

MSc in Integrative Biology - Handbook

2016/17



DEPARTMENT OF BIOLOGY
WILFRID LAURIER UNIVERSITY

Preface

This Guide outlines the policies and procedures followed by the Department of Biology with respect to the MSc in Integrative Biology. This document provides information for both new and continuing graduate students; it summarizes how the graduate program operates and the main regulations that you should be aware of. Graduate studies at Wilfrid Laurier University are administered under the regulations of the Faculty of Graduate Studies as described in the current Graduate Studies Calendar. The department also offers a PhD program in Biological and Chemical Sciences (in conjunction with the Department of Chemistry and Biochemistry). Please refer to the website for further information.

Graduate Officer:	Associate Professor Tristan Long	tlong@wlu.ca
Graduate Studies Committee:	T. Long, and two other faculty members in the Department, J. Williams, plus one graduate student representative	
Graduate Program Assistant:	Jennifer Williams	jennwilliams@wlu.ca biograd@wlu.ca
Biology Office:	Room N3022B 519.884.0710 x2905	

All correspondence, enquiries, and forms should be directed to the Graduate Program Assistant. All forms mentioned in this guide are available from either the Faculty of Graduate and Postdoctoral Studies or the Department of Biology Graduate websites.

The information provided in this document is supplemental to the Graduate Academic Calendar. It is the student's responsibility to ensure that all University, Faculty and Departmental regulations are met. Be sure to familiarize yourself with the contents of the Academic Calendar for the year you entered the program.

The Faculty of Graduate and Postdoctoral Studies has been in the process of reviewing policies and procedures for graduate programs, and this process will likely continue for the next year or more. Any policy revisions that affect the MSc in Integrative Biology or the PhD in Biological and Chemical Sciences, will be communicated to faculty and students as soon as they are approved by Faculty of Graduate & Postdoctoral Studies Council.

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Introduction

PROGRAM OBJECTIVE

The objective of the MSc program in Integrative Biology is to provide students with a trans-disciplinary approach to biological research that allows them to explore the answers to complex questions from a perspective that bridges the traditional sub-disciplines of biology, across diverse taxa, over time scales ranging from short (physiological) to long (evolutionary).

ROLE OF THE GRADUATE OFFICER

The graduate program in the Department of Biology is administered by a Graduate Officer, who is assisted by the departmental graduate administrative assistant. The Graduate Officer is responsible, in part, for recruiting new graduate students to the department and for responding to requests from prospective students. Inquiries from prospective students received by individual faculty members should be forwarded to the Graduate Officer or the Graduate Administrative Assistant. The Graduate Officer is also responsible for ensuring that the regulations for the MSc degree are met, approving Chairs for examinations, ranking and recommending students for scholarships and for the general conduct and operation of the graduate program.

The Graduate Officer reports to the Chair of the Department and the Dean of the Faculty of Graduate and Postdoctoral Studies. Recommendations for admission to the program are forwarded by the Graduate Officer to the Faculty of Graduate and Postdoctoral Studies for approval.

Graduate and senior-undergraduate students are welcome to approach the Graduate Officer at any time for clarification of rules or for advice. In the rare instance of a disagreement between a student and the supervisory committee, attempts at resolution should first be directed to the Graduate Officer.

The Graduate Officer will also be responsible for ensuring that graduate Teaching Assistants work their assigned number of hours and do not exceed that number of hours.

A REMINDER REGARDING COMMUNICATION

You are reminded that email is one of the official means by which the university will communicate with you. Every Laurier student is issued an email address at initial registration. The standard format for this address is the first four letters of your last name and the last four digits of your Laurier ID number (e.g., smit1111@mylaurier.ca). Official communications from the university will be forwarded to this address. You must be prepared to access the mailbox at this address.

Consult ICT Student Service Desk (not sure where to find the new link) for information on how to access your Laurier email account. You can also contact the Help Desk for information on all computing services at Laurier by phone: 519.884.0710 x2222 or by email: support@mylaurier.ca.

POLICY FOR ACADEMIC ACCOMMODATION OF GRADUATE STUDENTS WITH DISABILITIES

Laurier encourages applications from students with disabilities. The Accessible Learning Centre is available throughout the application and admission process to support and counsel students with disabilities, as well as faculty and administrative staff.

Documentation requirements are outlined in the [Accessible Learning Centre Student Guide](http://accessiblelearning.wlu.ca/registration/index.html): (accessiblelearning.wlu.ca/registration/index.html)

Program Information

PROGRAM REQUIREMENTS

The MSc in Integrative Biology is a full-time program that is normally completed in six consecutive terms. Students may begin the program in May, September or January. A thesis based on original research and defended before an examining committee is required of all students in the program. The program in Integrative Biology requires students to assemble the details of their research into a comprehensive explanation of biological phenomena.

In addition to the thesis, students are required to complete one mandatory 0.5 credit course (BI601 Research in Integrative Biology) plus one 0.5 credit graduate-level elective course. Students must also attend FOUR professional development workshops during their degree, TWO of which must be completed prior to the proposal defense. Laurier's Faculty of Graduate and Postdoctoral Studies (FGPS) offers numerous professional development workshops through the [ASPIRE program](http://wlu.ca/graduate-and-postdoctoral-studies/professional-development.html). (wlu.ca/graduate-and-postdoctoral-studies/professional-development.html)

The suitability of other professional development workshops can be determined by the student's supervisor prior to the student's participation in the workshop.

