McMaster University

Guidelines for Chemistry 4GO9
Senior Thesis

2015/2016

updated, Yurij Mozharivskyj, Jan. 2016
Guidelines for Chemistry 4GO9, Senior Thesis

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**Important Dates**

- **September, 2015**: 4GO9 Projects should start on first day of classes
- **October 21st and 22nd, 2015** (5:30 pm, ABB 165): 3 min presentations by each student
- **Thursday, November 26th, 2015** (by 4:00 pm): Due date for Progress Report to Linda Spruce
- **Friday, March 18th, 2016** (ABB 162-165, 4:30 – 9:30 pm): Chemistry 4GO9 Presentation Day
- **Friday, April 1st, 2016** (by 4:00 pm): Due Date of your Departmental Sign-Out Sheet
- **Friday, April 1st, 2016** (by 4:00 pm): Due date of your Theses to Linda Spruce (2 copies) and supervisor (1 copy)

Office Hours: as needed in my office: ABB 423; mozhar@mcmaster.ca ext. 27796.

Date for presentation day in 2016 are confirmed.

**NOTE**: All hardcopy submissions should go Linda Spruce in ABB-156
Guidelines for Students

This thesis course represents an exciting opportunity for you to get involved in real research. This course counts for 9 credits, and you should plan to spend on average about 2-3 days per week on your project. These Guidelines are here to help you succeed in the course. Please read them carefully, and do not hesitate to ask me, other faculty members, or your group members for advice at any time throughout the course.

Synopsis:

The Senior Thesis involves an individual research project carried out in a research lab, with guidance from your research supervisor and other members of your group. The project usually fits well within the envelope of work done by the research group, such that you can get advice, and learn, from other members of the group. The project should ask a unique research question, and attempt to find an answer through experimental research, in *vitro*, in *vivo*, or in *silico*. The steps along the way include project selection in March of your third year, followed by a 3-minute mini-presentation in October, an interim report in November, a 20 minute presentation to the department in March, and a final written thesis due in early April of your fourth year.

Selecting your Project:

Project selection involves matching students with available projects, and takes place in March of your third year. It consists of several elements:

1. In early spring we will publish a list of 4G09 projects offered by faculty. These are often designed to give you a general idea of the work done by that research group, and can be refined in discussions with the faculty member. If you do not find a project you like, you are also encouraged to discuss possible projects with professors directly. Projects need a chemistry faculty member as supervisor or co-supervisor, but it is possible to do a project in another lab on campus, or even off-campus – these usually require a bit of up-front discussion.

2. You will all be invited to come out for the 4G09 student presentations given by the 4G09 class that is one year ahead of you – watch for e-mails and in-class announcements in your third year classes, for the thesis presentation night. These presentations usually take place on a Thursday/Friday evening from about 5:30 – 9:30pm. The event starts with a social / pizza get-together, followed by 20 min student presentations in several parallel streams, similar in format to most scientific conferences. These presentations can give you a good idea about the kind of research being done, and so you should plan ahead and try to attend the talks by the students working on projects that are on your own short-list. Session-hopping is fine.

3. Shortly before or after this event the 4G09 course coordinator will call for an info meeting, colloquially called the pep talk, where we outline the thesis projects in general, the selection process, and generally field any questions you may have.

4. Following that, we will ask each of you to submit a shortlist of your preferred projects. We like to have a fairly even spread of students across research groups, to make sure everyone gets reasonable guidance from their supervisor/group. You should expect you get your first or second choice of projects in most cases.
Starting your Project:

1. You should plan to start your project on the first day of classes in the fall term of your thesis year. Get in touch with your supervisor ahead of time to arrange an initial meeting and sort out any details. The project may have changed over the summer, and purchasing chemicals can take a week or two.

2. 4G09 will meet on October 21st and 22nd, 2015, when I would like everyone to present their project in 3 minutes, using three overhead transparency, power point presentation or equivalent blackboard space. The point of this exercise is to learn to articulate the aim and key methods of your project.

