

Guide for the Biology and Biomedical Sciences Honours Research Project (BIO4009 and BIM4009)

What is an Honours research project?

The Honours research project is a 9 credit course which is undertaken during the fourth year of study to satisfy the requirements of a BSc Honours program. The Honours research project represents a unique opportunity to work in close collaboration with a principal investigator and graduate students to gain practical experience in current scientific techniques as well as in reviewing and reporting scientific data. The Honours project is the capstone course of your experience in Biology or Biomedical Sciences. It involves original and independent work, carried out over a period of two semesters, under the supervision of a principal investigator.

Should I do an Honours research project?

Yes, if I:

- Am in an Honours program.
- Am someone who likes to work independently and one-on-one with a professor or principal investigator and graduate students.
- Am willing to devote on average 16 hours per week to my project. More time may be necessary at some points during the year on your project and your goals.
- Am a self-motivated individual and can effectively manage my time.
- Wish to significantly enhance my qualifications for graduate school or acquire pertinent work experience to showcase during my job search.
- Am interested in, or curious about, becoming a researcher.
- Have a natural curiosity and desire to contribute towards the advancement of knowledge in a field that interests me.

What are the requirements to do an Honours research project?

- Be registered in an Honours program in the Faculty of Science.
- Be in your 4th year of study.
- Have successfully completed a minimum of 81 university credits in your program of study.
- Have a minimum CGPA of 6.0.
- Have identified a professor or an investigator who wants to supervise or co-supervise your research and have you join her or his research team.
- **For BIO4009 students**, your supervisor must be associated with the Department of Biology. If your identified supervisor is not, you will need a co-supervisor in the Department.

How do I find a supervisor?

The first step is for you to find research labs carrying out research in fields of potential interest. These can be professors in the Department of Biology, other departments within the Faculty of Science, or other research organizations. Check the departments' or the organizations' web sites to find potential supervisors. Feel free to speak to past Honours students, graduate students, lab coordinators and professors you may know. Once you have identified prospective supervisors, contact them (in person or by e-mail) to express your interest in carrying out an Honours project under their supervision. It is a good idea to include the following when you contact potential supervisors:

- A CV or résumé which includes relevant lab experience and theoretical courses you have taken in the proposed area of study.
- An unofficial transcript or grade audit.
- A cover letter that expresses your interest in doing a research project in their lab.
- The names of at least two references who can comment on your abilities.

N.B.: Obtaining a project that fits your interests exactly is not always possible or necessary at the Honours level, so flexibility is essential when considering projects and supervisors.

When should I start looking for a supervisor?

There is no set time as to when you have to start your search. Students generally start looking for a research lab towards the end of the first semester of their third year. However, it is not unheard of for students to find a supervisor as late as the beginning of their fourth year. Ideally, you will have secured a project supervisor prior to the end of April. This timing allows the student and the supervisor to start planning the research project or, in some cases, complete essential training in the lab during the summer months.

General expectations of the supervisor

- Develop in collaboration with the student a research project that is appropriate in scope and character for the Honours program, and is feasible in terms of time, facilities, equipment, and technical requirements.
- Provide an introduction to the relevant literature and resources.
- Help the student understand the rationale and context of the proposed research project.
- Instruct the student in the necessary experimental techniques, where appropriate.
- Assist the student in the critical analysis and interpretation of experimental data.
- Make the student aware of any compulsory health and safety course requirements, or other mandatory training sessions (e.g. animal care).
- Make the student aware of relevant university and faculty policies and procedures.
- Be aware that Honours students will spend on average 16 hours per week on their project, and that they have other courses and duties. Expectations of regular hours above 16 per week should be negotiated between the student and the supervisor prior to initiating the research project.
- Establish with the student mutual expectations and clearly identify the objectives.
- Provide regular feedback on all elements of the student's performance and progress.
- Integrate the Honours student fully into the activities of the lab including such things as weekly/biweekly lab meetings, maintenance of the lab and the instrumentation where appropriate, and enable the student to contribute to the research environment.
- Provide, in a timely fashion, formal approval of the project outline (October) and progress report (January).
- Contribute to the evaluation of Honours project posters and theses (April).
- Evaluate, in a timely fashion, the thesis and lab performance of supervised students (April).

General expectations of the student

In collaboration with the chosen Honours supervisor, you are expected to develop a research project. There are many different forms of projects, but in general it requires you to carry out a challenging and innovative research exercise. The work should be original and of a scope that is beyond the level of an undergraduate lab, but generally less than that of a graduate thesis.

The main types of research questions that may be asked are:

- What is going on? - Conducting a survey or evaluation
- Is this true? - Testing a hypothesis - Making predictions
- What will happen if? - Performing trials, experiments or testing new methods
- What is the solution? - Solving problems
- Can this be improved? - Designing a new experiment.

Although supported by your supervisor or a lab representative, you are expected to work independently to address a research question and then to present your findings. These findings will be presented both as a poster, similar to those presented at a research conference, as well as a final written report – the thesis.

