Overview of Senior Independent Study in Biology

Summer

- Some students may choose to collect data during the summer.

Fall (BIOL-451)

- Collect and analyze data as needed
- Meet weekly (or as agreed) with I.S. advisor
- Attend departmental seminars (Tuesday or Thursday, 11-12)
- Begin writing thesis as needed

Grade: S/NC (assigned by advisor)

Spring (BIOL-452)

- Complete data collection and analysis
- Meet weekly (or as agreed) with I.S. advisor
- Attend departmental seminars (Tuesday or Thursday, 11-12)
- Complete written thesis and submit Monday after Spring Break
- Schedule oral exam with I.S. advisor and 2nd reader (assigned by Department)
- Contribute to Senior Research Symposium

Grade: H/G/S/NC (assigned by advisor & 2nd reader, in consultation with Dept.)
Senior Independent Study in Biology

At the end of Independent Study in the Biology Department, you will have completed:

- an investigation of a biological research question,
- a presentation at the fall poster symposium,
- a written thesis,
- an oral examination, and
- a contribution to the Senior Research Symposium.

This section provides detailed information on how to accomplish these activities.

Getting Started

During Junior Independent Study you prepare a research proposal to investigate a biological research question, which you will typically pursue during your senior year. As each project has its own requirements, it is not possible to draw up a schedule of events that will apply uniformly, but for a general timeline, see the “Overview of Senior Independent Study in Biology” (above). Ideally, data collection will be completed during the first semester, and the thesis written in the second. In practice, the best-laid plans don’t always work out. It is almost a certainty that the collection of data, or the writing of the thesis, or both, will take longer than you anticipate. It is far better to finish a little early than to have to reach for the panic button as the due date approaches! The message is simple: Get started as quickly as possible.

Off-Campus Research

Data for I.S. research (field projects and laboratory investigations) may be gathered anywhere that is accessible to the student investigator. Field projects, for example, may have seasonal restrictions that require gathering data at a time other than the academic year. In such instances, the fieldwork will often be in progress or may be completed before the beginning of your senior year. Unless performed at the nearby OARDC, laboratory projects conducted off campus typically will be done in the summer prior to the senior year.

Before such a project is initiated, however, it must have the approval of the student’s on-campus I.S. advisor. While students may pursue investigations that are closely related to other research being performed in the same facility, for I.S. the student cannot serve merely as a technician. Rather, I.S. research is to be an independent, self-generated study including original observations as part of a project designed by the student. To ensure that the work you do is appropriate for an I.S. project, you should arrange a meeting or telephone conversation between the off-campus advisor and your Wooster faculty advisor. In addition, any restrictions on the publication of research findings due to confidentiality agreements should be discussed before the project commences.
The I.S. thesis advisor must be kept fully informed about all phases of data gathering regardless of where they occur. Students collecting data away from the campus have a special obligation to keep their advisors informed about their activities and progress. Likewise, they are expected to follow a work schedule agreeable to the host laboratory.

Students working off campus should share their results with the host institution. This is typically done by giving a copy of the thesis to the person in charge of the laboratory. Assistance and advising by persons away from the campus should be identified and acknowledged in the thesis.

**Departmental Poster Symposium**

All Biology and Neurobiology majors are required to participate in the fall poster symposium. During this event, seniors present their I.S. projects to each other and to the faculty gram. The goals of the poster symposium are:

1. To communicate your research question, experimental design, and preliminary results to fellow biologists.
2. To receive feedback on your I.S. project from fellow biologists.
3. To socialize with fellow biology majors so that you can exchange ideas throughout the rest of the year and provide each other with support.

Details of the time and location of the symposium as well as information about the poster content and format will be communicated early in the fall semester.

**Senior Research Symposium**

Each senior is required to make a contribution to the campus-wide I.S. celebration. This can take the form of an oral presentation or a poster presentation. However, this should be geared toward a more general audience than your departmental poster presentation. Consult with your I.S. advisor for additional guidance.

**Weekly Seminar Series**

All seniors are required to attend weekly departmental seminars throughout both semesters. Lack of attendance at departmental seminars will negatively influence your final I.S. grade.

**The Independent Study Thesis**

The I.S. thesis in Biology is to be written in the form of a scientific paper (i.e., with an Abstract, Introduction, Materials and Methods, Results and Discussion sections). The thesis should be formatted as described later in this Handbook. You should work on a timeline that allows you to ask your advisor to read and comment on thesis drafts. Advisors differ in the number of drafts they will read, the deadlines they impose, and the comments they will make. Please work with your advisor to ensure that your thesis reflects your best work. Advisors are not expected to edit your thesis line by line, and all
errors and omissions remain the responsibility of the student. You should submit your final draft to your advisor before the full draft deadline (often the week before Spring Break). You should not expect your advisor to be available during the break. Two copies of the completed thesis are due in the registrar’s office at 5:00 p.m. on the first day of classes after spring break (“I.S. Monday”). At this stage, do not bind your thesis; rather submit it to the Registrar in a three-ring binder.

