The primary goal of the thesis program is the development of independent research capabilities, culminating in the writing of a research paper. The program emphasizes creativity, independence and initiative on the part of the student. The primary goal is not necessarily for positive conclusive results in a given project, but for the development of skills which enable the student to complete a thorough literature search, design an experiment, analyze results and propose future experiments. In addition there should be close interaction between the student, faculty advisor and department members of the thesis committee.

General Information

BISC 360 (or BIOC or NEUR 360) is elected for one unit of credit, followed by a unit of 370 dependent on successful completion of 360. Students are encouraged to begin the research project in the summer preceding the senior year. This might involve a literature search or working with the faculty advisor in the laboratory or field that summer.

Each unit of credit is estimated to require an average of eleven hours of work per week. The student should be prepared to spend this amount of time. While the advisor will expect this amount of involvement, he/she should limit demands on students to this time frame.

The research project will culminate in the writing of a formal thesis and in an oral discussion with the thesis and examination committee.

The advisor should consider it his/her responsibility to guide the student to a project which may be, if properly executed and well understood, worthy of the distinction of honors. The advisor should also work with the student in the evaluation of data and in the correction of rough drafts. (The corollary to this, of course, is that the student should meet with her advisor frequently to discuss data, and should begin writing rough drafts and submitting them to the advisor as early as possible. A draft of the Introduction must be turned into the advisor by the January option date in order to proceed with a 370 in the second term.)

Registration

All junior majors will be invited to consider the Thesis program. Interested students should talk to faculty members whose research interests them, usually in the fall or winter prior to their senior year. Once a faculty member has agreed to serve as the thesis advisor, the student should notify the department in writing. Final acceptance into the thesis program is subject to a vote of the department faculty and, typically, a grade point of 3.5 or higher. Students with a GPA of 3.0 - 3.5 may be recommended

to the College Curriculum Committee after a positive vote of the Biology faculty. Once approved by the Department, the student needs to register for BISC 360 (or BIOC 360, NEUR 360). If a student is accepted to the thesis program with a GPA lower than 3.5, It is recommended that the student elect a reduced course load during the BISC 360/370.

In order to continue thesis research for a second semester (BISC 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 (student, advisor, and two other faculty members) must have had at least one formal meeting/discussion.

3) The student's course grades must be maintained during BISC 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 may continue with the BISC 370. Receiving grades below a B during the first term will generally disqualify a student from the thesis program.

Committee

The examination committee is composed of:

* The student's research advisor

* Two other faculty members to be agreed upon and invited by the student and the research advisor in the fall. (For Biological Chemistry and Neuroscience majors, one faculty member must come from each of the departments of the interdepartmental major.)

* One Wellesley faculty member in a field outside the department, chosen by the student (decided in spring and who only attends the oral.) This person represents the Curriculum Committee.

* The Department Chairperson or representative (usually only attends the oral.)

Each year the Thesis Student's Co-ordinator for the Department will host a meeting for students and advisors in September to review the goals of the BISC 360/370 program and to answer questions. Thesis Students are strongly encouraged to attend these meetings. The co-ordinator this year (2007-2008) is Professor David Ellerby. In addition, the advisor and two faculty members of the committee should meet with the student during the first half of the 360 term. At this time the student

should present an outline of the research project or preliminary data from previous work on the project.

Ideally, the committee should meet with the student frequently, and each member should actively participate in the continuing evaluation and development of the project.

Thesis

At least four copies of the thesis should be made. Do not permanently bind these copies as revisions are usually necessary.

At the time of the 370 due date, a copy should be delivered to:

* The Registrar's Office for the Curriculum Committee,

* Both departmental faculty members of the committee

* Department Chairperson.

(The student and advisor can usually use one of the rough drafts.)

It is the student's responsibility to deliver these copies to the appropriate office or individual by the designated time. After the oral discussion, revisions and corrections are usually needed. The revised copies should be distributed to the following: Faculty Advisor, Registrar's Office/Curriculum, Biology Department and Student

There is no set length for the thesis. It should be as concise as possible while being a complete report of the research project.

It is suggested that writing and rewriting of the thesis should be ongoing throughout both semesters of the project. A detailed draft of the Introduction should be reviewed with the advisor by the end of the first term, and is required prior to proceeding with the BISC 370. Rough drafts should be read by the advisor several times before the final draft is delivered to the Dean's Office. The thesis should be well written, neat in appearance and carefully proof-read.

There are no requirements for binding of the thesis, but permanent binding should not be done until after the oral when final revisions are made. The copy to be given to the Biology Department should not be bound since it will be sent outside the College for binding.

The Thesis should be written in journal format consisting of the following:

* Abstract
* Introduction
* Materials and Methods
* Results
* Discussion
* Bibliography

Abstract

The Abstract should be no more than one page, single-spaced type, containing 100 to 200 words.

Introduction

The introduction should present the major question 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 chemicals, biochemicals, animals, cell types, etc. used in the research should be included with their sources. Isotopes should include specific activity. Methods should be written clearly so that the reader could repeat the experiment based on the information provided. A more specific step-by-step description can be included in an appendix.

Results

The results should be organized for clarity. Data should be displayed in tables, graphs, photos (e.g. cell, gels, blots, etc). Be sure that all axes are labeled on graphs, and that each table, graph, and photo has a legend that contains sufficient information so that the reader does not need to consult the text. However, each figure and graph also must be referred to and discussed in the text itself.

Tables and figures should be clearly presented in a form that would be acceptable to a major journal in the field. Raw data and detailed methods should be placed in appendices following the body of the thesis.

Discussion

This section places the data in the context of the field, and should include a comparison of the author's results with similar data found in the literature. Similarities and differences between published data and thesis results should be discussed. The author should state the conclusions which can be drawn from the results and explain how this information fits into presently held hypotheses. The author should present alternate interpretations and hypotheses when necessary. The Discussion section should also include a statement of possible future directions of this work.

Literature Cited

The bibliography should contain the literature cited in the thesis and each reference should include:

* all authors

* the title of the article

* the name of the journal

* the year of publication

Examples:

Textbooks:

Campos-Ortega JA, Hartenstein V. 1997. The embryonic development of Drosophila melanogaster. Springer Verlag, Berlin, Heidelberg.

Journal articles:

Cayre M, Malaterre J, Scotto-Lomassese S, Strambi C, Strambi A. 2002. The common properties of neurogenesis in the adult brain: from invertebrates to vertebrates. Comp Biochem Physiol B Biochem Mol Biol 132:1-15.

Kemperman G, Gage FH. 1999. New nerve cells for the adult brain. Sci Am 48-53.

References should be either numbered in the sequence in which they appear in the text or in alphabetical order by the first author. Determine which format your advisor prefers.

Title Page

The title page should include title, author, faculty advisor's name, department, Wellesley College and date.

The title page should 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 xerox 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 major.

Thesis Oral

Scheduling

The thesis discussion will take place during reading period. Dates will be published by the Curriculum Committee.

The advisor is responsible for scheduling the discussion and for making sure the committee members can come at that time. The advisor should consult the master schedule at the Department Office as well as the committee members' individual schedule. After a date and time at which all participants are able to attend has been chosen and agreed upon, the advisor should send letters of confirmation to each committee member. Individuals other than those on the Committee may attend the oral discussion at the invitation of the advisor. The advisor should consult with the student before issuing such an invitation. Requests to attend the discussion should be addressed to the advisor in advance.

Presentation

The student should begin with a fifteen minute introductory statement giving background information, summarizing the project or discussing particularly interesting data or conclusions. The committee members then address their questions to the student for up to one hour.

Questions should be directed towards clarification of methodology and data, and the evaluation of the data. The intent is to discover the depth of the students' understanding of the project and her ability to carry on independent research.

Photography

Each student is responsible for printing high quality images for inclusion in the

Money

Each student is allowed up to $500 per term to defray expenses of 370 work. The costs which must be covered by this money include:

* Laboratory chemicals
* Photocopying
* Photography
* EM/instrumentation charges

Suggestions and Recommendations

Be prepared to work on the 370 project over winter term in January and, if necessary, Spring Break. Start writing early. The Introduction must be in draft form by the January option date in order to continue research in the second term.

Compile results as you go. Do not collect a notebook full of numbers and wait for the spring thaw to do calculations; compile tables and figures, and begin the evaluation of those data.

The thesis should be typed to allow for multiple revisions. The final copy should be printed on a laser printer. Backup your copy of the thesis frequently and keep copies in several places.

Advisors Outside of Wellesley

Although the department does not encourage off-campus 360/370 work for most students, we do recognize that in some situations such an arrangement may be in the best interest of the student. In such cases, the student must find a faculty member in Biological Sciences who is willing to sponsor the project. This faculty person is considered the primary advisor for the overall 360/370 experience, and therefore should be familiar with the subject area in which the student will be involved. The student must prepare a 1-2 page summary of the proposed project, including information about the lab in which the project will be done (research site and the names of the head-of-lab and the person who will serve as the student's immediate supervisor. The outside advisor may be a faculty member or postdoctoral fellow at another institution. Graduate students may serve only as

technical advisors and day to day supervisors of a project under the supervision of such a faculty member or postdoc. Laboratory technicians are not considered appropriate supervisors for the project. It is strongly preferred that the outside advisor be someone with whom the student has already worked (for example in a summer research capacity). In this case a preliminary report should be made available by the student to the department describing the project, and presenting data accumulated to date. The on-campus advisor is responsible for presenting the student's case to the full department, which will vote on the student's proposal for an off-campus 360/370 experience.

Once a proposal has been accepted by the department, the following guidelines should be followed to insure that the research work and the thesis are progressing.

1. By the end of September, there should be an oral discussion between the on-campus advisor and the off-campus supervisor concerning the research project so that both parties are informed of the other's expectations regarding the student's level of independence and the laboratory's support of that student. The supervisor also should be informed that the on-campus advisor will direct the writing of the thesis.

2. During the first term, there should be an on-campus meeting of the full thesis committee, including the off-campus supervisor. The student will not be allowed to register for the 370 unless this meeting has taken place.

3. The student must meet with the on-campus advisor on at least a monthly basis throughout the year, to review research results and any changes in experimental plans. The student is encouraged to bring laboratory notebooks/ data and to prepare a short written summary for each of these meetings so that research progress is documented.

4. The finished thesis is generally due during the last week in April. The on-campus advisor will serve as the overseer of the written thesis, not the off-campus supervisor.* Since most theses require several written drafts prior to the final presentation, the on-campus advisor and the student should plan a schedule for submitting sections of the thesis for comments and evaluation by both advisor and supervisor. Input from the off-campus supervisor is encouraged, however, the student is ultimately responsible to the on-campus advisor for the written product.

5. As with on-campus theses, a complete draft of the Introduction is required by the end of the first term. A student may not continue with the second semester of research (BISC 370) unless the Introduction has been turned into the on-campus advisor.

*[This division of labor must be made clear to the off-campus supervisor during the initial oral discussion in September.]