Timeline and requirements (Check the [website](#) for specific dates)

Registration

You should obtain a registration form from the Faculty of Science for the Honours project. Fill out the form, with the name of the supervisor and co-supervisor if any, his or her affiliation (e.g. Department of Biology) and the proposed title of your project. Ideally, this will be completed during the spring or summer *before* you begin your project; but registration in September is possible.

Honours research project outline

The first couple of months of your Honours project is generally spent reviewing pertinent literature, familiarizing yourself with the resources available to you in the lab, experimenting with the techniques you will be using, and developing an outline (essentially, a game plan) of the proposed research project. The outline must be approved by your supervisor and submitted to the Department of Biology. For BIO 4009 students that have a co-supervisor because the primary supervisor is outside of the Department of Biology, the co-supervisor must also approve the outline.

The outline should **not exceed one page** and should be written in the following format:

- **Title:** The title of your proposal should be informative.
- **Background and rationale:** Position the topic you propose to explore relative to the current state of knowledge (i.e. published research), summarizing what is known and/or not known and why the topic warrants investigation. Be sure to cite your sources.
- **Purpose and specific objectives:** State the purpose of your project, including the central question you intend to answer through your research. List the specific objectives that will be addressed by each part of your research project.
- **Materials and methods:** In general, what methods will you use? Describe your experimental design. What kind of data will you collect? How will you analyse these data? Describe the statistical analyses you will use.
- **Expected results:** What information do you expect to gain by doing this project and how will it contribute to advancing the field of research?
- **Literature references:** List the publications you have cited in your proposal.

Progress report

At the beginning of the second semester, you must complete a progress report of your research project that will be evaluated by your supervisor and submitted to the Department with a grade of "Pass" or "Fail". This report must **not exceed two pages** and should conform to the following format:

- Student's name.
- Supervisor's name and co-supervisor's name if appropriate.
- Thesis title.
- Specific objectives indicated in the proposal that were accomplished, including a brief summary of the results obtained.
- Specific objectives indicated in the proposal that remain to be accomplished.
- Any objectives that have been removed, added, or changed.
- Comments from the supervisor as to the level of satisfaction with the progress of the research including any suggestions for improvement.
- The progress report will be assigned a grade of Pass or Fail by the supervisor. In the case of Fail you will have to improve your report.
- For BIO 4009 students that have a co-supervisor because the primary supervisor is outside of the Department of Biology, the co-supervisor must also approve the outline.

Poster presentation

During the exam period at the end of the winter session (April), you must present a poster summarizing your research. The poster presentation is compulsory and counts for 20% of the final grade. As an integral part of your poster presentation, you must submit **an electronic copy of your Abstract** as it will appear on your poster and in your thesis.

Your poster will be evaluated by two professors other than your supervisor(s) on the basis of:

- The quality of material presentation (4 pts)
- The scientific content (8 pts)
- Your ability to explain and defend your research to the two examining professors (8 pts).

Abstract: Briefly describe your project and key results (200 words maximum). Consult one of the major journals in your field, or talk with your supervisor or project mentor for more information on writing an abstract. The general format should be as followed:

- Your name and that of your supervisor(s) (**in bold**)
- Full title of project (**centered and bold**)

e.g.: **Student's name and supervisor's name**

Title of Thesis

- Abstract text in paragraph form, double-spaced, 12 point font, and a maximum of 200 words.
- The abstract is NOT an introduction to the project, but a summary of the whole investigation. It should summarize: the aim of the work; hypothesis/es and prediction(s) or objectives; materials and methods; results obtained; and conclusions.

General guidelines for posters

Basic concepts

- Make your poster interesting. It should grab the attention of the viewers, educate them, and be easy to understand. The total poster should fit into a 1.0 m by 1.0 m space.
- Keep all written material to a minimum, less than a page for each section.
- Use 24-pt font or larger so that any **writing can be easily read from one meter away**.
- You can either print the poster as a single page on a plotter printer, or print several panels on a regular printer and pin them on the cork poster display board on poster day. It is not necessary to have your poster printed professionally (nor will professional printing affect your poster mark), although many students do opt to take this route.

Poster components

- **Title and authors.** Include your name and institution, as well as your faculty supervisor's names, department, and school. The title should be no smaller than 55-pt type.
- **Abstract (optional).** A one paragraph overview of the entire poster topic. Keep it brief and interesting. What are the research questions and/or problems? Ideally this abstract will match that submitted to the department, although in practice some projects progress even after the abstract has been submitted.
- **Introduction.** Introduce the topic with an outline including background information and relevance describing how this research will add new information to the field.
- **Methods.** Describe the steps you used for your project. Use diagrams as much as possible.
- **Results/Data analysis.** More space should be devoted to your results than to any other section. Data should be displayed in graphs or tables that are easy to read and clearly labelled. All figures should have a figure legend explaining what type of experiment was performed, a brief description of the data, and what the results demonstrate. This section can include diagrams or pictures presenting techniques or outlining the experimental design.

- **Conclusions.** Summarize the main points.

Presentation

- Be prepared to walk interested visitors, as well as your poster evaluators, through your poster. Give them the highlights and stay focused on the take-home message. Keep it brief and expect to be interrupted with questions.
- The John B. Armstrong Prize for Best Poster will be presented annually to the BIO 4009 or BIM 4009 student who prepares and defends the best poster at the annual spring Biology Poster Day. Posters are judged by two independent researchers. The award consists of a cash prize and the winner's name will be added to a plaque to be displayed in the Department of Biology.

Honours thesis

Students must also present the results of their research in a written thesis. The final copy of your thesis must be submitted to the Department of Biology. The thesis will be evaluated by your supervisor (20%) and by one external examiner (20%); the remaining marks will come from evaluation of laboratory work (40%, by supervisor) and poster evaluation. (20%). In the case of BIO 4009 students with a co-supervisor, the supervisor and co-supervisor are expected to agree upon the thesis and laboratory work marks before they are submitted to the Department of Biology. For BIM4009 students, the second thesis evaluator will be recruited by the supervisor; but please discuss this with your supervisor well in advance of the thesis deadline.

No extension on deadlines will be given without a medical certificate.

The thesis should be prepared either in the format of a journal article from a prominent journal in your field, or in the format of a formal master's thesis, at the discretion of the thesis supervisor. The student may also consult writing resources [online](#).

Formats for journal articles vary considerably. Consult the "Instructions for Authors" or "Author guidelines" on the relevant journal website for details. A typical, general format of a published article would include the following:

Cover page

- Title of the project. This is to be informative and yet concise (not more than 15 words).
- Full name of the author
- Supervisor(s) and co-supervisors (if any)
- The day, month and year of submission

Abstract

The abstract summarizes the rationale for the study, the main methods, results, and the conclusion that you draw from the work. The abstract must stand alone, without reference to the main text. It is entirely uninformative to include sentences like "Implications of the work are discussed".

Introduction

The purpose of the introduction is to involve the reader in the subject matter of the project and explain the reasons for undertaking the study. The Introduction should describe (and cite) earlier work or similar studies that set the stage for your research. The aim and the objectives of the project should be clearly stated. If your research is hypothesis-driven, state your hypothesis and prediction(s).

Materials and Methods

This section should contain the minimum amount of information needed to fully understand how you produced your thesis, such that someone could duplicate your project after reading it.

Results

This section simply states the data – the facts of what happened or what you found; the interpretation of these facts is reserved for the next section, the discussion. The point is to convey your findings simply and clearly, referring to tables or figures, photographs, or other items of documentation that support your statements.

Discussion/Conclusions

This section should bring the thesis full circle, linking your results back to the objective put forth in the introduction and comparing your observations to those reported in published studies on the same or a related topic. Do your results support your hypothesis (if applicable)? Were there any limitations to the methods or analyses? How does your research advance the field of study? What is left unsolved?

References

Every statement of fact in your work, except for very common knowledge, must be supported either by a citation to a published work, or by citing a result that you have shown in the paper. Cite sources using the format of a major journal in your field. Typically in Biology, references are cited in the text by the author's last name and the date of publication in parenthesis. If a paper has two authors, both names are given. If there are more than two, the name of the first author is followed by 'et al.'. e.g. (Smith 2009) or (Smith and Richards 2010) or (Smith et al. 2011b). Present an alphabetical list of all of the sources cited in the main text. Do NOT include papers that you have read but not cited in the text. Consult the journal for the format of citations to books, book chapters, web pages, etc. Maintain a consistent format for citations in the text and the reference list.

A common format is as follows:

Books: Author(s), year, chapter title, book editors, book title, page numbers of chapter, publisher, city of publisher. e.g.:

Clarkson DT and AW Robards. 1975. The endodermis, its structural development and physiological role. In: JG Torrey and DT Clarkson (eds.). The development and function of roots, pp. 415-436. Academic Press, New York.

Apak R. 2002. Adsorption of heavy metal ions on soil surfaces and similar substances. In AT Hubbard (ed). Encyclopedia of Surface and Colloid Science, pp. 385-417, Dekker Encyclopedias, New York.

Journal Article: Author(s), year, paper title, journal name, volume number, page numbers. e.g.:

Vierheilig H, Schweiger P, Brundrett M. 2005. An overview of methods for the detection and observation of arbuscular mycorrhizal fungi in roots. *Physiologia Plantarum* 125: 393-404.

Web Site: Author/s, year, page title, web address (<http://>), date accessed. Note that author/s is/are not always listed – you may have to try links such as “About us” or “Contact us” to discover who or what organization has published the site. e.g.: US Library of Congress. 1990. A Country Study: Uganda [Internet] <http://lcweb2.loc.gov/frd/cs/ugtoc.html>. Date accessed: 3 Dec 2007.

N.B.: Web sites vary considerably in their reliability; citations of web sites are expected to be sparse and to reliable sites. Honours students should not be citing Wikipedia in their thesis.

Final grade. 60% of the final grade of the Honours thesis will come from an overall assessment of the student's research performance, assigned by the supervisor(s) (20% on the thesis, 40% on lab performance); 20% from one external reviewer; and 20% from the poster presentation.