In addition, all students at every stage of the program are expected to attend all departmental seminars and to participate in the associated discussion forum in MyLearningSpace.

Notes:

- To obtain credit in a course or seminar, students must achieve a minimum grade of B-.
- Students may include one 0.5 credit course in their program from another graduate department with the consent of the supervisory committee.
- All written work in all courses of our program are submitted to Turnitin.com.
- Students in all years of the program must participate in the Biology Seminar Series.

Students in their second year must present a seminar based on their thesis research on Biology Colloquium Day. All students are encouraged to take the opportunity to meet several guest speakers throughout the year during the lunch sponsored by the Graduate and Postdoctoral Studies Office and the Faculty of Science.

REGISTRATION

A graduate student must register each term. The Laurier On-Line Registration Information System (LORIS) provides access to your student profile, your academic record and allows you to register for courses. Consult the LORIS (loris.wlu.ca/ssb_prod/twbkwbis.P_ValLogin) website regularly to review your information.

Graduate students may register for courses for the Fall, Winter, and Spring academic terms using LORIS. You may add or drop courses seven days a week, 24 hours a day. Late registration fees apply. To view Academic Calendar dates, visit the Graduate Calendar (legacy.wlu.ca/calendars/department.php?cal=3&d=1674&s=783&y=70) and click on Academic and Related Dates.

BI 699 Registration

You **MUST** register for BI699 in **EVERY** term (Fall, Winter and Spring) until you complete your program.

Students may be able to take elective courses at the University of Waterloo. To apply, fill out an Ontario Visiting Graduate Student application form (legacy.wlu.ca/forms_detail.php?grp_id=36&frm_id=145). This form requires the signature of the Chair and the Graduate Dean of WLU as well as your signature. To register for an elective out of province, please use the Canadian Visiting Graduate Student application form (www.cags.ca/documents/agreements/GRDT_TRNSF_AGRM.pdf).

Students who are planning to be away from campus for an entire term while undertaking degree-related activities will need to fill out a Petition for Extended Absence form (https://legacy.wlu.ca/forms_detail.php?grp_id=36&frm_id=988) and submit it to the Faculty of Graduate Studies after obtaining the necessary signatures.

COURSE LISTING

BI 601—Research in Integrative Biology

0.5 Credit

This seminar-based course is a core requirement for all students in the MSc in Integrative Biology. Over the course of the term the group will explore the principles underlying integrative approaches to biology.

BI 603—Biodiversity

0.5 Credit

This course explores biodiversity from the level of populations to communities. Biodiversity is one of the key biological issues of the 21st century, applications of which extend from the description of new species to the unravelling of historical relationships among organisms and the conservation of threatened systems. Topics include population genetics, metapopulation theory, speciation, systematics and community diversity. The course considers the diversity of organisms in all three domains of life.

BI 605—Evolutionary Ecology

0.5 Credit

This course explores recent advances in the conceptual, theoretical, and empirical development of ecology and evolutionary biology. Research exploring the nature and causes of variation in natural systems will be examined, with an emphasis on the formulation of research questions, research design, and methodologies for comparative data analysis and interpretation. Specific topics will be selected with a view to integrating the findings of curiosity-based research at all levels of biological organization to critical societal problems in such areas as conservation, agriculture, ecosystem integrity, and human health and welfare.

BI 609—Ecological Physiology**0.5 Credit**

This integrative course examines the physiological adaptations used by prokaryotic and eukaryotic organisms to survive within their environment. Areas of focus may include extreme habitats (high altitude, deserts, the deep sea as well as pH, temperature and salinity), degraded environments, seasonal or other variability, the impact of climate change or other conditions that alter ecological conditions and require animals to alter their physiology.

BI 610—Topics in Plant Biology**0.5 Credit**

Discussions on current research or current techniques in plant biology will take place in a seminar format. Students will present seminars and participate in discussions on recent advances in specific areas of plant biology such as plant development and plant physiology. Topics may include, among others, plant-pathogen interactions, plant hormone perception and signaling, supracellular organism: intercellular communication, and current perspectives on genetically modified foods.

BI 612— Advanced Biostatistics**0.5 Credit**

This course examines the totality of issues related to data collection, management and analysis for biologists: from the development of hypotheses, the design of experiments, measurement and sampling, to statistical analyses and final publication of results in formats acceptable for scientific reports and papers. Emphasis will be placed on the application of wide variety of statistical methods using statistical software rather than theory, and stress the practical aspects of biostatistics. A problem solving approach to graduate research planning, data acquisition, analysis and publication.

BI 645— Comparative Developmental Biology**0.5 Credit**

This course examines development, integrating topics from the genome to the whole organism. Emphasis is placed on using cell biology to understand evolution and development, as understanding the changes that drive developmental processes at the cellular level is fundamental for a broad understanding of plant and animal development. Emphasis is also placed on the genetic control and signaling events in embryonic development, plant morphology and flowering time, and on the different mechanisms of gene regulation, comparing the differences and similarities between plant and animal systems.

BI 670— Advanced Topics in Molecular Biology**0.5 Credit**

The course will investigate recent advances in molecular approaches to the study of prokaryotic and specialized eukaryotic cells. An organismal perspective will be enhanced through detailed examination of molecular processes. Specifically, cellular composition and output related to biochemical, biophysical and bioprocessing aspects will be discussed. Areas of focus may include genetic organization, protein structure and function, and byproduct formation. Throughout the course, students will be exposed to modern and emerging techniques used in the integration and understanding of these processes.

