Biochemistry 4P03, 4B06 and 4F09 Guidelines

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The following information is for students currently enrolled in Biochemistry 4P03, 4B06 and 4F09 and for students in their second and third year who are considering enrolling in Biochemistry 4P03, 4B06 or 4F09 in their senior year.

Communication of course information will be via email or the course folders on LearnLink. Please ensure we have your current email address and that you check it regularly.

Undergraduate Student Research Guidelines

Undergraduate research is considered a vital component of learning by the department of Biochemistry and Biomedical Sciences, and is therefore a degree requirement for students enrolled in both the Molecular Biology and Biotechnology & Genetic Engineering specializations. In their senior year, students will have the opportunity to conduct original scientific research in a faculty member’s laboratory. On some occasions, students have been able to accomplish work that has contributed to a scientific publication.

The following information will help in the selection of an appropriate research course, a potential supervisor and research project.

Course Basics

Students can select 3, 6 or 9 units of research, depending on the cumulative average (CA) achieved at the end of their third year. All three courses involve original research and the completion of a thesis, but differ in the time commitment and course requirements. These research courses will require at least as much time as a regular course for which you receive 3, 6 or 9 units of credit, respectively, and differs from a regular course in terms of the more independent nature of the work, and the degree of student responsibility and initiative.

Biochem 4P03: A 3-unit research project in Biochemistry during the first or second term. Assessment is based on laboratory work (approximately 12 hours per week in one term), two interim reports and a final thesis report. Minimum CA of 7.0 is required.

Biochem 4B06: An extended 6-unit senior research project in Biochemistry. Assessment is based on laboratory work (approximately 12 hours per week over two terms), a poster presentation and a final thesis report. Minimum CA of 8.0 is required.*

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Biochem 4F09: A 9-unit senior thesis based on a major research project in Biochemistry. Assessment is based on laboratory work (an average of approximately 18 hours per week over two terms; depending on the distribution of the course load), two oral presentations and a final thesis report. Minimum CA of 9.5 is required.*

Each course provides excellent experience and preparation for any career in Biochemistry. In particular, Biochem 4B06 and 4F09 are highly recommended to students considering a future in research or graduate school.

Making Arrangements for a Research Supervisor and Topic

In the fall of their third year, students should begin to think about potential supervisors and research projects for their senior year. The selection of a research topic should derive from a student’s course experience and interests. It is recommended that students review the research interests of the faculty and associate faculty members in the department and schedule an interview with at least 3 members to discuss possibilities for a research project. Supervisors must be full-time members or associate members of the Department of Biochemistry and Biomedical Sciences. A list of potential supervisors and a description of their research can be found at www.fhs.mcmaster.ca/biochem under ‘Research’. Research posters displayed in the hallways of the Department may also be useful resources in the investigation of your interests.

From September until January, both the students and faculty will have a chance to meet with a number of potential supervisors and potential thesis students, respectively. Final supervisory arrangements will be made during the month of February. A ‘Permission Form’ (which can be downloaded from the Department’s website) must be filled out by the student, signed by the supervisor and submitted to Mary Margaret Strong in the Undergraduate Office (HSC 4H45). This information must be submitted no later than March 1. In general, supervisors should not commit to more than two full year project students (i.e. 4B06 and/or 4F09) without special permission from the course coordinator. This provision ensures that students receive adequate attention and the best research experience possible. Course permissions will be put on SOLAR during the summer once the final results for the winter session are in.*

*Students who are unable to meet the required minimum CA for Biochem 4B06 and 4F09 at the end of their third year will automatically be considered for enrolment in Biochem 4P03 and 4B06, respectively.

If it is possible for students and supervisors to delineate the project before the student leaves in April, it may be feasible for the student to do some preliminary research and reading during the summer months.

In Preparation for Your Research Project

During the first week of September (or January, for 4P03 students in term II), the student should arrange to meet with his/her supervisor. At this initial meeting, the project will be defined and, in consultation with the supervisor, students will agree upon an approximate work schedule for each term and later agree to any changes that may be required. Students should expect to begin work in the laboratory immediately after the initial meeting with their supervisor. Students should
familiarize themselves with the background material at the beginning of the project and conduct a thorough literature review of the proposed project.

To assist with your review of the literature, students will find PubMed to be an excellent research tool. PubMed is a service of the National Library of Medicine which searches the MEDLINE database covering the fields of medicine, nursing, dentistry, veterinary medicine, the health care system, and the preclinical sciences. MEDLINE contains bibliographic citations and author abstracts from more than 4,600 biomedical journals published around the world dating back to 1966. PubMed includes links to many sites providing full text articles online and other related resources.


Remember when searching databases, that your choice of key words is important in getting the best search results possible.

The majority of the journals related to research in Biochemistry are located in the Health Sciences Library. Many of these journals can be accessed online through PubMed and also through the library’s subscription to online resources http://library McMaster.ca/. In addition, Neera Bhatnagar, the 4th year Undergraduate Biochemistry Student Liaison of the Health Sciences Library, can be consulted to aid you in your search for materials at ext. 23775.

