MICI Honours Research Project Manual[1]

MICI 4901/4902

Information for Students and Supervisors

Department of Microbiology & Immunology

Dalhousie University

[1] Updated AUGUST 31, 2022

CONTENTS

WELCOME TO MICI 4901/4902

If you are reading this but not yet accepted into the program, here is some pertinent information. Admission into Honours is contingent upon completing required courses and minimum grade standings in those courses (see the MICI Undergraduate Handbook, Calendar or contact the Honours Program Coordinator, *hereafter called the Coordinator*). You must identify a Faculty Member who agrees to be your Supervisor. There is no single list of Faculty Members who are accepting or not accepting students; however, the Coordinator and other Undergraduate Advisors are available to talk about Faculty Members' research interests. You are strongly encouraged to directly contact Faculty Members whose research interests you, to ask whether they have space and are willing to supervise you. You can identify a potential Supervisor who is not a MICI Departmental member; in this case an arrangement will need to be established through the Coordinator and a Co-Supervisor must be recruited. Ultimately, only the Coordinator can provide permission to the Registrar enabling you to register in MICI 4901/4902, and this is only after you have secured a Supervisor.

MICI 4901 and MICI 4902 are available in each of the 3 academic terms. If either course is taken during a summer term during which the student is paid to work in the lab, the student should not be paid to do their thesis work. The student can divide their time doing research relevant to their thesis while being paid for research that is not included in their Honours. This applies to Co-op students as well. There can be no "double dipping", i.e. being paid to work in a lab and completing either 4901 or 4902 in the same hours.

Learning Outcomes of the Honours Research Project and Thesis

1. Synthesize rationale for conducting research or a project
2. Design and conduct experiments
3. Analyze outcomes and construct summaries
4. Identify the relevance of observations
5. Apply knowledge to provide directions for further research
6. Apply experience to deliver a public seminar
7. Apply experience to prepare a report/thesis

Note on research conducted by the student during the summer prior to Honours:

Students are often hired to work in a lab during the summer months prior to their Honours year. This is not the same circumstance described above, when a student is concurrently paid while enrolled in their Honours course. It is not necessary to change projects between the paid summertime and Honours period; however, to respect the fact that MICI 4901/02 is a "self-contained" course, the Honours Supervisor and student share the responsibility to restrict thesis content to results obtained during the 2 academic terms. Key research results obtained during the summer period that are pertinent to the thesis may be included in the Introduction section providing this is clearly identified as such.

COURSE DESCRIPTION

MICI 4901 and MICI 4902, are taken sequentially. While typically requiring original research conducted under the supervision of a Faculty Member, in uncertain times such as during a pandemic, some adaptation must be accommodated. Therefore, 3 options are available for conducting the Honours research (appreciating there are subtle variations possible on each of these options, in discussion with the Coordinator):

1) If the student is permitted into the Supervisor's laboratory beginning in 4901, for both terms, the project should be original research conducted at the bench, with support from the Supervisor and, at the Supervisor's discretion, the Supervisor's staff as appropriate. In some circumstances the project may be "*in silico*", and not in a "wet" lab but based on computer analyses (for example, metabolomics or microbial or gene identification from publicly available data sets or data provided by the Supervisor). In either circumstance, the research includes compiling and reading relevant published background material (which will become material for the thesis Introduction), designing and carrying out experiments or analyses, interpreting outcomes and preparing final images (becomes Results) and explaining the relevance and application of the findings (becomes Discussion). A written thesis and an oral presentation of the thesis are typically required.

2) If the student is not in the laboratory for both 4901 and 4902, a written project will be based on research and critical appraisal of the literature on a problem related to the Supervisor's research, in consultation with the Supervisor. This may be the option for students who chose to not return to campus, in the example where all other courses are only available online during the terms. The project will include critical appraisal of methodologies relevant to the topic, for example, a critique of strengths and weaknesses of two or more approaches to detect or measure a property of proteins, nucleic acids or assays of biological outcomes. The project could speculate on a gap in understanding or it could be critical appraisal of a line of investigation. A written "thesis" is required and should be at least 20 pages of double-spaced 12pt font text. The use of original Figures is encouraged and are in addition to the 20 pages, as are the references. An oral presentation of the thesis is typically required.

3) If the student is permitted into the laboratory in one term only, the project could be a "hybrid" of a literature review, which includes a critique of methodologies/techniques, and original investigations and results. A written thesis is required. An oral presentation of the thesis is typically required.

