

## BIOLOGY 499 (Senior Honours Project)

### Introduction

Biology 499 is a two term experimental research course (Biol 499A, Biol 499B) with a total credit value of 1.0. While other one term lecture/lab courses involve 5-6 hours of participation per week, the time commitment for Biol 499 is less predictable. If you are considering taking Biol 499 based on the minimum number of hours required, you are likely not an appropriate individual for this course. Rather, it is for students who want to experience 'real life' science and the irregular time commitments and thrills involved. It is open to students who are entering their 4<sup>th</sup> year of the following Department of Biology programs: Honours Biology, Honours Biochemistry, Honours Biomedical Sciences, Honours Environmental Science (Ecology specialization), and Honours Life Physics (Biophysics specialization). Students in other programs may be considered if space is available; priority goes to students in Department of Biology programs. Only students attaining either a 73% or better cumulative major average or a 78% or better major average in their two most recent terms (normally 3A & 3B) will be accepted into this course. Biol 499 may not be taken by any students before they reach the fourth year of their program. Normally, the project will be done on campus and it must not be part of a Co-op work term or a USRA funded term.

### Prerequisite

It is strongly recommended that students enrolling in Biol 499 take Biol 361 - Statistics and Experimental Design.

### Informing yourself about a Project and a Supervisor

Before you complete Co-op Term 3B or the winter term of year Three Regular, you should review the list of potential supervisors and their research descriptions; the following link will help: <https://uwaterloo.ca/biology/research-areas>. You may then visit those faculty members whose research areas appeal to you to discuss further details. These visits are for information and discussion only and no commitment on either your part or on the faculty member's part is implied. Please note that this listing covers faculty members in Biology only. Faculty members in other Departments may also supervise Biol 499 students if they have cross-appointments in Biology. A list of cross-appointees is here: <https://uwaterloo.ca/biology/about/people/group/274> (check with the prof to ensure their Biology cross-appointment is still in force. Note that only some cross-appointees will supervise Biol 499 students). Only regular Biology faculty or those cross-appointed in Biology are able to supervise Biol 499 projects. Please be aware that a given faculty member may, or may not, choose to supervise 499 students in a given year, for a variety of reasons.

### Selecting a Project and Supervisor

After having read this information package and having visited faculty members whose fields of research appeal to you, it is time to make your choice. To begin a potential enrolment in Biology 499, use the form "Application to Enrol in Biology 499" found on-line at <https://uwaterloo.ca/biology/biol-499-senior-honours-project-0> (see links at bottom of page). Hard copies of the form are available in the Biology Undergrad Office, B1 381 or ESC 351C.

Students may have to go through the "course selection" process before they have found a supervisor. In this case, it is recommended that students select (& enrol if necessary) in an alternate course but pursue the possibility of finding a 499 supervisor. Once a student has been approved for academic requirements by the course coordinator, Biol 499 applications are passed on to the faculty members listed by the student for acceptance. If accepted, the student will be enrolled in Biol 499 by Biology's Administrative Staff, Undergraduate Studies, and a course swap with the alternate course will be completed if necessary. Students cannot enrol themselves in Biol 499; this must be done by personnel in the Biology Undergrad Office (students will be contacted via email as necessary). Students may begin 499A in either F, W or S terms provided this is

acceptable to the supervisor. Due to the large number of applicants wishing to start in the Fall term, there is a procedure for applying to Biol 499 on the following link: <https://uwaterloo.ca/biology/biol-499-senior-honours-project-0>.

Any student wishing to register for Biol 499 after the deadline for Fall term applicants, or for a W or S start, will be considered on an individual basis.

### **Beginning Biol 499:**

In early September (or January, or May), anyone who has been accepted into the course should meet with the faculty member (i.e., your research supervisor) to ensure that no problems have arisen, and to let the supervisor of your Biol 499 know you have returned to campus as planned.

After beginning the course, all further discussions or problems should be sorted out with your research supervisor, who is responsible for ensuring that you are working effectively on the project, and who will be checking on your progress and making suggestions and recommendations as it goes along. Lack of satisfactory progress in the first term will be brought to the attention of the Biol 499 Coordinator (and/or Biology Assoc Chair Undergrad, if appropriate). The Biol 499 coordinator should be contacted by either the student or the supervisor when serious problems arise during 499A. Efforts will be made to sort out such problems. **Not completing both Biol 499A and Biol 499B will result in no credit for either term.**

### **Biol 499 requirements:**

- 1.) Submission of a written **Project Proposal** by the end of the 4<sup>th</sup> week of Biol 499A (approx; Biol 499 coordinator will set a specific due date each term). If you think you cannot meet the set deadline due to extenuating circumstances, consult with your supervisor and contact the Biol 499 coordinator.

The proposal is to include:

- A. **Title.**
- B. **Introduction.** A 2-3 page review of literature on the topic and a statement of objectives.
- C. **Summary of proposed experiments.** This section should include explanation of how the objectives are to be achieved, including statistical analyses if appropriate, and a time line.
- D. **Results of research to date (if any).** Include data from experiments completed or in progress and indicate their significance. The majority of students have few/preliminary/no results to report this early in the project.
- E. **References.**

### **Proposal submission:**

The proposal should be in 12 point type and have a maximum length of about 6 pages of text (double-spaced; not including the list of References, Tables or Figures). When a good draft of the proposal (or Final Report, in Biol 499B) has been prepared, it should be turned in to the supervisor for editing. Following this, the student should **submit an electronic copy of the final version of their Proposal (or Final Report, in Biol 499B) to the Dropbox on Learn**. Please submit a .pdf version and a Word version, and ensure the names of both your supervisor and your second reader appear on your title page, in addition to other pertinent information (i.e., title, your name, ID, date). The Biology Undergrad Office staff will forward the Proposal to your two readers to be marked, along with a Project Proposal Grade Reporting sheet.

Typically the supervisor will arrange for a second reader, although the student's input may be requested also, in choosing the faculty member to serve this role. Once available, marks will be posted on the course Learn site. Students are strongly encouraged to retrieve their marked Project Proposals, so that any comments and/or feedback from the markers can be

noted and kept in mind when writing the Final Project Report. Graded Project Proposals may be retrieved from supervisors &/or second readers. It is the student's responsibility to seek-out their graded work.

**Penalty:** Late Proposals will be penalized at 2% per weekday.

## **2.) Biol 499 Colloquium:**

In the third month of term two, students are to present their results at the Biol 499 Colloquium (late March, July or November).

- A. The colloquium is for all students enrolled in Biol 499B.
- B. The submission of a talk abstract is required approx 1 week prior to the colloquium. It will be included in a Colloquium Abstracts booklet for distribution.
- C. Each student will give an oral presentation, typically with power point slides. Each student is allotted a 15-min slot (a talk of 10-11 minutes plus 4-5 minutes for questions and set-up of the subsequent speaker).
- D. The talk should include an introduction, a description of the materials and methods used, a description of results, and a discussion of their significance; different projects emphasize different sections. The Biol 499 Coordinator will hold an information session for Biol 499B students at the beginning of March, July and November. Tips on oral presentations will be among topics discussed. (Final Report information will also be disseminated).

The oral presentation will be assessed by the supervisor and a 2<sup>nd</sup> faculty member (normally the 2<sup>nd</sup> reader); the audience members (typically your Biol 499 peers) are also encouraged to submit comment forms during the sessions, to provide more feedback on presentation.

## **3.) Biol 499 Final Report:**

The Senior Honours Project report is to be submitted to the Dropbox on the Learn site no later than one week before the end of the final examination period. (The Biol 499 Coordinator will provide a due date each term, at the Biol 499B information session). The final written report will be read and graded by your supervisor and by one other faculty member (second reader) selected by her/him. In the case of students working in labs of faculty cross-appointed to Biology, the second reader must be a faculty member in the Department of Biology. The following comments are meant to serve as a guide and are not intended to be inclusive. Your supervisor is your best guide for help with format, style, how much material to include, and in what detail. He/she will have available copies of previous submissions, journal articles, graduate student theses, etc. for your inspection and guidance.

### **The following general instructions should be noted:**

- A. Laboratory work must be finished before the end of the second term lecture period and the Final Report should be submitted as soon as possible thereafter, preferably before the start of the final exam period, but, in any event, no later than one week before the end of the final exam period. Late reports will be penalized in marking (2% per weekday), so plan accordingly.
- B. The report should be formally presented, as if a graduate thesis, or a report to a government agency, or a manuscript for submission to a scientific journal, or similar. Such presentations are readily available to you, so look at what is commonly done in your field, and follow suit. Your supervisor can provide advice.

- C. The first page should list the Title of the project, the author, the date of submission, the supervisor and the 2<sup>nd</sup> reader, and that it is being submitted as a requirement of Biology 499, Senior Honours Project.
- D. The next page should be Acknowledgements and should thank the research supervisor and any other Faculty or Department members who have been especially helpful with any aspect of the project.
- E. The next page should be a Summary or Abstract, not normally more than half a page, concisely summarizing what is being presented in the report. The summary must be informative, highlighting any important information or conclusions.
- F. The Summary or Abstract is followed by a Table of Contents, including a List of Tables and a List of Figures. These items C-E should be numbered as pages i, ii, iii, etc., and item G should begin with regular page numbers 1, 2, 3 ....
- G. The body of the report will usually be written under main headings such as:

**Introduction:** a brief outline of what the project is about and why it was started. It should include an outline of previous work in the area and clear statements of hypotheses tested and/or the main objectives.

**Methods:** sufficient experimental details to enable another worker to duplicate your work or continue it. This section should also include site descriptions if it is a field project.

**Results:** a description of what you accomplished, including figures, tables and diagrams etc.

**Discussion:** an interpretation of your results with reference to other published work and to the hypotheses and objectives stated in the Introduction.

Results and Discussion may be combined under certain circumstances. Long tables of results, raw data, or computer output may be included in an Appendix.

- H. **References:** the last pages should list all previous work to which reference was made. References should be listed alphabetically. Consult recent theses or journal papers in your field for an acceptable format. Be consistent in your formatting.
- I. The length of the report will vary with the project and its details. Neatness, logical order of thought, and clarity of expression are important and will greatly influence your final mark.

The student should submit their Final Report to the Dropbox on the course Learn site (in .pdf format and in Word format). Biology Undergrad Office personnel will forward Final Reports and associated Grade Reporting Sheets to supervisors and second readers via email.

### **Assessment of the Final Report:**

The Biology 499 grade is based on both your written and oral reports and your performance and attitude in the lab. The Final Report should be a careful exposition of what you have done and why you have done it. Your supervisor will also make some subjective judgement of the quality and quantity of your day-to-day work and this will be factored in to your final grade (as the laboratory participation grade).

Your supervisor and the other regular faculty member appointed as second reader will each decide on a grade for your reports (Proposal and Final) and oral presentation. These marks will be submitted on a grade report sheet to the Biol 499 coordinator & Biol Dept Undergrad Office personnel as soon as possible so that final course grades may be transmitted to the Registrar's office. The Biol 499 coordinator will have no input into your final grade except in the case of a severe dispute between the two readers, either of whom may refer the dispute to her/him for resolution.

If you put in a good solid two terms of work and present a good Final Report you can expect a fair grade, even if your experimental results did not turn out as expected. The Biology faculty are realistic and do not expect miracles, but they do expect effort, enthusiasm, responsibility, and reasonable experimental competence. Most students enjoy this field/laboratory/*in silico* project course and learn a lot from it.

#### 4.) Breakdown of Grades:

Project Proposal	15%
Oral Presentation	15%
Laboratory Participation	40%
Final Report	30%

Note: Biol 499A will be recorded as "IP" (in progress) on your transcript at the end of term 1. When Biol 499B is complete and the overall course grade calculated, that mark will appear under both Biol 499A and Biol 499B on the transcript. **Not completing both Biol 499A and Biol 499B will result in no credit for either term.**

#### Check List for Written Reports

Before submitting your Project Proposal or Final Report, you should go through this checklist of common student errors in writing to optimize your grade in these portions of the course.

##### 1) *Correct format:*

- 12 point type
- double spacing throughout
- within the page limit (~6 pages, not counting the References or any Figures & Tables for the Proposal; as suits the project for the Final Report)
- all references referred to in text
- all references in text listed at the end
- uniform style of references (refer to a journal in your field for format)

##### 2) *Read the manuscript for typographical errors:*

- Even with a spell-checker, errors can occur since the erroneous word might still be a correctly spelled word (with a different meaning). Example from a previously submitted proposal: "... fatal bovine serum ..."

##### 3) *All paragraphs should be longer than one sentence*

##### 4) *No plagiarism*

- This is a very serious academic offence. For example, graduate students who include plagiarized material in their theses usually forfeit their degrees. Small sections of text can be quoted directly when set in quotation marks and the source is cited.

5) *Avoid using active verbs with passive nouns*

- A common example “The proposed research will examine...”

6) *Correct spacing*

- Leave a space between a number and its unit, e.g. 10 cm.
- Do not leave a space between a number and a percent sign, e.g. 25%.

7) *Use commas correctly*

- Commas are the most common punctuation problem in student reports. If you do not know the rules for using commas, look them up in a grammar text.

8) *Use brackets correctly*

- Do not include one set of brackets inside another set when the two are identical, e.g. (...(...)...). You can construct this with different brackets, e.g. [...(...)...].
- Do not use two sets of brackets next to each other, e.g. (...)(...). You can use (...;...).

9) *Use semicolons correctly*

- They are equivalent to a coordinate conjunction (and, but, or). They divide two complete sentences.

10) *Always start a sentence with a capital letter and never with an abbreviation, e.g., E. coli.*

- Numbers do not qualify unless they are written out, e.g. “Seven days ago...”

11) *Explain specialized terms and spell out abbreviations at first mention, e.g. “The tissue was treated with triiodobenzoic acid (TIBA) before ....”*

12) *Use topic and concluding sentences in paragraphs*

- Essential in discussion-type sections, e.g. the Introduction and Discussion. A topic sentence introduces the content of the paragraph, while the concluding sentence ends it. The concluding sentence can be a link to the next paragraph.

13) *Last, but certainly not least, make sure there is a logical flow of ideas.*

- Remember, a poorly written report will be marked down some regardless of the scientific content.

### **Meetings**

An initial general meeting for Biol 499A students will be held near the beginning of the course, normally in the first full week of the term. This is an “orientation”, wherein students will meet other members of their cohort, and course requirements (i.e., contents of this document) will be overviewed. The official due date for proposal submission will be set. A second general meeting for students will be scheduled during the third month of the second term (i.e., in Biol 499B), and will feature some pointers on organizing oral presentations. The official due dates for colloquium abstracts and final reports will be set.