BI 690 Advanced Field Studies**0.5 Credit**

This course allows students to study organisms in living environments, and may also include human issues (e.g., harvesting, indigenous land use) where appropriate. The timing and location of the course will vary depending on the interests of the faculty and students involved, and may include high latitude, alpine, coastal, or tropical studies.

BI 691 Directed studies**0.5 Credit**

An individual reading course focussing on current literature in an area not covered by currently offered courses. This course may be taken with any faculty member in the Department of Biology, including

the student's thesis advisor, with the approval of the graduate coordinator and the student's supervisory committee.

Because students cannot register for a directed studies course on LORIS, they must fill out the Graduate Program Change Request form, a blue Directed Studies Card AND a Letter of Agreement form (3 forms in total). These forms can be obtained from the Administrative Assistant in Biology or from the Faculty of Graduate Studies directly.

BI 699 MSc Thesis

2.0 Credit

Students will complete a thesis based on original research and defend it before an examining committee.

Graduate Students Taking Undergraduate Courses

It is not recommended that graduate students take undergraduate courses, but should the need arise please read the following information in the [Graduate Calendar](#) (legacy.wlu.ca/calendars/section.php?cal=3&s=719&sp=2681&ss=3058&y=66).

Funding

FINANCIAL SUPPORT

The Biology Department guarantees a minimum level of financial support for the first two years of full-time study in the MSc program. This minimum is \$21,500 per academic year for eligible domestic students. The financial support is provided by a combination of scholarships, teaching assistantships and research assistantships (paid by the supervisor). Students are eligible for a maximum of four teaching assistantships over the course of a two-year program. Students in financial need may apply for additional bursaries; details are available on the [Student Awards](#) website (wlu.ca/graduate-and-postdoctoral-studies/funding-at-a-glance/index.html).

Students with major scholarships (OGS or NSERC) are eligible for a \$5,000 scholarship from the Faculty of Graduate and Postdoctoral Studies and one teaching assistantship. All students who are eligible for major awards should apply by the deadlines set by the Faculty of Graduate and Post-Doctoral Studies and the Department of Biology each fall.

Tuition and student fees are paid by the student (see Graduate Calendar for details).

TEACHING ASSISTANTSHIPS

The Chair of Biology and the Graduate Officer will decide on the allocation of TA-ships to students every academic year.

Once you have been assigned to TA a particular course, you should meet with the lab coordinator to discuss the duties you will be expected to fulfill. Each course will have a Teaching Assistant Job Responsibility form that you and the instructor must sign. The signed forms are to be submitted to the Biology office for the signature of the Graduate Program Officer. The forms must be sent to the Faculty of Graduate and Postdoctoral Studies by the end of the second week of classes for payroll to be processed.

All graduate students are required to attend TA training/graduate program orientation sessions put on by the Department of Biology at the start of the Fall semester.

EXTERNAL SCHOLARSHIPS AND AWARDS

Students are expected to apply for any awards or scholarships for which they may be eligible. Consult the Graduate and Postdoctoral Studies website concerning application requirements and deadlines for major award competitions each fall which require university pre-selection.

Awards are remitted to the student in the manner stipulated by the granting agency and/or, if applicable, as noted below.

Since there may be a maximum amount of funds that can be awarded and held by a student, full-time graduate students who accept an award that is not directly administered by Laurier must immediately inform their department chairperson and the Dean of the Faculty of Graduate and Postdoctoral Studies in writing. This requirement applies to any awards or assistance offered by any agency or institution.

Unless otherwise stipulated by the award granting agency, a student who is successful in winning an external award will have that award applied against the student (tuition) account. Any outstanding payments owed to the University will be deducted at source before a refund is issued (by direct deposit) for the balance. Major external scholarships from national (Tri-Council) or provincial (Ontario Graduate Scholarship/Ontario Graduate Scholarship in Science and Technology) are paid in installments, one at each term, starting with the term you selected on your Response Form. The award is applied, along with any other scholarship awarded to you by Laurier, against your student account (tuition).

You must be registered in order to receive your award payment, and the refund will be issued no earlier than the last date for late registration (see the Academic Schedule in the Graduate Calendar for specific dates). That is, your September installment will be paid in mid-September, your January installment in mid-January, etc.

Students may wish to begin their search for other funding opportunities at any of the sites listed below. The following list is not exhaustive.

2016/17 Scholarship Competitions:

Ontario Graduate Scholarship (OGS)
NSERC Canada Graduate Scholarship – Master’s (CGS M)
Vanier Canada Graduate Scholarship Program
Ontario Trillium Scholarships: W.L. Mackenzie King Scholarships
Queen Elizabeth II Graduate Scholarship in Science and Technology
Tri-Agency CGS Michael Smith Foreign Study Supplements (CGS-MSFSS)

Also see:

wlu.ca/graduate-and-postdoctoral-studies/funding-at-a-glance/external-funding.html

STUDENT TRAVEL AWARDS

Most graduate students will have an opportunity to travel during the course of their program. In most cases the purpose of the travel will be to present results at scientific conferences. Some students may also travel to conduct research or course work. There are a number of sources of funding available to students to help offset the cost of travel.