RESPONSIBILITIES: STUDENTS

MICI 4901/4902 comprises a 6 credit-hours but the hours are not scheduled by the Registrar, and need to be negotiated with Supervisors. A typical commitment is a minimum of 7 hours/week. There are important considerations:

- Ensure you and your Supervisor are clear on what is expected of you.

- You will have to satisfy regulatory agency requirements to work in a Biosafety Level 2 laboratory, including but not limited to WHIMS and Biosafety training and Medical Surveillance, required by Dalhousie. Laboratories in the local hospitals may have additional, requirements. These approvals may need to be completed before starting your work in the laboratory.

- After a period of training, you will be expected to become quite independent, working on your research project. You may be guided in the day-to-day operations in the laboratory by your Supervisor, or by another staff member of the Supervisor. You are typically part of a team, and the project you are working on will likely be integral to a larger research enterprise. You will almost certainly be asked to participate and discuss research in lab staff meetings. It is recommended that you plan regular meetings with your Faculty Supervisor.

- While the Coordinator will host meetings with the entire Honours class, should you experience significant obstacles making progress in your project, or conflict with your Supervisor, arrange to privately discuss these with the Coordinator.

- Budget your time! One role of the Coordinator is to ensure you do not procrastinate on important milestones during the Honours terms. The First Thesis draft is one such milestone (described in detail later in this document). You must meet deadlines, as in any other course. If you are absent for your scheduled presentation time, another time will be scheduled. Other activities are not commonly substituted for the presentation.

- Monthly Honours class meetings are scheduled by the Coordinator. These times may be used to provide information and guidance, but may also be used as class time, for example, to review statistical methods. Your attendance is highly encouraged. You can suggest meeting/learning topics and the Coordinator will work to try satisfy the suggestion(s). A meeting may be cancelled in advance if there is no new business.

RESPONSIBILITIES: SUPERVISORS

Supervising an Honours student is a major responsibility, requiring your time and resources, thus a Supervisor is limited to 2 MICI students. Accordingly:

- Guide your students through the completion of all training/certificates/approvals necessary to work in your laboratory.

- Choose a project suitable to the circumstance of your student(s). Students are expected to conduct original, hypothesis-driven research. They are not typically tasked with developing technologies or materials that are not applied to the hypotheses. The project should yield some results within the first term (4901).

- Ensure you are clear on your expectations of your student(s), and that the student understands and is agreeable to your expectations. In determining your expectations, remember that MICI 4901/02 is just 1 course of a typical load of 5 courses in each term. The student's commitment is a minimum of 7 hours/week. This can include preparation work outside of the laboratory. If conflicts or problems with students not meeting expectations arise, discuss them with the Coordinator early in the Academic year. There are precedents in which students switch Supervisor before completing their project.

- Day-to-day instruction and supervision may be assigned to a lab staff member; however, you are ultimately responsible for all oversight of the student and their project. Therefore, it is recommended that you plan regular meetings with your student(s). You can encourage your students to participate in lab activities, including scheduled lab meetings, but these are not compulsory.

- You will participate in the evaluation of yours and others' Honours students. You are expected to read and edit your own student's First Thesis draft. (Subsequent to the First Thesis draft, you will not provide any further direct editing of their thesis but are welcome to discuss all aspects of the thesis with your students.) You will grade their final thesis and possibly other students' theses. You will provide a grade for your student's performance and accomplishments in the lab. You are strongly encouraged to attend all the Honours student presentations and grade them.

- In grading theses from other labs, you are not evaluating productivity but are grading the thesis as an example of scientific communication. A marking sheet is provided in the Appendix for this purpose.

- You are obliged to inform the Coordinator of any advantage/disadvantage your student may have had leading to their completed thesis (e.g. worked in your lab the previous summer, had reduced course load so committed more time to their project, periods of illness, etc.).

FIRST THESIS DRAFT ("Thesis draft")

The Thesis draft gets you started writing your thesis. You are encouraged to write as complete a draft of your thesis, including references, as you can, with the following guiding points.

- include all headings and any subheadings for the entire thesis, including the preliminary pages (see "Honours Thesis")
- include in the Results at least one result, presented as a Table or Figure, including a legend and description in the Results section.
- as much Discussion as you are prepared to write, with subheadings
- Reference format includes all authors' names, title, journal, volume, page numbers and year. Be consistent in all aspects of the format that you chose to use, for all references.
- the Thesis draft is typically due within 2 weeks of beginning MICI 4902

Two Faculty Members will read your Thesis draft.

