu/provost/students>.

Questions regarding policies related to off-campus research should be directed to Marc Tetel (Department Chair).

Summer Research

Many students' first laboratory experience occurs as part of a summer program, either at Wellesley or another institution. Many of these programs, including the one we offer at Wellesley, offer generous stipend support that allows students to focus on research and forego summer employment. One of the advantages of summer research is that students can focus solely on the research project without having to juggle course work and other academic activities. As competition for summer research programs is intense, we generally suggest that students explore our Wellesley program as well as others, to insure the best chance of finding a placement.

If you are interested in summer research at Wellesley, you should begin to explore various options by discussing the summer program with faculty whose work is of interest to you. The applications for the summer program are generally available early in the second term, are due before spring break, and decisions are made within a few weeks. The application will ask you to identify the faculty member(s) with whom you want to do research. It is in your best interest to have met with each of these faculty, discussed specific projects, and asked them if a position in his/her lab during the summer might be available. Doing footwork early in the year, may help you to avoid disappointment later!



2019-2020