Laurier encourages students to engage in scholarly activity by providing financial support to students who make presentations at academic conferences related to their program of study. The Faculty of Graduate and Postdoctoral Studies offers conference travel awards of up to \$250 (for travel within Ontario) and \$500 (for travel outside of Ontario and international) for students making poster or oral presentations at national or international meetings. The Faculty of Science may have travel funds available over and above what is offered from the Faculty of Graduate and Postdoctoral Studies.

Students need to apply for these funds prior to their travel. Details of the travel assistantship program, including application deadlines, can be found on the [Faculty of Graduate and Postdoctoral Studies website](http://wlu.ca/graduate-and-postdoctoral-studies/index.html) (wlu.ca/graduate-and-postdoctoral-studies/index.html). Inquiries about funding from the Faculty of Science should be directed to the Administrative Manager of the faculty.

In addition to the conference travel funds available from the University, students should discuss other sources of funds with their supervisors. Many scientific societies offer funding to students making presentations at society-sponsored meetings. Finally, the Graduate Students Association has some funding available for students who have been unable to acquire conference travel funds from other sources. Applications for GSA funds should be made after attendance at the conference. Full details of the GSA travel awards and application deadlines can be found on the GSA website.

For travel associated with research or course work, you should consult the Student Awards and Laurier International websites for a list of available funding opportunities.

MSc Thesis

COMPOSITION OF THESIS SUPERVISORY COMMITTEES

The Department of Biology appoints a Thesis Advisory Committee (TAC) for each candidate consisting of a supervisor and two additional members, chosen in consultation with the supervisor. At least one of the two additional members must be a member of the department. The supervisor and committee members must be members of the graduate faculty at WLU.

Should it be deemed desirable to invite a member of the graduate faculty of another university (or another qualified individual) to act as a member of the thesis advisory committee, this person should function as a member of the committee so that no committee would consist of fewer than three members of the graduate faculty at WLU. An appointment to graduate faculty may only be made by the Dean of Graduate Studies upon receipt of a written recommendation from the Department.

The Dean of Graduate Studies shall be informed of the appointed thesis advisory committee membership as soon as the candidate's thesis topic is approved. Any change to the advisory committee composition must be made in writing to the FGPS office.

MONITORING OF GRADUATE STUDENT PROGRESS

Students have a responsibility to maintain regular contact (i.e., at least monthly at the thesis stage) with their thesis supervisor.

Minimally, graduate students should meet with their Thesis Advisory Committees twice in the first year of the program and at least once per year thereafter. The initial committee meeting should be held within the first month of the student's enrolment in the program, with subsequent meetings in by then end of the second (MSc proposal), in the fourth (progress update), and in the sixth (thesis defence) terms. A committee meeting should also be held when major changes to a student's program are contemplated, such as a major change to the student's proposed research project, or if the student is not meeting program expectations.

The first committee meeting should be used as an opportunity to introduce the student to the members of the committee, for the student to outline in brief the plans for the thesis research, and for the committee to recommend courses that the student should complete as part of the program. At the end of the meeting, the committee will establish a time frame for the student to complete a formal research proposal

Graduate student committee meetings must be documented with the Graduate Student Progress Report Form that is available on the Biology web page. Graduate student progress is monitored by the Biology Graduate Studies Committee. Once a date and time have been chosen for a committee

meeting, students should inform Graduate Program Assistant in the Biology office, who can then assist with room bookings and preparation of meeting documentation.

The Graduate Student Progress Report Form should contain sufficient detail to fully document issues discussed, student progress in the program, courses completed or in progress, and anticipated deadlines for research and writing outcomes as determined during the committee meeting prior to all committee members signing the document. Graduate students should take the opportunity to officially document any of their concerns or respond to committee members' comments on the form prior to signing it.

IMPORTANT: When a graduate student's progress has been deemed unsatisfactory, the committee will meet again within six months to evaluate the student's progress. Students may be dismissed from the graduate program after two successive committee meetings in which their Research Progress is deemed to have been Unsatisfactory.

All documents relating to student progress should be submitted to the Graduate Program Assistant, who will obtain the program officer's signature, make copies for distribution to the student and committee members, and submit a copy to the FGPS for inclusion in the student's official file.

MSc RESEARCH PROPOSAL

A research proposal must be written by the student and submitted to the thesis advisory committee. The proposal will normally be presented during the second term, but not later than the first half of the third term.

The proposal should comprise a body of 10 – 12 pages, references, tables, figures, details of methodology, and any necessary appendices.

An abstract is required. In the body of the document, the student should outline the relevant literature and rationale supporting the research; explain any hypotheses and predictions relevant to the study; outline the species that are the focus of the research and the rationale for choosing them; and give a general outline of the methods including facilities to be used and a rough timeline for the progress of the research. The proposal of the thesis should demonstrate how it fits within the objective of the program.

The document should be laid out as follows:

Title Page
Body of the Proposal
Lay Summary
References
Tables
Figures
Additional Methodological Details
Appendices

General presentation guidelines for the written proposal:

- Print must be in black ink and of letter quality.
- Text must be double-spaced, 12-point font.
- Use white paper, 8 1/2 x 11 inches (21.5 cm x 28 cm), portrait format, with a single column, unless specified otherwise.
- Set margins at 1 inch (2.5 cm) all around.
- Enter your name and an abbreviated title in the header of every page.
- Number your pages sequentially.
- Print on one side of the page only.

