The Department of Biology is committed to providing meaningful research experience to as many eligible students as possible through the Biology 4999E Honors Research Thesis course. The goal of this course is to provide students in Honors Specialization modules with direct research experience including aspects of information literacy, hypothesis development, experimental design, data collection, analysis, and interpretation. In addition, students will gain experience in scientific communication by submitting a written thesis for examination and presenting the results of their research in a public oral presentation. In order to facilitate these goals, a number of guidelines are outlined below. Biology 4999E has a weight of 1.5 full course equivalents (FCE).

Class Lectures: Tues. 6:30-8:30 pm fall term; BGS 0165

Eligibility and Pre-requisites
Only students registered in the final year of either an Honors Specialization module offered by the Department of Biology or a joint Honors Specialization module involving Biology are eligible to enroll in Biology 4999E. It is the responsibility of the student to find an appropriate supervisor. Co-supervisors are required if 1) the supervisor is not a regular or cross-appointed faculty member in the Department of Biology and 2) the supervisor has not previously supervised a Biology 4999E student. The co-supervisor must be a regular or cross-appointed faculty member in the Department of Biology. Co-supervisors are found with the help of the supervisor.

“Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.”

Admission Procedures
Students interested in completing a Biology Honors Research Thesis must apply through the Course Coordinator, using the application form available from the Biology Undergraduate Office (NCB301D) or from the Biology Website. Available faculty and potential research thesis topics are normally posted within the Department in the winter term for theses to be completed in the
following academic year. Students are required to make appointments and discuss potential
thesis topics with faculty with whom they would like to work, before submitting their
applications. The potential supervisor/supervisors/co-supervisor must sign the application before
it is submitted. In signing the application, the faculty member agrees to supervise the Biology
4999E thesis of named student. The application deadline is normally the beginning of June. The
onus is on the student to meet with potential supervisors.

Course Requirements
The Biology Research Thesis course consists of:

1. developing and writing a viable research proposal (6-8 pages in length),
2. attending weekly meetings organized by the Course Coordinator,
3. conducting the proposed work,
4. completing a progress report (5 page written report and oral presentation, responding to
   questions),
5. writing a thesis based on the work,
6. presenting an oral presentation on the work during Biology /Environmental Science
   Research Day and responding to questions,
7. attending lab meetings when appropriate and/or requested by the Supervisor.

Research Proposals
With the assistance of their supervisors, Biology 4999E students will prepare research proposals.
Each proposal should be 6-8 pages in length with a minimum of 1500 words and consist of a
preliminary literature search, statement of hypothesis, proposed research project and a
description of the planned methods. Students are required to submit a written research proposal
to their Advisory Committee within 4 weeks of the beginning of the fall term (see timelines
below). Students will then organize an Advisory Committee meeting within the next 2 weeks to
present and discuss their proposal with their Advisory Committee. At this meeting, students
should present a brief (~ 10 min) overview of the project. A formal PowerPoint presentation is
not required but is recommended. In the event the proposal is judged unsuitable, students will be
given explicit directions for improving the proposals and 2 weeks to resubmit their proposals for
a second review. A Project Approval form must be completed and returned to the Course
Assistant (NCB 301D). Research proposals are worth 10% of the final grade of the project. In the
event a rewrite of the proposal is required, the mark will be based upon the original proposal, not
the revised version. Guidelines on how to write a research proposal are available on OWL and
will be discussed in class in the fall term.

Students who plan to enroll in Biology 4999E in the fall term, but will be collecting their
data in the summer months, will submit a research proposal to their Advisory Committee
and meet with them in the spring, prior to collection of data.

Experimental Work
Normally, experimental work or data collection begins shortly after the approval of the proposal
and is normally completed by the end of February to allow adequate time for data analysis and
thesis writing. Students are expected to spend a minimum of 15 hours per week in the lab for the
duration of the thesis. The quality of the experimental work/data collection, as assessed by the
thesis supervisor (see below), is worth 25% of the final grade of the project.

Progress Report and Meeting
At the end of the fall term, students will submit a written progress report (up to 5 double-spaced pages of text, up to 10 figures and/or tables, plus references), which will include a summary of progress to date and plans for completion of the thesis, **to their Advisory Committee at least 2 business days prior** to their committee meeting. Students will arrange a meeting with their Advisory Committee prior to the end of the fall final examination period to discuss their progress. At the meeting, students will make a 10-15 min oral presentation, which summarizes their progress to-date and their plans for completion of their thesis, and be prepared to answer questions the advisors may have regarding any aspect of the thesis project. The goal of this meeting is to assess the progress on data collection/analysis and the progress the student has made in understanding their topic. This progress report and meeting is worth 25% of the final grade of the project.

**Thesis**
A thesis presents the major findings of the project and is due near the end of winter term, the date to be set by the Course Coordinator/Assistant each year (see timetable below). Theses should be a minimum of 15-20 pages (excluding figures or tables or references) and consist of the following sections: title page, abstract, introduction, materials and methods, results, discussion, conclusion, and references. Guidelines on how to write the thesis will be presented in class and posted on OWL. The thesis is evaluated by the Advisors and is worth 25% of the final grade of the project. Thesis Advisors will return the thesis to the students within 10 days of receipt along with a brief written report, highlighting the strengths and weakness of the thesis and pointing out any changes that need to be made. Students are encouraged to consult with their supervisors regarding any recommendations for changes made by Advisors. Copies of the thesis, including changes that may result after the evaluation by Supervisor and Advisors, must be submitted to the Supervisor and Course Assistant before a final grade will be submitted. The Supervisor must sign off on the submitted thesis. The thesis mark will be based upon the initial submission, not on any revised version.

**Public Presentation of Thesis Work**
Biology 4999E students will present and defend the major findings of their research thesis, in an oral presentation at the Joint Biology/Environmental Science Research Day, normally scheduled before the last day of classes in the winter term. Details regarding format will be provided. Oral presentations will be 12 minutes followed by a 3-minute question period from Examiners, who will then assign a mark. The public presentation and defence of research projects is worth 15% of the final grade of the project.

**NOTE:** Since the research presentation day will include Environmental Science Honors Thesis students, you may be presenting in a group with some of these students. The students from both groups will be evaluated using the same criteria and evaluation forms.

**Roles and Responsibilities**
**Students**
The goal of the honors research thesis is for you to gain experience in conducting research… from start to finish! While every lab has different research interests and methodologies, it is expected that each honours student will achieve these learning outcomes.
(1) **Further develop and enhance information literacy skills**

Essential to conducting research is developing the hypothesis or question. To do this you will need to further develop your information literacy skills (see below) and be able to: 1) find relevant primary literature; 2) critically read this primary literature; 3) synthesize the relevant information to form the basis of your hypothesis and; 4) place the data you collect during your research into the appropriate context. You may ask your supervisor for articles that are highly relevant for your project, including recently published articles and works in progress.

(2) **Complete the necessary health and safety training sessions**

Working in a safe environment is everyone’s responsibility: the student, co-workers and supervisor. No student will be allowed to start their research project until they have completed the necessary safety training. It is part of your supervisor’s responsibility to ensure you have the appropriate training. A general overview and introduction to Health and Safety will be presented in class. Once you have completed the necessary training, you must provide your supervisor with proof of completion (e.g. certificate) for her/his records.

(3) **Set a weekly work schedule within the lab**

In Biology 4999E you will most likely be collecting your own data which may mean conducting your own experiments. In addition, you will be reading the literature, analyzing the data collected, and writing a proposal, a progress report, and ultimately, the thesis. So, budget your time accordingly. It is highly recommended you set up a weekly work schedule with your supervisor. Your work schedule will likely increase as you progress through your research project.

(4) **Set an appropriate meeting schedule with your supervisor**

The supervisor will help you understand the theoretical perspective of the lab, the goal of current lab projects, and guide your research project. It is a constructive relationship that should help you critically evaluate the literature as well as your research. Remember that the supervisor is there to guide you in finding answers to your questions, not give you answers. You should come fully prepared to each meeting to make continual progress in research. *Common meeting content: questions about new research theory/methodology, potential research hypotheses/questions, outline of the thesis prior to writing, and updated drafts of the thesis/statistical analysis questions.*

(5) **Further develop and enhance research skills**

Having information literacy skills will enable you to develop the framework for your hypothesis/research question. As a result, you should be able to formulate testable hypotheses/questions, identify an appropriate research design, and choose the statistical analyses necessary to evaluate them yourself (it is assumed you will remember the material covered in your statistics course!). Some guidance from your supervisor and/or advisors may still be necessary, but you should always rely on yourself to find answers before asking for help. For example, if you are stumped on a question, be sure to exhaust all resources in trying to find an answer before approaching your supervisor. If you need to run a complicated statistical analysis, then your advisor/supervisor may help you run it, but they should not do it for you. As noted above, they are there to guide you, not tell you the answers!
(6) **Further develop professional writing skills.**
A key to being a successful scientist is to be able to read and write technical research articles. You should apply the critical analysis and writing skills you developed in previous courses to the work you produce in the lab. From writing a research proposal to completing your thesis, you should identify the thesis/goal of the document, highlight key points clearly and concisely, use appropriate writing mechanics, and adhere to formatting style in the sciences (see below). We will cover aspects of scientific writing/communication in class.

(7) **Promote a respectful work environment.**
An honors student will work intimately within the existing lab structure, and to do so, must maintain a professional, respectful demeanor toward research participants, lab personnel, and toward the projects themselves. Likewise, you should expect to be treated respectfully by others in the group. Your meetings, deadline requests, etc., must also respect the schedule of those around you.

(8) **Set progress goals!**
From learning the ropes in the lab and sifting through literature to completing the final draft of the thesis is a long process…. and requires substantial planning so you do not find yourself running out of time at the end of the year. Remember you will need to balance your research with your other academic course requirements, work responsibilities, etc. Keep in mind that all of these take quite a bit of time: (a) lab training/familiarization, (b) critical analysis of literature/hypothesis development, (c) research protocol/design, (d) proposal writing, (e) piloting the protocol & collecting data, (f) data analysis; (g) thesis writing, and (h) oral presentation.

(9) **Attend and participate in all Biology 4999E class meetings**
The class will meet weekly, Tuesdays 6:30-8:30 pm Rm BGS 0165 during the fall term and as needed in the winter term. This time will be used to enhance skills and knowledge necessary for success in Biology 4999E and your development as a research scientist. Although these classes are not mandatory, they are highly recommended and will be extremely helpful in your quest for success.

**Responsibilities of the Supervisor**
Potential supervisors will submit project outlines to the Department for posting in the winter term. Typically projects will be of sufficient nature as to net reasonable results in a 4 to 5 month period.

Supervisors of student projects are expected to:
1. arrange for the appropriate infrastructure and direction/guidance for the proposed work;
2. ensure that projects provide sufficient challenge to students, and comply with expectations established within the Department of Biology;
3. evaluate the performance of students for whom they are supervisor
4. be available to meet with students on a regular basis
5. integrate students into the existing laboratory, ensuring they are treated respectfully
6. ensure students receive the necessary health and safety training as well as any other relevant training (e.g. animal care) prior to the start of the project
7. ensure members of the advisory committee are aware of course procedures and timetables.
8. assume the role of Chair for the Progress Evaluation Meeting.
Responsibilities of the Advisors
Advisors are expected to:
1. be familiar with the course procedures and timetables
2. participate in supervisory meetings
3. review, comment on and evaluate all written material, which includes providing the student with a written evaluation of their thesis, indicating the strengths and weaknesses and any required or suggested changes, within 10 days of receiving the thesis.
4. evaluating the mid-term progress of students
5. providing guidance as necessary

Co-supervisors and Joint Supervisors
Co-supervisors are required if 1) the supervisor is not a regular faculty member in the Department of Biology and 2) the supervisor has not previously supervised a Biology 4999E student. Co-supervisors must be familiar with the course requirements and procedures, will attend all meetings, and will take on supervisory duties if necessary. They are not responsible for supervising the research, but will usually adopt an advisory role.

Joint Supervisors take on equal responsibility as supervisors.

Advisory Committee
Each research thesis is supervised by a committee normally composed of the thesis supervisor (or joint supervisors), the co-supervisor (if necessary), and two advisors, one of whom must be a regular or cross-appointed faculty member in the Department of Biology. Ph.D. students and post-docs can also be advisors but they CANNOT be from your supervisor’s lab (i.e. you cannot be working in the same lab with them). The composition of the advisory committee is subject to approval by the Course Coordinator.

Examiners
The Course Coordinator will select examiners. There will be a panel of 3 examiners participating in the evaluation of each presentation during Biology & Environmental Science Research Day. Examiners may be asked to examine Biology and Environmental Science students.
Examiners are expected to:
1. attend all presentations to which they are assigned
2. ask questions of the students after their presentation
3. assign a mark to the presentation, based upon the quality of
   a. the presentation (includes, but is not limited to, quality of the slides and oral presentation),
   b. the data collected
   c. the interpretation of the data
   d. the answers to questions
Course Coordinator/Assistant
The Biology 4999E research thesis course is coordinated by at least one faculty member and a Course Assistant. The responsibilities of the Course Coordinator include, but are not limited to,
1. facilitating the matching of students to supervisors and projects,
2. approval of Advisory Committee members,
3. the tracking of student progress through the course
4. collection of all submitted materials, assignment of grades (based on input from the Supervisor, Advisors and Examiners),
5. organizing writing and seminar preparation workshops,
6. organizing Biology/Environmental Science Research Day,
7. assignment of presentation examiners and
8. facilitating student access to appropriate university resources.

Evaluation
Biology 4999E students are evaluated according to the following criteria:

Proposal, written: 10% (evaluated by Advisors)
Evaluation criteria include, but are not limited to:
• Clarity of hypothesis/research question
• Clarity of proposed methodology and plan for analysis of data (if appropriate)
• Quality of the written proposal

Mid-term Progress Evaluation: 25% (evaluated by Advisors and Supervisor)
Evaluation criteria include, but are not limited to:
• Quality of the written report (content and style)
• Quality of the oral presentation (content and style)
• Quality and quantity (if applicable) of progress
• Quality of answers to questions posed during the meeting
• Plans for completion

Experimental Work: 25% (evaluated by Supervisor)
Evaluation criteria include, but are not limited to:
• Professional integrity
  ° showed good character in all aspects of work, including positive attitude toward research, appropriate communication regarding work/progress, produced quality work, and adhered to lab rules/standards. Above all, honors students should demonstrate an eagerness to learn and do well in all endeavors.
• Scientific ability
  ° demonstrated critical thinking about research, ability to independently access & use scientific literature, engaged in thoughtful discussions about research, and demonstrated ownership of the project.
• Time management
  ° met research schedule/appointments & deadlines
• Task completion
  ° fulfilled paperwork/general lab duties and responsibilities
• Relational conduct
  ° engaged with lab personnel & research participants in respectful, considerate, helpful ways
Written Thesis: 25% (evaluated by Advisors)
Evaluation criteria include, but are not limited to:
• clarity of content
  ° adequacy of literature review
  ° adequate development of hypothesis/research questions
  ° completeness of methods
  ° appropriate presentation and analysis of data
  ° clarity of data interpretation; arguments well supported by data/literature
  ° conclusions supported by data
• quality of the written thesis

Public Presentation and Questions: 15% (evaluated by Examiners)
Evaluation criteria include, but are not limited to:
• clarity of content
  ° hypothesis/research question
  ° methodology
  ° interpretation of data
  ° conclusions supported by the data
• quality of visual aids
• quality of oral presentation
• ability to answer questions

During the public presentation, students will determine which presentation will be awarded the best presentation in each session (Ecology and Evolution/Environmental Science, Physiology & Biochemistry, Cell Biology & Genetics).

Accessibility
Please discuss with your supervisor and/or Course Coordinator if you require workshop material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 if you have questions regarding accommodation.

Accommodation for Medical Illness or Other Serious Circumstances
If you are unable to meet ANY course requirement due to illness or other serious circumstance, you must provide valid medical documentation or other supporting documentation to the Dean's office as soon as possible and contact the instructor immediately. It is your responsibility to make alternative arrangements with the instructor once the accommodation has been approved by the Dean’s office and the instructor has been informed. Please see for further information: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

Student’s requiring academic accommodation due to illness for any assignment/exam should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) if you visit Student Health Services. The Student Medical Certification form can be downloaded from this site: https://studentservices.uwo.ca/secure/index.cfm
This site also has the Policy on Accommodation for Medical Illness.

**Plagiarism Rules and Scholastic Offenses**

"Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar)."

This concept applies with equal force to all assignments, including laboratory reports, diagrams, and computer projects. Students wishing more detailed information should consult their instructor, Department Chair or their Dean's office. In addition, they may seek guidance from a variety of current style manuals available in the University's libraries.

“Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:"

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/schalastic_discipline_undergrad.pdf

The following guide will help you avoid committing an academic offence:
http://www.uwo.ca/ombuds/student/cheating.html

**Support Services**

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling. Students who are in emotional/mental distress should refer to Mental Health@Western for a complete list of options about how to obtain help:

http://www.health.uwo.ca/mental_health

For additional student-run support services offered by the USC, see:

http://westernusc.ca/services.

The website for Registrarial Services is:

http://www.registrar.uwo.ca.
Table 1. Schedule of Timelines for Biology 4999E, 2014-15

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2-12, 2014</td>
<td>Meet with supervisor to organize project, establish Advisory Committee, start working on research proposal, complete Project Registration and return to NCB 301D</td>
</tr>
<tr>
<td>September 9, 2014</td>
<td>Weekly meetings with Course Coordinator will commence 6:30-8:30 pm, BGS 0165 Schedule and topics to be discussed in class (posted on OWL)</td>
</tr>
<tr>
<td>October 3, 2014</td>
<td><strong>Written research proposals are due for evaluation by the Advisory Committee.</strong> Follow Guidelines for Preparing Biology 4999E Research Proposals (posted on OWL)</td>
</tr>
<tr>
<td>By October 17, 2014</td>
<td>Meet with your Advisory Committee and supervisor for approval of your project. Complete Project Approval form and return to NCB 301D along with a copy of your proposal.</td>
</tr>
<tr>
<td>By mid-Nov. 2014</td>
<td>Book your progress report meeting with your Advisory Committee! Don't wait until December.</td>
</tr>
<tr>
<td>By December 17, 2014</td>
<td>Progression Evaluation. Written progress reports are submitted to your Advisory Committee and a meeting needs to be organized to present your results to date. <em>Note: progress reports are to be submitted at least two business days prior to your committee meeting.</em> A copy of the progress report must be given to the Course Assistant (NCB 301D).</td>
</tr>
<tr>
<td>End of February 2015</td>
<td>Experimental work completed</td>
</tr>
<tr>
<td>Saturday, March 28, 2015</td>
<td><strong>PRESENTATION DAY</strong></td>
</tr>
<tr>
<td>April 8, 2015 4:00 pm</td>
<td><strong>THESIS DUE</strong> Please provide your Supervisor and Advisors a hard copy of your thesis, unless you have prior permission from your advisors to submit your thesis electronically. Follow Guidelines for Preparing Biology 4999E Theses (posted on OWL)</td>
</tr>
<tr>
<td>April 18, 2015</td>
<td>Thesis comments received from Advisors</td>
</tr>
<tr>
<td>April 30, 2015 by 4:00 pm</td>
<td><strong>Corrected Thesis DUE</strong> Hand in final, corrected thesis, signed by your supervisor, to Course Assistant (NCB 301D) Provide supervisor with final copy of thesis</td>
</tr>
</tbody>
</table>