This file and others can be found at http://www.dal.ca/faculty/science/biology/honours.html

Biology & Marine Biology Honours Research and Thesis, and Honours Qualifying Exam
BIOL / MARI 4901 & 4902
BIOL 8880

Class Times and Locations
Tuesdays and Thursdays 11:30-13:00
LSC 240 – FALL and WINTER TERMS

Class Instructors
• Paul Bentzen | paul.bentzen@dal.ca
• Erin Bertrand | erin.bertrand@dal.ca (fall term only)
• Glenn Crossin | gtc@dal.ca
• Alan Pinder | alan.pinder @dal.ca

Honours Committee (each serves as program advisor for Biology and Marine Biology students)
• Glenn Crossin | gtc@dal.ca | Chair of Honours Program
• Christophe Herbinger | christophe.herbinger@dal.ca
• Julie LaRoche | julie.laroche@dal.ca
• Nancy McAllister-Irwin | nancy.mcallister-irwin@dal.ca
• Mindy McCarville | mindy.mccarville@dal.ca
• Alan Pinder | alan.pinder @dal.ca
• Allison Schmidt | allison.schmidt@dal.ca

Course Grading

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis</td>
<td>85%</td>
</tr>
<tr>
<td>Class Presentation</td>
<td>5%</td>
</tr>
<tr>
<td>Cameron Conference Presentation</td>
<td>10%</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ops submit in Jan or Apr, others in Apr</td>
<td></td>
</tr>
<tr>
<td>Done either in fall or winter term</td>
<td></td>
</tr>
<tr>
<td>Saturday 10 February 2018</td>
<td></td>
</tr>
</tbody>
</table>
Course Requirements: Biology and Marine Biology

1) BIOLOGY

Core Class Requirements (3.3 GPA including BIOL 3050 or 3078 & 3079)

- BIOL 2003 – Diversity of Life 1
- BIOL 2020 – Cell Biology
- BIOL 2040 – Evolution
- BIOL 2004 – Diversity of Life 2
- BIOL 2030 – Genetics & Molecular Biology
- BIOL 2060 – Ecology

Additional Core Requirements

- BIOL 3050 – Developmental Biology
- BIOL 3078 & 3079 (MARI 3074 & 3076) – Animal Physiology 1 and 2

2) MARINE BIOLOGY

Core Class Requirements (3.3 GPA in the six below)

- BIOL 2003 – Diversity of Life 1
- BIOL 2020 – Cell Biology
- BIOL 2040 – Evolution
- BIOL 2004 – Diversity of Life 2
- BIOL 2030 – Genetics & Molecular Biology
- BIOL 2060 – Ecology

Additional Core Requirements

- 9 cr hrs of 3000-4000 level classes from the following: BIOL/MARI 3042; 3063; 3067 or 3080; 3074 & 3076; 3101; 3211; 3301; 3600 or 3602; 3761; 3626 or 3090 or 4060; 3 cr hr MARI Seaside; 3 cr hr OCEA/MARI
- 9 cr hrs of 2000-4000 level classes in MARI/BIOL or equivalent – 3 cr hrs of which must be at 3000-4000 level
- 12 cr hrs MARI or strong MARI emphasis: 3326, 3102, 3615, 4061

Additional Requirements for both Biology and Marine Biology

- Minimum grade requirements
  - B+ average (3.3) in the Core Requirements listed above, for all those classes taken at the time of application. A B+ average is also required, for all Core classes, at time of graduation. *(Note that the classes included in the calculation of the Core GPA differs between Biology and Marine Biology)*
  - B average (3.0) cumulatively at graduation.
  - No grade below a C in any BIOL / MARI class
  - A maximum of 2 of the above required classes can be repeated.

- A written thesis is produced, through registration in BIOL / MARI 4901 & 4902.

- A qualifying exam is also registered, via BIOL 8880. Students do not register for 8880; this will appear on the transcript automatically at the time of graduation. This exam is Pass/Fail, and is based solely on two criteria:
  - Attendance and participation in the Honours class.
  - Attendance and presentation at the Cameron Conference.

---

Honours course overview

Our philosophy regarding Honours is that students should have a high degree of independence and autonomy with respect to their research projects, just as if they were in graduate school. To that end, we stress that the key to success in Honours is the relationship that the student develops with his or her supervisor. With the supervisor’s guidance, the student is responsible for pursing all aspects of their research project. Students learn how to formulate hypotheses and predictions and how to prepare a thesis proposal. They also learn how to conduct laboratory of field research, how to collect and analyse data, and how to write a thesis manuscript. These skills are all learned directly from their research experience, which means that that the supervisor is responsible for mentoring the student. For example, if
a student has questions about a particular statistical methodology needed to properly analyse their data, then the onus is on him/her to talk with the supervisor and/or lab-mates to find the answers. Similarly, the student should be self-directed and seek information in the library and in books, or by talking to other faculty members. In essence, the student is expected to take command of their experience and seeks out answers, but of course under the wing of a supervising professor. The professors running the Honours course are available to advise the student too, or they can suggest additional or alternate avenues that the student might explore to find answers. The reason that the Biology Honours program is structured this way is because many of our students eventually enrol in graduate programs, and we believe that this kind of independent but supervised approach to research is the best way to prepare students for graduate research. Our program therefore differs from other Honours programs elsewhere at Dalhousie, where students often have structured classroom lectures, scheduled assignments, and exams.

What should the student and supervisor expect from the Honours class (BIOL/MARI 4900, 4901 and 4902)? The Biology Honours class has two functions. First, it is serves as the administrative arm of the Biology Honours Program – students submit their written theses through the class, where it is then distributed to 3 faculty evaluators. These evaluators can come from any department, so long as they have a familiarity with the general thesis subject. Once evaluated, the individual thesis scores are returned to the Honours class and are compiled so that a final Honours thesis grade can be calculated. Second, the Honours class provides students with opportunities for science communication, in the form of classroom presentations of each student’s thesis work as well as presentation at the annual Cameron Conference (see Appendix 5). In class, students present the aims and results of their thesis research and get direct feedback from their peers and from the class professors. At the Cameron Conference, students present a more refined version of their class presentations and additional feedback from University faculty, post-docs, adjuncts, staff, graduate students and fellow undergraduates.

Aside from science communication, the honours class runs a small number of guest lectures, where faculty and university staff tell students about resources available to them to aid research (e.g. library catalogues and databases, the GIS Centre, microscopcy and imaging facilities, etc), as well information about graduate funding opportunities and NSERC application procedures. Finally, as many students are considering a life in academics, professors present lectures that detail "A Day in the Life of a Professor", which is always well received.

Ultimately, the grade that a student receives for his or her Honours degree depends on the class presentation grade (5%), the Cameron Conference grade (10%) and the thesis grade (85%). The first two scores are class based communications scores. The thesis grade is the fruit of independent thesis research, done not in the honors class, but in the various laboratories across the Dalhousie campus and elsewhere.

TIMELINE – Registration and Program Details

Honours course BIOL/MARI 4900, 4901 and 4902 – timeline to application

By the end of the Third Year (i.e. before beginning the Honours program) students should have:

1) Completed, or be close to completing, the 6 core classes with a minimum B+ (3.3) average.

2) Identified a suitable thesis supervisor and research topic (see Appendices 1 and 2). Finding a supervisor is the student’s responsibility. If a prospective supervisor is not from Dalhousie, or has never supervised a student before, he/she must be deemed suitable by the Honours committee (Appendix 1). The student should contact the Honours committee and provide a CV of the prospective supervisor for review. Once a supervisor and project have been secured by the student, he/she will draft a 1-2 page thesis proposal, which must be submitted to and approved by the Honours committee by September before beginning BIOL / MARI 4901 – or January for Coop students. See Appendix 3 for details about thesis proposals.

3) Completed an Honours Application. This must be filled in, reviewed, and approved by an Honours advisor (e.g. member of the Honours Committee). Once an Honours advisor has signed the application, it will then be submitted to the Registrar for final approval.
During the **Fourth Year** students will:

1) Conduct research and write a thesis.

   - **NOTE TO SUPERVISORS:** We ask that all supervisors comment on drafts of their own students’ theses whenever drafts are written. We also ask that supervisors provide a formal evaluation of the thesis when it is submitted for grading in April. By agreeing to supervise an Honours student, supervisors are also required to evaluate the theses of other students!! Ultimately, each student’s thesis is evaluated by his/her supervisor AND two other faculty readers - as assigned by the Honours Committee. It is therefore essential that all supervisors help in the assessment of other students, as other supervisors are helping in the assessment of their own. **Generally, the Honours Committee assigns a supervisor with his/her own students theses, plus 2-3 additional theses.**

   - **NOTE ON SABBATICAL LEAVES:** If a supervisor agrees to supervise an Honours Student during their sabbatical, this does not relieve the supervisor from thesis evaluations. Supervisors will be still be required to read and evaluate their own student’s thesis, as well as the additional theses assigned by the Honours Committee. Failure to meet this expectation may preclude one from supervising our Honours students in the future.

2) Attend the class and participate. Attendance is mandatory and will be recorded as this determines whether or not students pass the Honours Qualifying Exam (BIOL/MARI 8880)**.

3) Give an oral presentation of their on-going thesis research in class. This should be prepared with the assistance of the thesis supervisor. We ask that supervisors help their students prepare their talks and if possible, attend the class the day of their student’s presentation.

4) Give an oral presentation or a poster presentation at the Cameron Conference (February each year). We ask that supervisors help their students prepare their abstract and their presentation, and that supervisors attend the conference and help evaluate the presentations of other students. You will also be asked to contribute a food item to the luncheon for the students.

** In addition to a grade in BIOL/MARI 4901 & 4902, a grade in BIOL 8880 - Honours Qualifying Exam - will appear on the student transcript when all the requirements for the Honours program have been satisfied. The Biology Department grades this “exam” on a pass/fail basis. In order to pass, students must:

   - Satisfy the Honours course requirement listed above, AND attend all classes. **ATTENDANCE WILL BE RECORDED** and participation noted.
   - Participate and present at the Cameron Conference.

### More Specific Information About the Honours Program

#### 1. HONOURS RESEARCH AND THESIS

The aim of the Honours thesis program is to give students their first complete research experience, and to coordinate all aspects of a project -- from conceptualization and identification of research questions and hypothesis, to experimental design and data collection, to data analysis, and finally to interpretation, all of which results in a final written thesis.

#### 1a. Submit a Formal Honours Thesis Proposal

Proposals for thesis projects should be approved BEFORE beginning thesis research. If a student wants to begin research before the start of the Honours class in September (or January for Co-op students), he/she should submit a thesis proposal to the Honours committee asap. All proposals will be circulated through the Honours committee for approval. Guidelines for the proposal are included in the **Appendix 3** at the end of this document. Both the student and the thesis supervisor must sign the proposal.
1b. February Reading Week, End the Research, Thesis Writing

By Reading Week (or by November for the Co-op Honours students) students should have completed their data collection and have begun writing. If at that time experiments and data collection are still on-going, students should attempt to end experiments and begin writing. See Appendix 4 for details on thesis format.

Students must allow ample time for their supervisors to provide comments on thesis drafts. Although supervisors will ultimately provide a grade on their student’s thesis, they should nevertheless provide considerable feedback along the way.

1c. Submit a PDF or Word document of the Thesis via email to the Honours Committee Chair – Dr. Glenn Crossin, gtc@dal.ca
   - Coop students submit in early January or April
   - All others submit in Early April – usually the last day of classes. Date will vary year to year.

We have moved to an electronic thesis review system. Evaluation of a thesis is done by 3 people: the thesis supervisor, and 2 additional readers assigned by the Honours committee. The evaluators (e.g. thesis readers) will receive an electronic version of the thesis, along with a document explaining our scoring criteria. If readers wish to receive paper copy, we can provide these when requested. The evaluation and final grade depends on three main criteria:

- 30% - Scientific rationale, hypotheses, and predictions
- 20% - Scientific method and experimental design
- 50% - Analysis and interpretation, and writing skills

In addition to a final grade, supervisors will submit a separate assessment of their student’s ability to work independently, scientific curiosity, industriousness and motivation, technical proficiency, etc. This assessment will not be factored into the final grade, but is a qualitative assessment of student aptitude.

In addition to the thesis, which is 85% of the final Honours course grade, the Cameron Conference presentation is worth 10% and the in-class presentation is worth 5%. These are summed and a final grade is determined as:

- A+ = > 90
- A  = 85-89.9
- A- = 80-84.9
- B+ = 77-79.9
- B  = 73-76.9
- B- = 70-72.9
- C+ = 65-69.9
- C  = 60-64.9
- C- = 55-59.9
- D  = 50-54.9

Because each Honours student require 3 reader of their thesis, we expect all Honours supervisors, whether based in Biology or elsewhere, to read and evaluate a certain number of theses in addition to their own student’s thesis. Typically, the Honours committee will assign 2-3 additional theses, so for a supervisor with one Honours student, he/she would evaluate 3-4 theses. Having supervisors read and evaluate additional theses is the only way that we can ensure students get a proper evaluations. This is an expectation for taking on an Honours student.

1d. Thesis extensions

Extensions for submitting theses will be considered on the basis of:
• a documented medical excuse
• a letter from the supervisor stating the reasons for an extension and approving the request

Thesis extensions are granted only in very extenuating circumstances, such as a health crisis or in cases where a student’s experiments fail due to circumstances outside of his/her control and where such a failure prevents the student from completing a thesis. Each of these cases are reviewed by the Honours Committee before an extension is granted. Requests for extensions so that a student can expand a thesis into a manuscript for submission are not granted. Creating a publishable manuscript is indeed encouraged, but the thesis must be submitted at the end of the Honours course in April (or December option for Coops)

Requests for extensions must be submitted in writing to the Honours Committee two weeks BEFORE the thesis submission date in April. The student will then have until August 1 to complete and submit the thesis.

Those receiving an extension will not graduate in May, but will do so the following fall. The student will receive in “INC” on their record (BIOL/MARI 4900 or 4901 & 4902). When the final grade has been determined in August, the INC will be removed and the appropriate grade inserted. If students intend to graduate in May, then a thesis extension is not possible.

2. CAMERON CONFERENCE

The Cameron Conference is a one-day event held on a Saturday during the winter term, usually in early February, and is organized by the Honours Committee in a format similar to any formal, international, scientific conference. Students will give either an oral presentation or a poster presentation that describes their Honours research or last Co-op work term. Teams of faculty will evaluate each presentation, and student attendance and participation at the conference is used to satisfy part of the requirement for the qualifying exam (BIOL/MARI 8880.00). The conference runs from 9:30am to 4:30pm, with a luncheon provided for all attendees and a social at the end. **Attendance is mandatory for all 4900 students. Reschedule any other commitments.** Co-op Honours students who start the 4900 class in January have not normally started their Honours thesis work yet and can therefore prepare a poster on their last co-op work term. More details on the Cameron Conference are found in **Appendix 5.**

3. Other information

**Library resources** - [http://www.library.dal.ca/Killam/](http://www.library.dal.ca/Killam/)

Biology’s subject specialist at the Killam Library is Michelle Paon, michelle.paon@dal.ca. There are several workshops and online tutorials offered by the library to aid research (e.g. literature searches), which can be key to developing ideas and research questions.

- Biology Libguide - [http://dal.ca.libguides.com/biology](http://dal.ca.libguides.com/biology)

**Integration with the Biology Department**

Supervisors should provide their student(s) with a desk and laboratory space. For students whose supervisors are outside of Dalhousie, we may be able to provide a desk in the Life Sciences Centre. To inquire about a desk, contact our departmental administrative office, Julie Walker. Julie is in the Biology Main office (LCS 2078), and can be reached at julie.walker@dal.ca. Students are encouraged to attend weekly FISH talks and BIOBEER, the departmental informal seminar series and social hour held each Friday at 3:30pm in the 5th floor lounge. Weekly Departmental seminars occur on
Thursdays at either 11:00am or 3:30pm. Notices for these events are usually posted around the department and on the Biology homepage.

**Science Atlantic Biology Undergraduate Conference**

All Atlantic Canadian Universities send student delegates to the Science Atlantic Biology Undergraduate Conference, held each year in early March at alternating institutions. A group of students will be selected from the presenters at the Cameron Conference to attend this year’s conference and give presentations. More details will be available in February.
Appendix 1: Procedure for having an external, non Biology faculty scientist approved as a Biology or Marine Biology Honours supervisor

Meet with a member of the Honours Committee to discuss the potential external supervisor. If the external has supervised Biology or Marine Biology Honours students in the recent past, s/he will be automatically approved.

If the external has never (or rarely) supervised Honours students, the Committee will request either:

- Confirmation that the proposed external is a member of the Faculty of Graduate Studies at Dalhousie. If the external is a member of our faculty, s/he will be automatically approved.
- or -
- If the external is NOT a member of the Faculty of Graduate Studies and has not been previously approved to supervise students, the Committee will need a copy of his/her CV, showing the degree earned, present position, and list of recent publications.

At minimum, external supervisors must hold a PhD, have published in the primary scientific literature, and (ideally) have previously supervised Honours or other undergraduate student projects.

Appendix 2: Suitable Honours projects

The research projects that Honours students use for their Honours theses MUST BE DIFFERENT FROM ANY OTHER RESEARCH PROJECTS FOR WHICH THEY MAY GET CREDIT IN OTHER CLASSES. This applies to projects that are submitted as part of credit for a Special Topics class at Dalhousie and/or for research based classes at another University. There must not be any overlap between the Honours thesis research and any other research for which the student has already (or will concurrently) receive credit. If a student or supervisor has questions about this, contact Chair of the Biology Department’s Curriculum Committee for a copy of the Guidelines for a Special Topics Class.

The Biology Department considers proposals for several types of Honours theses that are capable of meeting the requirement for generation of new knowledge. They are listed below, more or less in order of increasing difficulty from the student’s point of view.

1) Adequately designed laboratory or field research in which the student collects his or her own data.

2) Analysis of historical data: "Historical" in this sense means, not ancient history, but analysis of published or unpublished data collected by other researchers. The new knowledge consists of the creative analysis and conclusions drawn from the data. (Examples of "historical" data are databases from other studies, records of whaling catches from sea captains logs).

3) Theoretical research: Examples might be contributions to theories of the evolutionary significance of apoptosis (programmed cell death), sexual reproduction or optimal foraging strategies. This type of thesis might be associated with analysis of historical data as in (2), above.

4) Creative review of present knowledge: A straightforward review of the current state of knowledge in some area of science, similar to the review papers you may already have written in connection with particular courses, will NOT meet the Honours requirement for generation of new knowledge. However there are circumstances in which a creative review can lead to new understanding, particularly where the field is deadlocked in controversy. Examples might be the technical analysis of estimates of heritable variation in IQ, ethical issues connected with proprietary use of DNA sequences, permissible exposure limits for toxic or radioactive substances in the environment etc. A student who chooses this type of thesis will have to convince his or her Honours supervisor, in
advance, that the thesis has a good chance of contributing new understanding of the issue. The Honours supervisor and the student together will then have to convince the Honours Committee.

Appendix 3: Guidelines for the Honours Thesis Proposal

The proposal should be approximately 1-page long, but it can be up to 2 pages. It must provide sufficient details about the specific scientific question(s) being addressed. The proposal must be clearly written, using concise, jargon-free language, and should contain:

1) An overview of the relevant background literature, which provides a broader context for the specific study. This helps us to understand why the study is important and whether it is feasible. Only 1-2 key references should be cited.

2) Statement of the scientific question that will be addressed. This should be a specific question that can be answered within the time constraints of the Honours thesis. This should take the form of a specific hypothesis or hypotheses, with testable predictions.

3) A concise description of the methods that to be used to address the questions, hypotheses, and predictions. What is the general experimental design? What will be measured? What experimental, analytical, and statistical methods will be used? These should be fairly general, but must provide enough information to allow the Honours committee to determine whether the methods are appropriate for the study.

STUDENTS MUST SUBMIT THEIR HONOURS PROPOSAL USING THE TEMPLATE COVER SHEET FOUND HERE:
http://www.evophys.ca/teaching.html

In the proposal, clearly state the student’s name and the supervisor’s name. Both student and supervisor must sign the proposal.

Structure the proposal with these headings:

1) COVER SHEET – with Title, Names of Student and Supervisor(s), and Signatures of both.
2) Overview / Background
3) Specific scientific question, hypotheses, and predictions
4) Methods and experimental design
5) No more than 5 key References

Appendix 4: Thesis Formatting

The following guidelines for the preparation of the thesis are adapted from the regulations for preparing postgraduate theses at Dalhousie. The thesis should roughly follow the standard format of a scientific report, and contain the elements listed below. Supervisors can provide specific details about thesis structure. THESIS MUST BE WRITTEN IN THE FIRST PERSON SINGULAR, AND WHEN CERTAIN ASPECT OF THE STUDY WERE CONDUCTED BY OTHER PEOPLE (e.g. LAB MATES) IT SHOULD BE MADE CLEAR WHO DID WHAT.

Parts of the thesis and their order of appearance
1. Title page (see sample at the end) – THESIS MUST BE FIRST PERSON SINGULAR – ONLY 1 AUTHOR!
2. Dedication page (optional)
3. Table of Contents (optional)
4. List of Figures and/or Tables (optional, see below)
5. Abstract (1 page)
6. List of abbreviations and symbols used (optional)
7. Acknowledgments (optional)
8. Body of thesis (main text)
   • Introduction
   • Methods and materials
   • Results
   • Discussion
   • References / Literature cited (see below for details about formatting)
9. Tables (with table headings if not using a List of Figures and/or Tables as above)
10. Figures (with figure legends if not using a List of Figures and/or Tables as above)
11. Appendices (optional)

Page Formatting
• Standard 8.5” X 11” inch paper
• Double-spaced
• Margins: 1.0 inch (2.5 cm) on all sides.
• Pages can be double-sided.
• Font: 12 pt.
• Figure captions should accompany figures in a consistent fashion, either on the same pages as the figures or on the preceding page.
• All pages will be numbered consecutively, excluding Title Page (the Title Page is not numbered but is considered to be the first page). Numbering begins on the next page, which will be page 2. Conventionally, preliminary pages (i.e., dedication page, table of contents etc.) are numbered with lower-case Roman numerals (i,ii,iii,iv etc.) in the bottom right corner of the document. Arabic numbering (1,2,3,4, etc) then begins with the Body of the thesis and runs through to the end of the document.

References
These can be formatted in any style, just be sure to be consistent. You can use APA guides for references, or use the style of any peer-reviewed journal. Specific references should be first cited in the text at the appropriate places using this format … (Jones et al. 1999; Smith et al. 2009; Bartlet and Pear 2014).

The formatting of the title page should conform to the example provided on the next page:
Effects of *Saccharomyces cerevisiae* fermentation metabolites on the motor control, social standing, and general attractiveness of *Homo sapiens*.

by

Juan Morfor de Rhode

Submitted in partial fulfilment of the requirements for the degree of Honours Bachelor of Science in Biology (or Marine Biology)

at

Dalhousie University
Halifax, Nova Scotia
April, 2013

© J.M. de Rhode, 2013
Appendix 5: CAMERON CONFERENCE

Sponsored by: Department of Biology, Dalhousie University
               Dalhousie Association of Biology Students
               Dalhousie Association of Marine Students

The Cameron Conference is held annually to showcase the diversity of research conducted by the Biology and Marine Biology Honours students. The conference format is similar to that of an international scientific conference and includes two oral presentation sessions and two ninety-minute poster sessions. Biology professors and instructors, Honours supervisors, and other generous individuals provide a potluck lunch for all the participants and guests.

All Honours students must present either an oral presentation (limited to 8 students chosen by the Honours committee), or a poster presentation (all the rest). These presentations will highlight student research, or in the case of Co-op students, work done during their last work term.

• Each speaker has 15 minutes MAX. Talks should therefore be ~12 minutes in duration, followed by 3 additional minutes for follow-up questions. Unlike in the class, were more time is allowed for questions, students will be pulled from stage at 15 mins.
• Posters will be 40” x 40” or smaller, e.g. 40” x 36”.

Written Abstracts must be submitted via email to Glenn Crossin (gtc@dal.ca) at the beginning of the Winter term in January each year. These will be published in the Conference Programme / Book of Abstracts, which will be given out at the Cameron Conference to all in attendance.

Abstract Format
Students will submit their abstract using the Abstract Template file, which can be downloaded from the Honours Brightspace site and the Biology Honours homepage.