3. You will prepare a formal Progress Report on your thesis project and submit it to Linda Spruce by 4 pm on Thursday, November 26th, 2015. This report should be about 5 pages in length, prepared without direct input from your supervisor, and contain:
   - an Introduction, outlining the background and aims of the project;
   - a Results & Discussion section, describing what results you have obtained to date and how you interpret them;
   - an outline of what remains to be done.

4. Your thesis supervisor and I will read your report, comment on both your research progress and your report (excellent/ satisfactory/ unsatisfactory) and give you feedback in early December. The purpose of this exercise is to make sure you and your project are on the right track, and to address any issues. Submission of the progress report is mandatory, but the comments will not form part of your final mark for the course.

Completing your Project and Final Grade

5. You should plan to have completed most of your experimental work by early March, so that you can spend time interpreting your data, and preparing your presentation. Interpretation and organization of results are just as important as doing experiments, and you must take time for this throughout your project. Half of the 4G09 course mark will be based on the written thesis itself.

6. The 4G09 Seminar Day will tentatively be scheduled for the evening of Friday, March 18th, 2016. All students registered in the course will be required to present the results of their research in a 15+5 minute seminar. This presentation will be evaluated by attending faculty and a grade will be assigned.

7. Two completed hardcopies of the thesis should be submitted to Linda Spruce, and at least one hardcopy should be submitted to your research supervisor(s), on Friday, April 1st, 2016 by 4:00 pm. This will be a “hard deadline”, and you are advised to plan accordingly. If serious circumstances make it impossible to meet this deadline, let me know as soon as possible, to avoid late penalties of 10% of the final grade per day past the due date.
8. Your **final grade** for Chemistry 4GO9 will be the average of a mark determined by your research supervisor and a mark assigned by the Thesis Committee (two readers who are full time, associate, or emeritus faculty members in the Chemistry Department).

(i) The supervisor's mark (worth 50% of the total) will be based on all aspects of the research work (effort, ability to learn, contribution of ideas, competence, etc.),

(ii) The Thesis Committee’s mark will be based on the thesis document (40%) and seminar (10%).

**Further Comments:**

Your goal is to show that you understand the science behind your project, have made significant progress towards addressing the scientific question(s) in your thesis, and to present your work in a clear, and concise fashion. Your supervisor as well as other group members can provide much help and advice in your writing and in planning your seminar. Ask for their help and suggest a test run of your seminar a week before the Seminar Day.

You should realize that an element of uncertainty is inherent in all research. Some projects will work out as anticipated while others will not. Faculty members have been asked to submit proposals that are well defined and have a high likelihood of success. Again, the purpose of the course is to provide the students with experience in original research, and in presenting the results of the work in a coherent and intelligible manner.

The grade awarded will be less dependent on whether you succeed in making or studying some prospective structure, and more dependent on the scientific skills you demonstrate in getting there. You may expect a good grade in the course if you demonstrate competence and diligence in the laboratory, a good grasp of the scientific problem and the significance of your results, and if you prepare a proper written report of your work.
Your written Thesis

Your thesis, excluding graphs, figures and tables, should be no more than 20 pages in length. Formatting: 1.5-space; 12-pt. Times New Roman; margins: top and bottom 1 inch, left 1.25 inches, right 1 inch; reference style: ACS style, eg. JACS. You will need to express your ideas and results concisely, in order to stay within this page limit. Please do not exceed it. Your thesis should be organized according to the accepted format for such documents:

i. Abstract  
a 150-300 word synopsis of the results and their significance.

ii. Table of Contents

iii. Introduction  
a brief review of the relevant literature and a statement of the purpose of the work.

iv. Experimental.  
Detailed descriptions of the experiments done, written in a way that someone else could repeat them and continue the work. Alternatively, this section may appear as section (vi), immediately after “Suggestions for Future Research”

v. Results & Discussion  
describes the experiments carried out, presents the data, and discusses their significance. Include Tables and Figures (properly titled and captioned) where appropriate. Try to rationalize unexpected results and suggest improvements which may allow the original goals of the proposal to be better realized.

vi. Suggestions for Further Research

vii. References  
a list of references, numbered in order of their citation in the text, figures and tables.