1. Your Supervisor will read and provide edits but not grade the draft. Discuss the edits with your Supervisor. Important: your Supervisor will not be editing future drafts of your thesis. The Coordinator will not be reviewing your Supervisor's edits, but you must provide evidence to the Coordinator that your Supervisor read your Thesis draft.
2. Independent of your Supervisor, the Coordinator will also read the Thesis draft and grade it for 15% of your final grade. You will receive edits from the Coordinator. This is a writing exercise. It is understood that topics, details, even results may change subsequently. The Thesis draft will not be compared to the final thesis. The Coordinator will grade the Thesis draft using a guide provided in the appendices.

ORAL PRESENTATIONS

Early during 4901 students will be asked to give a 5 minute/3 slide presentation of their project, to the Honours class and Coordinator. This presentation is not graded. Near the end of MICI 4902, students will deliver an Oral Presentation of their research to the Department. Each student will have 10-12 minutes to present, then 3-5 minutes for questions. Plan your presentation carefully and with assistance from your Supervisor: you will not be permitted to go overtime. It is highly recommended that you do a trial run in advance; consider recruiting your lab mates and Supervisor to critique your trial run. This audience should provide you with constructive criticism and suggestions to improve your Presentation. You will be expected to present the story of your research to an audience that include people who know little about your field. Present the elements of your thesis but with an emphasis on results. Provide your audience with enough background information to appreciate why your work was important to do, a brief description of your methodological approaches, major results, and your conclusions and interpretation/impact. Audience questions can be either theoretical or technical in nature.

You are permitted to use only 2 non-original images downloaded from the Internet or from your laboratory and none from textbooks. This restriction is to encourage you to use drawing software and bring concepts into an image.

HONOURS THESIS

Communicating through writing remains an important means of disseminating information in science. You will have read many scientific articles, including many writing styles and some variations in organization. MICI Honours students are required to write and submit a thesis based on their research, by the end of MICI 4902. The following elements need to be included in the final thesis. Each heading starts on a new page, sub-headings do not necessarily start on a new page. Each page has 2.5 cm margins and page numbers are centred on the bottom.

PRELIMINARY PAGES (use Roman numerals for these pages, e.g. I, II, IV. Do not include a "running header" of the title on subsequent pages)

Title page

includes: thesis title, your name, course name/degree, Supervisor's name, year), centre justified, hide the page number but it is considered page I

Table of Contents

thesis headings (double spaced) and subheadings (single spaced) with dotted line ending with page numbers on the right margin, full justified

List of Figures and Tables (double spaced)

List Figures and Tables each on a separate pages. In both cases, include the Figure/Table number, title followed by a dotted line leading to the relevant page number on the right margin, full justified.

Abstract (double spaced, left justified)

A 300-350 word summary of the thesis. Get to the facts; 1 or 2 introductory sentences, 1 sentence of methods/approach, your hypothesis, results, conclusions and interpretations/ applications/significance

List of Abbreviations (double spaced, left justified)

sorted alphabetically, each starting on a new line

Acknowledgments (double spaced, left justified)

BODY OF THESIS (use Arabic numerals, e.g. 1, 2, 5, 10)

Introduction (double spaced, left or full justified)

Can use left justified subheadings. Introduce the overall problem/challenge, then details of the scientific field that are immediately germane to your research; what science led to your research? You should write to familiarize a non-expert scientist with concepts that are crucial to understanding your research. Then introduce the gaps in knowledge that your project is intended to address. It should end with a concise rationale and hypothesis for your project. References for others' work and findings must be included. Use authors' names and year in the in-text citations (3 names if 3 or fewer authors + year; first author plus *et al.* + if more than 3 authors + year). Define each abbreviation the first time it is used, then use only the abbreviation for the remainder of the thesis, e.g. hour (hr).

Materials and Methods (double spaced, left justified)

Use left justified subheadings. Methods need to be described in sufficient detail that someone else could repeat the work. While some details need to be provided, it is acceptable to say that greater detail can be found in a (cited) reference. Sources/commercial supplier(s)/vendor's

identity for materials must be provided. Include the city, province/state the first time you cite a company. Use the 2-letter province/state abbreviations. It is not necessary to include the country if the product is from Canada or the USA. Do not write each iteration of a method: for example, use “Restriction enzyme digestion” as a subheading, followed by a generic description for all of these digestions. Avoid repetition.