**Acknowledgement of Previous Work Related to the Project**

Students who may have previously worked in the same laboratory in which they are completing their thesis are asked to provide a one page summary of any work that is related to the project being undertaken for their thesis. This summary should be to the appropriate drop box located outside HSC 4H39 by **October 1** (or by **January 15**, for 4P03 students in term II). Any work done during summer months or prior to this time should not be included in the thesis or any presentations without clearly identifying and acknowledging it.

**Laboratory Performance**

To ensure the most success out of their project, students will be expected to spend an adequate number of hours in the laboratory each week (approximately 12 hours for 4P03 and 4B06 students, and approximately 18 hours for 4P09 students). Problem solving, creativity, innovation and good experimental technique are the qualities of a good scientist. Students are encouraged to explore alternative interpretations of data or to suggest what line of investigation should be next.

Safety in any laboratory setting is first and foremost. Before performing any protocol, students should be familiar with the materials, reagents and possible hazards involved in the experiment. Consult the Material Safety Data Sheets (MSDS) for each reagent that you use. It is the
responsibility of the supervisor to ensure that students have received appropriate safety training (ie. WHMIS, Radiation Safety).

Laboratory supplies and reagents are very expensive and should be used as required and not wasted. It pays to be efficient and think ahead.

Demonstrating a firm commitment to your project, efficiency and safety in the lab will be reflected in the laboratory portion of your assessment given by your supervisor.

**Laboratory Notebook**

A notebook is an essential tool to help organize your laboratory research. Number each page of the notebook, date and record each experiment, including the experimental procedure, results and analysis with calculations. The content of the notebook should be easily readable and should contain enough information so that another undergraduate student could repeat the experiment with no prior knowledge. This notebook is an integral part of your supervisor’s research and must be left with the supervisor at the conclusion of the project.

**Completion of Lab Work**

Students enrolled in 4B06 and 4F09 should aim to have their laboratory experiments completed by the end of Reading Week in February, to allow sufficient time for data analysis, preparing your presentation and writing your thesis. Students enrolled in 4P03 should allow sufficient time to analyze their data and complete their thesis by the last day of classes.

Students are strongly encouraged to begin writing their thesis in stages throughout the term (ie. an extensive literature review completed at the beginning of the course will allow you to write a draft of your introduction, and experimental procedures can be written up as you go along). The following section contains some general instructions for the final thesis report.

**The Final Thesis Report**

The final thesis report will be submitted by the last day of classes. The report should follow the format of a standard biochemical journal, eg. Biochemistry. ‘Information for authors’ on how to prepare and submit a manuscript can be downloaded at [http://pubs.acs.org/journals/bichaw/](http://pubs.acs.org/journals/bichaw/).
Your thesis should contain the following sections:

1. **Title Page:**
   - Title of project
   - Student name and number
   - Supervisor name and department
   - Course name
   - Term(s) in which the project was carried out
   - Date submitted

2. **Table of Contents:**
   - With page numbers

3. **List of Abbreviations:**
   - Abbreviate only words or terms used more than 3 times. It is not necessary to include standard abbreviations for time, mass, DNA, RNA, etc...

4. **Abstract:**
   - A one page concise summary of the questions asked, results and significance.

5. **Introduction:**
   - A summary of the current state of knowledge in the area of study, a statement of the problem and the approach used to address it (3-4 pages in length).

6. **Experimental Procedures:**
   - This section should contain sufficient details of the experimental protocols for someone else to repeat the experiment. If the procedure has already been published in a journal article in detail, a reference will suffice. However, if a published procedure was modified, the alterations to the original protocol should be clearly outlined. Describe in detail any new techniques developed during the project.

7. **Results:**
   - Summarize the data obtained from your experiments in figures and/or tables, as appropriate, following the journal format for table headings and figure legends. Figures and tables should be clearly labeled and easy to interpret. Proper statistical analysis is required in most cases or at least some statement about reproducibility. Include both positive and negative results, making brief mention of failed experiments.

8. **Discussion:**
   - This section is where you interpret the results of your experiment. Be cautious not to simply restate the results, but to analyze the meaning of these results in the context of the problem you posed in your introduction. Explain the significance of your results and what the impact of these is on the field of study. If appropriate, use figures, diagrams and models to illustrate your point. Attempt to explain any possible causes for failures or negative results. Also include suggestions for future work.

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9. **References:**

   Any standard style of referencing is acceptable. Accuracy in your referencing is important, and be sure to find the most current papers on a subject.

   The following are some additional general guidelines for the preparation of the thesis:
   - 20-30 pages in length
   - double-spaced throughout
   - 12 point font
   - 2.5 cm side margins
   - 3 cm top and bottom margins
   - all pages numbered consecutively, including title page, references, tables and figures
   - the thesis may be bound in any manner the student desires

   *Presentation does make a difference.*
   *A clear and organized thesis is much easier and more enjoyable to read.*

   Though it is not a course requirement, it would be helpful for students to submit interim reports to their supervisor. These reports will not be graded, but will give the students an opportunity to receive feedback from their supervisor on their progress and how to organize and write a formal report.

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<td>Mary Margaret Strong – Undergraduate Administrator (HSC 4H45, ext. 22059, <a href="mailto:strongm@mcmaster.ca">strongm@mcmaster.ca</a>)</td>
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