The thesis will be graded and one copy will be returned to the student. The mark breakdown will be:

- Introduction 30%
- Experimental 20%
- Results & Discussion 30%
- Overall organization & presentation 20%

Check-Out Procedure
Upon completing your research work in your supervisor's group, the Chemistry Department requires that you complete the attached "Department of Chemistry and Chemical Biology Sign-Out Sheet" (back printed as pages 8 and 9 in this guide) and obtain the appropriate signatures.

Please note the "Research Checklist" contained in this form and comply with it literally. All data in the form of spectra, computer files, diagrams, etc. need to be organized, clearly labelled and presented to your supervisor prior to your departure. This includes the original copy of your laboratory notebook(s) and all related research samples and materials. While you hold the copyright to your written thesis, these items are the property of your supervisor, and you must endeavour not to prevent or encumber his/her access to them.

The completed sign-out form is to be submitted to Jane Garneau (ABB 156) not later than Friday, 4:00 pm., April 1\textsuperscript{st}, 2016.

These Check-Out points above are required as part of your 4G09 project. They reflect common practice in universities, research institutes and industry. Failure to comply will result in a reduction in your final grade. The penalty assessed in these respects will be arrived at in consultation with your thesis research supervisor.
DEPARTMENT OF CHEMISTRY AND CHEMICAL BIOLOGY
SIGN-OUT SHEET

THIS FORM MUST BE COMPLETED BY EVERY RESEARCHER* BEFORE LEAVING THE DEPARTMENT

Please obtain the appropriate signatures and return this form to Jane Garneau (ABB-156)

NAME: ____________________________________________

KEYS: All the keys that were issued to me have been returned to:

Administrative Secretary, Jane Garneau

THESES: Copies of all theses borrowed by me from the departmental office have been returned:

Administrator, Connie Carrabs

RESEARCH CHECKLIST:

1. The work area(s) I have used for research have been cleared up to the satisfaction of my research supervisor. I have dismantled all the equipment and cleaned all of the glassware and apparatus that I have used, except for the equipment and apparatus that will be needed by others in the research group in the near future.

2. All of the laboratory notebooks, spectra, data, and experimental procedures that I have produced, developed or acquired while at McMaster are the property of my research supervisor and McMaster University. All of these items and documents have been turned over to my research supervisor and have been labeled and organized to my supervisor’s satisfaction.

3. Books, journals, etc., that were borrowed for my research supervisor or from the research lab have been returned.

4. Chemicals or items borrowed by me from other research labs have been returned.

5. All bottles containing chemicals or samples that I have prepared have been labeled with the proper workplace labels and have been stored in appropriate places.

6. All chemicals or samples which are no longer of use to me or anyone else in the research group have been destroyed or disposed of properly.

7. All computer programs, computer codes or files that I have developed or produced have been copied as back-up files on floppy disks or on tape; the back-up files have been given to my supervisor.

8. I have cleaned up and backed up all of my files and my directories on the computer(s) that I have used.

__________________________________________  ____________________________________
Researcher  Research Supervisor

*Researchers are defined as those persons who undertake any research work in the Department of Chemistry and Chemical Biology and include graduate students, undergraduate students (summer students and senior thesis students), post-doctoral fellows, research associates, visiting scholars and technicians.

...OVER
Would you please provide your forwarding address so we can forward mail, etc., to you.

**Forwarding Address (if known)**

__________________________________________

__________________________________________

__________________________________________

Tel: ______________________________

Email address:- __________________________

If possible, could you also please indicate the type of employment/studies you will be entering? This type of information is sometimes requested from us in government surveys.

**Company/University:**

**Department:**

**City/Province (State):**

**Position:**

**Start Date:**