Results (double spaced, left or full justified)

Can use subheadings (left justified, do not start each subheading on a new page). In each subsection briefly introduce the rationale for the experiment (often building on the previous result), state what you did, and refer to the appropriate Figure that displays the data. Do not abbreviate “Figure” or “Table”. Figures and Tables appear only one per page and will follow the text; do not compile all the figures and tables at the end of the thesis. Try to include the Legend on the same page as the Figure, ahead of the Figure, and use single spacing, otherwise put it on the page preceding the Figure. Again, Figures are on pages separate from all other text except the Legend.

Discussion (double spaced, left justified)

Use subheadings, left justified. Resist directly repeating your results in detail. Write about the significance of your observations, referring to your data, in the context of published literature, and about what avenues might now usefully be explored. If you had difficulty with data collection or with techniques you were using, write about the difficulties, and suggest ways to overcome the obstacle(s). Suggest avenues that could be pursued in future work.

References (single spaced within a citation, double spaced between citations)

Cite published works in the thesis using the authors’ names and year of publication enclosed in parentheses (Smith et al., 1999; Jones and Smith, 1997). You can use the bibliographic style of your choice for your reference list but include all authors’ names, the title, journal, volume, page numbers and year. Common formatting inconsistencies are: including the “issue #” in some but not all citations, inconsistently abbreviating the last page number (456-459 versus 456-9), inconsistently capitalizing words in the article title (“A Study Of” versus “A study of…” versus “A STUDY OF…’). Proof-read the references for consistency, correcting the format that your download software may have applied.

Appendices

These are only included if thought absolutely necessary for the reader to understand what was done. Here, you may include large data sets, recipes for complex growth media or buffer formulations critical to understanding the experiments.

REMINDER: Your Supervisor will not read or edit your thesis after the First Thesis draft since they will be grading the final version. Still, you are encouraged to discuss details with them, for example, the order of the results (which do not necessarily have to be written in the order you obtained them), the Figures and Table contents and formatting, themes for the discussion, etc.

EVALUATION

Criteria	Coordinator	Supervisor	Other Faculty
First Thesis draft Due shortly after 4902 starts	options 1, 2, 3: 15%		
laboratory/*in silico* performance appraisal		options 1 & 3: 20%	
Thesis/Report	option 2: 20%	all options: 20%	all options: 2 readers 15% each*
10 min oral presentation**			15% total***

* the grades of multiple readers (recruited by the Coordinator) are additive

**subject to circumstances, for example, a pandemic, may be a video conference. If all oral presentations are cancelled, a third "other Faculty" grader will be sought.

***the average of all the scores submitted by Faculty Members

Numerical grades will be rounded up from 0.5 within the intervals between letter grades and will be awarded according to the grade scale established by the Senate of Dalhousie University as follows:

Grades & Percentage Range			
A+	90–100	C+	65–69
A	85–89	C	60–64
A–	80–84	C–	55–59
B+	77–79	D	50–54
B	73–76	F	0–49
B–	70–72		

21st Credit, a Faculty of Science requirement, is graded as Pass/Fail by this Department. You must meet GPA and individual course grade requirements as specified in the Calendar.

Students graduating with a cumulative GPA equal or greater than 3.7 are conferred "distinction"

PLAGIARISM

The attention of all students is drawn to the University's policy on plagiarism described under "intellectual honesty" in the Calendar. If you have any doubts about a particular practice, for example, directly quoting others' material, then discuss it with your Supervisor or the Coordinator.

CO-OP CONSIDERATIONS

Co-op degree programs require that one academic term be interrupted by a work term. Accordingly, a co-op degree takes a minimum 4.5 years to complete. Some students will elect to carry out their Honours research over a time frame that is not two consecutive terms. In this case students are still required to submit their Thesis draft when they start 4902 and give an oral presentation at a date and time arranged between the student and the Coordinator during 4902.

APPENDIX A: FIRST THESIS DRAFT GRADING GUIDE

MICI 4901/4902 Thesis draft grading guide (15% of the final grade)

10 marks of the 15(%) will be based on the following composition considerations
Is the story in the Introduction focused and progressive, building a foundation of knowledge?
Does the introduction clearly establish a case specific for the thesis research?
Is the research question and/or hypothesis clearly stated?
If a methodological approach is provided, is it limited to general terms?
Is the Introduction suitably referenced?
Note: (it is not necessary to provide conclusions in the Introduction.)
Are the methods used to establish the data clear, concise and correct?
Are the results/data understandable, 1. in the context of the hypothesis, 2. reading the legend?
Is it clear what the intentions are experimentally, going forward?

2 marks of the 15(%) will be based on the following criteria
Are the subheadings of the Materials & Methods, and of the Results so far, provided and appropriate?
Are the sources of materials, animals, protocols (if not written out) provided?
Are the references correctly and consistently, style-wise, compiled?