The College and the Department may request additional electronic or paper copies of the thesis for archiving purposes. Check with the College Registrar and the Biology Department administrative assistant for the current requirements.

**Evaluation of the Thesis**

**The Second Reader:** Soon after I.S. Monday, the department will assign another member of the department faculty to be your second reader. Your faculty advisor (the first reader) and the second reader will review your thesis.

Your second reader will be chosen based on their expertise and on the need to distribute readerships equally among faculty members. Your second reader will probably not be an expert in your area of research; therefore write your thesis so that it is clear to a reader outside your specific area of research.

**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. This exam typically lasts an hour and can be thought of as a conversation among scientists about your I.S. thesis. If you have done your work off campus (e.g., at the OARDC), you are encouraged to invite 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., but you will not receive a grade at this time.

**I.S. grade:** 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 Biology faculty has met as a group to discuss and assign grades.

**Corrections to the Thesis:** After your oral exam you will likely have a list of minor changes to make to the thesis before you can receive your grade. You should then prepare a copy of the corrected thesis, which you then submit to the College. In addition, your IS advisor may request that you submit a permanently bound paper copy or an electronic copy. If you worked off-campus, you should also provide a copy of the final thesis to your off-campus advisor.
**Am I Done Yet?** The checklist on the last page of this handbook must be completed before you are done with I.S. You will not receive your grade until you have finished all items on the checklist. Once you have finished these items and have discussed them with your adviser, you can consider yourself finished!
Format for the 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. The Biology Department regards this book, required for many of our courses, 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. INTRODUCTION

V. MATERIALS AND METHODS

VI. RESULTS

VII. DISCUSSION

VIII. ACKNOWLEDGEMENTS

X. LITERATURE CITED

XI. 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.)
HOW LONG DOES IT TAKE CRICKET FROGS TO CROAK?
A STUDY OF LONGEVITY AND SURVIVORSHIP IN
BLANCHARD’S CRICKET FROG ACRIS BLANCHARDI

DEPARTMENT OF BIOLOGY
INDEPENDENT STUDY THESIS

Michael Callahan MacDonald

Adviser: Richard Lehtinen

Submitted in Partial Fulfillment of the Requirement for
Independent Study Thesis in Biology at the
COLLEGE OF WOOSTER 2009
Mechanics of the Thesis

Margins

1. 1 1/2 inch margin at the top and left of the page.
2. 1 inch margin at the bottom and the right.

Major Heading and Subheadings

1. Center all major headings and subheadings.
2. The major headings should be in capital letters; subheadings in small letters except for the first letter.
3. Start all major sections of the paper on a new page.

Spacing

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

Numbering Pages

1. Numbers are placed 3/4 of an inch from the top of the page, in the center of the page, and should have a hyphen on each side (e.g., -2-).
2. The page on which the introduction begins is the first page of the paper, but it is not numbered. The next page is numbered page -2-.
3. All pages except the title page, the table of contents, and the first page should be numbered. This includes pages containing illustrations exclusively.

Illustrations

Illustrations, figures, graphs or tables can be embedded within the text of the document near to where they are first referred to. Alternatively, they can be placed after the literature cited at the end of the thesis.

Binder

The two copies of the thesis submitted to the Registrar on I.S. Monday should be bound according to the standard departmental procedures.
Evaluation Criteria for Independent Study in Biology

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 biology faculty members, in assigning a grade for Biology 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. Participation in Scientific Research Presentations

   A. Attendance at departmental seminars
   
   B. Presentations (Fall Department Poster and Spring I.S. Symposia)

      PROJECT DESCRIPTION
      • Background information
      • Clarity of goals / specific aims
      • Explanation of experimental design

      PRESENTATION MECHANICS
      • Organization
      • Clarity
      • Responses to questions

2. Research Process

   FIELD AND LABORATORY 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)
   • Practice of good lab citizenship (lab upkeep, materials cleanup, etc.)

   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

3. Written Thesis

   ABSTRACT
   • Organization
   • Clear and concise description of the project

   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

4. 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.

Turn in your final copy of your thesis to your advisor.

Clean your work space(s) to the satisfaction of your advisor.

Give your advisor all data and lab/field notebooks and any other items she/he requests.

Return all borrowed equipment and chemicals. All chemicals and solutions made by you and not to be used in the future should be disposed of properly.

Turn in any keys that were issued to you (if applicable).

Turn in a corrected copy of your thesis to the Registrar’s Office.

Complete Senior Survey and/or I.S. course evaluation, (if applicable, please discuss with your advisor).