MSc PROPOSAL DEFENCE

Steps to follow:

1. A master's thesis proposal approval form is to be completed at the proposal defence (plus a Committee Report Form) and submitted with one hard copy (electronic copy will not be accepted) of the proposal to the Faculty of Graduate and Post-doctoral Studies via the Biology Graduate Administrative Assistant, who will retain a copy of the form and proposal for the student's file and send the originals on to FGPS.
2. The MSc proposal is to be defended in an oral examination conducted by the thesis advisory committee; this will normally be the second committee meeting. The committee should receive the written proposal **no less than one week** prior to the examination. **Failure to do so may result in the delaying of the proposal defence date.**
3. Proposal defences will be advertised within the department by the Biology Graduate Administrative Assistant. All members of the department are invited to attend the first part of the defence. The committee in consultation with the student will decide if the audience may remain through the question period.
4. At the examination, the student will make a short presentation (approximately 15-20 minutes) outlining the key details of the proposal. The committee members will then have an opportunity to question the candidate on the proposal. The committee members will agree to the order and duration of questioning prior to the beginning of the exam. At the end of the questioning, the committee will deliberate on the evaluation of the examination. There are three possible outcomes: satisfactory, marginal, and unsatisfactory. If the outcome is marginal, the student will normally be required to revise a section of the proposal. This may be completed in consultation with the members of the committee, and no further examination will be necessary. If the outcome is unsatisfactory, the student will be given an opportunity to rewrite and present the proposal for examination. The proposal defence is chaired by the student's supervisor, and the examining committee is the TAC.

THESIS REQUIREMENTS

Acceptable Formats

The Department of Biology recommends that the text be organized into one of two formats that differ mainly in whether the information is arranged in a form publishable in biological journals or in a more traditional thesis style. In either case, there should be uniformity to the text, which should appear as one column, with a single font and a single size of font. The style, however, may be different if there is more than one manuscript included (see p. 19). The student must follow the below mentioned guidelines given by the Office of Graduate Studies.

Thesis Style and Format Guidelines

- The thesis must be double-spaced throughout.
- Print size: standard throughout and not less than 11 point.
- Paper used for the final copies should be 8.5 x 11 inches, 20 lb or similar equivalent. Paper used for the defence copies may be of a lighter weight, but must be 8.5 x 11 inches. Acceptable printers include laser and ink-jet.
- Copies prepared for the defence may be double-sided, however, final copies must be single-sided.
- The left margin must be a minimum of 1.5 inches to allow for binding. All other margins must be a minimum of one inch.
- The first line of every paragraph should be indented five spaces.
- Abbreviations may be used (if conventional in the particular discipline) but must be defined the first time they are used.
- If there are alternative correct spellings of a particular word, either form may be used, but such use must be consistent throughout the thesis.
- The thesis pages should be numbered in consecutive order with Arabic numerals, starting with the first page of text and continuing through to the last page of the entire thesis, including endnotes/footnotes, appendices and references. Pages preceding the text, starting with the first page of the abstract should be numbered consecutively with lower case Roman numerals.
- The title page of the thesis must contain the Universal Copyright Notice ©

Format Outlines

Below are the gross outlines, which must be followed for either of the two formats the student will have chosen.

Traditional Format:

Title page

Abstract (350 words)

Co-authorship (if necessary)

Acknowledgements

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List of Tables

List of Figures & Illustrations

Ch.1: General Introduction

Ch.2: Literature Review (may be included in intro.)

Ch.3: Materials and Methods

Manuscript or Publication format:

Title page

Abstract (350 words max.)

Co-authorship (if necessary)

Acknowledgements

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List of Figures & Illustrations

Ch.1: General Introduction / Literature Review

Ch.2-n: Manuscripts

Ch.n+1: General Discussion

Ch.4-n: Results
Ch.n+1: Discussion
Summary
Literature Cited
Appendices

Summary (may be in Chapters)
Literature Cited
Appendices

Cover Page:

TITLE OF THESIS
by
(full name of the author)
(Undergraduate degree, University, Year)

THESIS
Submitted to the Department of Biology
Faculty of Science
in partial fulfilment of the requirements for the
Master of Science in Integrative Biology
Wilfrid Laurier University

201_

(Name of Author) 201_©

Manuscript Format

Theses prepared using this format should generally conform to the style required for submission to the prospective journal. The Literature Cited section may be collected in one section at the end of the thesis or at the end of each manuscript. In addition, Figures and Tables should be numbered (Figure 3.1 etc.) to conform to Chapter numbers.

Manuscripts included as Chapters may be review, theoretical or data papers organized as required by the appropriate journals. The General Introduction should outline the subject and background for the research and indicate how the manuscripts are related to one another in addressing the subject of the thesis. Manuscript titles can be used as chapter titles. The General Introduction and Literature Review may be combined and it should have a broader perspective than the Data Chapters themselves. The General Discussion should briefly discuss the contributions to the field made by this work, highlighting the major findings and tying the Chapters together. In this discussion, a short section must be included outlining the link of the thesis research to other research done in the supervisor's lab, in other labs at WLU or even in labs elsewhere. This section should be written in the context of integrative biology. The Summary (usually one or two pages) should list, numerically, the main subject and findings from the thesis research.

The student must be first author on the majority of manuscripts included in the thesis. Manuscripts on which the supervisor or another person is first author may be included in the thesis. Theses containing manuscripts that are included in another individual's publication or thesis, or co-authored, must include a detailed statement in the General Introduction stating the student's contribution to the work.

Copyright and the Graduate Student: Graduate students should be cognizant of Canadian copyright law especially with regards to their own works. Students who want to use material in their thesis or dissertation from their own previously published works must maintain copyright when the work is published. Publication agreements are signed between authors and publishers before a work is distributed. Students will need to ensure that the copyright transfer agreement does not transfer the right of copyright to the publisher. Most publishers will waive this agreement when asked. If you have already published your work without maintaining copyright and wish to include material from the already published work in your thesis or dissertation, you will need to obtain permission from the copyright holder, usually the publisher, to publish the material in your thesis or dissertation. By maintaining your own copyright over material you have created, you maintain the right to reproduce the work and to make derivative works. You may choose to publish your work in an open access venue where a Creative Commons license agreement (www.creativecommons.org) allows you to maintain copyright. Be aware of your rights. You may have to sign a document to publish in your work but you do not have to include the transfer of copyright agreement.

Graduate students who use third party materials (someone else's work) in their thesis or dissertation including figure(s), image(s), photo(s), graphic(s) and so forth, will require permission from the copyright holder. Just because the material is freely available on the Internet does not mean that the copyright or license agreement is not held by someone else to whom you may be required to attribute the work.

As of June 2, 2014, all graduate students in our Department are required to submit their Masters theses electronically. Students will deposit a Microsoft Word or PDF version of their thesis to Scholars Commons @ Laurier, Laurier's Institutional Repository, where it will be made openly accessible to researchers worldwide. Currently, all theses and dissertations are made available online through Library and Archives Canada and subscription databases. However, making scholarship open access eliminates price barriers for both individuals and organizations and reaches a much wider audience than is allowed by traditional forms of distribution. A step-by-step guide for the submission of the electronic copy is available both as a PDF document and a screen cast. For more information, please visit Scholars Commons @ Laurier (scholars.wlu.ca).

ORAL EXAMINATIONS

The purpose of the oral defence of a master's thesis is to demonstrate to the examiners that the candidate fully understands the work that was completed, how the research was completed, and the meaning and significance of the findings and conclusions. The candidate must also have a clear understanding of how the work fits with the relevant literature and/or practice.

The defence shall not cover general course work unless it relates to the thesis in some definite way.

Procedures for Scheduling of the Oral Defence

1. Obtain written approval of the TAC to schedule the Oral Defence and survey the committee for availability.
2. Notify the Biology Graduate Administrative Assistant of the intention and request a room booking for this purpose. The Admin. Assistant will ensure that the **Master's Thesis Defence - Request to Schedule Oral Examination** form is completed prior to scheduling the defence date, and will hand it to student to obtain all signatures.
3. The candidate is responsible for ensuring that the thesis is submitted in the format required by the current WLU Thesis Format Guidelines. The candidate is also responsible for ensuring that all members of the TEC have received a copy of the thesis **two weeks** prior to the defence.

4. Provide two additional copies to the Biology Office for distribution to the external examiner and the defence Chair. It is the responsibility of this office to distribute these copies; however, the costs associated with printing the thesis are to be covered by the student and/or the thesis advisor.

Guidelines for Determining "Arm's Length" of External Examiners

An external examiner must be at "arm's length" from the candidate and the DA. Arm's length means not being a close friend, a regular or current collaborator, a former supervisor, or a former colleague. It also means not being in a conflict-of-interest position with regard to the candidate or DA and not having a vested interest in the outcome of the oral defence. If in doubt, consult the program officer.

The Examination Committee

The Examination Committee (TEC) must consist of all the members of the TAC and an external examiner who is knowledgeable on the subject of the thesis. The external examiner must be approved by the graduate coordinator. Normally, at least one member of the TEC must be from outside the academic unit/program of the candidate. Thus, if all members of the TAC are internal to the candidate's academic unit/program, the external examiner may not be. When the external examiner must come from outside Biology, normally this person will be a faculty member from another WLU department. Where there is no available faculty member with requisite expertise in another department at WLU, a suitable member of another nearby university may be asked to serve as external examiner. The chairperson for the defence, appointed by the Biology Department, must be a member of the Graduate Faculty of the University and be external to the TEC, but may come from within Biology.

Conduct of the Oral Defence and Role of the Chairperson

The chairperson must assume the responsibility of becoming familiar with the content of the thesis, thereby assuring that the thesis examination is fair. A document entitled "Procedures for Conducting Oral Defence Examinations of Master's Theses" is available from the FGPS office. However, the Graduate Program Assistant will make them available to the Chair.

The defence begins with a 18-20 minute summary of the thesis by the candidate. This presentation should conclude with a statement in which the candidate indicates the most significant contribution of the thesis to knowledge. Following the presentation, the candidate will be questioned by the members of the examining committee following the rules set out by the chairperson prior to the start of the defence. The chairperson is not a member of the examining committee per se, and should not, normally, address questions to the candidate about the thesis. The examination should normally be completed within 1.5 to 2 hours.

Following the questioning the candidate will be excused from the room while the committee deliberates. The chairperson does not have a vote. The following three decisions are available to the committee:

Acceptance:

- Unconditional
- With Editorial Changes
- With Minor Substantive Changes
- Decision Deferred: This option is selected when the thesis has not been adequately defended or when the thesis requires major revisions. The Committee will specify the length of time of the deferral, and the work that must be completed in order for the thesis to be accepted. The Committee may require a second defence.

- Unconditional Failure: The student's candidacy will be terminated. The student may petition for readmission to write a new thesis (see Student Appeals below)

Once the committee has made a decision, the candidate will be informed of the decision and will be given an opportunity to offer any comments about the defence, especially with regard to the fairness of the examination and the findings.

The student will be asked to make the appropriate corrections. Once these are done, the supervisor (or a person named by the committee) will accept the thesis as it is. Four (4) hard copies of the thesis will be submitted to the Faculty of Graduate and Post-Doctoral Studies office for binding and an electronic copy (as a pdf file) will be submitted to the Laurier Library (refer to pp.24-25). In both cases, you will have to sign a license agreement allowing the copies to be accessed for scholarly research.

Procedures

SAFETY CONSIDERATIONS

Safety is of utmost importance in all aspects of graduate work, as well as in students' future careers. Both department and university are committed to fostering a study and workplace culture that is supportive of professional and personal development of our graduate students and free from all forms of discrimination and harassment. Such an environment promotes mutual respect and understanding for the dignity and rights of others. It is in this environment that work and learning can best be accomplished.

All students should be aware of Laurier's policies on prevention of harassment and discrimination:

https://legacy.wlu.ca/documents/46309/6.1_Prevention_of_Harassment_and_Discrimination.pdf

and the procedures to be pursued with the Office of Dispute Resolution and Support in the case of harassment and/or discrimination:

http://legacy.wlu.ca/documents/58643/Procedures_-_Policy_6.1_Prevention_of_Harassment_and_Discrim.pdf

Violence in the Workplace is a serious issue, and all students should be aware of Laurier's Workplace Violence Prevention Policy:

http://legacy.wlu.ca/documents/43509/FINAL_WVP_Program_May_20_13.pdf

All Biology graduate students must complete Workplace Violence & Harassment Prevention Training (administered via MyLearningSpace):

https://legacy.wlu.ca/page.php?grp_id=159&p=18560

SAFETY CONSIDERATIONS FOR LAB AND FIELD WORK

Laurier is committed to making students appreciate the importance of safety, and providing a safe working environment

All Biology graduate students must complete WHMIS training.

WHMIS training is offered monthly during the year as part of Health and Safety New Employee Orientation, during the month of September, and just before the spring term begins. To schedule a training session, contact Sarah Lamb (slamb@wlu.ca), the Biological/Chemical/Radiation Safety Officer. WHMIS is also available online at

http://www.wlu.ca/page.php?grp_id=159&p=21656#WHMIS. The course consists of a few hours on lab safety procedures, followed by a short exam. Upon successfully passing the exam, students will be issued a WHMIS certificate. Students may also be required to take other safety-related courses, such as those dealing with radioactivity, or specific chemical environments, depending on their research.

WHMIS is also included in the Young Worker Health & Safety Orientation that is required for all students. If you take the Young Worker Health & Safety Orientation, you do not need to complete an additional module of WHMIS. In addition, the Young Worker Health & Safety Orientation includes an Laboratory Safety, Biosafety, and Laser Safety training modules. It is an online training session through MyLearningSpace that is paired with job specific training given by your lab supervisor.

Other courses are also offered by the University. For example, the University offers First Aid and CPR training. Information about these courses can be found on the Safety, Health, Environmental and Risk Management (SHERM) website: http://legacy.wlu.ca/page.php?grp_id=159&p=21655.

Laboratory environments may have several potential hazards, with which the student should be familiar. In an effort to promote lab safety, the Faculty of Science together with SHERM have produced a general Laboratory Health and Safety Manual and a Biosafety Manual. Copies of these manuals are available online http://legacy.wlu.ca/page.php?grp_id=159&p=12689. The lab technicians each have one hard copy and one is in the main Biology office. In addition MSDS sheets for the chemicals in each lab should be available and consulted. Open dialogue with supervisors, colleagues and other staff can help ensure a safe working environment. Students are expected to be familiar with the location and operation of safety features in the lab, such as chemical showers, eye wash stations, protective eyewear, footwear and other clothing, fire extinguishers etc.

Students should understand the safety implications of their work. Any student who feels at any time s/he are working in an unsafe environment is responsible for identifying the problem to their supervisor or other faculty member. Students have the right to refuse immediately any work or responsibility that is not safe.

Field-related work can pose additional hazards. The Office of Research Services has established a committee to develop a university-wide policy on field safety in coordination with researchers who conduct fieldwork and Laurier International.

Currently, the Department of Biology has a voluntary field safety planning procedure in place. It is strongly recommended that all field researchers fill out, in consultation with their supervisors, a Field Research Safety Planning Record that is signed and filed with the Chair of Biology before any fieldwork is undertaken. These forms can be downloaded from the departmental website.

Memorize the University's Emergency number: 519-885-3333 (or 3333 from an internal phone).

ETHICAL CONSIDERATIONS FOR ANIMAL RESEARCH

Students working with vertebrate animals as part of their thesis, either in the lab or in the field, must have completed and received certification of appropriate animal care training, which can be arranged by contacting the Animal Care Coordinator, Kelley Putzu (ext. 3456, kputzu@wlu.ca). The University Animal Care Committee (ACC) oversees all research involving animals at Wilfrid Laurier University, and any research involving vertebrate animals must be covered under an approved Animal Use Protocol (AUP). This is in accordance with federal and provincial regulations on the use of animals for research, teaching and testing. Please be aware that other permits may be necessary in addition to the AUP. For further information on the use of animals in research, see the Office of Research Services website.

STUDENT APPEALS

A graduate student may appeal any decision taken by an individual or body acting in the name of the university that affects her/his academic standing and that she/he believes was made unfairly. Before appealing any decision, a student should attempt to resolve the issue through informal or formal procedures (e.g., see Grade Reassessment). With the exception of the regulations pertaining to grade reassessment, no appeal may be commenced when the student has graduated from the program to which the appeal relates.

Normally, the Graduate Student Appeals Committee (GSAC) is the first level of appeal for graduate students and the Senate SAC is the second and final level of appeal. It should be noted that there are limits to the grounds of appeal at the second level (i.e., there must be new evidence or evidence of a substantial procedural irregularity; see Procedures for Considering Student Appeals). Furthermore, there are different procedures regarding appeals of academic misconduct decisions (see WLU policy 12.2: Student Code of Conduct and Discipline).

The petition to GSAC form:

https://legacy.wlu.ca/forms_detail.php?grp_id=36&frm_id=1391

Request for extension to complete coursework form:

https://legacy.wlu.ca/forms_detail.php?grp_id=36&frm_id=147

The status in a student's academic program will remain unchanged while an appeal is pending. The following deadlines apply to student petitions:

Students wishing to appeal an academic decision must do so within six (6) weeks of the date of receiving the decision.

Normally, students wishing to seek any kind of extension to program time lines must submit their request at least two (2) months prior to the date when the work is due. This deadline may be waived in exceptional circumstances at the discretion of the chair of the Graduate SAC.

Further details on the student appeals process can be found on the Faculty of Graduate and Post-Doctoral Studies website.

Biology Department Information

GRADUATE FACULTY RESEARCH INTERESTS

Dr. Jennifer Baltzer	Comparative tree biology and responses of forests to global change
Dr. Mihai Costea	Systematics, biodiversity and biogeography of angiosperms
Dr. Stephanie DeWitte-Orr	Investigating innate immune responses to virus infections with a focus on dsRNA-mediated responses
Dr. Frédérique Guinel	Development and hormonal regulation of root symbiosis
Dr. Tristan Long	Sexual selection and conflict, genetics of behaviour and speciation
Dr. Deborah MacLatchy	Determining source, identity, and mechanisms of action of anthropogenic contaminants on fish reproduction, development and growth
Dr. Allison McDonald	Environmental stress physiology and biochemistry; role of terminal oxidases in respiration and photosynthesis
Dr. James McGeer	Stress physiology of aquatic animals; environmental toxicology and risk assessment of metals
Dr. Gabriel Moreno-Hagelsieb	Comparative and functional genomics; stability and evolution of genetic functional modules
Dr. Scott Ramsay	Reproductive ecology of songbirds
Dr. Jane Rutherford	Factors affecting the structure of benthic invertebrate communities in streams
Dr. Robin Slawson	Survival and persistence of natural populations of potential pathogens from surface waters
Dr. Matthew Smith	Mechanisms of protein targeting and import into chloroplasts

Dr. Kevin Stevens	Wetland plant ecology: plant growth in wet areas
Dr. Joel Weadge	Microbial glycobiology: Structure-function analysis of proteins that synthesize and export bacterial cellulose
Dr. Michael Wilkie	Environmental physiology and toxicology of aquatic vertebrates
Dr. Jonathan Mark Wilson	Fish molecular physiology with a focus on elucidating the mechanisms of ion regulation within evolutionary and environmental contexts.

GRADUATE STUDENT REPRESENTATIVES AND THEIR RESPONSIBILITIES

Position Title	Description
Graduate Student Coordinator (2)	<p>Liaison between graduate students and graduate office</p> <p>Organize meetings once per month (30 minutes before Biology café)</p> <p>Ensure all departmental, faculty, and GSA representatives are fulfilling duties</p> <p>Prepare monthly calendars (all departmental, faculty, and GSA events) to post on My Learning Space and in research building</p>
Faculty Council and Departmental Rep (2)	<p>Attend faculty of science meeting once per month</p> <p>Attend Biology Departmental meeting once per month</p> <p>Report minutes to graduate students (posted on MLS)</p>
Graduate Faculty Rep (1)	<p>Attend meetings with Biology graduate council once per month</p> <p>Report minutes to graduate students (posted on MLS)</p>
Biology Café Coordinator (2)	<p>Recruit speakers for Biology café (monthly event)</p> <p>Report date/time 2 weeks in advance to Student coordinator</p> <p>Book boardroom, set-up room, and introduce speaker</p>
Biology Lab Olympics (1)	<p>Organize 3 teams of Biology students, faculty, and staff</p> <p>Organize weekly events for summer (schedule, rules, location)</p> <p>Report date/time 2 weeks in advance to Student Coordinator</p>
President of Biology (1)	<p>Attend monthly GSA meetings</p> <p>Liaison between all other GSA positions and graduate student coordinator</p> <p>Report minutes to graduate students (posted on MLS)</p>

Secretary / Treasurer (1)

Responsible for Biology finances

Write proposals for funding

Report to President of Biology (GSA)

Social Coordinator (1)

Responsible for planning social events once per month

Report to President of Biology (GSA)

Inform graduate student coordinator of all events