3 marks of the 15(%) will be based on the following gestalt criteria
Frequency of spelling errors and incorrect but correctly spelled words.
Overall clarity of the writing with respect to grammar, spelling, vocabulary, clarity;
would it benefit significantly from another round of proofreading?

APPENDIX B: THESIS GRADING GUIDE

Item	Comments for grading	Grade
Formatting: Page setup: Margins at 1" all around, Page numbering – top right corner, 1.5 line spacing		/2
All sections present: Title page, Table of contents, List of Figs & Tables, List of Abbrevs, Acknowledg, Abstract, Intro, M & Ms, Results, Disc., Refs. **Figures and Tables** are interspersed throughout the text, **each on a separate page**		/2
Abstract (approx 300 words) introduces background, problem to be addressed, provides results.		/4
Introduction Is appropriate material included/excluded? Logical? Refs cited? Quality of writing		/20
Materials & Methods Concise, referenced. Lists of primers / plasmids / antibodies.		/5
Results Is it well-organized? Does it flow? Are there informative sentences that introduce each subsection? Does text reference Figures? Do Fig. Legends contain the correct info.? Are Fig Legends NOT repetitive, within themselves or with the text? Are Figures original, labeled clearly, neatly, using sufficiently large font?		/35
Discussion Is appropriate material included/excluded? Logical? Refs cited? Quality of writing		/30
References Cited correctly in text and formatted correctly		/2
TOTAL	Letter Grade:	**/**100

APPENDIX C: RESEARCH GRADING GUIDE

Supervisor's evaluation of the student's laboratory research:

Student's name:
Supervisor's name:
Grade:_____/100 (worth 25% of final grade)

Provide comments on laboratory performance. Evaluate work ethic, willingness to follow instruction, productivity in the lab, intellectual contribution, development as an investigator, independent experimentation, independent reading, amount of effort required to aid student in writing reports, and any other aspects you deem relevant.

Appendix D: EVALUATION OF FINAL ORAL PRESENTATION

Please complete and return the form to the Honours Coordinator immediately after the presentations.

Please provide critical comments that will benefit the student.

Student's Name: _____

1. **Content:** (Was the material presented appropriate? Background explained? Level of Detail suitable?)

2. **Organization:** (Was the talk well organized such that the data presented was logically analyzed and a clear concluding message conveyed?

3. **Presentation Style**:
(a) audiovisual (e.g., appropriate number of slides, effective use of presentation media, pointer use)

(b) **voice** (clarity, speed)

(c) **manner** (relaxed/nervous, eye contact with audience, enthusiasm, distracting mannerisms)

4. **Understanding & Questions:** (Did the student appear to understand the material/project? How well were questions answered? Was the student prepared?)

5. **General Comments & Suggestions for Improvement:**

Presentation grade:_____/10

_____

Name of Reader / Supervisor Date *Department of Microbiology & Immunology*

APPENDIX E: HONOURS DEGREE PROGRAM FEEDBACK

DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY

Honours Degree program feedback[2]

Please consider commenting on the following questions:

1. Are there areas of Microbiology or Immunology that our Program did not cover adequately, or did not cover at all?

2. Did our core (or other) classes (including those offered by other Departments) meet your expectations, based on the syllabi?

3. Are there any Faculty-wide regulations that should be instituted, changed, or eliminated (i.e. you found them an obstacle)?

4. What did you most like about your program, or the environment, provided by this Department?

5. What did you least like about your program, or the environment, provided by this Department?

6. **Would you mind sharing your future plans**?

   a) in the near-term?

   b) long-term?

   c) prefer not to answer

7. **Academic advising**:

   Overall, I was pleased with the quality of academic advising that was provided when I asked (throughout my Degree).

1	2	3	4	5
Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree

[2] last updated April 2021

8. **MICI 4901/4902**: (1 is most negative; 5 is most positive)

Program coordination/directions:

Overall, I was satisfied with the coordination of the program, i.e. I knew what had to be done and by when.

1 2 3 4 5

Supervision:

Expectations on the part of my Supervisor were reasonable.

1 2 3 4 5

Overall, I was satisfied with the quality of supervision by my Faculty mentor.

1 2 3 4 5

Research:

My research project was designed such that there was a reasonable expectation of success.

1 2 3 4 5

My project presented novel opportunities for intellectual development.

1 2 3 4 5

My research project was interesting to me.

1 2 3 4 5

9. Additional comments you may wish to add: