



School of Graduate Studies

1280 Main Street West  
Hamilton, Ontario, Canada  
L8S 4L8

Phone 905.525.9140  
Ext. 23679  
<http://graduate.mcmaster.ca>

May 23<sup>rd</sup>

To : Graduate Council

From : Christina Bryce  
Assistant Secretary and SynApps System Administrator

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The next meeting of Graduate Council will be held on **Tuesday, May 28 2013 at 2:00 pm in GH-111, Council Chambers**

Listed below are the agenda items for discussion.

Please email [cbryce@mcmaster.ca](mailto:cbryce@mcmaster.ca) if you are unable to attend the meeting.

#### A G E N D A

- I. Minutes of the meeting of April 23<sup>rd</sup>, 2013
- II. Business arising
- III. Report from the Associate Vice-President and Dean of Graduate Studies
- IV. Report from the Associate Deans of Graduate Studies
- V. Report from the Assistant Dean, Graduate Student Life and Research Training
- VI. New Program Proposal – Biomedical Discovery and Commercialization
- VII. Additional GPCC Report from Faculty of Health Sciences (Dr. Cathy Hayward)
- VIII. Additional GCPC Report from the Faculty of Engineering (Dr. Heather Sheardown)
- IX. Graduate Calendar Changes
- X. 2013 Spring Graduands (to be circulated)

Motion:

“that Graduate Council approve the list of the 2013 Spring graduands, with amendments/corrections to be made as necessary by the Associate Graduate Registrar.”

- XI. Other Business

## **Graduate Council**

**April 23<sup>rd</sup> 2013 – 2:00 pm**

### **Gilmour Hall 111**

**Present:** Dr. A. Sekuler (Chair), Ms. B. Gordon, Dr. B. Ibhawoh, Dr. N. Agarwal, Dr. C. Hayward, Dr. A. Holloway, Dr. V. Ighneski, Dr. T. Porter, Ms. E. Tatham, Mr. J. Jaskolka, Dr. S. Fast, Ms. Y. Hunter, Ms. J. Kim, Ms. D. Parker, Dr. A. Guarne, Dr. P. Baxter, Dr. M. Heath, Dr. J. McDermid, Dr. A. Campos, Dr. P. Graefe, Dr. R. Hackett, Dr. W. Wiesner, Dr. H. Sheardown, Dr. D. Goellnicht, Dr. P. Bennett, Dr. T. Chamberlain, Dr. M. Lawford, Ms. C. Bryce

**Regrets:** Mr. A. Shakir, Dr. K. Cruikshank, Ms. B. Basse, Dr. B. Milliken, Dr. D. Welch, Dr. M. Horn, Dr. T. Hoare, Ms. A. Thyret-Kidd

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#### **I. Minutes of meeting**

After introductions, the minutes of the meeting of March 26<sup>th</sup>, 2013 were approved on a motion by Dr. Baxter seconded by Dr. Hackett with one abstention.

#### **II. Business arising**

There was no business arising from the previous meeting.

#### **III. Report from the Associate Vice-President and Dean of Graduate Studies**

Dr. Sekuler reported on the following activities:

- There is a new Scholarships Liaison Officer for the School of Graduate Studies, Laura Bagnulo.
- The most recent Best Practices was an update and information session on the MOSAIC project, providing context and describing goals and objectives and was very well attended. The upcoming Best Practices focuses on positive space training and the LGBTQ community. The speaker is Deirdre Pike, a columnist from the Spectator.
- Upcoming IQAP Information Session. On April 10<sup>th</sup> Donna Woolcott from the Council of Ontario Universities is the speaker
- Graduate Writing Circles are ongoing and they're trying to incorporate some form of stress relief.
- Provincial 3 Minute Thesis Competition
- Movement on the new tuition framework. The proposal is moving through various groups, including fees committee. The goal is to hold graduate research fees as low as possible, in line with the strategy that most universities around Ontario will be taking.
- Program Growth. There is still no word in terms of new allocations. A document is being put together with consultation from various departments to emphasize the importance of growth.

- Discussions with MTCU around the program approval process. There are still programs waiting for approval and the MTCU has not committed to a firm statement of timelines. The new minister has suggested they might triage various programs.
- Tri-agencies harmonization program. Masters for CIHR, SHERC and NSERC will be coming downloaded to the institution. Each institution will be given an allocation. The Ph.D. competition will still be run externally and there will be a single application for all three agencies.

#### **IV. Report from the Associate Deans of Graduate Studies**

Dr. Bonny Ibhawoh reported on transition in the Faculty of Humanities and mentioned that Dr. Ken Cruikshank is the new Dean. Dr. Cathy Hayward mentioned the new FHS graduate student representatives as well as the FHS Plenary happening May 14<sup>th</sup> to May 16<sup>th</sup> showcasing the work of graduate students and post-doctoral fellows. Dr. Heather Sheardown reported that M.Eng. Energy Systems is in progress and that the Faculty is trying to get a graduate student association for engineering students started.

#### **V. Report from the Assistant Dean, Graduate Student Life and Research Training**

Peter Self elaborated on Dr. Sekuler's remarks about the provincial and McMaster 3MT competition. 38 students here at McMaster competed in heats and final and various judges participated for different heats. All finalists are now available on the web. The top 2 eligible students from McMaster went on to the provincial competition in Kingston. Peter also mentioned that there was a People's Choice award yet to be decided and encouraged everyone to go vote.

#### **VI. Mosaic Update**

Brooke Gordon reported on the McMaster systems renewal project. A decision document went forward from the campus solutions module to discontinue use of Synapps. A front end form will be built that will feed into Peoplesoft, specific to non-OUAC applicants.

Brooke mentioned that one of the challenges in Mosaic is how to pay a graduate student. She described the existing system which utilizes SGS Administrative tools and facilitates equalization payments for students, a function that is not supported in Peoplesoft as graduate student pay intersects a number of different modules. The recommendation is that all employment earnings (including TA/RA-in-lieu) will be processed through the HR/Payroll system. All financial aid (i.e. scholarships and bursaries) will be assigned to the student account to pay tuition and fee charges, or refunded to the student through the Accounts Payable system.

Dr. Sekuler asked if tuition will still be able to be automatically deducted if there isn't sufficient money in scholarship income on its own without the additional employment income. Brooke answered that Peoplesoft has option to have students pay per term if they have sufficient aid (anticipated aid).

Another council member asked if the student doesn't receive enough money to cover tuition, would the net amount be due at the beginning of the year. Brooke responded that yes, in that case students will

have to pay at the beginning of the year. She said that in this new model there is a greater distinction between tuition/fees and what's being paid to the student in the new system.

A discussion ensued between council members about the relative merits of different payment models. It was noted that if equalization is not used then students will have their money in hand earlier – they're not receiving any less money. A council member commented that the new system should be less cumbersome for administrators than the current model. A suggestion was made that a working group of Graduate Council members be put together to discuss the relative merits of the issues and Brooke asked for volunteers from council members to help put together a preferred recommendation.

#### **VII. New Scholarship**

Dr. Allison Holloway moved and Dr. Cathy Hayward seconded **“that Graduate Council approve the new graduate scholarship as described in the document.”**

The motion was **carried**.

#### **VIII. New Program – M.Sc. in Biomedical Discovery and Commercialization (Dr. Michelle McDonald)**

This item was removed from the agenda.

#### **IX. Report from the Faculty of Business Graduate Curriculum and Policy Committee**

##### **I. Masters of Finance Calendar Copy**

Dr. Agarwal noted that the first item for approval is the Masters of Finance calendar copy for the program slated to start in September. He also mentioned that the copy has been formatted to fit requirements of the Graduate Calendar and does not contain any information not already seen at Graduate Council.

Dr. Agarwal moved and Dr. Hayward seconded **“that Graduate Council approve the Masters of Finance copy as described in the document.”**

The motion was **carried**.

##### **II. Management Science Ph.D.**

Dr. Agarwal reported on the course requirement changes for the Ph.D. Degree, noting that all MBA courses have been removed and replaced by Ph.D. level courses, leaving students with slightly greater choices.

Dr. Agarwal motioned and Dr. Chamberlain seconded **“that Graduate Council approve the course requirement changes as described in the document.”**

The motion was **carried**.

Dr. Agarwal then briefly discussed the rest of the report for Graduate Council information.

**X. Report from the Faculty of Engineering Graduate Curriculum and Policy Committee**

Dr. Sheardown described four different items for approval. The Chemical Engineering Internship program has not had any enrollment in twelve years and there are many graduate research projects within the department already involve collaboration with industry. The department of Chemical Engineering would also like to raise their required average for admission from a B- to a B+ based on comparable practices.

The Civil Engineering Ph.D. comprehensive procedure was revised to reflect more appropriate timing.

Dr. Sheardown noted that the M.Eng in Manufacturing Engineering was originally set up to be a mainly McMaster intake program. There was an influx of interest from outside of McMaster and, as a result, a course that counted for no credit was removed along with other admission requirements that were McMaster specific.

Dr. Sheardown motioned and Dr. McDermid seconded **“that Graduate Council approve the proposed curriculum and policy changes as described in the documents.”**

The motion was **carried**.

Dr. Sheardown then briefly discussed the rest of the report for Graduate Council information.

**XI. Report from the Faculty of Health Sciences Graduate Policy and Curriculum Council**

- I. Dr. Hayward reported the change in the M.Sc. Health Science Education program was not a change in the total course requirement, it just a change in what courses were required versus what were electives.

Dr. Hayward moved and Dr. Agarwal seconded **“that Graduate Council approve the proposed curriculum and policy changes as described.”**

The motion was **carried**.

- II. Dr. Hayward reported that the online Rehabilitation Science M.Sc. proposed to reduce the course requirements and to provide students with the option to complete their degree through course work only or through 6 courses and a scholarly paper.

Dr. Hayward moved and Dr. Holloway seconded **“that Graduate Council approve the proposed curriculum and policy changes as described.”**

- III. Dr. Hayward reported on a new course for Rehabilitation Science that was approved via e-ballot.

Dr. Hayward moved and Dr. Hacket seconded **“that Graduate council approve the new course.”**

The motion was **carried** pending approval from Faculty of Health Science Executive Council.

(Please note – this item was voted on in error. It was simply for Graduate Council information.)

- IV. Dr. Hayward reported that the eHealth program has proposed to add a statistics course to their list of required courses for M.Sc. students to better reflect the skills a student in the program requires.

Dr. Hayward moved and Dr. Agarwal seconded **“that Graduate Council approve the proposed curriculum and policy changes as described.”**

The motion was **carried**.

Dr. Hayward then briefly discussed the rest of the report for Graduate Council information.

## **XII. Report from the Faculty of Humanities Graduate Curriculum and Policy Committee**

Dr. Ibhawoh reported on three items for approval. A change in course requirements for the M.A. in Cultural studies has been proposed to eliminate overlap in old courses. The English program has proposed eliminating a second language requirement for M.A. students. The Gender Studies and Feminist research program has proposed an additional ‘Knowledge in Action’ required course for their students and reducing the number of elective courses to maintain the total of required courses.

Dr. Ibhawoh moved and Dr. Sheardown seconded **“that Graduate Council approve the proposed curriculum and policy changes as described.”**

The motion was **carried**.

Dr. Ibhawoh then briefly discussed the rest of the report for Graduate Council information.

## **XIII. Report from the Faculty of Social Sciences Graduate Curriculum and Policy Committee**

Dr. Porter reported on a proposed change in the Anthropology M.A. The program would like to eliminate the comprehensive exam option for students as no one had taken it up in ten years. A second curriculum change was proposed by Globalization; the program would like to formalize their Major Research Project with a course number so it would be better recognised. Political Science has proposed

a reorganization of their comprehensive exam for Ph.D. students in International Relations and Comparative Public Policy to ensure the exam covers the breadth of the field and create a more balanced workload. Finally, Health and Aging proposed to reduce their number of required courses for students to allow for more flexibility.

Dr. Porter moved and Dr. Baxter seconded **“that Graduate Council approve the proposed curriculum and policy changes as described.”**

There was some discussion about whether there is (or should be) consistency between programs with respect to the thesis or Major Research Project being undertaken as a course.

The motion was **carried**.

Dr. Porter then briefly discussed the rest of the report for Graduate Council information.

#### **XIV. Report from the Faculty of Science Graduate Curriculum and Policy Committee**

Dr. Sheardown reported on behalf of Dr. Welch two items for approval. The first was a change to the comprehensive exam in the Math program. Currently there are two written exams and one additional oral, to bring the program in line with other departments, the new proposed process will be one written exam testing breadth and one oral testing depth. The other item for approval was the calendar copy for the new specialization in Astrobiology.

Dr. Sheardown moved and Dr. Hayward seconded **“that Graduate Council approve the proposed curriculum and policy changes as described in the documents.”**

The motion was **carried**.

Dr. Sheardown then briefly discussed the rest of the report for Graduate Council information.

#### **XV. 2013 Spring Graduands**

Faculty of Health Sciences (except Nursing)

Dr. Baxter moved and Dr. Lawford seconded **“that Graduate Council approve the list of the 2013 Spring graduands, with amendments/corrections to be made as necessary by the Associate Graduate Registrar.”**

The motion was **carried**.

The meeting was adjourned at 3:55 pm.

McMASTER UNIVERSITY PROGRAM PROPOSAL BRIEF FOR THE  
PROGRAMS

HONOURS BACHELOR OF HEALTH SCIENCES **IN BIOMEDICAL DISCOVERY AND  
COMMERCIALIZATION** and  
MASTER OF ~~SCIENCE~~  
~~IN~~ BIOMEDICAL DISCOVERY AND COMMERCIALIZATION

Revised from the document that was conditionally approved at Undergraduate Council on April 16, 2013

Submitted with revisions contained herein to UPC on May 10, 2013 ~~March 7, 2013~~



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## APPENDICES

**Appendix A:** Summary of the association of program learning outcomes with undergraduate degree level expectations

**Appendix B:** Summary of the association of program learning outcomes with graduate degree level expectations

**Appendix C:** Course descriptions for the BDC program

**Appendix D:** Summary of existing programs that combine business and biochemistry/biotechnology

**Appendix E:** List of attendees at the one-day stakeholders workshop on October 5, 2011

**Appendix F:** List of ad-hoc program development committee members

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## 1. PROGRAM

The Biomedical Discovery and Commercialization (BDC) program will be a multidisciplinary training program, concentrated in the biomedical sciences that will produce graduates with the combined strengths of discovery research skills and business acumen. An important goal of the BDC program is the exposure of students to business curriculum in the DeGroote School of Business to complement a strong foundation in the biomedical sciences obtained in the Faculty of Health Sciences. Further, the program seeks to make strong connections with the health research business community in order to provide internships and community mentors for its trainees. With this unique combination of skills and knowledge, BDC graduates will be well positioned for employment in the biotechnology, pharmaceutical and other biomedical science sectors of the economy. Likewise they will be equipped to pursue further studies in, for example, graduate studies in research, Master of Business Administration, Law or Medicine.

The proposed format of the BDC program is a '4+1' Bachelor plus Master program. It will comprise a four-year undergraduate Bachelor's degree that begins in level III, followed by a fifth year Master's degree. Candidates who successfully graduate from the four-year undergraduate BDC program may then choose to apply for admission to the one-year non-thesis, course-based Master's program. Upon successful completion of each of the degree requirements, candidates will have graduated with a Bachelor of Health Sciences degree in BDC and subsequently a Master of ~~Science degree in BDC~~ **Biomedical Discovery and Commercialization**. This document presents a combined proposal for the two degree programs and as such is being submitted to both Undergraduate Council and Graduate Council for approval. **Our goal is to begin offering the Undergraduate BDC Program in September of 2014, and the Graduate BDC Program would follow with its initial offering in September of 2016.**

### 1.1 Consistency of program with University's mission and academic plan

The Department of Biochemistry and Biomedical Sciences is an accomplished, nonclinical, research-intensive department in the Faculty of Health Sciences. The Department was founded in 1967 and since that time has offered undergraduate and graduate programs leading to Bachelor of Science (B.Sc.), Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.) degrees. Our faculty members are appointed to the Faculty of Health Sciences and our graduate degrees are awarded through the Faculty of Health Sciences, while our undergraduate degrees are awarded through the Faculty of Science. The Department has been running a sizeable undergraduate program for more than 45 years, and we currently have more than 120 graduate students enrolled in our graduate programs. We have a strong track record in discovery research and have established cutting-edge educational offerings at both the undergraduate and graduate levels that integrate research and education. Inquiry-based learning approaches emphasize transferable skills in the biomedical sciences, including oral and written communication, problem-solving, critical thinking, and the acquisition of important and practical laboratory and research skills. The undergraduate program is further underpinned by a cooperative education option with a high degree of success in work placements.

Likewise, the DeGroote School of Business is recognized as an international leader in innovative approaches to teaching, learning and service to the business community. The School provides a full range of business education opportunities. Through its mission of excellence in management research, education and professional service, structured within an experiential learning environment, it has achieved international stature. The DeGroote School of Business is accredited by the Association to Advance Collegiate Schools of Business (AACSB) International. AACSB International is arguably the most recognized business school accreditation body around the world. Less than 5% of Schools of Business worldwide have earned this accreditation of excellence in management education.

The new BDC program will offer an alternative and unique point of entry for students from level II

Health Sciences, Biochemistry, (this amendment is pending formal approval of Undergraduate Council) and Life Sciences programs, attracting students with an aptitude for the basic sciences and strong interest in health, drug discovery and business. The BDC program will draw on the existing strength, expertise and a culture of excellence in research and education in the Department of Biochemistry and Biomedical Sciences, emphasizing leading-edge pedagogy and integrating research and education. Further, the program will provide opportunities for students to learn from thought-leaders in commerce at McMaster and business leaders in the community. Indeed, the BDC program will take new and unprecedented steps to engage the commercial health research sector of southern Ontario to facilitate experiential learning in the community (e.g., pharmaceutical, biotechnology and investment companies). The attributes and goals of the BDC program are thus aligned with the University's mission, academic plan and President Deane's letter to the McMaster community, *Forward with Integrity*:

- to excel in teaching, research and scholarship, with a commitment to creativity, innovation and excellence in our undergraduate offerings (*University Mission Statement*, [http://www.mcmaster.ca/univsec/reports\\_lists/mission.cfm](http://www.mcmaster.ca/univsec/reports_lists/mission.cfm))
- to link teaching and scholarship (*McMaster University Academic Plan*, <http://www.mcmaster.ca/newsevents/acadplan.htm>)
- to impart technical and professional skills that will permit our graduates a range of career choices (*McMaster University Academic Plan*, <http://www.mcmaster.ca/newsevents/acadplan.htm>)
- to improve the student experience through experiential and self-directed learning, and to serve the community (*Forward with Integrity*, <http://www.mcmaster.ca/presidentsoffice/fwi.html>)

## 1.2 Clarity and appropriateness of program requirements and learning outcomes in meeting University's Degree Level Expectations

### Program learning outcomes

The program learning outcomes for the BDC program were developed in a highly consultative process that included substantive consultation and brainstorming sessions with stakeholders from both academia and the private sector (please refer to Section 110 for details). The following learning outcomes characterize the consensus that emerged from these discussions.

#### **B.H.Sc. degree**

Upon completion of the undergraduate program, graduates will be able to:

1. Apply their basic knowledge of the process of drug development, manufacturing and marketing to function effectively in the biotechnology, pharmaceutical and other biomedical science sectors of the economy.
2. Contribute to research and development of new commercial products and pharmaceutical therapies using their understanding of drug targets, diseases, protein/gene structure and function.
3. Undertake laboratory research using sound research practices and methodologies.
4. Critically analyze the primary literature, case studies, and theory to propose innovative solutions to scientific and business problems.
5. Communicate clearly, both verbally and in writing, utilizing various formats to benefit both academia and industry.

6. Function as effective collaborative team members in a variety of roles in cross-disciplinary teams.
7. Apply knowledge of commercial development and biomedical research in experiential learning opportunities within industry and academia.
8. Pursue career and lifelong learning opportunities related to biomedical science.

### **M.Sc. Master's degree**

In addition to the above program learning outcomes, upon completion of the graduate program, graduates will be able to:

1. Integrate theoretical concepts and synthesize knowledge from various disciplines to develop an original commercial product for the market.
2. Manage a research project, set goals and priorities within a team.
3. Analyze data, make critical interpretations and place these findings into context with the published scientific literature in the development of a new product.
4. Communicate clearly and lead effectively to maximize potential opportunities within and outside of academia.
5. Undertake biomedical discovery while being mindful of its scientific, commercial, ethical, political and social contexts and implications.
6. Demonstrate evidence of entrepreneurial and leadership skills.

The learning outcomes identified for these programs resonate strongly with a commentary published in the journal *Biochemistry and Molecular Biology Education* that states "...our [Biochemistry] students need to appreciate the amount of capital needed to commercialize a scientific discovery. As informed, scientifically literate citizens, they should appreciate the cost of discovery and commercialization of new pharmaceuticals for both rare and common diseases."

(<http://www.kgi.edu/Documents/BusinessBio%20bambed.pdf>)

### **Overview of the program requirements**

#### **B.H.Sc. degree**

In level III, students will obtain inquiry style exposure to real world efforts in drug discovery and development through an introduction to the principles of discovery research in BDC 3A03 (Road to Biomedical Discovery) and the application of these principles to drug discovery in BDC 3B06 (Biotechnology and Drug Discovery). For example, in BDC 3B06, students will be required to gather and review current studies of drug therapies and use this information to develop creative and sound new treatments based on the scientific literature, and communicate their findings to their peers and experts. Students will concurrently acquire some of the technical skills discussed in these two theoretical courses in BDC 3C09 (Research Skills Laboratory and Inquiry). The latter course is experiential in nature, as the techniques will be applied in the context of mini-laboratory projects that mimic actual primary research, rather than being presented as a series of disconnected techniques. Students will also gain their first introduction to the business aspects of the industry through COMMERCE 2BA3 (Organizational Behaviour) and COMMERCE 3MD3 (Introduction to Contemporary Applied Marketing).

In level IV, the program draws additional courses from the DeGroote School of Business with COMMERCE 4AK3 (Accounting Information for Decision Making) and COMMERCE 4FW3 (Finance for Entrepreneurs) to round out student exposure to key areas of business. Students will also have access to four additional commerce courses as electives, COMMERCE 4KH3 (Management Issues in Electronic Business), COMMERCE 4MC3 (New Product Marketing), COMMERCE 4PA3 (Business Policy: Strategic Management), and COMMERCE 4QA3 (Operations ~~Modelling~~ Modeling

and Analysis). This capstone year will culminate with a senior thesis in BDC 4A15 (Senior Research Thesis) in which students will have first-hand exposure to discovery research when they undertake their own original independent research project under the supervision of a faculty member in the Department of Biochemistry and Biomedical Sciences. Ultimately, the senior research thesis will foster creative and critical thinking in primary research through a close oversight of each student's research path by the supervisor and the examining committee. Students will participate in the experimental design and goal setting throughout the thesis experience. Finally, level IV of the program will be especially flexible to facilitate student-centered exploration of additional elements of drug discovery, clinical biochemistry, immunology, pharmacology, epidemiology, clinical research, intellectual property, quality control and quality assurance, clinical trials, research ethics, regulatory affairs, public health, or commerce in BDC 403 (Current Topics in Biomedical Discovery and Commercialization) by subscribing to two modules (each module is 6 weeks in duration – equivalent to half of the term) that suit their interests. This degree requirement will contribute to the breadth of knowledge acquired through the program as students develop an understanding of the major fields in the discipline, as well as the ability to apply learning from areas outside of the discipline.

### Master's degree

During the one-year Master's program, students will build upon the skills and knowledge acquired in the undergraduate program. The first semester of the Master's program includes BDC 701 (Team Project) which integrates the business and science of the development of a novel commercial product, and is complemented by two business courses that are offered through the MBA program in the DeGroot School of Business: BUSINESS B748 (~~Entrepreneurship from a Diverse University Base~~**Multidisciplinary Entrepreneurship**), and a choice of BUSINESS B730 (Strategic Management of Technology) or BUSINESS C727 (Pharma/Biotech Business Issues). During the second semester, students will complete an internship in a related field (BDC 702) (for example, a placement in clinical trials or pharmaceutical marketing) with co-supervision from a faculty member ~~of in~~ the Department of **Biochemistry and Biomedical Sciences** ~~in order to ensure consistency in the learning outcomes associated with this placement~~. The Master's concludes with the ~~culminating task of a preparation of a~~ scholarly paper (BDC 703) that demands a rigorous **systematic understanding and** synthesis of the student's experiential and in-course learning **to meet graduate degree level expectations**, under the guidance and supervision of a member of the Department of **Biochemistry and Biomedical Sciences**. **Table 2a in Section 7.2 provides a list of faculty who are qualified to teach and supervise graduate students in graduate level BDC courses.** While ~~it is~~ not required, the scholarly paper may be submitted for publication to an appropriate journal.

An overview of the programs ~~is~~are shown in Tables 1a and 1b below. ~~Descriptions of the courses are included in Appendix C.~~

**Table 1a:** Biomedical Discovery and Commercialization ~~P~~programs

| Level | Cours   | Units     |
|-------|---|-----------|
| III   | BDC 3A03 (Road to Biomedical Discovery)   | 3 units   |
|       | BDC 3B06 (Drug Discovery and Development)   | 6 units   |
|       | BDC 3C09 (Research Skills Laboratory and Inquiry)   | 9 units   |
|       | COMMERCE 2BA3 (Organizational Behaviour)  | 3 units   |
|       | COMMERCE 3MD3 (Introduction to Contemporary Applied Marketing)                              | 3 units   |
|       | *BIOCHEMISTRY 3G03 (Nucleic Acids and Proteins) if BIOCHEMISTRY 2B03 and 2BB3 not completed | 0-3 units |
|       | Elective(s)   | 3-6 units |

|                 |   |  |
|-----------------|---|--|
| <b>IV</b>       | COMMERCE 4AK3 (Accounting Information for Decision Making)<br>COMMERCE 4FW3 (Finance for Entrepreneurs)<br>BDC 4A15 (Senior Research Thesis)<br>BDC 4B03 (Current Topics in Biomedical Discovery and Commercialization)<br>Elective(s)  | 3 units<br>3 units<br>15 units<br>3-6 units<br>3-6 units     |
| <b>Master's</b> | BDC 701 (Team Project)<br>BDC 702 (Community Internship)<br>BDC 703 (Scholarly Paper)<br>BUSINESS B748 ( <del>Entrepreneurship from a Diverse University</del><br>BaseMultidisciplinary Entrepreneurship)<br>BUSINESS B730 (Strategic Management of Technology) <b>or</b><br>BUSINESS C727 (Pharma/Biotech Business Issues) | 1 course<br>1 course<br>1 course<br>1/2 course<br>1/2 course |

\* Candidates who have not completed BIOCHEMISTRY 2B03 (Nucleic Acid Structure and Function) and BIOCHEMISTRY 2BB3 (Protein Structure and Enzyme Function) prior to entering the BDC Program, will be required take BIOCHEMISTRY 3G03 (Proteins and Nucleic Acids) in level III (in place of 3 units of electives).

**Table 1b: BDC graduate program schedule**

| <b>Term</b>               | <b>Course</b>  | <b>Courses</b>                           |
|---------------------------|--|--|
| <b>Fall</b>               | <b>BDC 701 (Team Project)</b> <ul style="list-style-type: none"> <li>700-level graduate course taught and assessed by faculty from the Department of Biochemistry and Biomedical Sciences</li> </ul> <b>BUSINESS B748 (Multidisciplinary Entrepreneurship)</b><br><b>BUSINESS B730 (Strategic Management of Technology) or BUSINESS C727 (Pharma/Biotech Business Issues)</b> <ul style="list-style-type: none"> <li>MBA courses taught and assessed by faculty members from the DeGroot School of Business</li> </ul> | 1 course<br><br>1/2 course<br>1/2 course |
| <b>Winter</b>             | <b>BDC 702 (Community Internship)</b> <ul style="list-style-type: none"> <li>Conducted in an industry, government or community placement</li> <li>Supervised and assessed by the site supervisor and by a faculty member from the Department of Biochemistry and Biomedical Sciences</li> </ul>  | 1 course                                 |
| <b>Spring/<br/>Summer</b> | <b>BDC 703 (Scholarly Paper)</b> <ul style="list-style-type: none"> <li>Supervised and assessed by a faculty member from the Department of Biochemistry and Biomedical Sciences</li> </ul>   | 1 course                                 |

The tables in **Appendix A** and **Appendix B** show the association of the program learning outcomes with the undergraduate degree level expectations (<http://c1l.mcmaster.ca/COU/degree/undergraduate.html>) and graduate degree level expectations (<http://c1l.mcmaster.ca/COU/degree/graduate.html>), respectively. **Course descriptions are provided in Appendix C.**

### 1.3 Appropriateness of degree nomenclature

The degree nomenclature ~~is was~~ commensurate with the primary focus and content of each degree.

The primary interactions of students in the undergraduate BDC program will take place with faculty members in the Faculty of Health Sciences with a focus on biomedical research. The B.H.Sc. degree in Biomedical Discovery and Commercialization is a four year Honours Program grounded in Program Learning Outcomes that were designed to meet the Undergraduate Degree Level Expectations.

~~Although Most~~ Master level programs in the Faculty of Health Sciences are designated as Master's of Science, ~~and~~ the focus and content of this degree is **more** consistent with ~~these~~ **a designation that reflects the true nature, relevance and application of the degree.** The ~~M.Sc. degree~~ Master ~~in~~ of Biomedical Discovery and Commercialization is a one-year course-based Master's designed to meet the Graduate Degree Level Expectations through the Team Project, Scholarly Paper and M.B.A. level Business courses.

The program name *Biomedical Discovery and Commercialization* encompasses the two key components of the training program to prepare graduates for direct entry into the workforce: 1) to prepare students with the scientific and technical knowledge and understanding that underlies breakthrough discoveries in the biomedical sciences **and drug discovery**, and 2) to educate students with business fundamentals. Perhaps, foremost, the degree nomenclature implies one of the most important features of the program – that is, the integration of business and science.

## 2. ADMISSION REQUIREMENTS

### 2.1 Appropriateness of program's admission requirements for the learning outcomes established for completion of program

#### Culture and philosophy

The aim of the BDC program is to offer rigorous leading-edge training designed for students who desire a rich, scholarly experience that an internationally competitive research-intensive institution can provide. McMaster is at the forefront of scientific discovery, yielding dramatic discoveries that uncover the inner workings of biological systems and that hold great promise for understanding the nature of human diseases. This program, in particular, seeks out exceptional individuals with a capacity for translating basic research into commercial enterprise. Students will receive a strong foundation in modern biomedical science and commercialization through an integrated program of laboratory research, group projects, business courses and an internship placement.

#### B.H.Sc. degree

Selection will be based on academic achievement, a written statement of interest and an interview but requires, as a minimum, submission of an on-line application by the stated deadline, completion of ~~any~~ Level II ~~program~~ **Health Sciences, Biochemistry or Life Sciences (this amendment is pending formal approval of Undergraduate Council)** with a Cumulative Average of at least B (equivalent to a McMaster 8.0 GPA out of 12) and completion of both CHEMISTRY 2OA3 and 2OB3 (or both CHEMICAL BIOLOGY 2OA3 and 2OB3). **The program will be open to applicants who have completed equivalent level II courses at another university. (this amendment is pending formal approval of Undergraduate Council)**

The prerequisites imply that the vast majority of applicants will apply from the Faculty of Health Sciences or the Faculty of Science and have strong foundational knowledge in the basic sciences or health sciences that underpin drug discovery. Successful applicants will likewise be business-minded with an ability to work collaboratively in both small groups and large groups, and with individuals from diverse backgrounds in order to meet the Program Learning Outcomes.

#### ~~M.Sc.~~ Master's degree



Admission to the M.Sc. program is not automatic. Applicants must submit an application to the School of Graduate Studies following the online application guidelines and submission deadlines. Admission to the M.Sc. program will require, at minimum, a cumulative average of B+ (equivalent to a McMaster 8.5 GPA out of 12) from the undergraduate BDC program and will be based on a written statement of interest and an interview. Successful applicants must also meet all School of Graduate Studies admission requirements as stated in the Graduate Calendar ([http://digitalcommons.mcmaster.ca/sgs\\_cal/10/](http://digitalcommons.mcmaster.ca/sgs_cal/10/)).

Students in the BDC Master's program are expected to show, over the course of study, evidence of scholarly accomplishments, excellent communication in writing and in oral presentation, and novel contributions to their research project. To the best of our ability, we will assess the candidate's application package to identify those candidates who we feel will meet and/or exceed these expectations. Admission will be offered to qualified B.H.Sc. graduates from the undergraduate BDC program. Any ~~unused-unfilled~~ slots ~~will~~ **may** be filled from outside applicants who qualify **with completion of the equivalent undergraduate courses required for the BDC Program, as specified in Table 1a.**

## 2.2 Alternative requirements for admission into the program

### B.H.Sc. degree

In exceptional cases, there may be students from faculties outside of Health Sciences and Science with these prerequisites and aptitudes, and with a strong interest in the program. The BDC program will be an inclusive and open one that will evaluate such applications on a case-by-case basis. This approach will be facilitated by evaluation of statements of interest and interviews with short-listed applicants.

### ~~M.Sc.~~ Master's degree

Applicants who have not completed the undergraduate BDC program may apply and will be considered for admission if they have completed the equivalent of the required undergraduate courses for the BDC program in levels III and IV from another program/institution (please refer to the program requirements **specified in Table 1a**). Again, these applications will be evaluated on a case-by-case basis **to fill any unused slots not filled by graduates from the undergraduate BDC Program.**

## 3. STRUCTURE

### 3.1 Administrative, governance and communication processes

The BDC program will be administered by the Department of Biochemistry and Biomedical Sciences in the Faculty of Health Sciences. The curriculum and program will be overseen by the Associate Chair, Undergraduate Studies and the Associate Chair, Graduate Studies. A Program Director (~~contractually limited faculty appointment~~) will ~~be hired to coordinate the program~~, teach and provide community outreach leadership ~~in the program~~. In the latter function, this individual will liaise and coordinate with leaders in the health research business community who will **be teaching** and **supervising** interns in the Master's program. The Program Director will report to the Chair of the Department and work in collaboration with the respective Associate Chairs of Undergraduate Studies and Graduate Studies. ~~Three new contractually limited appointment faculty will be hired to teach and carry out research in discovery science and supervise/train many of the new graduate students associated with this program.~~ A Program Coordinator (staff member) will ~~be hired to~~ oversee the administration of the program and will function as the primary administrative contact for admissions, calendar changes, degree audits, in addition to the coordination and support of teaching by mentors from industry. Two administrative assistants will ~~be hired to~~ provide front-line assistance to students, faculty, the Coordinator and the Director for each portion of the program (undergraduate and graduate).

Finally, a lab technician will ~~be hired to~~ oversee the teaching labs and provide support for the laboratory course (BDC 3C09). All communications related to the program will originate from the Program Coordinator, Program Director or the Associate Chairs.

Program and course changes are first approved by the Undergraduate and Graduate Curriculum Committees in the Department of Biochemistry and Biomedical Sciences, which are chaired by the respective Associate Chairs, and then presented to the Department for approval. Subsequent approvals are sought from the Health Sciences Education Committee, the Graduate Policy and Curriculum Council and the Faculty Executive, the governing committees that oversee all education programs in the Faculty of Health Sciences. Changes relating to the DeGroot School of Business will be presented for approval to the School's Undergraduate Curriculum and Policy Committee, the Graduate Curriculum and Policy Committee and the Faculty Executive ~~of Business~~. Undergraduate Council approval will be sought for final approvals of the B.H.Sc. components, while Graduate Council approval will be sought for final approvals of the Master's components.

### **3.2 Appropriateness of program's structure and regulations to meet specified program learning outcomes and Degree Level Expectations**

The Program Director will be primarily responsible for overseeing the BDC program. This person will work closely in collaboration with the Associate Chair of Undergraduate Studies and the Associate Chair of Graduate Studies who meet annually with their respective Curriculum Committees to assess the programs, courses and enrollments. Both ~~Associate~~ Chairs have open door policies and are tuned in to the needs of the students, graduates, teaching assistants and faculty. Based on feedback, the curriculum and/or the level of support and guidance will be routinely adjusted to meet the needs of the students, teaching assistants, faculty and the learning objectives of the program. In conjunction with the Program Director, the Associate Chairs will be responsible for preparation of the documentation required for the cyclic IQAP reviews.

The Associate Dean (Academic) in the DeGroot School of Business will work closely with the Associate Chairs in the Department of Biochemistry and Biomedical Sciences in monitoring the progress of the BDC students as they proceed through the program and the Commerce/~~Business~~ courses. The curriculum will be overseen carefully and adjusted appropriately to ensure that the needs of the students are met. Representatives from the DeGroot School of Business will be invited to attend Curriculum Committee meetings when matters concerning the BDC program are discussed.

Student progress will be reviewed at the end of each term by the Program Coordinator and Director. Students in the ~~B.H.Sc.~~ program who fail to maintain a minimum grade of B in each of the required program courses will be invited to meet with the Program Director to discuss areas of weakness and suggest remedial strategies. Students must successfully complete all required BDC courses in level III in order to advance to level IV.

Students registered in the ~~M.Sc.~~ Master's program will be required to meet with the Program Director at the end of each term to review the learning objectives and set new goals for the upcoming term that will align with the Program Learning Outcomes **as outlined in Appendix B**.

### **3.3 Rationale for program length**

#### **B.H.Sc. ~~D~~egree**

The duration of the undergraduate BDC program is in accordance with the traditional four-year Honours program.

#### **~~M.Sc.~~ Master's ~~D~~egree**

The Master's of Science in BDC program is designed as a one-year non-thesis course of study where students complete the required course work during the Fall term, a community internship during the Winter term, and scholarly paper during the Spring/Summer terms. The planning of the curriculum was done with care, to ensure that students could fulfill the degree level expectations in a timely fashion and prepare them for transition into their future careers. The program length is similar to that of the Master of Science in Global Health in the Faculty of Health Sciences which is a 12-month program of study.

#### 4. PROGRAM CONTENT

##### 4.1 How curriculum addresses the current state of the discipline or area of study

The pharmaceutical and health biotechnology sectors are very significant contributors to the Canadian economy and are poised for considerable growth. Indeed, these areas represent a rapidly advancing industry worldwide and are targets of the innovation agendas of the federal, provincial and municipal governments in Canada. Related opportunities in associated health policy and regulatory elements of government are likewise predicted to grow.

In Ontario, there is a particular concentration of commercially-oriented pharmaceutical companies, including research-based and generic drug makers, with a focus on areas related to drug discovery, drug development, medical and regulatory affairs, intellectual property, technical sales and marketing. Furthermore, there is a growing cohort of early and mid-stage biotechnology companies with high prospects to emerge as flagships of a knowledge-based health technology economy. These sectors and the associated health policy and regulatory arms of government require employees with strong multi-disciplinary credentials in the biomedical sciences and commerce.

While strong training in either basic biomedical sciences or in business has been the traditional path for career success in these fields, there is an unmet need for graduates with cross-disciplinary training in these areas. Our survey of training programs in Ontario, Canada and North America reveals that there is a unique opportunity to provide such training in preparation for a career in the health sciences industry and health policy sectors of the economy. (See **Appendix D** for a list of existing related programs.)

The Master's BDC program is analogous to the Master of Engineering Entrepreneurship and Innovation and the Master of Technology Entrepreneurship and Innovation in the Faculty of Engineering here at McMaster University, however, there are important differences in focus that justify creation of the new program. Specifically, the BDC program has an unique emphasis on the biological aspects of biotechnology and biomedical research, for example, drug design and discovery, in recognition of the needs for individuals with this type of background to meet industry needs in Ontario, Canada and other countries. The most closely aligned similar program is a two-year Master of Biotechnology at the University of Toronto Mississauga. Unlike the latter mentioned program and a small number of other related, and like others in the small numbers of programs in the areas of biotechnology, that combines varied courses from the Sciences with a selection of courses from Business courses. However, our program has a different focus and its structure is different. The unique aspect of our program is that it has both undergraduate and graduate components, custom tailored with graduate level (700-level) BDC courses that designed specifically for the integration of biomedical education knowledge and discoveries with and business knowledge important for commercialization. The fact that the Master's degree component builds upon the undergraduate BDC degree ensures that that includes the Masters level students have the needed a strong foundation in biomedical sciences and supporting business courses. The preparation from that was initiated in level III onward in their undergraduate studies, and integration, facilitates timely completion of learning objectives. The proposed intention of this program is to pursue new training markets with students who are uniquely trained through a robust and cohesive education program is designed to that provide

learners a mix of skills that are different from ~~other~~ existing programs.

~~This one year Master's condensed~~ program allows students to graduate and enter the workforce ~~with a Master's degree~~ after five years of post-secondary education, rather than the traditional route that is not coordinated and often requires ~~consists of~~ a four year undergraduate degree in Science, followed by years in the workforce, then entry into an MBA program to obtain academic training in business courses.

~~To the best of our knowledge, there are no similar programs that span graduate and undergraduate training in biomedical discovery and commercialization. Thus our students should fill a unique niche with very strong discovery research and business skill sets that will be valued by future employers of the graduates. There are a small number of related programs in the province of Ontario that produce graduates with a similar skill set, and~~ Our discussions with industry, including potential internship partners, reveal that there is indeed demand for students with the skills and knowledge required to work in pharmaceutical and biotechnological industries. The program capitalizes on strengths in Ontario's growing biomedical science sector ~~in the biomedical industry is strong and~~ that has unmet needs for graduates with the very type of skills that the program is structured to provide.

## 4.2 Unique curriculum or program innovations or creative components

### B.H.Sc. degree and Master's degree

~~Unlike traditional basic science programs~~ For optimal education in the BDC program, there are important roles for full time faculty and the potential to recruit adjunct faculty from industry ~~will figure prominently in the BDC program.~~ The position and role of adjunct faculty is further explained in Section 8.5. Adjunct faculty will ~~ostensibly be important~~ -participant~~ste~~ in the fourth year topics course (BDC 4B03) and at the Master's level, ~~in the through a~~ team project course (BDC 701) and ~~a~~ the community internship (BDC 702). These thought-leaders will hail from diverse elements of the health business and government sectors including areas of biotechnology, pharmaceutical, venture capital, regulatory affairs, intellectual property and medicine, providing a rich environment for student-focused learning.

~~Unlike other combined business and science programs, where students are enrolled in existing business courses, the DeGroote School of Business will mount separate sections of the Commerce courses for BDC students in order to tailor the content, examples and cases in order to make the applications relevant to the field.~~ BDC students will participate in Commerce and Business courses alongside students from diverse backgrounds, ultimately enriching the learning experience for course participants.

Furthermore, this unique program will benefit from strong existing links between the Department of Biochemistry and Biomedical Sciences and outstanding research institutes in the Faculty of Health Sciences as well as commercialization facilities located at McMaster. These include the Institute for Infectious Disease Research, McMaster Immunology Research Centre, Stem Cell and Cancer Research Institute, Farncombe Family Digestive Health Research Institute, McMaster Industry Liaison Office and the McMaster Innovation Park.

### B.H.Sc. degree

One of the novel aspects of the program is the small class sizes that will be offered through the fourth year Topics Course modules (BDC 4B03) noted above. Each of the members of the Department of Biochemistry and Biomedical Sciences will offer a 6-week module that will be focused in their research area and provide a special opportunity for students to interact with faculty who are thought-leaders in a variety of research fields. These modules will provide ultimate flexibility for students to

tailor their studies to suit their emerging interests. See the course description for BDC 4B03 in Appendix C for some examples of modules that will be offered in the curriculum.

### Master's degree

In the first semester of the Master's program, we envision a team project (BDC 701 Team Project) where students will work in small teams leveraging their training and developing career interests to develop new technology in a discovery research laboratory or to create business plans and an entrepreneurial pitch for a new venture in biomedicine. Indeed, we see students self-identifying for one of two kinds of experiences. This first will be fashioned after iGEM, a yearly world-wide competition known as International Genetically Engineered Machine, where teams of university students are charged with creating simple biological machines from iGEM's Registry of Standard Biological Parts. The ~~second~~ alternative project will be a team effort toward an entrepreneurial pitch for a new venture in biomedicine that encompasses cutting edge science and sound business strategy and will culminate in a presentation to members of the local venture community. The presentation will be akin to the popular television series 'Dragon's Den', and will include submission of a written business plan.

## 4.3 Nature and suitability of major research requirements

### B.H.Sc. Degree

The undergraduate BDC program requires completion of a 15 unit laboratory research thesis under the supervision of a researcher ~~affiliated~~ who is a core member with the Department of Biochemistry and Biomedical Sciences (see Table 2a in Section 7.2). This research thesis comprises a major component of the fourth year curriculum, and will be conducted over the course of the Fall and Winter semesters. Requirements for the thesis course include: 1) a research proposal for the work that they expect to conduct, 2) an extensive review of the relevant literature, 3) reviewing and setting goals in collaboration with the supervisor on a regular basis (at minimum on a monthly basis), 4) communication of the proposed project and progress-to-date in a formal presentation at the end of the first term to supervisor, examining committee and peers, 5) formative evaluation from the supervisor at the end of the first term with a formal response from the student, 6) thesis defense at the end of the second term, and 7) submission of a final written thesis report.

### M.Sc. Master's Degree

The Master of BDC program is a course-based Master's which culminates with the completion of a scholarly paper (BDC 703) ~~which that~~ integrates the theoretical constructs from the coursework (BDC courses and BUSINESS courses) with experiential learning ~~opportunities~~ obtained through the community internship (BDC 702). Upon completion of the first two semesters of the Master's program, each student will have obtained an individual learning experience that is unique to them. The specific product conceived, produced and marketed through the Team Project in combination with the specific nature of their community internship placement (for example, marketing vs. clinical trials) will provide an opportunity for creative exploration of Biomedical Research and Commercialization. Students will select a topic for their scholarly paper in consultation with their Scholarly Paper Supervisor who will be a faculty member affiliated with the BDC graduate program and who has supervisory privileges at the graduate level (see Table 2a in Section 7.2). At the beginning of the term, a 'matching process' will couple students with a supervisor that will best be able to mentor the student on for their selected topic through the completion of the scholarly paper.

Students may begin preparation of the scholarly paper during the course of their internship, gathering resources and primary research papers that integrate their specific Team Project outcomes with their work placement experience. Students will be expected to draw from the primary literature, and ground their thesis and experiences on established principles and theories from Biomedical Sciences and Business.

The scholarly paper must also meet the minimum requirements set out in the Scholarly Paper Guidelines for the BDC program.

#### **4.4 Appropriateness of the courses for graduate level degrees**

##### **Master's ~~Sc.~~ degree**

The Master's program requires completion of three full BDC courses at the Master's level, and two half courses in Business which stem from the MBA program from the DeGroot School of Business. The BDC program is a non-thesis course-based Master's in which the traditional thesis and collection of data is replaced with a graduate level team project course that integrates learning across the disciplines. At the conclusion of the internship, students will also be required to complete a scholarly paper as described above in section 4.3. Upon completion of these two courses, students will have amassed a broad and systematic understanding of discovery research and its novel application to formulating a creative solution for a current and relevant medical problem, and how to bring their treatment to market through the commercialization process. Grounded in fundamental principles in the basic biomedical sciences, students will be learning and working at the leading cusp of biotechnology and commercialization. A common thread that is woven through the Team Project and Community Internship is the collaboration within an interdisciplinary team where decision-making, communication and leadership are key factors.

### **5. MODE OF DELIVERY**

#### **5.1 Appropriateness of proposed mode(s) of delivery to meet program learning outcomes and Degree Level Expectations and availability of necessary physical resources**

As mentioned in Section 1, the Department focuses its educational offerings on student-centered inquiry-based learning with an emphasis on communication and other transferable skills. The BDC program will be no exception, and in fact it will take student-centered learning to the next level with, for example, the Topics course modules offered in fourth year in BDC 4B03 with a student to faculty ratio of 5:1. The pedagogical style will be increasingly inquiry-based and team-based as students progress through to fourth year. The curriculum will hone their group skills over the course of the B.H.Sc. and Master's programs as discussed above in section 4.4.

This mode of delivery and requirement for small group team-based work requires small classrooms. These are available through Education Services in the Health Sciences Centre and the Michael DeGroot Centre for Learning **as confirmed by the Director of Education Services (see letter of support in Appendix G).**

### **6. ASSESSMENT OF TEACHING AND LEARNING**

#### **6.1 Appropriateness of proposed methods for instruction and assessment of student achievement for intended Program Learning Outcomes**

In addition to traditional tests and exams that measure recall of content and application of knowledge, the BDC program will assess comprehensive knowledge through projects that require application, as well as creative problem-solving, deep learning and critical thought. The BDC, Business and Commerce courses will emphasize teamwork and collaborative skills. These skills will be evaluated through progress meetings with the instructor or teaching assistants and formative feedback through peer evaluation. BDC program students will also demonstrate their learning through written and oral presentations, which are key skills that need to be practiced and developed to prepare graduates for career success.

## 6.2 Plans for documenting and demonstrating the level of performance of students

The level of student performance will be assessed throughout the program through key projects, oral presentations, the scholarly paper and internship placement.

The BDC program will be externally reviewed during cyclical reviews, and assessed on an ongoing basis through indicators such as student grades and awards data. The BDC program will be closely monitored as it unfolds, and as we receive feedback from students, faculty, teaching assistants and placement supervisors. Ultimately, we will judge success by assessing the career success and satisfaction of our graduates and thus we will make every effort to maintain contact with our graduates to this end.

~~Efforts~~ The efforts to improve the program, whether in content or delivery, in response to the data/feedback will be routine and on-going.

~~The level of student performance will be assessed throughout the program through key projects, oral presentations, the scholarly paper and internship placement.~~

## 7. RESOURCES FOR ALL PROGRAMS

### 7.1 Administrative unit's planned utilization of existing human, physical and financial resources and any institutional commitment to supplement the resources

i) **Human Resources** – The Department of Biochemistry & Biomedical Sciences is a research intensive department with a strong commitment to undergraduate and graduate education. Two faculty are currently dedicated to undergraduate education, Dr. Michelle MacDonald (Teaching Professor and Associate Chair, Undergraduate Studies) and Dr. Felicia Vulcu (contractually-limited appointment) both of whom teach, counsel students and engage in teaching research while the graduate portfolio is led by an Assistant Dean, Faculty of Health Sciences Graduate Program (Dr. Brian Coombes, PhD., Associate Professor and Canada Research Chair) who also serves in the capacity of Associate Chair, Graduate ~~Studies-Education~~ for the Department of Biochemistry and Biomedical Sciences. The Department currently consists of fifty-one faculty members that include a number of joint and associate members. Department operations, finance management of support staff are the domains of the Manager of Operations and the Manager of Strategy & Planning. An administrative assistant/laboratory technician provides direct support to the Biochemistry undergraduate program and an administrative assistant supports the graduate program.

The research intensive nature of the department creates numerous opportunities for exposure to cutting edge research. ~~Students-Undergraduate students~~ who subscribe to research-based courses and seek summer research employment in faculty laboratories benefit enormously from a strong culture of integrating research and education. In this context, the BDC program will likewise benefit from significant capacity in the faculty complement of the Department of Biochemistry and Biomedical Sciences who routinely integrate research and education.

**Plans for additional human resources:** Three new ~~contractually-limited~~ faculty appointments (one of whom will be hired as the Program Director, and two replace faculty who have recently departed from the University), one Program Coordinator, two Administrative Assistants and one part-time Laboratory Technician (~~described on page 15~~) will round out the ~~is~~ complement of existing human resources described above, as will contributors from the Business School and Adjunct faculty from the health research and business community. Finally, the Department of Biochemistry and Biomedical Sciences

has a large graduate student contingent (>120 students) available to participate as Teaching Assistants. This resource is currently only partially tapped with fifty-three existing 130-hr Teaching Assistantships. The BDC program will enlist additional TAs from this pool of graduate trainees and from the Business School.

ii) **Library Resources** – Our Department is located in the Health Sciences Centre, which is home to the University's major medical/life sciences library. The Health Science Library houses an extensive collection of books and journals that are relevant to the students in our program. The HSC Library also subscribes to an extensive collection of online journals, which are fully accessible from campus and off-site using the E-Resources website (as outlined in the letter of support from the Director of the Health Sciences Library in Appendix G). All students have access to the library's online collection using their MacID, a unique authenticator that grants access to all of the web resources of the University. This off-site access is especially important to the trainees located at the Hamilton General Hospital's Thrombosis and Atherosclerosis Research Institute (TaARI), as part of the David Braley Research Institute (Werstuck, Trigatti). The second major library that serves the needs of our students is the H.G. Thode Library of Science and Engineering. This library houses collections that are relevant to those working mainly in the areas of chemical biology, chemistry, and structural biology. Of special note is the access to the Innis Library for the commerce course work. It maintains an extensive collection of business books and periodicals in print and online formats. The Innis Library subscribes to a vast collection of online resources that provide quick access to full-text articles, journals, reports and statistics for business students. There are approximately 18,000 business titles held by Innis and an additional 15,000 online resources related to business.

iii) **Laboratory Facilities (Individual)** – Most of our faculty's individual laboratories are self-contained with equipment routinely used for their research needs. All of our faculty members hold at least one research grant (most hold several) and a portion of these funds are used on a discretionary basis for equipment renewal, etc., as needed. Infrastructure programs from the Canada Foundation for Innovation (CFI) and Ontario Research Fund (ORF) have supported equipment needs for our newer faculty. The Department occupies approximately 25,000 square feet of wet-lab research space in the Health Sciences Centre. Core faculty members (Wright, Brown, Magarvey) occupy an additional ~7,000 square feet of wet-lab space in the Michael DeGroote Centre for Learning and Discovery (MDCL) for operation of their individual research programs. The Stem Cell and Cancer Research Institute (Bhatia) is also in the MDCL and occupies more than 13,000 square feet on the fifth floor of this building.

iv) **Laboratory Facilities (Common)** – Several major infrastructure grants have been secured by Biochemistry faculty over the past 7 years that have been used to enhance the equipment available to trainees in our program. These grants have allowed the procurement of cutting-edge equipment and build-outs of major research centers. **The Centre for Microbial Chemical Biology (CMCB)** (<http://fhs.mcmaster.ca/cmcb/index.html>) is a \$20M facility built in 2009 that houses state-of-the-art infrastructure to support research at the interface of the disciplines of chemistry and biology. The CMCB is located in two 12,000 square foot multi-user labs on the 2nd floor of MDCL and is professionally managed by several full-time staff. Ensclosed in the CMCB operations is a high-throughput screening laboratory, celebrated as being among the first in Canadian Universities, a bioinformatics suite, natural products chemistry lab, and equipment for protein and biophysical experiments. The **MacBiophotonics** laboratory is an imaging facility that provides access to the latest and best in microscopy, fluorimetry and high content screening. This 3,000 square foot facility is located on the 4th floor of the Health Sciences Centre in Department-managed space. **The Canadian Centre for Electron Microscopy** is a major 8,000 square-foot research facility supporting world-class research from scientists across the country. One of our faculty members (Ortega, Co-Director of the EM Facility) and his trainees use the two field emission gun transmission electron microscopes in this facility for their work in cryo- electron microscopy. The Department also runs a common autoclave facility for all labs (400 square feet), a developer room (250 square feet), and a newly renovated space



that houses the x- ray source that supports structural biologists in the Department (Guarne, Junop, Yang).

v) **Undergraduate Teaching Laboratories** – The undergraduate teaching laboratory in the Department of Biochemistry and Biomedical Sciences is comprised of two main rooms (6,000 square feet in total) which typically house a maximum of 24 students/room for a total of 48 students. The teaching labs are equipped with up-to-date equipment and supplies designed to allow students first-hand training in relevant biochemical techniques. Aside from an Olympus fluorescence microscope, four micro- centrifuges and a new Avanti JE high-speed centrifuge, the labs are also home to two Genesys10 UV/Vis Spectrophotometers, twelve new Spectronic20D+ Spectrophotometers, a plate reader, two thermocyclers, six Bioreactors (1.5-2L) and five Napco Microbiological Safety Cabinets. The labs also contain ample pipettes (1 set/pair of students), automatic and multi-channel pipettors, six desktop computers for data collection and analysis and other supplies designed to enhance the student experience in techniques such as: PCR, SDS-PAGE, protein expression and purification, Western blotting, protein crystallization, enzyme kinetics and mammalian tissue culture (including mouse embryonic stem cells).

vi) **Gould Trading Floor** – Students will also benefit from experiential learning through real-life business learning opportunities in the Allen H. Gould Trading Floor housed in the DeGroote School of Business. The Gould Trading Floor is a unique interactive, experiential classroom, where students learn the fundamentals of the capital markets. It is a state-of-the-art facility delivering real-time data feeds from North American financial markets, allowing students to acquire necessary skills and competencies demanded by today's business environment.

vii) **Homebase** – In 2009 the Department secured a sizable meeting room adjacent to the Ewart Angus Centre in the Health Sciences Centre as a meeting place for our students. The space is used for specific events, general socialization or for group projects. It is equipped with a conference table and chairs, a sofa and maintains wireless access to the internet.

viii) **Financial Resources** – The Department is very research intensive and is able to integrate our research expertise successfully into our undergraduate and graduate programs. Eleven core members are current or past holders (last 5 years) of Canada Research Chairs (4 Tier I and 7 Tier II). In 2011, the faculty members in the Department of Biochemistry & Biomedical Sciences held 33 CIHR operating grants and 104 total operating grants for an average per investigator of \$288,032/yr from CIHR and \$728,378/yr from all sources totaling \$16.6 million. These faculty members have made a commitment to the mentoring of students, both graduate and undergraduate and they have the resources to do so.

## 7.2 Participation of a sufficient number and quality of faculty who are competent to teach and/or supervise in the program

~~The Department of Biochemistry and Biomedical Sciences has a large faculty complement with the right skills to teach and supervise in the program. Due to the recent departures of three faculty members, three new contractually limited appointment faculty will be hired to support our program offerings. These individuals will develop independent research programs and will also contribute to teaching and scholarship in the department that relates to the new BDC program, including the supervision and training of the graduate students associated with this program. One of the novel aspects of the program is the small class sizes that will be offered through the fourth year Topics Course modules. Each of the members of the Department of Biochemistry and Biomedical Sciences will offer a 6 week module that will be focused in their research area and provide a special opportunity for students to interact with faculty who are thought leaders in a variety of research fields. These modules will provide ultimate flexibility for students to tailor their studies to suit their emerging interests. See Appendix C for some examples of modules that will be offered in the curriculum.~~

~~In addition, we have had strong interest from leaders in the local biotech, pharma and biomedical business community. Several individuals have expressed strong interest in teaching and mentoring in our proposed program and thus we anticipate that the modules offered in the fourth year Topics course will grow to include offerings by adjunct members of the department from the community.~~

The Department of Biochemistry and Biomedical Sciences is a research-intensive unit with a strong track-record of funding and includes senior faculty who are at the top of their fields as well as junior faculty who are emerging stars. ~~Three new faculty will be hired to support the program offerings. These individuals will also have the right skills to participate in the supervision and training of the graduate students associated with this program.~~ ~~and w~~ With the addition of ~~3~~ ~~the new complement of~~ faculty, the Department will expand on its breadth of research strength that spans diverse aspects of biochemistry including-infection, metabolism, ~~drug discovery~~, stem cell biology and cancer. Please refer to Table 2a below for a listing of the core faculty members that are qualified to teach in the BDC programs at the undergraduate and graduate levels. Table 3 contains a summary of the faculty publications in the last three years, reflecting the quality of the research faculty. The BDC program will capitalize on this excellence in research to provide quality thesis topics and mentoring for independent study ~~and supervision for the scholarly paper. To facilitate delivery, faculty, three new contractually limited appointment faculty will be hired to support the program offerings. These individuals will participate in the supervision and training of the graduate students associated with this program.~~

Faculty members at the DeGroote School of Business play a leadership role in solidifying McMaster's status as one of the country's "most innovative" research-intensive universities. The research conducted at DeGroote generates new business knowledge and has important practical implications for both management and teaching. Presently, there are 69 full-time faculty in the School with 8 teaching-track faculty members. ~~The faculty members who will be teaching the Commerce and Business courses for the BDC program are indicated below in Table 2b. These teaching assignments are potentially subject to change in the future, but will be taught by faculty members who are qualified to teach the assigned course.~~ Teaching assistants will be provided for each course.

Faculty members in the Business School have built an international reputation on its research. Researchers publish regularly in the Financial Times Top 45 Business School Journals. The Financial Times (FT) compiles the Business School research rank, and is calculated according to the number of faculty publications published in 45 academic and practitioner journals.

In addition, ~~as discussed earlier in Section 4.2,~~ we have had strong interest from leaders in the local biotech, pharma and biomedical business community. Several individuals have expressed ~~strong~~ interest in teaching and mentoring in our proposed program and thus we anticipate that the modules offered in the fourth year Topics course (~~see course description for BDC 4B03 in Appendix C~~) will grow to include offerings by adjunct members of the ~~D~~department ~~that will hail~~ from the community.

~~One of the novel aspects of the program is the small class sizes that will be offered through the fourth year Topics Course modules (BDC 4B03). Each of the members of the Department of Biochemistry and Biomedical Sciences will offer a 6 week module that will be focused in their research area and provide a special opportunity for students to interact with faculty who are thought leaders in a variety of research fields. These modules will provide ultimate flexibility for students to tailor their studies to suit their emerging interests. See the course description for BDC 4B03 in Appendix C for some examples of modules that will be offered in the curriculum.~~

**Table 2a:** Core faculty members from the Department of Biochemistry and Biomedical Sciences who will be involved in delivery of the BDC program

| Faculty Name        | M/F | Rank      | Home Unit <sup>a</sup> | Status             | Supervisory Privileges at Graduate Level | Teaching UG/G <sup>b</sup> |
|---------------------|-----|-----------|------------------------|--------------------|--|----------------------------|
| <b>Core Members</b> |     |           |                        |                    |  |                            |
| M. Bhatia           | M   | Professor | BBS <sup>c</sup>       | Tenure             | Full                                     | UG & G                     |
| R. Bishop           | M   | Associate | BBS                    | Tenure             | Full                                     | UG & G                     |
| E. Brown            | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| L. Burrows          | F   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| B. Coombes          | M   | Associate | BBS                    | Tenure             | Full                                     | UG & G                     |
| B. Doble            | M   | Assistant | BBS                    | Special            | Full                                     | UG & G                     |
| A. Guarne           | F   | Associate | BBS                    | Tenure             | Full                                     | UG & G                     |
| R. Gupta            | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| J. Hassell          | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| K. Hope             | F   | Assistant | BBS                    | Special            | Full                                     | UG & G                     |
| M. Junop            | M   | Associate | BBS                    | CAWAR <sup>d</sup> | Full                                     | UG & G                     |
| Y. Li               | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| M. MacDonald        | F   | Associate | BBS                    | Permanent teaching |  | UG                         |
| N. Magarvey         | M   | Assistant | BBS                    | Tenure-track       | Full                                     | UG & G                     |
| J. Ortega           | M   | Associate | BBS                    | CAWAR              | Full                                     | UG & G                     |
| J. Schertzer        | M   | Assistant | BBS                    | Special            | Full                                     | UG & G                     |
| K. Singh            | M   | Assistant | BBS                    | Special            | Full                                     | UG & G                     |
| D. Sloboda          | F   | Associate | BBS                    | CAWAR              | Full                                     | UG & G                     |
| D. Trigatti         | M   | Associate | BBS                    | Tenure             | Full                                     | UG & G                     |
| R. Truant           | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| F. Vulcu            | F   | Assistant | BBS                    | CLA                |  | UG                         |
| G. Wright           | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| D. Yang             | M   | Professor | BBS                    | Tenure             | Full                                     | UG & G                     |
| B. Zhorov           | M   | Professor | BBS                    | CLA                | Full                                     | UG & G                     |
| <b>Emeritus</b>     |     |           |                        |                    |  |                            |
| E. Epand            | M   |           | BBS                    |                    |  |                            |

<sup>a</sup> This is the budget unit paying the salary: department, school, research centre or institute, or other.

<sup>b</sup> UG/G, Undergraduate/Graduate

<sup>c</sup> BBS, Department of Biochemistry and Biomedical Sciences

<sup>d</sup> CAWAR, Continuing Appointment Without Annual Review

**Table 2b:** Faculty members from the DeGroot School of Business who will teach Commerce and Business courses for the BDC program

| Course Taught | Faculty Name     | M/F | Rank      | Home Unit <sup>a</sup> |
|---------------|------------------|-----|-----------|------------------------|
| COMM 2BA3     | T. McAteer       | F   | Associate | DSB <sup>b</sup>       |
| COMM 3MD3     | M. Kacker        | M   | Associate | DSB                    |
| COMM 4AK3     | E. Mohammad      | M   | Associate | DSB                    |
| COMM 4FW3     | To Be Determined |     |           |                        |
| BUSINESS B748 | B. Honig         | M   | Professor | DSB                    |
| BUSINESS B730 | P. Vilks         | M   | Assistant | DSB                    |
| BUSINESS C727 | C. Longo         | M   | Associate | DSB                    |

<sup>a</sup> This is the budget unit paying the salary: department, school, research centre or institute, or other.

<sup>b</sup> DSB, DeGroot School of Business

**Table 3:** List of faculty publications in the Department of Biochemistry and Biomedical Sciences (last 3 years)

| PEER-REVIEWED    | 2010 | 2011 | 2012 |
|------------------|------|------|------|
| Journal articles | 114  | 125  | 109  |
| Book chapters    | 6    | 4    | 8    |

### 7.3 Evidence of adequate resources to sustain the quality of scholarship produced

The resources outlined in section 7.1 will support and sustain the quality of scholarship produced.

## 8. RESOURCES FOR UNDERGRADUATE ~~AND GRADUATE~~ PROGRAMS

### 8.1 Plans for adequate numbers of faculty and staff to achieve program's goals

Please refer to item 8.2 below.

### 8.2 Plans to provide the necessary resources in step with the program's implementation

Since 2004, the Department of Biochemistry and Biomedical Sciences has recruited 13 new faculty members at all ranks (2 Professor; 5 Associate; 6 Assistant) in areas that enhance the quality of our research and teaching offerings. For example, four of these recruits were in the area of stem cell and cancer biology (Bhatia, Hope, Doble, Singh), adding significant new research capacity in this burgeoning area of biology. The Stem Cell and Cancer Research Institute at McMaster has become a leading centre in Canada for attracting the best graduate students and postdoctoral fellows into this area. Five new faculty recruits have added new capacity to an area of existing strength in microbiology and chemical biology (Bishop, Burrows, Coombes, Magarvey, Surette). The Centre for Microbial Chemical Biology

and the Michael G. DeGroot Institute for Infectious Disease Research at McMaster has provided a central hub for these investigators and their trainees to interact and to enhance the quality of the student experience. Further, the Department of Biochemistry and Biomedical Sciences has added significant strength in the area of human metabolism (Schertzer, Sloboda, Steinberg, Szabo).

To support the new BDC program, seven new positions (as discussed in Section 7.1) will be hired/recreated in step with the development of the program and the progression of the undergraduate and graduate programs. Three FTE contractually limited faculty will be hired due to the recent departure of three faculty members. One of these, will be ~~—, one of which will be the Aa—~~ Program Director, hired will be appointed to oversee the program and liaise with industry (0.5 FTE is assigned to the undergraduate program, 0.5 FTE is assigned to the graduate program), ~~the other two FTE faculty will have research specializations in discovery.~~ The additional four new staff positions are as follows: one full-time Program Coordinator (one FTE staff member) will be hired to oversee the administration of the program (0.5 FTE is assigned to the undergraduate program, 0.5 FTE is assigned to support the graduate program), two FTE Administrative Assistants will be hired to provide front-line assistance for the undergraduate and graduate sections of the program and finally, a part-time Laboratory Technician (0.5 FTE) will be hired support the laboratory course (BDC 3C09).

Additional space for the new undergraduate program office will be provided by the Faculty of Health Sciences. Classrooms will be available for formal lectures via the Registrar's office and small learning and teaching spaces for the Level IV groups will be available via the Faculty of Health Sciences Education Services Department. The current undergraduate teaching lab, located on the first floor of the Health Sciences Building, will be utilized to its maximum capacity and another lab (1074 square feet) on the 4th floor has been confirmed by the Director of Education Services in the Faculty of Health Sciences (see Appendix G) for our use as an additional teaching lab space for the BDC program.

In keeping with the University's plan to secure adequate resources to invest in faculty, staff, student services and support, library resources, and space the department is committed to using those resources strategically. The current Student Experience Task Force position paper from the President's Forward with Integrity document (2011) recommends four key goals and recommendations to transform the student experience at McMaster. Goal 3 speaks directly to support: Improve institutional structures that support learning.

### 8.3 Planned/anticipated class size

While our existing Biochemistry programs currently have high rates of retention, and we anticipate a similarly high rate of retention in the BDC program, we plan to admit fifty-five students to level III of the BDC undergraduate program each year in order to achieve a steady-state enrolment of 100 students across levels III and IV of the undergraduate program (50 students in level III, plus 50 students in level IV) while allowing for some attrition at either level. Likewise, we will admit up to 55 graduate students at the Master's level to allow for some attrition.

An intake of 50 (plus 5 to account for possible attrition) is our ideal capacity for the program, but size will be determined by funding from the Ministry of Training, Colleges and Universities and the number of available spots at the Master's level.

Enrolment will be limited during the first few years of the program to ensure adequate placement opportunities in the private sector and government during the internship in the second semester of the Master's program. We will endeavor to build new relationships and develop new partnerships to potentially expand the program in future years, provided that student demand and institutional support grow in measure with the program.

### 8.4 Provision and supervision of experiential learning opportunities

## B.H.Sc. Degree

Experiential learning is an integral component of the program. Several experiential components are described above, including the capstone undergraduate experiential element, the fourth year thesis. Here, the students will spend approximately half of their efforts in fourth year completing a thesis research project in the laboratory under the supervision of a faculty member.

## Master's Degree

The graduate portion of this program incorporates one term of a required unpaid internship where students will receive valuable on-the-job training and mentoring in the business community, while reflecting on these learning experiences in their journal and learning portfolio. In response to the Stakeholders' Workshop that was held in the preliminary stages of the development of this program (described in Section 11.1), attendees from industry (refer to Appendix E for a list of attendees) expressed enthusiastic support for the program and for sponsoring internships. Mirroring the preceptorships of the MD program, internship supervisors will be paid a small stipend/honorarium for supervision of our students in the workplace and will be asked to monitor student learning and performance by adhering to a template that will be used as a guide to report back to the BDC program.

Students will be placed in an internship position through a matching process. Our long term goal is to secure a large number of placements in the future such that employers can interview students as part of the matching process, and such that each party can find a suitable match based on more than one choice. Efforts to secure placement sites have already begun and are on going. It is our objective to provide We will have these letters of support from our industrial partners over the next few months, and these will be provided to Graduate Council compiled in time for the external review of the program.

As discussed in Section 4.1, given the specialized nature of these placements, the BDC internships will not interfere with placements for students in other programs at McMaster (for example, the MBA or eHealth programs) or for placements of nearby universities. If placements are identified where there is overlapping interests for students from other programs or universities, we will work collaboratively with these education programs to identify any such placements, and will then seek out new areas for placing BDC students.

In advance of the placement, at the end of the Fall semester, all program students will take part in an internship orientation which will describe the professional and academic requirements for the internship. The academic requirements include completion of a learning portfolio and that includes entries into a weekly reflective journal to track student learning. Students will record and collect evidence that demonstrates a fulfillment of their individual learning objectives and the Program Learning Outcomes and to form the connection in the manner that their learning experiences are grounded in the literature. Short term and long term goals will be set for the placement, in conjunction with the site supervisor, in the context of project management, report writing and synthesis of textbook knowledge that is put into practice. The contents of the learning portfolio and reflective journal will provide the background and basis for the student presentation at the 'Internship Day Symposium' which will take place on campus during the first month of the Spring term. All students will be required to participate and present on the skills and knowledge that were acquired through the internship, and any key works or projects that were accomplished during their placement. Students will present to an audience composed of partners from industry, University faculty, staff and students.

The student will have a primary site supervisor, but will also be co-supervised by a faculty member from the Department. The co-supervisor will be responsible for assessing and providing feedback on the learning portfolio and weekly reflective journal entries. Midway through the placement, the site

supervisor and student will each receive formative feedback to ensure a positive, healthy and productive learning environment with ample opportunity for communication and feedback. Any issues or concerns from the supervisor or the student will be brought to the attention of the Program Coordinator and Director, and every attempt will be made to arrive to an earnest resolution. At the conclusion of the internship, the co-supervisor will assign a final grade for the course based on the portfolio, ~~reflective~~ journal and feedback from the site supervisor.

## **8.5 Role of adjunct and sessional faculty**

In the Golden Horseshoe and Greater Toronto Area, there exists a tremendous resource of expertise in the pharmaceutical and health research sectors. ~~These individuals represent an untapped group of and~~ thought-leaders for advanced training and mentoring. We ~~aim to establish~~ already have strong ties with this community and will further strengthen these through adjunct departmental appointments.

Individuals who have strong interests in contributing to multidisciplinary education with avant-garde classroom and inquiry learning, as well as internships in the Master's program will be welcome contributors to the BDC program. Any potential recruits for adjunct positions will be vetted through the Tenure and Promotion Committee, and will be judged to qualify for teaching and/or supervising at the undergraduate and/or graduate level. Adjunct faculty appointments will be reviewed every three years.

## **9. RESOURCES FOR GRADUATE PROGRAMS**

### **9.1 Plans for adequate numbers of faculty and staff to achieve program's goals**

As outlined in section 8.2, seven new positions are required to support the new program. Three faculty will be hired, and one of these, will be a Program Director, appointed to oversee the program and liaise with industry (0.5 FTE is assigned to the undergraduate program, 0.5 FTE is assigned to the graduate program). The additional four new staff positions are as follows: one full-time Program Coordinator (one FTE staff member) will be hired to oversee the administration of the program (0.5 FTE is assigned to the undergraduate program, 0.5 FTE is assigned to support the graduate program), two FTE Administrative Assistants will be hired to provide front-line assistance for the undergraduate and graduate sections of the program and finally, a part-time Laboratory Technician (0.5 FTE) will be hired support the laboratory course (BDC 3C09).

All members of the Department are qualified to teach in the undergraduate program, and the majority of members are qualified to teach and supervise graduate students as summarized in Table 2a above in Section 7.2.

### **9.2 Plans to provide the necessary financial assistance for students**

The tuition for the one-year Master of BDC program was set according to a broad survey of similar programs (listed in **Appendix D**). As discussed earlier, the program with the most similarity to the proposed BDC program is the Master of Biotechnology at the University of Toronto Mississauga, and this was the gauge that was used to set the tuition for the BDC program. A comparison of similar programs outside of Canada (also listed in **Appendix D**) demonstrates that the proposed tuition for the BDC program is significantly lower than some of the major comparator programs in the United States.

Master's students of the BDC program will not be funded, receive a stipend but they will be eligible for bursaries. Master's students will also be eligible for BDC entrance scholarships. We have recently received a pledge from industry for \$50,000 in scholarship funding. We will continue to solicit endowments from industry in order to off-set tuition costs for students, should the program be approved.

**9.3 Evidence that faculty research supervisors have ongoing funding, space and relevant research infrastructure to support students in program**

The description of research supervisors' space and research infrastructure has been previously outlined in section 7.1, and funding to faculty Biochemistry faculty members is summarized in Table 4 below.

**Table 4:** Funding awarded to Biochemistry faculty members<sup>a</sup>

|                          | '04/'05 | '05/'06 | '06/'07 | '07/'08 | '08/'09 | '09/'10 | '10/'11 | '11/'12 | '12/'13 |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>CIHR</b>              | 1.801   | 2.689   | 3.119   | 3.235   | 3.571   | 4.107   | 4.300   | 5.184   | 6.457   |
| <b>OTHER<sup>b</sup></b> | 22.284  | 12.039  | 28.527  | 10.336  | 27.477  | 12.357  | 20.874  | 23.262  | 25.603  |

<sup>a</sup> data is in millions of dollars

<sup>b</sup> includes CFI

**9.4 Supervisory load distribution and qualifications**

The Department The availability of faculty who are competent and qualified to teach and supervise in the proposed BDC program are summarized in Table 2a in Section 7.2. Each core faculty member will be required to supervise approximately 4-5 BDC students across the undergraduate and graduate levels. Senior Ph.D. students from the Biochemistry Graduate Program will also ~~provide assistance~~ support the program in roles as ~~through~~ Teaching Assistantships and as second markers for scholarly papers within the allotted TA Hours of Work, ~~etc...~~

**9.5 Evidence of prior experience in graduate teaching and research supervision for faculty**

A listing of faculty supervision is provided in Table 5 (below). Faculty who supervise graduate students teach one graduate course every second year. This teaching is student-evaluated and becomes part of the faculty's teaching dossier.

**Table 5:** Current thesis supervisions by faculty members and student publication output in the Biochemistry Graduate Programs and other Graduate Programs in which all of our affiliated faculty (core, joint and associate members) participate



| Faculty Member     | Completed Degrees   |                 |          | Current Degrees |                |              | Student Publications |
|--------------------|---------------------|-----------------|----------|-----------------|----------------|--------------|----------------------|
|                    | MSc                 | PhD             | MD/PhD   | MSc             | PhD            | MD/PhD       | 2004-2011            |
| Berti, Paul        | 3 (10) <sup>a</sup> | 1               |          | 1 (4)           | 0 (2)          |              | 14                   |
| Bhatia, Mick       | 0 (1)               | 2 (9)           | 1        | 5               | 3              | 1            | 43                   |
| Bishop, Russell    | 1 (2)               | 1               |          | 2               |                |              | 7                    |
| Brown, Eric        | 10                  | 6               |          | 2               | 8              |              | 62                   |
| Burrows, Lori      | 6 (7)               | 2 (5)           |          | 3               | 3              |              | 29                   |
| Coombes, Brian     | 1                   | 1 (2)           |          | 2               | 6              |              | 24                   |
| Doble, Bradley     | 1                   |                 |          | 2               |                |              | 1                    |
| Draper, Jonathan   | 1                   |                 |          | 1               |                |              | 0                    |
| Eband, Richard     | 4                   | 5               |          | 1               | 0              |              | 73                   |
| Fradin, Cecile     | 0 (3)               | 1 (5)           |          | 1 (5)           | 1              |              | 4                    |
| Gilberger, Timothy | 0 (16)              | 0 (7)           |          |                 | 1 (4)          |              | 0                    |
| Guarne, Alba       | 4                   | 1               |          | 2               | 2              |              | 11                   |
| Gupta, Radhey      | 15                  | 8               |          | 2               | 1              |              | 34                   |
| Hassell, John      | 3                   | 1               |          | 1               | 1              |              | 10                   |
| Hope, Kristin      |                     |                 |          |                 | 1              |              | 0                    |
| Junop, Murray      | 4                   | 3               |          | 6               | 3              |              | 26                   |
| Larche, Mark       | 0 (5)               | 0 (5)           |          | 1 (1)           | 0 (3)          | 1            | 1                    |
| Li, Yingfu         | 9 (11)              | 3 (6)           |          | 5               | 4 (5)          |              | 57                   |
| Magarvey, Nathan   |                     |                 |          | 1 (2)           | 1 (3)          |              | 1                    |
| Mossman, Karen     | 1 (2)               | 2 (4)           |          |                 | 1 (2)          |              | 14                   |
| Nodwell, Justin    | 4                   | 6               |          | 4               | 3              |              | 14                   |
| Ortega, Joaquin    | 2                   | 2               |          | 4               | 1              |              | 13                   |
| Singh, Sheila      | 1                   | 0               |          | 2               | 0              |              | 5                    |
| Surette, Michael   | 0 (3)               | 0 (7)           |          | 4               | 1 (4)          |              | 0                    |
| Trigatti, Bernardo | 5                   | 2               |          | 1               | 3              |              | 8                    |
| Truant, Ray        | 5                   | 1               |          | 3               | 4              |              | 28                   |
| Weitz, Jeffrey     | 2 (13)              | 1 (6)           |          | 0 (2)           | 2              | 1 (2)        | 4                    |
| Werstuck, Geoff    | 4 (5)               | 1               |          | 1               | 2 (5)          |              | 9                    |
| Wright, Gerard     | 10 (13)             | 12 (14)         |          | 3 (4)           | 3              | 1            | 77                   |
| Yang, Daniel       |                     | 6               |          |                 |                |              | 21                   |
|                    | 7 (9)               | 4 (7)           |          |                 |                |              | 30                   |
| <b>TOTALS</b>      | <b>117 (176)</b>    | <b>82 (161)</b> | <b>1</b> | <b>64 (88)</b>  | <b>60 (88)</b> | <b>4 (6)</b> | <b>655</b>           |

<sup>a</sup> For Faculty members who are involved in more than one graduate program, the number of students supervised in the Biochemistry Graduate Program is given, and in parentheses, the total number of students supervised in all graduate programs.

## 109. QUALITY AND OTHER INDICATORS

### **109.1 Definition and use of indicators that provide evidence of quality of the faculty**

Faculty members are assessed based on their research performance through the quality of publications, research funding, supervision of graduate and undergraduate students, teaching evaluations and administrative service to the university or community.

i) **Faculty Operating Grants** – In 2011, the faculty members in the Department of Biochemistry and Biomedical Sciences held 33 CIHR operating grants and 104 total operating grants for an average per investigator of \$288,032 from CIHR and \$728,378 from all sources. From 2004 to the present, CIHR funding awarded to department faculty has increased by 234%. Grants awarded in 2011/12 total \$16.6 million.

ii) **Faculty Awards and Honours** – Eleven core members of the Department of Biochemistry and Biomedical Sciences are current or past holders (last 5 years) of Canada Research Chairs (Tier 1: Andrews, Bhatia, Surette, Wright; Tier 2: Brown, Coombes, Doble, Draper, Fradin, Li, Steinberg), and two Associate Members are CRC holders (Brennan, Singh). Together, our CRC holders supervise 48 graduate students in our program, representing 40% of our total student body (average 4.5 students per CRC holder). These numbers reflect a strong commitment to the health and vitality of the training environment. Several prestigious personal honours have been bestowed on our faculty over the past 6 years that recognize the prominence and influence of our program mentors in their areas of science. These include 5 CIHR New Investigators Awards (Burrows, Coombes, Guarné, Magarvey, Ortega); the Killam Prize (Wright); the Canadian Society of Molecular Biosciences New Investigator Award (Brown, Bhatia); the W.A.E. McBryde Medal (Li); the CSM Murray Award for Career Achievement in Microbiology (Brown); Canada Top 40 Under 40 (Bhatia, Coombes); the Fisher Scientific Award for outstanding career achievement by a junior investigator (Coombes); and Fellow of the Royal Society of Canada (Wright). In addition, two of our newest faculty members received a Tier II CRC (Sloboda) and a Canadian Diabetes Career Award (Schertzer).

The DeGroote School of Business is fortunate to have recently recruited two world-renowned Research Chairs in the Finance and Business Economics Area: Dr. John Maheu, Professor and BMO Financial Group Chair in Capital Markets – Financial Literacy and the Individual Investor, and Dr. Ronald Balvers, Professor and Michael Lee-Chin & Family Chair in Investment and Portfolio Management. In addition, Dr. Jiaping Qiu was appointed the CIBC Chair in Financial Markets.

Dr. Manish Kacker, a key instructor in the program, holds the Michael Lee-Chin & Family Professor in Strategic Business Studies. His research interests, especially of significance to the BDC students, address managerial problems in the domains of marketing channels, marketing strategy and entrepreneurship.

### **109.2 Evidence of a program structure and faculty research that will ensure the intellectual quality of the student experience**

#### **Faculty enhancement and renewal**

Since 2004, the Department of Biochemistry and Biomedical Sciences recruited 13 new faculty members at all ranks (2 Professor; 5 Associate; 6 Assistant) in areas that enhance the quality of our research offerings. For example, four of these recruits were in the area of stem cell and cancer biology (Bhatia, Hope, Doble, Singh), adding significant new research capacity in this burgeoning area of biology. The Stem Cell and Cancer Research Institute at McMaster has become a leading centre in Canada for attracting the best graduate students and postdoctoral fellows into this area. Five new faculty recruits have added new capacity to an area of existing strength in microbiology and chemical biology (Bishop, Burrows, Coombes, Magarvey, Surette). The Centre for Microbial Chemical Biology and the Michael G. DeGroote Institute for

Infectious Disease Research at McMaster has provided a central hub for these investigators and their trainees to interact and to enhance the quality of the student experience. The IIDR holds an annual Trainee Day where the research accomplishments of graduate students and postdoctoral fellows working in IIDR laboratories are showcased. The appeal of these new faculty recruits and their research foci is evidenced by the 33 new graduate students they currently supervise in the Biochemistry graduate program.

### **Graduate research and supervision**

The tremendous record of success by our **Biochemistry** graduate students in funding competitions and their research output suggest that we enjoy a healthy culture of student mentorship in our graduate programs as well. In addition, members of our faculty are heavily engaged in the quality of graduate training through active participation on graduate supervisory committees for other students. Most of our faculty serve on 2-3 supervisory committees for every one of their own students. This is an ongoing and active commitment, since these committees meet every 6 months (for M.Sc.) or annually (for Ph.D.) for a 2-hour face-to-face meeting where feedback on the student's research progress and their written report is discussed. In exit surveys for doctoral students from 2008-2011, students graded the overall accessibility of their committee members and the guidance they provided as 8 of out 10 (exceeded expectations).

### **Undergraduate research and supervision**

Here the record of the existing Biochemistry undergraduate program is instructive. In the past five years, there has been a movement by students toward integrating research experience into the curriculum. We have added three more research courses to our existing Biochemistry programs, and they have been subscribed to increasingly over the last two years. With the growth in our department faculty complement, we have been able to accommodate every student in our program who sought out a third year 6-unit research project or a fourth year 12-unit thesis. Indeed, there is an excess of capacity in these research laboratories and a strong appetite to mentor young scientists.

Each year, nearly 50% of the incoming class of Master's level students originated from our undergraduate Biochemistry program. This is a testament to the quality of leadership and mentorship that students experience in our undergraduate program.

### **Facilities and services**

Furthermore, the research infrastructure within the department allows for student access and exposure to high-end, state-of-the-art research facilities such as the Biophotonics facility, High Throughput Screening facility, and state-of-the-art NMR, Mass Spectrometry and DNA sequencing services, successfully merging our research and teaching activities.

## **110. CONSULTATION PROCESS**

### **110.1 Description of the consultation process undertaken during the development of the proposal**

Discussions have been on-going for the past three years among the leadership of Biochemistry and Biomedical Sciences and of the DeGroot School of Business on the possibilities of a new multidisciplinary program that would integrate commerce and biomedical sciences. We have consulted informally with students and graduates during the same time period.

The program was formally proposed at a Departmental meeting in March of 2011, and in October of 2011, the Department organized a one-day workshop inviting participants from the community, industry and academe. Also in attendance were alumni from our Biochemistry programs. This workshop was put on with the help of a professional facilitator with strong credentials in education with the expressed purpose of establishing well-informed goals for the BDC program. The list of attendees is provided in **Appendix E**. The results of the workshop were presented to the faculty at a Departmental meeting later in October. The Department members unanimously approved to pursue the

development of this program.

| Following the workshop, an ad-hoc Program Development -Committee -was struck and met bi- weekly from January through May 2012 to assemble a potential framework for the new program. Members of the ad-hoc committee are provided in **Appendix F**.

| On June 5, 2012, the Department held a departmental- retreat to discuss the framework. The members were extremely enthusiastic about this initiative and unanimously (informally) approved of the framework.

On September 5, 2012 the Department unanimously approved the new program proposal.

This program proposal was prepared in consultation and in collaboration with the DeGroote School of Business.

## Appendix A

### Summary of the association of program learning outcomes with undergraduate degree level expectations

| Program Learning Outcomes* | Degree Level Expectations | Teaching and Learning Activities   | Evidence/Assessments   |
|----------------------------|---------------------------|--|--|
| 1                          | 1a,1b, 3b                 | <ul style="list-style-type: none"> <li>BDC 3A03 (ROAD TO BIOMEDICAL DISCOVERY)</li> <li>BDC 3B06 (DRUG DISCOVERY AND DEVELOPMENT)</li> <li>BDC 3C09 (RESEARCH SKILLS LABORATORY AND INQUIRY)</li> <li>BDC 4A15 (SENIOR RESEARCH THESIS)</li> <li>COMMERCE 3MD3 (INTRODUCTION TO CONTEMPORARY APPLIED MARKETING)</li> </ul> | <ul style="list-style-type: none"> <li>Assignments</li> <li>Projects</li> <li>Laboratory experiments</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests/exams</li> </ul> |
| 2                          | 1, 2, 3, 4, 5, 6          | <ul style="list-style-type: none"> <li>BDC 3A03 (ROAD TO BIOMEDICAL DISCOVERY)</li> <li>BDC 3B06 (DRUG DISCOVERY AND DEVELOPMENT)</li> </ul>   | <ul style="list-style-type: none"> <li>Assignments</li> <li>Projects</li> <li>Laboratory experiments</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests/exams</li> </ul> |
| 3                          | 2a, 5                     | <ul style="list-style-type: none"> <li>BDC 3C09 (RESEARCH SKILLS LABORATORY AND INQUIRY)</li> <li>BDC 4A15 (SENIOR RESEARCH THESIS)</li> <li>COMMERCE 3MD3 (INTRODUCTION TO CONTEMPORARY APPLIED MARKETING)</li> </ul>   | <ul style="list-style-type: none"> <li>Assignments</li> <li>Laboratory experiments</li> <li>Thesis</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests/exams</li> </ul>   |
| 4                          | 1, 2a, 2b, 3, 4, 5        | <ul style="list-style-type: none"> <li>BDC 3A03 (ROAD TO BIOMEDICAL DISCOVERY)</li> <li>BDC 3B06 (DRUG DISCOVERY AND DEVELOPMENT)</li> <li>BDC 4A15 (SENIOR RESEARCH THESIS)</li> </ul>  | <ul style="list-style-type: none"> <li>Projects</li> <li>Laboratory experiments</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests/exams</li> </ul>                      |

|   |            |   |   |
|---|------------|---|---|
| 5 | 4          | <ul style="list-style-type: none"> <li>• BDC 3B06 (DRUG DISCOVERY AND DEVELOPMENT)</li> <li>• BDC 3C09 (RESEARCH SKILLS LABORATORY AND INQUIRY)</li> <li>• BDC 4A15 (SENIOR RESEARCH THESIS)</li> </ul> | <ul style="list-style-type: none"> <li>• Projects</li> <li>• Laboratory experiments</li> <li>• Thesis</li> <li>• Symposium</li> <li>• Portfolios (across the program)</li> <li>• Tests/exams</li> </ul> |
| 6 | 6a, 6b, 63 | <ul style="list-style-type: none"> <li>• BDC 3B06 (DRUG DISCOVERY AND DEVELOPMENT)</li> </ul>   | <ul style="list-style-type: none"> <li>• Assignments</li> <li>• Projects</li> </ul>   |
|   |            | <ul style="list-style-type: none"> <li>• COMMERCE 2BA3 (ORGANIZATIONAL BEHAVIOUR)</li> </ul>  | <ul style="list-style-type: none"> <li>• Symposium</li> <li>• Portfolios (across the program)</li> </ul>  |
| 7 | 1, 2, 3, 6 | <ul style="list-style-type: none"> <li>• BDC 4A15 (SENIOR RESEARCH THESIS)</li> </ul>   | <ul style="list-style-type: none"> <li>• Laboratory experiments</li> <li>• Thesis</li> <li>• Symposium</li> <li>• Portfolios (across the program)</li> </ul>  |
| 8 | 6          | <ul style="list-style-type: none"> <li>• BDC 4A15 (SENIOR RESEARCH THESIS)</li> </ul>   | <ul style="list-style-type: none"> <li>• Laboratory experiments</li> <li>• Thesis</li> <li>• Symposium</li> <li>• Portfolios (across the program)</li> </ul>  |

\*Program Learning Outcomes for B.H.Sc. Degree:

1. Apply their basic knowledge of the process of drug development, manufacturing and marketing to function effectively in the biotechnology, pharmaceutical and other biomedical science sectors of the economy.
2. Contribute to research and development of new commercial products and pharmaceutical therapies using their understanding of drug targets, diseases, protein/gene structure and function.
3. Undertake laboratory research using sound research practices and methodologies.
4. Critically analyze the primary literature, case studies, and theory to propose innovative solutions to scientific and business problems.
5. Communicate clearly, both verbally and in writing, utilizing various formats to benefit both academia and industry.
6. Function as effective collaborative team members in a variety of roles in cross-disciplinary teams.
7. Apply knowledge of commercial development and biomedical research in experiential learning opportunities within industry and academia.
8. Pursue career and lifelong learning opportunities in biomedical discovery.

## Appendix B

### Summary of the association of program learning outcomes with graduate degree level expectations

| Program Learning Outcomes* | Degree Level Expectations | Teaching and Learning Activities  | Evidence/Assessments  |
|----------------------------|---------------------------|---|---|
| 1                          | 1, 2                      | <ul style="list-style-type: none"> <li>BDC 701 (TEAM PROJECT)</li> <li>BUSINESS B730 (STRATEGIC MANAGEMENT OF TECHNOLOGY)</li> <li>BUSINESS C727 (PHARMA/BIOTECH BUSINESS ISSUES)</li> </ul>  | <ul style="list-style-type: none"> <li>Assignments</li> <li>Projects</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests</li> </ul>                  |
| 2                          | 4                         | <ul style="list-style-type: none"> <li>BDC 701 (TEAM PROJECT)</li> <li>BUSINESS B730 (STRATEGIC MANAGEMENT OF TECHNOLOGY)</li> </ul>  | <ul style="list-style-type: none"> <li>Assignments</li> <li>Projects</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests</li> </ul>                  |
| 3                          | 2, 3, 6                   | <ul style="list-style-type: none"> <li>BDC 702 (COMMUNITY INTERNSHIP)</li> <li>BDC 701 (TEAM PROJECT)</li> <li>BUSINESS C727 (PHARMA/BIOTECH BUSINESS ISSUES)</li> </ul>  | <ul style="list-style-type: none"> <li>Assignments</li> <li>Projects (team and internship)</li> <li>Symposium</li> <li>Portfolios (across the program)</li> </ul>           |
| 4                          | 5                         | <ul style="list-style-type: none"> <li>BDC 702 (COMMUNITY INTERNSHIP)</li> <li>BDC 701 (TEAM PROJECT)</li> <li>BUSINESS B748 (MULTIDISCIPLINARY ENTREPRENEURSHIP FROM A DIVERSE UNIVERSITY BASE)</li> </ul>   | <ul style="list-style-type: none"> <li>Projects</li> <li>Symposium</li> <li>Portfolios (across the program)</li> </ul>  |
| 5                          | 1, 2, 4, 6                | <ul style="list-style-type: none"> <li>BDC 702 (COMMUNITY INTERNSHIP)</li> <li>BDC 701 (TEAM PROJECT)</li> <li>BUSINESS B748 (MULTIDISCIPLINARY ENTREPRENEURSHIP FROM A DIVERSE UNIVERSITY BASE)</li> <li>BUSINESS B730 (STRATEGIC MANAGEMENT OF TECHNOLOGY)</li> <li>BUSINESS C727 (PHARMA/BIOTECH BUSINESS ISSUES)</li> </ul> | <ul style="list-style-type: none"> <li>Projects (team and internship)</li> <li>Thesis</li> <li>Symposium</li> <li>Portfolios (across the program)</li> <li>Tests</li> </ul> |

|   |   |  |   |
|---|---|--|---|
| 6 | 4 | <ul style="list-style-type: none"> <li>• BDC 702 (COMMUNITY INTERNSHIP)</li> <li>• BDC 701 (TEAM PROJECT)</li> <li>• BUSINESS B748 (MULTIDISCIPLINARY ENTREPRENEURSHIP <del>FROM A DIVERSE UNIVERSITY BASE</del>)</li> </ul> | <ul style="list-style-type: none"> <li>• Assignments</li> <li>• Projects (team and internship)</li> </ul> |
|---|---|--|---|

\*Program Learning Outcomes for ~~Master's~~ Degree:

1. Integrate theoretical concepts and synthesize knowledge from various disciplines to develop an original commercial product for the market.
2. Manage a research project, set goals and priorities within a team.
3. Analyze data, make critical interpretations and place these findings into context with the published scientific literature in the development of a new product.
4. Communicate clearly and lead effectively to maximize potential opportunities within and outside of academia.
5. Undertake biomedical discovery while being mindful of its scientific, commercial, ethical, political and social contexts and implications.
6. Demonstrate evidence of entrepreneurial and leadership skills.



## Appendix C

### Course descriptions for the BDC program

#### I. New BDC courses

##### **BDC 3A03 ROAD TO BIOMEDICAL DISCOVERY**

The course will review examples of work in basic biochemistry that have paved the way to breakthroughs in drug discovery. Starting from a seminal paper, we will review the biophysical and physical chemistry concepts underlying the research and discuss how the initial scientific hypothesis evolved and how the process of discovery research eventually led to the discovery of a new drug. Through the structures and mechanistic studies of essential biomolecules, such as the ribosome or ion channels, we will study the fundamental principles that govern protein and nucleic acid folding, drive enzyme catalysis or enhance biomolecular interactions. Basic principles will be taught from current literature.

Three lectures; one term

Prerequisite(s): Registration in level III of the Biomedical Discovery and Commercialization program

Course capacity: 55 Categories: NIL

##### **BDC 3B06 DRUG DISCOVERY AND DEVELOPMENT**

Selected topics on genomics, proteomics and bioinformatics illustrating the modern application of molecular biology and biochemistry to pharmaceutical and other research.

Three lectures; two terms

Prerequisite(s): Registration in level III of the Biomedical Discovery and Commercialization program

Course capacity: 55 Categories: NIL

##### **BDC 3C09 RESEARCH SKILLS LABORATORY AND INQUIRY**

A laboratory-based inquiry course where students learn and apply current techniques used in drug discovery. The course will integrate the scientific principles and methods being taught concurrently in BDC 3A03 and BDC 3B06.

One lecture or workshop (two hours), one lab (four hours); two terms

Prerequisite(s): Registration in level III of the Biomedical Discovery and Commercialization program

Course capacity: 55 Categories: NIL

##### **BDC 4A15 SENIOR RESEARCH THESIS**

A thesis based on a major research project supervised by a member or associate member of the Department of Biochemistry and Biomedical Sciences. The results will also be presented to the department in a seminar or as part of a poster session.

Six workshops (three hours); two terms

Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program

Course capacity: 55 Categories: NIL

##### **BDC 4B03 CURRENT TOPICS IN BIOMEDICAL DISCOVERY AND COMMERCIALIZATION**

Students will examine two current topics in biomedical discovery and commercialization. Students must sign up for two topics from a list of available modules on a first-come, first-served basis. This course may be repeated with different topics.

Seminar and discussions (three hours, six weeks per topic); one term

Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program

Course capacity: 55      Categories: NIL

**Module A:      BACTERIAL MACHINES**

Bacteria are incredibly complex organisms that occupy every niche on our planet and perhaps even beyond. They interact with their environment and each other using sophisticated molecular machines to communicate, to move around, to wage war against competitors and to obtain the nutrients they need to replicate and survive. This module will discuss the mechanisms that bacteria have developed to interact with their world and what we can learn from studying them. Seminar and discussions (three hours); one term

Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program

Module capacity: 5      Categories: NIL

**Module B:      EARLY LIFE ORIGINS OF DISEASE RISK**

The increase in the prevalence of obesity in recent decades has been more rapid than can be explained purely by genetic susceptibility or diet, which suggests that other factors are contributing to the current epidemic. There is now a large body of evidence demonstrating that adverse events that occur during early development, such as poor maternal nutrition or stress, can have long-term effects on the offspring and increase their risk of disease in adulthood. The developmental origins of health and disease paradigm proposes that early-life environmental conditions mitigate fetal adaptations and influence long-term individual disease risk. Herein, the organism capitalizes on a critical, but temporary, period of plasticity early in life during which it makes developmental adaptations; changes that have long-term sustained effects on physiological processes that lead to increased disease risk later in life. Despite the evidence from human and animal studies, the underlying mechanisms by which early life adversity influences the long-term disease risk in offspring are poorly defined.

Seminar and discussions (three hours); one term

Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program

Module capacity: 5      Categories: NIL

**Module C:      ADVANCED MOLECULAR DIAGNOSTIC TECHNOLOGIES**

This module will discuss biochemical basis of prevailing molecular diagnostic practices that explore either proteins or nucleic acids as molecular recognition elements. Several emerging diagnostic technologies that take advantage of advances made in the field, such as nanotechnology or molecular evolution, will also be reviewed.

Seminar and discussions (three hours); one term

Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program

Module capacity: 5      Categories: NIL

**Module D:      IMMUNOMETABOLISM**

The field of immunometabolism has emerged in order to integrate and understand the intricate links between immune and metabolic systems. This is particularly relevant to nutrition and metabolic disease since inflammation has emerged as a critical link between obesity and chronic diseases, such as diabetes. Understanding mutual pathogen and nutrient sensing systems and the relationship between the food we eat and the bacteria that surround us are key issues that can help to unravel immunometabolism problems. In particular, this research is interested in how obesity causes inflammation and how inflammation causes insulin resistance leading to diabetes?



Seminar and discussions (three hours); one term  
Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program  
Module capacity: 5      Categories: NIL

**Module E:      FROM LAPTOP TO BENCHTOP I**

The search for new drugs to combat the war against drug-resistance has reached an all-time high. With the development of high-throughput screening technologies and multiple compound and drug libraries at our fingertips we must now turn to novel methods for identifying the “diamond in the rough”: the perfect inhibitor/drug for our specific purpose. Students will utilize a virtual drug screening procedure for different target proteins with the use of online virtual screening labs like Dock Blaster to test a virtual library of compounds/drugs against the active site of the target protein structure. Students will analyze the “hits” using targeting criteria discussed in the course. Seminar, discussions, virtual lab (three hours); one term  
Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program  
Module capacity: 5      Categories: NIL

**Module F:      FROM LAPTOP TO BENCHTOP II**

Students will test the findings from the virtual screening experiment in the previous course using biochemical assays. Students will publish their results in their own Undergraduate Scientific Journal which would be coordinated by the students themselves with guidance from graduate student mentors.  
Seminar, discussions, lab (three hours); one term  
Prerequisite(s): Module F  
Module capacity: 5      Categories: NIL

**Module G:      BIOMEDICAL SCIENCES AND SOCIETY**

This course will investigate the social, political, cultural, environmental and ethical impacts of biomedical research.  
Seminar and discussions (three hours); one term  
Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program  
Module capacity: 5      Categories: NIL

**Module H:      ENERGY METABOLISM AND LINKS TO DIABETES**

This course will examine energy metabolism in humans and how diet can affect the regulation of glucose metabolism, leading to type II diabetes.  
Seminar and discussions (three hours); one term  
Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program  
Module capacity: 5      Categories: NIL

**Module I:      NEURODEGENERATION AND PROTEIN FOLDING**

Over half of people over 65 will be at risk for some form of neurodegenerative disease. The future challenge to human medicine will likely be as great as cancer. Most neurodegenerative diseases like Alzheimer's disease and Parkinson's disease have no known causes, but for a small group of individuals, there are defined genetic components. Rarer neurodegenerative diseases like Huntington's disease have one well defined genetic cause, giving researchers a huge advantage to try and uncover the precise mechanism of disease. In all neurodegeneration, one commonality that has been defined is at the level of protein misfolding, and recently, this misfolding has been seen to impact the cell cytoskeleton, which increases as a function of age. The role of stress in the

ageing brain, the cell cytoskeleton and the misfolding of proteins in diseases will be reviewed.  
Seminar and discussions (three hours); one term  
Prerequisite(s): Registration in level IV of the Biomedical Discovery and Commercialization program  
Module capacity: 5      Categories: NIL

Additional 6-week modules will be offered each year by contributing adjunct faculty from industry. Topics could include intellectual property, quality control and assurance, clinical trials, research ethics, regulatory affairs, public health, careers in the biomedical industry, etc...

## **BDC 701    TEAM PROJECT**

### **Course overview:**

Students will work in small teams leveraging their training and developing career interests to develop new biotechnology in a discovery research laboratory or to create business plans and an entrepreneurial pitch for a new venture in biomedicine. ~~Indeed, we see s~~Students will self-identify ~~ing~~ for one of these two kinds of 'Team Project' experiences. This first will be fashioned after iGEM, a yearly world-wide competition known as International Genetically Engineered Machine, where teams of university students are charged with creating simple biological machines from iGEM's Registry of Standard Biological Parts. The ~~second~~ alternative project will be a team effort toward an entrepreneurial pitch for a new venture in biomedicine that encompasses cutting edge science and sound business strategy and will culminate in a presentation to members of the local venture community. The presentation will be akin to the popular television series 'Dragon's Den', and will include submission of a written business plan. Students will work as part of a team to manage ~~at their biochemistry~~ biomedical science-based project -from conception to completion, including design, manufacturing, quality control, marketing, etc., in the delivery and sale of the final manufactured commercial product ~~with biomedical implications~~. Students will generate ~~a business plan and set~~ short term and long term goals in order to meet ~~all of~~ the program learning outcomes.

This course will test and assess the following graduate degree level ~~e~~expectations:

- (i) Depth and breadth of knowledge. This course will require a systematic understanding of knowledge relevant to discovery research and business.
- (ii) Research and Scholarship. Students will acquire conceptual and methodological competence of established techniques in business and biomedical discovery. Both Team Project streams will allow students to demonstrate creativity and originality in the application of knowledge.
- (iii) Level and Application of Knowledge. Students must show competence in the research and development process by using and applying existing knowledge to the critical analysis of a new problem in a new setting.
- (iv) Professional Capacity and Autonomy. The Team Project requires strong group work skills with an emphasis on personal responsibility, initiative, accountability. Decision making processes will figure prominently in the Team Project .
- (v) Level of Communication Skills. The Team Project will assess the ability of individuals and teams to express their views in writing and verbally, take a position and defend an argument and clearly communicate their process and approach to problem solving. .

### **Assessment:**

This course will be evaluated and assessed by a faculty member who is qualified to teach and supervise graduate students, with feedback and input from other affiliated or adjunct faculty who are also experts in the field.

### **Course information:**

Seminars and discussions (9 hours); term 1 (full course)  
Prerequisite(s): Registration in the Biomedical Discovery and Commercialization Master's program  
Course capacity: 55      Categories: NIL

## **BDC 702 COMMUNITY INTERNSHIP**

### **Course overview:**

This internship provides students with the opportunity to explore career options and integrate academics through an experiential placement ~~irrelated to the pharmaceutical or biotechnology industry, with the government or in the community. Students will record a weekly reflective journal and communicate their experience to their colleagues and the department during an “Internship Day” symposium to be held on campus at the beginning of the following term.~~

Students will be placed in an internship position through a matching process.

Assessment: In advance of the placement, at the end of the Fall semester, all program students will be required to take part in an internship orientation which will describe the professional and academic requirements for the internship. The academic requirements include completion of a learning portfolio and a weekly journal to track student learning. Students will record and collect evidence that demonstrates a fulfillment of their individual learning objectives and the Program Learning Outcomes and to form the connection in the manner that their learning experiences are grounded in the literature. Short term and long term goals will be set for the placement, in conjunction with the site supervisor, in the context of project management, report writing and synthesis of textbook knowledge that is put into practice. The contents of the learning portfolio and journal will provide the background and basis for the student presentation at the ‘Internship Day Symposium’ which will take place on campus during the first month of the Spring term. All students will be required to participate and present on the skills and knowledge that were acquired through the internship, and any key works or projects that were accomplished during their placement. Students will present to an audience composed of partners from industry, University faculty, staff and students.

### **Supervision:**

The student will have a primary site supervisor, but will also be ~~co~~-supervised by a faculty member from the Department (designated as the supervisor) listed in Table 2. The ~~co~~-supervisor will be responsible for assessing and providing feedback on the learning portfolio and weekly journal entries. Midway through the placement, the site supervisor and student will each receive formative feedback from the supervisor to ensure a positive, healthy and productive learning environment with ample opportunity for communication and feedback. Any issues or concerns from the ~~co~~-supervisor or the student will be brought to the attention of the Program Coordinator and Director, and every attempt will be made to arrive to an earnest resolution. At the conclusion of the internship, the ~~co~~-supervisor will assign a final grade for the course based on the portfolio, reflective journal and recommendations ~~feedback~~ from the site supervisor.

This course will test and assess the following primary graduate degree level expectations:

- (i) Research and Scholarship. Students will acquire conceptual and methodological competence of established techniques in business and biomedical discovery. The written materials produced during the course of the internship will be used, in part, to assess the level of competence obtained.
- (ii) Level and Application of Knowledge. Students will be challenged to think critically in a new setting, apply their existing knowledge from undergraduate study to the critical analysis of new problems and issues in the business world. The experiential learning that will take place during the internship placement will enhance and strengthen the learning acquired during the undergraduate curriculum.
- (iii) Professional Capacity and Autonomy. The internship placement will build on the student’s professional and transferable skillset, including, but not limited to, the exercise of initiative, creativity, personal responsibility, decision making and accountability. Students will enhance their capacity for intellectual independence required for long-term professional development.
- (iv) Level of Communication Skills. Students will be challenged to communicate clearly to a range of stakeholders in the community in areas related to ideas, approaches to problem solving, conclusions and next steps.

### **Course information:**

Students will complete 13-15 weeks of placement work through the duration of the experience.

Term 2 (full course)

Prerequisite(s): Registration in the Biomedical Discovery and Commercialization Master’s program

Course capacity: 55    Categories: NIL

### **BDC 703    SCHOLARLY PAPER**

#### **Course overview:**

The culminating task of the scholarly paper will synthesize the knowledge, skills and attitudes acquired throughout the course of study and community internship. To be completed in the final semester of study (Spring/Summer). The purpose of the scholarly paper is for students in the Master's program to integrate the theoretical constructs from the coursework (BDC courses and BUSINESS courses) with experiential learning opportunities obtained through the community internship (BDC 702). Upon completion of the first two semesters of the Master's program, each student will have obtained an individual learning experience that is unique to them. The specific product conceived, produced and marketed through the Team Project in combination with the specific nature of their community internship placement (for example, discovery research, marketing ~~vs~~ or- clinical trials) will provide an opportunity for creative exploration of Biomedical Research and Commercialization. Students will select a topic for their scholarly paper in consultation with their Scholarly Paper Supervisor who will be a faculty member affiliated with the BDC program.

#### **Supervision:**

At the beginning of the term, a 'matching process' will couple students with a supervisor that will best be able to mentor the student on their selected topic through the completion of the scholarly paper.

This course will test and assess the following primary graduate degree level expectations:

- (i) Depth and Bread of Knowledge. The scholarly paper will test and assess the student's systematic understanding of a body of knowledge, including where appropriate, their learning from individual internship experiences and professional practice. Students will acquire conceptual and methodological competence of established techniques in business and biomedical discovery.
- (ii) Research and Scholarship. Students must demonstrate their ability to critically evaluate current research and integrate this with their working professional experiences.
- (iii) Level and Application of Knowledge. Students will demonstrate competence in the research process by applying their existing experience and knowledge to the critical analysis and synthesis of a new specific problem or question.
- (iv) Level of Communication Skills. Students will be challenged to communicate ideas, issues and conclusions clearly in writing in a manner that is receptive to a range of audiences in the discovery research and business communities.
- (v) Awareness and Limits of Knowledge. The scholarly paper provides the opportunity to evaluate the student's awareness of knowledge complexity, potential alternative interpretations, methods and approaches.

#### **Assessment:**

The scholarly paper requires a systematic understanding and synthesis of the student's experiential and in-course learning to meet graduate degree level expectations. Students may begin preparation of the scholarly paper during the course of their internship, gathering resources and primary research papers that integrate their specific Team Project outcomes with their work placement experience. Students will be expected to draw from the primary literature, and ground their thesis and experiences on established principles and theories from Biomedical Sciences and Business. The scholarly paper must ~~also~~ meet the minimum requirements set out in the Scholarly Paper Guidelines that will be prepared for the BDC program. While it is not required, the scholarly paper may be submitted for publication to an appropriate journal.

#### **Course information:**

One term (full course)

Prerequisite(s): Registration in the Biomedical Discovery and Commercialization Master's program

Course capacity: 55    Categories: NIL

## II. New Commerce course

### COMMERCE 3MD3 INTRODUCTION TO CONTEMPORARY APPLIED MARKETING

The course is oriented for advanced undergraduate (3<sup>rd</sup> or 4<sup>th</sup> year) or graduate students (e.g. M.Sc.) in programs which require training in Marketing but who have no previous background in Commerce. The students of such programs are expected to be joining the workforce as technical managers and/or entrepreneurs in the general domain of their core disciplines. The purpose of the course is to provide the students a high level overview of contemporary Marketing concepts and a hands-on experiential component leading up to a Marketing Plan.

Prerequisite(s): Registration in level III or IV of an Honours program. Not open to students registered in any Commerce, or Honours Business Informatics, or Engineering & Management program; or the Minor in Finance.

## III. Existing Commerce/Business courses

### COMMERCE 2BA3 ORGANIZATIONAL BEHAVIOUR

The central objective of this course is to develop an understanding of human behaviour in organizations with a view toward effective management of such behaviour.

Prerequisite(s): Registration in any Commerce, Engineering and Management, Honours Business Informatics, Labour Studies or four or five-level non-Commerce program. Antirequisite(s): KINESIOL 3L03

### COMMERCE 4AK3 ACCOUNTING INFORMATION FOR DECISION MAKING

This course covers the basic principles in financial and managerial accounting as well as the use of accounting information in decision making. In the financial accounting part of the course, the course covers the conceptual framework of accounting, Generally Accepted Accounting Principles, financial statements, and financial statement analysis. In the managerial accounting part of the course, the course covers cost behaviour, cost-volume-profit relationships, budgeting, and the use of cost information in decision making.

Prerequisite(s): Registration in Level III or above of a non-Commerce program. Not open to students registered in any Commerce, Honours Business Informatics, or Engineering and Management program.

### COMMERCE 4FW3 FINANCE FOR ENTREPRENEURS

This course is intended for students who wish to enhance their skills and knowledge in those areas of business that lead to successful entrepreneurship and/or small business management. The focus will be on those financial issues and decisions of particular concern to sole proprietors, partnerships, family-owned businesses and small non-public corporations. This will include the financial aspects of the relationship between the firm and its owners.

Prerequisite(s): Students in a 3<sup>rd</sup> or 4<sup>th</sup> year non-Commerce program. Not open to students registered in any Commerce, or Honours Business Informatics, or Engineering & Management program; or the Minor in Finance.

### BUSINESS B748 ~~MULTIDISCIPLINARY ENTREPRENEURSHIP FROM A DIVERSE UNIVERSITY BASE~~

This course examines issues associated with mounting entrepreneurial ventures from a heterogeneous university base and addresses such concerns as intellectual property, marketing, strategic human resources, raising capital, and starting and growing a business in that context. The course is open to students from all faculties at McMaster and provides an opportunity to develop networks for accessing varied resources for entrepreneurial ventures. (This is a special topics course.)

### BUSINESS B730 STRATEGIC MANAGEMENT OF TECHNOLOGY

In today's competitive environment technology has become a central component of the strategic process



of many innovative organizations. This course surveys the issues involved in this new role for technology including competitive advantage, analytical tools, technology-based strategies, partnerships and alliances, and the process for managing technology so that it is closely integrated with the activities of the firm.

**BUSINESS C727 PHARMA/BIOTECH BUSINESS ISSUES**

This course will allow students to familiarize themselves with the strategic and management issues currently facing the Pharma/Biotech industries through a consideration of the structure and challenges of the industry at the global, national and provincial levels.

## Appendix D

### Summary of existing programs that combine business and biochemistry/biotechnology at the undergraduate (Table 1) and graduate (Table 2) levels

| Country   | University                 | Program Name   | Industry Placement? | Program Length       |
|---|----------------------------|--|---------------------|----------------------|
| <b>Table 1: Undergraduate programs with a bioscience and business focus: on average 4-5 years in length</b> |                            |  |                     |                      |
| Canada  | McMaster University        | Bachelor of Technology Certificate/Diploma                 | Yes                 | 4.5 yrs              |
| Canada  | Simon Fraser               | Molecular Biology & Biochemistry & Business                | Optional            | 5 yrs                |
| Canada  | Trinity Western University | Bachelor of Science (B.Sc.) degree                         | Yes                 | 122 hrs<br>+ 2 co-op |
| Canada  | University of Waterloo     | Biotechnology & Economics                                  | Yes                 | 5 yrs                |
| Canada  | University of Waterloo     | Biotechnology & Chartered Accountancy                      | Yes                 | 5 yrs                |
| Canada  | Western University         | Business Administration/Bachelor of Science                | Optional            | 5-6 yrs              |
| U.S.  | Georgia Tech               | Biochemistry - Business Option                             | No                  | 4 yrs                |
| Other   | Imperial College           | Biochemistry with Management                               | No                  | 3-4 yrs              |
| Other   | Imperial College           | Biochemistry with Management and Year in Industry/Research | Yes                 | 4-5 yrs              |

| Country   | University                                  | Program Name  | Industry Placement? | Program Length | *Approximate Tuition                 |
|---|---|---|---------------------|----------------|--------------------------------------|
| <b>Table 2: Graduate programs with a bioscience and business focus:: on average 1-2 years in length</b> |   |   |                     |                |                                      |
| Canada  | University of Toronto                       | Master of Biotechnology   | Yes                 | 2 yrs          | \$15,907/year                        |
| Canada  | McMaster University                         | Master's degree in engineering entrepreneurship and innovation (M.E.E.I.)                                 | No                  | 1.5 yrs        | \$6,055/term + \$816.47 fees         |
| Canada  | McMaster University                         | Master's degree in engineering technology and innovation (M.T.E.I.)                                       | No                  | 1.5 yrs        | \$6,055/term + \$816.47 fees         |
| Canada  | University of Calgary                       | Master of Biomedical Technology   | Yes                 | 1 yr           | \$10,190                             |
| Canada  | McGill Biotechnology Graduate Programs      | Masters of Science (Applied)  | Yes                 | 1 yr           | \$3,251.70/ year<br>\$1,500 lab fees |
| U.S.  | Brandeis University                         | The Professional Science Master's Program in Biotechnology  | Yes                 | 2 yrs          | **\$34,413/year                      |
| U.S.  | California State University Channel Islands | Master Of Science Degree In Biotechnology & MBA Dual Degree   | Yes                 | 72 units       | unknown                              |
| U.S.  | Carnegie Mellon University Heinz College    | Master of Science in Biotechnology and Management (MSBTM)   | Yes                 | 2 yrs          | **\$33,494/ semester                 |
| U.S.  | Johns Hopkins University                    | Master of Biotechnology Enterprise and Entrepreneurship   | Optional            | 10 courses     | **\$3,488/ course                    |
| U.S.  | MIT School of Engineering                   | Biomedical Enterprise Program (Master's) - degrees offered: M.S. and M.B.A.                               | No                  | 3 yrs          | unknown                              |
| U.S.  | Penn State University                       | The Master of Biotechnology at Penn State University (Professional Science Master's (PSM) degree program) | Yes                 | 1.5 yrs        | **\$18,672/ year                     |
| U.S.  | Rutgers                                     | Master of Business and Science: Biotechnology and Genomics  | No                  | 1 yr           | ** \$10,500/ year                    |
| U.S.  | Rutgers                                     | Master of Business and Science: Drug Discovery and Development  | No                  | 1.5 yrs        | **\$10,500/ year                     |
| U.S.  | University of California                    | Master of Science Program in Biotechnology Management   | No                  | 2 yrs          | **\$15,049/ year                     |
| U.S.  | University of Florida                       | Masters of Science in Translational Biotechnology   | Yes                 | 2 yrs          | **\$13,720/ year                     |
| U.S.  | University of San Francisco                 | Professional Science Master's program in Biotechnology  | Yes                 | 1.75 yrs       | **\$ 21,150/ year                    |
| U.S.  | University of Wisconsin                     | Master of Science in Biotechnology  | No                  | 2 yrs          | **\$40,000 total                     |
| Other   | University of Auckland                      | Postgraduate Diploma in Bioscience Enterprise   | No                  | 1 yr           | # \$7,844/ year                      |
| Other   | University of Auckland                      | Master of Bioscience Enterprise   | No                  | 1 yr           | # 7,372/ year                        |
| Other   | University of Cambridge                     | Master of Bioscience Enterprise   | Yes                 | 1 yr           | ## 19,266/ year                      |

\*Please note; tuition rates were quoted for in-province/state residents only. On average, out of state/province tuition rates were 2-3 times the in-province/state rates.

\*\* US Currency

#New Zealand Currency

## Pounds Currency

~~Undergraduate programs:~~

- ~~1. Simon Fraser University (Molecular Biology and Biochemistry and Business Joint Major)~~
- ~~2. University of Waterloo (Biotechnology & Chartered Accountancy Co-op)~~
- ~~3. University of Waterloo (Biotechnology & Economics Co-op)~~
- ~~4. Western University (Business Administration/Bachelor of Science)~~
- ~~5. Georgia Tech (Biochemistry Business Option)~~
- ~~6. Imperial College (Biochemistry with Management)~~
- ~~7. Imperial College (Biochemistry with Management and Year in Industry/Research)~~
- ~~8. McMaster University (Bachelor of Technology Certificate/Diploma)~~

~~Graduate/post graduate programs:~~

- ~~9. University of Toronto (Master of Biotechnology)~~
- ~~10. University of Calgary (Master of Biomedical Technology)~~
- ~~11. University of Auckland (Postgraduate Diploma in Bioscience Enterprise)~~
- ~~12. University of Auckland (Master of Bioscience Enterprise)~~
- ~~13. University of Cambridge (Master of Bioscience Enterprise)~~
- ~~14. Harvard University (Master of Biotechnology: Management Principles)~~
- ~~15. Rutgers (Master of Business and Science: Biotechnology and Genomics)~~
- ~~16. Johns Hopkins University (Master of Biotechnology Enterprise and Entrepreneurship)~~

## Appendix E

### List of attendees at the one-day stakeholder's workshop on October 5, 2011

#### Internal to the University

1. Michelle Benjamin, Manager, Science Career & Cooperative Education
2. Dr. Nick Bontis, Associate Professor and Director UG Programs, DeGroot School of Business
3. Dr. Eric Brown, Professor and Chair, Department of Biochemistry & Biomedical Sciences
4. Dr. Lori Burrows, Professor and Associate Chair, Research, Biochemistry & Biomedical Sciences
5. Dr. Brian Coombes, Associate Professor and Associate Chair, Graduate Education, Biochemistry & Biomedical Sciences
6. Dr. Lisa Dolovich, Research Director, Family Medicine
7. Dr. Carolyn Eyles, Professor, School of Geography & Earth Sciences
8. Dr. Gerhard Gerber, Professor Emeritus, BBS – former Chair and VP Research & International Affairs
9. Lori Goff, Educational Consultant, Centre for Leadership & Learning
10. Dr. Del Harnish, Professor, Pathology & Molecular Medicine and Assistant Dean, BHSc Program
11. Dr. Benson Honig, Professor, DeGroot School of Business
12. Dr. Michelle MacDonald, Associate Professor and Associate Chair, Undergraduate Program, Biochemistry & Biomedical Sciences
13. Ms. Bonnie Murphy, Manager, Strategy & Planning, Biochemistry & Biomedical Sciences
14. Dr. Nathan Magarvey, Assistant Professor, Biochemistry & Biomedical Sciences
15. Dr. Beth Marquis, Educational Consultant, Centre for Leadership & Learning
16. Dr. Alan Neville, Professor of Oncology and Associate Dean, Education, Faculty of Health Sciences
17. Dr. Glen Randall, Associate Professor, DeGroot School of Business
18. Dr. Patangi Rangachari, Professor Emeritus, Medicine
19. Elsie Quate-Randall, Executive Director, McMaster Industry Liaison Office (MILO)
20. Dr. Ian Rodger, Professor Emeritus, Medicine
21. Joanne Smith, Assistant Dean, Faculty of Science
22. Jon Stokes, PhD student, Biochemistry & Biomedical Sciences
23. Dr. Felicia Vulcu, Assistant Professor, Biochemistry & Biomedical Sciences
24. Dr. John Wallace, Farncombe Institute

(continued on next page)

External to the University

1. Dr. Luis Barreto, Consultant, formerly at Sanofi-Pasteur Limited
2. Brian Bloom, President & Head of Institutional Sales, Bloom Burton & Co., Toronto
3. Rebecca Bourque, MITACS, Director of Strategic Accounts & Business Development, Toronto
4. Carrie Brooks-Joiner, Management Consultant, Carrie Brooks-Joiner & Associates, Toronto
5. Mark Chamberlain, President & Senior Partner, Trivaris Ltd., Member, McMaster Board of Governors
6. Dr. Kevin Canning, Director, R&D Alliances at GlaxoSmithKline
7. Jay Lefton, LLP, Borden Ladner Gervais Law Firm, Toronto
8. Tony Legault, Program Director, Bioscience Education Canada
9. Dr. Daniel Mamelak, Director, Custom Biologics
10. Dr. Tushar Shakya, Postdoctoral Fellow, MITACS (former BBS PhD graduate)
11. Dr. Roderick Slavcev, Professor, Pharmaceutical Sciences, U. Waterloo
12. Dr. Brian Underdown, Managing Director, Lumira Capital Corp

## **Appendix F**

### **List of ad-hoc program development committee members**

1. Dr. Eric Brown, Professor and Chair, Department of Biochemistry & Biomedical Sciences
2. Dr. Brian Coombes, Associate Professor and Associate Chair, Graduate Education, Biochemistry & Biomedical Sciences
3. Dr. Del Harnish, Professor, Pathology & Molecular Medicine and Assistant Dean, BHSc Program
4. Dr. Benson Honig, Professor, DeGroot School of Business
5. Dr. Michelle MacDonald, Associate Professor and Associate Chair, Undergraduate Program, Biochemistry & Biomedical Sciences
6. Dr. Nathan Magarvey, Assistant Professor, Biochemistry & Biomedical Sciences
7. Dr. Felicia Vulcu, Assistant Professor, Biochemistry & Biomedical Sciences

**Appendix G**

**Letters of support**





Health 12800 Main Street West Phone 905.525.9140 Ext. 22545  
Sciences Hamilton, Ontario Fax 905.528.3733  
Library Canada L8S 4K1 Email bayleyl@mcmaster.ca  
Website hsl.mcmaster.ca

## **LIBRARY REPORT ON RESOURCES AND SERVICES**

### **TO SUPPORT AN UNDERGRADUATE PROGRAM IN**

#### **Biomedical Discovery and Commercialization**

**September 2012**

This summary of the Health Sciences Library's information resources and services in support of the proposed undergraduate program in Biomedical Discovery and Commercialization has been prepared by the Health Sciences Library.

#### **A. LIBRARY RESOURCES**

##### **COLLECTION DEVELOPMENT**

Books, print journals and other research resources for students in Biomedical Discovery and Commercialization are held in or licensed by the Health Sciences Library, with the exception of business resources which are held in Innis Library (Business). The acquisition of health sciences material in support of the Biomedical Discovery and Commercialization will be coordinated through the Health Sciences Library.

McMaster University Libraries' holdings currently total 2 million volumes. To expand access to journals and books, the Libraries participate in national and regional consortium licenses for online full-text books and journals, and register for campus-wide electronic access instead of print subscriptions or purchase whenever possible.

The acquisition of material in the Health Sciences Library is governed by a Collection Policy that assigns a collection level based on the research intensity and degree level offered for a program. Much of the collection required to support Biomedical Discovery and Commercialization falls within the subject classification for Pharmacology (QV), and specialized areas within this classification are collected at various intensities. Publications in pharmacology, which includes experimental pharmacology, drug research, pharmacokinetics, and toxicology are purchased frequently and the collection is current. Please note that due to budget restrictions we have only actively purchased materials in support of specific needs within the Faculty of Health Science's clinical and non-clinical programs. These often come in the form of book recommendations from faculty and students. Publications in the category of Pharmacy and Pharmaceuticals are collected on a much less frequent basis, and not comprehensively. This category includes: pharmacy, drug industry, pharmacopoeias, formularies, medicinal chemistry, drug discovery, dosage calculation and prescription writing, pharmacognosy, materia medica, medicinal plants, herbs, drug standards and evaluation, regulation, drug catalogues of commercial medications and patent medicines, and types of pharmaceutical preparations and dosage forms. The Library does not collect in the area of compounding and dispensing of drugs.

Resources in the area of drug discovery and commercialization are very expensive, and funding is required to help to build and maintain the collection.

## **BOOKS**

McMaster University currently holds approximately 2,400 titles in the QV classification, Pharmacology, although many of these items are drug guides. The Health Sciences Library holds approximately 120 current print titles related to Pharmacology, 7 of which are printed books and 5 of which are e-books which deal with drug discovery. The Health Sciences Library has not collected specifically in this area.

## **JOURNALS**

Currently the McMaster community has access to over 21,000 full-text electronic journals. Full-text journals are accessible through the e-Journal Portal <http://library.mcmaster.ca/ejournals>.

The journal collection in this area is strong due to titles being included in large consortially licensed packages. A review of McMaster holdings identified 3 academic, peer-reviewed journals related to Biomedical Discovery and Commercialization. Articles from any additional titles missing from the Library's subscriptions could be supplied through Interlibrary Loans, which is a fee-based service.

## **DATABASES IN SUPPORT OF HEALTH SCIENCES EDUCATION**

Databases licensed by McMaster include direct links to McMaster library holdings. Of particular usefulness for this program are:

- Embase (1980- )
- MEDLINE and PreMEDLINE (1950- )
- Proquest Dissertations and Theses
- PubMed
- Web of Science (includes citation mapping)

## **B. LIBRARY FACILITIES AND SERVICES**

### **PHYSICAL SPACE, EQUIPMENT, SUPPORT, AND HOURS**

The Health Sciences Library is open 97 hours per week during the term. The library offers 725 public seats, 15 group study rooms and 82 public computer stations. Students in Faculty of Health Sciences educational programs can pre-book group study rooms up to a week in advance. The Health Sciences Library eClassroom accommodates 36 people with 24 participant workstations.

There are 10 laptops and 3 projectors available for loan for in-library use and wireless service is available throughout the library. A Learning Commons provides a variety of software. Users have access to printing and photocopying facilities.

Information technology assistance is available in person at the Health Sciences Library Information Desk. The service is designed to assist patrons with library computer technology, including setting up their laptops and handheld devices to access the wireless network.

### **LIBRARY SERVICES**

Research/Reference assistance at McMaster University is provided in person, by telephone, and by e-mail. The library offers regularly scheduled orientation and library instruction sessions (library basics, database and web

searching). This service is coordinated by the Head of Public Services. Online tutorials are also available for selected resources.

Because many of the courses will be senior-level inquiry-based research courses, experience has shown that specialized literature search training and support will be required for this program. Other Faculty of Health Sciences educational programs have liaison librarians who work closely with curriculum planners to provide timely and appropriate support to students in those programs. Due to the nature of the proposed Biomedical Discovery and Commercialization program, we recommend that .25 of a librarian be funded for the first year, expanding to .4 on an on-going basis.

For items not available in McMaster's Libraries, students can use Interlibrary Loan Services through RACER (<http://library.mcmaster.ca/racer.htm>). The cost of the service is paid by the student or faculty member.

Reciprocal agreements with various library consortia allow McMaster faculty, staff, and students to borrow in person from other university libraries in Canada.

### **ACCESS TO THE COLLECTION, CIRCULATION, AND RESERVE**

The Health Sciences Library website (<http://hsl.mcmaster.ca>) provides access to the online catalogue and Web-based electronic resources, including full-text electronic journals, reference tools, databases, and e-books. All full-text electronic journals are also accessible from the e-journal portal at: <http://library.mcmaster.ca/ejournals>. The online library catalogue provides information on the material held or licensed by all McMaster Libraries. Most items circulate, with the exception of print journals and reference materials.

Students may borrow books that circulate from the McMaster collections for either two weeks or for shortened loan periods for popular items. Depending on the item books may be renewed online or from any campus library.

Submitted by:

Liz Bayley, Director

Health Sciences Library

McMaster University

Jennifer McKinnell, Head of Public Services

Health Sciences Library

McMaster University

Andrea McLellan, Head of Collections

Health Sciences Library

McMaster University

| <b>Health Sciences Library Acquisition Budget<br/>5 Year Summary</b>  |                    |                    |                    |                    |                    |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|
| The Health Sciences Library collection is utilized in varying degrees by all programs within the Faculty. As a result, the library does not allocate this expenditure by educational or research programs |                    |                    |                    |                    |                    |
|   | <b>2007/2008</b>   | <b>2008/2009</b>   | <b>2009/2010</b>   | <b>2010-2011</b>   | <b>2011-2012</b>   |
| Books   | \$266,037          | \$187,038          | \$387,000          | \$236,645          | \$235,322          |
| Journals  | \$999,985          | \$1,236,899        | \$1,234,644        | \$1,148,270        | \$1,293,473        |
| Databases   | \$249,904          | \$270,763          | \$277,039          | \$305,233          | \$294,711          |
| <b>Total Budget</b>   | <b>\$1,557,400</b> | <b>\$1,709,746</b> | <b>\$1,945,894</b> | <b>\$1,774,344</b> | <b>\$1,903,181</b> |



OFFICE OF THE DEAN  
DEGROOTE SCHOOL OF BUSINESS

1280 Main Street West  
DSB 244  
Hamilton, ON  
L8S 4M4

T (905) 525-9140 Ext. 24431  
F (905) 526-0852

October 3, 2012

Dr. Eric Brown  
Chair  
Biochemistry and Biomedical Science  
HSC 4N59  
Faculty of Health Sciences  
McMaster University

Dear Dr. Brown: *Eric*

On behalf of the DeGroote School of Business, I am providing details regarding the resources that will be required from the School for the proposed Honours Bachelor of Health Sciences Program in Biomedical Discovery and Commercialization (BDC). Of course, the below figures will be superseded by the new budget model when it is implemented fully for the University.

It has been agreed that the recovery cost for the School of Business of a full-time faculty member for a phased-in approach will commence at \$12,000 annually per course offered on load basis, and increasing in increments of \$2,000 annually to a maximum of \$20,000 annually per course per faculty member. These figures will change accordingly when the new budget model is implemented at which time the concept of a maximum figure will be irrelevant. This is based on two courses in Year III and two courses in Year IV.

Additional costs consist of teaching assistants (TA):  
Graduate teaching assistants at \$5,500 per course  
Undergraduate teaching assistants at \$2,750 per course  
Year III – two graduate TAs for two courses x \$5,500                 \$11,000  
Year IV – one senior undergraduate TA for one course x \$2,750     \$ 2,750  
                  one graduate TA for one course x \$5,500                 \$ 5,500

For the eventual addition of Year V, the costs will continue in the phased-in model for full-time faculty involvement at the rate that year until the new budget model is implemented, and the teaching assistant costs for two graduate-level TAs will be \$11,000.

The BDC multi-disciplinary program will be an innovative addition to the curriculum offerings in the DeGroot School of Business. The partnering of DeGroot and the Faculty of Health Sciences provides important collaborative and creative opportunities for students and faculty. In addition, the program will be an important contribution in supporting the academic direction of the University and the emphasis on interdisciplinarity in its offerings.

Sincerely,



Dr. Bob McNutt  
Acting Dean

cc: S. Denburg  
G. Kanagaretnam  
S. Mitchell

Eric - any concerns with these  
numbers, please talk to  
Gini + me



**Faculty of Health Sciences**  
1200 Main Street West  
Hamilton, Ontario, Canada L8N 3Z5  
Phone 905.525.9140

To: Whom it may concern

From: Susan Birnie  
Director, Education Services  
Faculty of Health Sciences,  
McMaster University

Date: September 19, 2012

Re: Availability of Teaching Rooms for Biomedical Discovery and Commercialization BHSc Program

Please be advised that I have reviewed the classroom requirements for the proposed BHSc program in Biomedical Discovery and Commercialization. The program will be primarily taught in classrooms that seat 25 to 30 students, in a set-up that facilitates discussion. The Faculty of Health Sciences has 20 such rooms, and capacity to meet the needs of the program is available. In addition, a biochemistry laboratory currently utilized by Midwifery and graduate students is utilized at less than 50% of the time, so we can meet the laboratory teaching needs of the new program.

I trust this information meets your needs.

A handwritten signature in cursive script that reads "S. Birnie".

## New Undergraduate Program: Biomedical Discovery and Commercialization

|                     | 2014/15       | 2015/16        | 2016/17        | 2017/18        | 2018/19        | Estimate       |                |
|---------------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                     |               |                |                |                |                | 2019/20        | 2020/21        |
| Number of students  | 55            | 110            | 110            | 110            | 110            | 110            | 110            |
| Total Gross Revenue | 781,722       | 1,571,462      | 1,590,819      | 1,610,757      | 1,631,294      | 1,651,294      | 1,671,294      |
| Total Expenses      | 1,160,222     | 1,397,107      | 1,416,608      | 1,441,695      | 1,470,722      | 1,499,749      | 1,528,776      |
| One-time expenses   |               |                |                |                |                |                |                |
| Furniture           | 8,000         |                |                |                |                |                |                |
| Lab equipment       | 315,000       |                |                |                |                |                |                |
| Start-up funds      | 400,000       |                |                |                |                |                |                |
| Carry forward       |               | 21,500         | 195,855        | 370,066        | 539,128        | 699,700        | 851,245        |
| <b>Balance</b>      | <b>21,500</b> | <b>195,855</b> | <b>370,066</b> | <b>539,128</b> | <b>699,700</b> | <b>851,245</b> | <b>993,763</b> |

| Without start-up funds |                 |                 |                |                |                |                |                |
|------------------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|
| Carry forward          |                 | -378,500        | -204,145       | -29,934        | 139,128        | 299,700        | 451,245        |
| <b>BALANCE</b>         | <b>-378,500</b> | <b>-204,145</b> | <b>-29,934</b> | <b>139,128</b> | <b>299,700</b> | <b>451,245</b> | <b>593,763</b> |

## New 1 year Master's Program: Biomedical Discovery and Commercialization

|                            | 2016/17        | 2017/18        | 2018/19        | 2019/20        | 2020/21        |
|----------------------------|----------------|----------------|----------------|----------------|----------------|
| Number of students         | 50             | 50             | 50             | 50             | 50             |
| Total Gross Revenue        | 1,689,900      | 1,769,900      | 1,856,300      | 1,949,612      | 2,050,389      |
| Total Expenses             | 1,594,702      | 1,623,459      | 1,860,120      | 1,936,899      | 2,021,154      |
| Carry forward              |                | 105,198        | 251,639        | 247,819        | 260,532        |
| One-time start-up from SGS | 10,000         |                |                |                |                |
| <b>Balance</b>             | <b>105,198</b> | <b>251,639</b> | <b>247,819</b> | <b>260,532</b> | <b>289,767</b> |

|                               |               |                |                |                |                |                  |                  |
|-------------------------------|---------------|----------------|----------------|----------------|----------------|------------------|------------------|
| <b>UG and Grad cumulative</b> | <b>21,500</b> | <b>195,855</b> | <b>475,264</b> | <b>790,767</b> | <b>947,519</b> | <b>1,111,777</b> | <b>1,283,530</b> |
|-------------------------------|---------------|----------------|----------------|----------------|----------------|------------------|------------------|

|  |                 |                 |               |                |                |                |                |
|--|-----------------|-----------------|---------------|----------------|----------------|----------------|----------------|
| <b>UG and Grad cumulative (without start-up funds)</b> | <b>-378,500</b> | <b>-204,145</b> | <b>75,264</b> | <b>390,767</b> | <b>547,519</b> | <b>711,777</b> | <b>883,530</b> |
|--|-----------------|-----------------|---------------|----------------|----------------|----------------|----------------|



**Undergraduate Program: Biomedical Discovery and Commercialization**

**Based on New Budget Model**

| ENROLMENT   | FTE          | 2014/2015      | 2015/2016        | 2016/2017        | 2017/2018        | 2018/19          | Comments   |
|---|--------------|----------------|------------------|------------------|------------------|------------------|--|
| <b>Projected Student Enrollment - registered in FHS</b> |              |                |                  |                  |                  |                  |  |
| Year III (2 semesters)                                  |              | 55             | 55               | 55               | 55               | 55               | - 18 units BBS = 60%   |
| Year IV (2 semesters)                                   |              |                | 55               | 55               | 55               | 55               | - 18 units BBS = 60%   |
| <b>Total Projected UG Student Enrollment</b>            |              | <b>55</b>      | <b>110</b>       | <b>110</b>       | <b>110</b>       | <b>110</b>       |  |
| <b>UG REVENUE</b>                                       |              |                |                  |                  |                  |                  |  |
| UG Tuition = \$5,793/yrIII; \$5,765/yr IV plus 3% inc   |              | 318,615        | 645,248          | 664,606          | 684,544          | 705,080          |  |
| UG: 1 BIU 5403.06-2386(formula fee) + 5403.06=8420.12   |              | 463,107        | 926,213          | 926,213          | 926,213          | 926,213          |  |
| <b>Total Gross UG revenue</b>                           |              | <b>781,722</b> | <b>1,571,462</b> | <b>1,590,819</b> | <b>1,610,757</b> | <b>1,631,294</b> |  |
| <b>Overhead expenses</b>                                |              |                |                  |                  |                  |                  |  |
| 38% Central overhead - tuition                          |              | 121,074        | 245,194          | 252,550          | 260,127          | 267,931          |  |
| 38% Central overhead - BIU                              |              | 175,981        | 351,961          | 351,961          | 351,961          | 351,961          |  |
| FHS Dean - 5%   |              | 39,086         | 78,573           | 79,541           | 80,538           | 81,565           |  |
| <b>Total UG Overhead costs</b>                          |              | <b>336,140</b> | <b>675,729</b>   | <b>684,052</b>   | <b>692,626</b>   | <b>701,456</b>   |  |
| <b>Total Net UG revenue</b>                             |              | <b>445,581</b> | <b>895,733</b>   | <b>906,767</b>   | <b>918,132</b>   | <b>929,837</b>   |  |
| <b>Service Teaching Costs - tuition only</b>            |              |                |                  |                  |                  |                  |  |
| Sessional rates - Business                              | 0.4          | 50,000         | 100,000          | 100,000          | 100,000          | 100,000          | 6 units/year = 20%   |
| Sessional rates - electives                             | 0.4          | 50,000         | 100,000          | 100,000          | 100,000          | 100,000          | 6 units/year = 20%   |
| <b>Total Sessional Teaching Expenses</b>                |              | <b>100,000</b> | <b>200,000</b>   | <b>200,000</b>   | <b>200,000</b>   | <b>200,000</b>   |  |
| <b>OTHER EXPENSES*</b>                                  |              |                |                  |                  |                  |                  | <b>Faculty salaries 5% ATB annually</b>                            |
| <b>1. SALARIES &amp; BENEFITS</b>                       |              |                |                  |                  |                  |                  | <b>Staff salaries 3.5% ATB annually</b>                            |
| Associate Chair   | 0.5          | 65,100         | 68,355           | 71,773           | 75,362           | 79,130           | Replacement cost for existing teaching in other programs           |
| Program Director - Tenure-track                         | 0.5          | 45,150         | 47,408           | 49,778           | 52,267           | 54,880           | Fill tenure-track slot vacancy in department                       |
| Faculty CLA   | 0.5          |                |                  | 52,093           | 54,698           | 57,433           | Replacement cost for existing teaching in other programs           |
| Program Coordinator CAW                                 | 0.5          | 60,000         | 63,000           | 33,075           | 34,729           | 36,466           | New - 16/17 onwards .5 paid by grad budget                         |
| Admin Assist  | 0.5          | 41,400         | 42,850           | 22,175           | 22,951           | 23,755           | New - 16/17 onwards .5 paid by grad budget                         |
| Lab Coordinator   | 0.5          |                | 29,459           | 30,490           | 31,557           | 32,661           | New  |
| Teaching Assistants - Graduate                          | 9            | 56,475         | 112,950          | 112,950          | 112,950          | 112,950          | 2.5 Business, 6.5 Biochem (full TA's - 260 hrs each) - incl 13% fb |
| Teaching Assistants - Undergraduate                     | 1            | 2,880          | 2,880            | 2,880            | 2,880            | 2,880            | Business   |
| Faculty Fringe benefits @ 32%                           |              | 35,280         | 37,044           | 55,566           | 58,345           | 61,262           |  |
| Staff Fringe benefits @ 45%                             |              | 45,630         | 60,889           | 38,583           | 40,157           | 41,797           |  |
| Librarian - .17 FTE (includes FB)                       | 0.17         | 7,200          | 15,300           | 16,868           | 17,711           | 18,597           | .08 in first year  |
| <b>Total Salary Expenses</b>                            | <b>13.97</b> | <b>359,115</b> | <b>480,135</b>   | <b>486,231</b>   | <b>503,606</b>   | <b>521,811</b>   |  |
| <b>2. SUPPLIES/SERVICES/COMMUNICATION</b>               |              |                |                  |                  |                  |                  |  |
| Promotional material                                    |              | 5,000          | 5,000            | 5,000            | 5,000            | 5,000            |  |
| Promotional events                                      |              | 5,000          | 5,000            | 5,000            | 5,000            | 5,000            |  |
| Meeting expenses  |              | 2,000          | 2,000            | 2,000            | 2,000            | 2,000            |  |
| Office Supplies   |              | 1,000          | 1,200            | 1,400            | 1,600            | 1,800            |  |
| Printing & photocopying                                 |              | 1,500          | 1,700            | 1,900            | 2,100            | 2,300            |  |
| Computer equipment and maintenance                      |              | 3,300          | 1,500            | 5,000            | 2,550            | 2,950            |  |
| Postage & Courier                                       |              | 1,000          | 1,100            | 1,200            | 1,300            | 1,400            |  |
| Telephone Equipment Rental                              |              | 1,667          | 1,833            | 2,000            | 2,167            | 2,333            |  |
| Telephone Long Distance                                 |              | 500            | 550              | 600              | 650              | 700              |  |

|  |                  |                  |                  |                  |                  |
|--|------------------|------------------|------------------|------------------|------------------|
| <b>Total Supplies/Services/Communication</b>   | <b>20,967</b>    | <b>19,883</b>    | <b>24,100</b>    | <b>22,367</b>    | <b>23,483</b>    |
| <b>3. EDUCATIONAL ACTIVITIES/CURRICULUM</b>    |                  |                  |                  |                  |                  |
| E-learning resources                           | 4,000            | 4,000            | 4,500            | 5,000            | 5,500            |
| Videoconference/Webcasting Services            | 5,000            | 5,100            | 5,202            | 5,306            | 5,412            |
| Lab Supplies                                   | 8,000            | 8,160            | 8,323            | 8,490            | 8,659            |
| Faculty Development                            | 2,000            | 2,000            | 2,000            | 2,000            | 2,000            |
| Library - estimated annual costs               | 2,000            | 2,100            | 2,200            | 2,300            | 2,400            |
| <b>Total Educational Activities/Curriculum</b> | <b>21,000</b>    | <b>21,360</b>    | <b>22,225</b>    | <b>23,096</b>    | <b>23,972</b>    |
| <b>Total non-salary expenses</b>               | <b>41,967</b>    | <b>41,243</b>    | <b>46,325</b>    | <b>45,463</b>    | <b>47,455</b>    |
| <b>7. ONE-TIME START-UP COSTS</b>              |                  |                  |                  |                  |                  |
| Office furniture                               | 8,000            |                  |                  |                  |                  |
| Laboratory equipment                           | 315,000          |                  |                  |                  |                  |
| <b>TOTAL START-UP COSTS</b>                    | <b>323,000</b>   |                  |                  |                  |                  |
| <b>TOTAL OVERHEAD</b>                          | <b>336,140</b>   | <b>675,729</b>   | <b>684,052</b>   | <b>692,626</b>   | <b>701,456</b>   |
| <b>TOTAL OPERATING EXPENSES</b>                | <b>1,160,222</b> | <b>1,397,107</b> | <b>1,416,608</b> | <b>1,441,695</b> | <b>1,470,722</b> |
| <b>Start-up funds</b>                          | <b>400,000</b>   |                  |                  |                  |                  |
| <b>Carry forward</b>                           |                  | <b>21,499</b>    | <b>195,854</b>   | <b>370,065</b>   | <b>539,128</b>   |
| <b>BALANCE</b>                                 | <b>21,499</b>    | <b>195,854</b>   | <b>370,065</b>   | <b>539,128</b>   | <b>699,700</b>   |

|                               |  |                  |                  |                 |                |
|-------------------------------|--|------------------|------------------|-----------------|----------------|
| <b>Without start-up funds</b> |  |                  |                  |                 |                |
| Carry forward                 |  | - 378,501        | - 204,146        | - 29,935        | 139,128        |
| <b>BALANCE</b>                |  | <b>- 378,501</b> | <b>- 204,146</b> | <b>- 29,935</b> | <b>139,128</b> |

| <b>Tuition calculations</b> | <b>2014/2015</b> | <b>2015/2016</b> | <b>2016/2017</b> | <b>2017/2018</b> | <b>2018/19</b> |
|-----------------------------|------------------|------------------|------------------|------------------|----------------|
| Year 3                      | 318,615          | 328,173          | 338,019          | 348,159          | 358,604        |
| Year 4                      |                  | 317,075          | 326,587          | 336,385          | 346,476        |
| <b>TOTALS</b>               | <b>318,615</b>   | <b>645,248</b>   | <b>664,606</b>   | <b>684,544</b>   | <b>705,080</b> |

**BBS Graduate Program in FHS - 1 YEAR Master's - Biomedical Discovery and Commercialization**

| <b>BASED ON NEW BUDGET MODEL</b>                   |             |                  |                  |                  |                  |   |  |
|--|-------------|------------------|------------------|------------------|------------------|---|--|
| <b>REVENUE</b>                                     | <b>FTE</b>  | <b>2016/2017</b> | <b>2017/2018</b> | <b>2018/2019</b> | <b>2019/2020</b> | <b>2020/2021</b>                        | <b>Comments</b>  |
| Projected graduate enrolment                       |             | 50               | 50               | 50               | 50               | 50                                      |  |
| <b>Graduate Revenue</b>                            |             |                  |                  |                  |                  |   |  |
| MSc = grad exp rate = 13,798                       |             | 689,900          | 689,900          | 689,900          | 689,900          | 689,900                                 |  |
| MSc tuition: 20,000 (+8% annual increases)         |             | 1,000,000        | 1,080,000        | 1,166,400        | 1,259,712        | 1,360,489                               |  |
| <b>Total gross graduate revenue</b>                |             | <b>1,689,900</b> | <b>1,769,900</b> | <b>1,856,300</b> | <b>1,949,612</b> | <b>2,050,389</b>                        |  |
| <b>Overhead costs</b>                              |             |                  |                  |                  |                  |   |  |
| BIU - 38%  |             | 262,162          | 262,162          | 262,162          | 262,162          | 262,162                                 |  |
| Tuition - 38%                                      |             | 380,000          | 410,400          | 443,232          | 478,691          | 516,986                                 |  |
| FHS Dean - 5%                                      |             | 84,495           | 88,495           | 92,815           | 97,481           | 102,519                                 |  |
| FHS Graduate Studies - 5%                          |             | 84,495           | 88,495           | 92,815           | 97,481           | 102,519                                 |  |
| <b>Total overhead costs</b>                        |             | <b>811,152</b>   | <b>849,552</b>   | <b>891,024</b>   | <b>935,814</b>   | <b>984,187</b>                          |  |
| <b>Net Revenue</b>                                 |             | <b>878,748</b>   | <b>920,348</b>   | <b>965,276</b>   | <b>1,013,798</b> | <b>1,066,202</b>                        |  |
| <b>Graduate Student Expenses</b>                   |             |                  |                  |                  |                  |   |  |
| Entrance Scholarships                              |             | 50,000           | 50,000           | 50,000           | 50,000           | 50,000                                  |  |
| Recruitment/Travel/Awards                          |             | 50,000           | 50,000           | 55,000           | 55,000           | 55,000                                  |  |
| <b>Teaching Costs</b>                              |             |                  |                  |                  |                  |   |  |
| Internship stipends to mentors (graduate)          |             | 54,500           | 54,500           | 54,500           | 54,500           | 54,500                                  | 13-15 week terms to be negotiated with firm; \$1K/mentor+9%CPP |
| School of Business                                 | 0.4         | 50,000           | 50,000           | 50,000           | 50,000           | 50,000                                  | 6 units  |
| Graduate teaching assistants (senior PhD students) | 2           | 25,100           | 25,100           | 25,100           | 25,100           | 25,100                                  | 4 half TA's (130 hours each) @ \$6275/1/2 TA (incl 13%fb)      |
| <b>Total student/teaching costs</b>                |             | <b>229,600</b>   | <b>229,600</b>   | <b>234,600</b>   | <b>234,600</b>   | <b>234,600</b>                          |  |
| <b>OTHER EXPENSES*</b>                             |             |                  |                  |                  |                  |   |  |
| <b>1. Salaries &amp; Benefits</b>                  |             |                  |                  |                  |                  | <b>Faculty salaries 5% ATB annually</b> |  |
|  |             |                  |                  |                  |                  | <b>Staff salaries 3.5% ATB annually</b> |  |
| Associate Chair                                    | 0.5         | 72,500           | 76,125           | 79,931           | 83,928           | 88,124                                  | Replacement cost for existing teaching in other programs       |
| Program Director - Tenure-track                    | 0.5         | 47,250           | 49,613           | 52,093           | 54,698           | 57,433                                  | Fill tenure-track slot vacancy in department                   |
| Faculty CLA  | 2           | 125,000          | 131,250          | 262,813          | 275,953          | 289,751                                 | New 2nd CLA begins in 18/19                                    |
| Program Coordinator CAW                            | 0.5         | 33,075           | 34,729           | 36,466           | 38,289           | 40,203                                  | New (other .5FTE in UG budget)                                 |
| Administrative assistant                           | 0.5         | 22,175           | 22,951           | 23,755           | 24,943           | 26,190                                  | New (other .5FTE in UG budget)                                 |
| Administrative assistant                           | 1           | 51,688           | 53,497           | 55,369           | 57,307           | 59,313                                  | New - career development role                                  |
| Faculty fringe benefits @ 32%                      |             | 78,320           | 82,236           | 126,348          | 132,665          | 139,299                                 |  |
| Staff fringe benefits @45%                         |             | 48,122           | 50,030           | 52,016           | 54,243           | 56,568                                  |  |
| Librarian - .08 FTE (includes FB)                  | 0.08        | 7,920            | 8,316            | 8,732            | 9,169            | 9,627                                   |  |
| <b>Total Salary Expenses</b>                       | <b>7.48</b> | <b>486,050</b>   | <b>508,747</b>   | <b>697,523</b>   | <b>731,195</b>   | <b>766,507</b>                          |  |
| <b>2. Supplies/Services/Communication/Travel</b>   |             |                  |                  |                  |                  |   |  |
| Telephone equipment and long distance              |             | 1,500            | 1,650            | 1,800            | 1,950            | 2,100                                   |  |
| Office furniture                                   |             | 5,000            |                  |                  |                  |   |  |
| Meeting Expenses/seminars (incl honorariums)       |             | 4,000            | 4,080            | 4,162            | 4,245            | 4,330                                   |  |
| Postage  |             | 1,200            | 1,250            | 1,300            | 1,350            | 1,400                                   |  |
| Printing and Photocopying                          |             | 4,000            | 4,080            | 4,162            | 4,245            | 4,330                                   |  |
| Stationery and Office Supplies                     |             | 1,400            | 1,600            | 1,800            | 1,900            | 2,000                                   |  |
| Marketing and Publications                         |             | 30,000           | 5,000            | 5,000            | 5,000            | 5,000                                   |  |
| Computer Maintenance                               |             | 200              | 250              | 300              | 350              | 400                                     |  |
| Computer equipment/Programming                     |             | 5000             | 2,000            | 2750             | 500              | 500                                     |  |
| Learning Resources                                 |             | 5,500            | 5,500            | 5,500            | 5,500            | 5,500                                   |  |

|   |  |                  |                  |                  |                  |                  |                                   |
|---|--|------------------|------------------|------------------|------------------|------------------|-----------------------------------|
| Audio Visual Services                                       |  | 100              | 150              | 200              | 250              | 300              |                                   |
| Travel and conferences                                      |  | 10,000           | 10,000           | 10,000           | 10,000           | 10,000           | Site visits to community partners |
| <b>Total supplies/services/communication/travel</b>         |  | <b>67,900</b>    | <b>35,560</b>    | <b>36,973</b>    | <b>35,290</b>    | <b>35,859</b>    |                                   |
| <b>TOTAL OVERHEAD</b>                                       |  | <b>811,152</b>   | <b>849,552</b>   | <b>891,024</b>   | <b>935,814</b>   | <b>984,187</b>   |                                   |
| <b>TOTAL OPERATING EXPENSES</b>                             |  | <b>1,594,702</b> | <b>1,623,459</b> | <b>1,860,120</b> | <b>1,936,899</b> | <b>2,021,154</b> |                                   |
| <b>One-time start-up revenue for recruitment (from SGS)</b> |  | <b>10,000</b>    |                  |                  |                  |                  |                                   |
| <b>Carry forward</b>  |  |                  | <b>105,198</b>   | <b>251,639</b>   | <b>247,819</b>   | <b>260,532</b>   |                                   |
| <b>BALANCE</b>  |  | <b>105,198</b>   | <b>251,639</b>   | <b>247,819</b>   | <b>260,532</b>   | <b>289,768</b>   |                                   |



**School of Graduate Studies**

1280 Main Street West  
Hamilton, Ontario, Canada  
L8S 4L8

Phone 905.525.9140  
Ext. 23679  
<http://graduate.mcmaster.ca>

To: Graduate Council

From: Christina Bryce

Assistant Secretary and SynApps Systems Administrator

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At its meeting on March 21<sup>st</sup>, 2013 the Faculty of Health Sciences Graduate Policy and Curriculum Council approved the following graduate curriculum recommendations.

Please note that these recommendations were approved at the April 24<sup>th</sup>, 2013 meeting of the Faculty of Health Sciences Executive Committee.

**FOR APPROVAL OF GRADUATE COUNCIL:**

**Global Health:**

- I. Calendar Copy
- II. M.SC. – Change in Admission Requirements
- III. M.Sc. - Change in Course Requirements

**FOR INFORMATION OF GRADUATE COUNCIL:**

**Global Health:**

-New Courses

- \*712 Global Health Practicum
- \*711 Scholarly Paper
- \*710 Global Health Symposium/Field Orientation



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM  
- FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS /  
PROCEDURES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.
2. An electronic version of this form must be emailed to the Assistant Secretary and SynApps System Administrator (Email: *espiritu@mcmaster.ca*).
3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|   |                 |                   |  |  |             |                                      |                     |                 |
|---|-----------------|-------------------|--|--|-------------|--------------------------------------|---------------------|-----------------|
| <b>DEPARTMENT</b>   |                 |                   |  |  |             |                                      |                     |                 |
| <b>NAME OF PROGRAM</b>  |                 | MSc Global Health |  |  |             |                                      |                     |                 |
| <b>PROGRAM DEGREE</b>   | Ph.D. ( )       | M.A. ( )          | M.A.Sc. ( )  | M.B.A. ( )   | M. Eng. ( ) | M.Sc. (x)                            | Diploma Program ( ) | Other (Specify) |
| <b>NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)</b>  |                 |                   |  |  |             |                                      |                     |                 |
| <b>CHANGE IN ADMISSION REQUIREMENTS</b>   |                 |                   | <b>CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE</b> |  |             | <b>CHANGE IN COURSE REQUIREMENTS</b> |                     |                 |
| <b>CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR</b>  |                 |                   | x  | <b>EXPLAIN:</b><br>The Global Health Symposium/Field Orientation course takes place in partnership with Manipal University in India. |             |                                      |                     |                 |
| <b>OTHER CHANGES</b>  | <b>EXPLAIN:</b> |                   |  |  |             |                                      |                     |                 |
| <b>DESCRIBE THE <u>EXISTING</u> REQUIREMENT/PROCEDURE:</b>  |                 |                   |  |  |             |                                      |                     |                 |
| <p>McMaster University has established a collaborative international learning experience with Maastricht University, The Netherlands. McMaster and Maastricht will be offering two core courses—Global Health Foundations I and II online by faculty members at both universities. Students from both universities will also join together for the learning symposium/field orientation (service learning) in Term 3.</p> |                 |                   |  |  |             |                                      |                     |                 |

**PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE (*Attach additional pages if space is not sufficient.*)**

McMaster University has established a collaborative international learning experience with Maastricht University, The Netherlands. McMaster and Maastricht will be offering two core courses—Global Health Foundations I and II online by faculty members at both universities. Students from both universities will also join together for the learning symposium/field orientation (service learning) in Term 3 at Manipal University in India. Alternatives will be found for students with disabilities or for whom travel to India might cause undue hardship.

**RATIONALE FOR THE RECOMMENDED CHANGE:**

Manipal University provides an ideal setting for a Global Health Symposium and field orientation.

**PROVIDE IMPLEMENTATION DATE: (*Implementation date should be at the beginning of the academic year*)**

September 2013

**ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.**

No

**PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR:**

McMaster University has established a collaborative international learning experience with Maastricht University, The Netherlands. McMaster and Maastricht will be offering two core courses—Global Health Foundations I and II online by faculty members at both universities. Students from both universities will also join together for the learning symposium/field orientation (service learning) in Term 3 at Manipal University in India. Alternatives will be found for students with disabilities or for whom travel to India might cause undue hardship.

**CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:**

Name: Christy Gombay    Email: gombayc@mcmaster.ca    Extension: 22206    Date submitted: February 2013

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.



## GLOBAL HEALTH PROGRAM PROPOSED CHANGES TO GRADUATE CALENDAR FEB. 2013

| Existing   | Proposed  |
|--|---|
| <p>McMaster University has established a collaborative international learning experience with Maastricht University, The Netherlands. McMaster and Maastricht will be offering two core courses—Global Health Foundations I and II online by faculty members at both universities. Students from both universities will also join together for the learning symposium/field orientation (service learning) in Term 3. (Calendar page 349)</p>  | <p>McMaster University has established a collaborative international learning experience with Maastricht University, The Netherlands. McMaster and Maastricht will be offering two core courses—Global Health Foundations I and II online by faculty members at both universities. Students from both universities will also join together for the learning symposium/field orientation (service learning) in Term 3 at Manipal University in India. Alternatives will be found for students with disabilities or for whom travel to India might cause undue hardship.</p>  |
| <p><b>Admission</b><br/>Admission to the M.Sc. Global Health program requires an honours bachelor’s degree with at least a B+ from an accredited university (equivalent to a McMaster 8.5 out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. All students entering the program must have completed a university level course in statistical analysis with a minimum grade of B-.</p>   | <p><b>Admission</b><br/>Admission to the M.Sc. Global Health program requires an honours bachelor’s degree with at least a B+ from an accredited university (equivalent to a McMaster 8.5 out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. All students entering the program must have completed a university level course in statistical analysis with a minimum grade of B-.</p>  |
| <p><b>M.Sc. by Course Work</b><br/>Requirements for the course-based M.Sc. degree include:<br/>1. Completion of the program with at least a B- standing, a minimum of eight graduate half courses which must include the five required courses: GLOB HTH *701, GLOBALST *710, HRM *721, BUS C721, GLOB HTH *702; two courses from the selected field of interest and an additional course from the elective offerings.<br/>2. Successful completion of the learning symposium/field orientation (GLOB HTH *710).<br/>3. Completion of a 15-20 page written scholarly paper on a topic approved by the student’s supervisor (GLOB HTH 711). (Calendar page 347)</p>   | <p><b>M.Sc. by Course Work</b><br/>Requirements for the course-based M.Sc. degree include:<br/>1. Completion of the program with at least a B- standing, a minimum of eight graduate half courses which must include the five required courses: GLOB HTH *701, GLOBALST *710, HRM *721, BUS C721, GLOB HTH *702; two courses from the selected field of interest and an additional course from the elective offerings.<br/>2. Successful completion of the learning symposium/field orientation (GLOB HTH *710).<br/>3. Completion of a 15-20 page written scholarly paper on a topic approved by the student’s supervisor (GLOB HTH 711) and a Global Health Practicum (GLOB HTH 712(?)).</p>  |
| <p><b>*710 / Learning Symposium and Field Orientation</b><br/>All students in the Master of Science in Global Health program are required to complete a Global Health Learning Symposium/Field Orientation, working in an approved public or private organization engaged in the prevention of disease, health promotion, health service delivery, health policymaking, or research in a global context. The placement provides the opportunity to become familiar with the kinds of organizations that put into practice the theory, concepts, and methods taught in the Master’s program. This course will take place through field visits, small group discussions and the presentations of the conclusions from project work undertaken during the placement. After three weeks, students will also present their research findings, in order to receive feedback from peers. (Calendar page 357).</p> | <p><b>*710 / Learning Symposium and Field Orientation</b><br/>All students in the Master of Science in Global Health program are required to complete a Global Health Learning Symposium/Field Orientation in India. The objective of the course is to consolidate collaboration and decision-making in transcontinental teams. In the Symposium students are required to a present abstracts of their scholarly paper/thesis research project in a real life, peer reviewed environment. It is interactive in nature where the students are challenged to integrate critical feedback from interdisciplinary faculty members and other experts in the global health field.</p> <p>The field orientation is designed to deepen critical thinking and research methods in a real life setting. It provides the opportunity to enhance assessment skills and cross-cultural intuition in a diverse complex setting. The experience includes field visits, small group discussions and final group presentations based on the findings from the field visits.</p> <p>Students unable to participate in the India Global Health Symposium because of disabilities or travel causing them undue hardship will have to fulfill the course requirements locally.</p> |

|   |  |
|---|--|
| <p>711 / Scholarly Paper (For students in the M.Sc. by Course Work Option)</p> <p>This full course is designed as an opportunity for graduate course-based M.Sc. students to demonstrate in writing, their ability to integrate ideas that reflect current knowledge in Global Health. The scholarly paper is to determine integrative thinking at a general and abstract level. A student will identify a topic, and in consultation, with a faculty member with expertise in the area, develop a proposal that is individualized to the student's area of interest. The student will then develop the paper under the guidance of a faculty member. The paper must be 15 to 20 pages, excluding references and appendices. The paper does not involve the collection or analysis of primary data or the conduct of research with subjects. It is a scholarly essay, not a thesis. It is critical to the course-based M.Sc. students to demonstrate mastery of the theoretical and methodological understandings that have been acquired during the course work.</p> | <p>711 / Scholarly Paper (For students in the M.Sc. by Course Work Option)</p> <p>This <b>half-course</b> is designed as an opportunity for graduate course-based M.Sc. students to demonstrate in writing, their ability to integrate ideas that reflect current knowledge in Global Health. The scholarly paper is to determine integrative thinking at a general and abstract level. A student will identify a topic, and in consultation, with a faculty member with expertise in the area, develop a proposal that is individualized to the student's area of interest. The student will then develop the paper under the guidance of a faculty member. The paper must be 15 to 20 <b>single-spaced</b> pages excluding references and appendices. The paper does not necessarily involve the collection or analysis of primary data or the conduct of research with subjects. It is a scholarly essay, not a thesis. It is critical to the course-based M.Sc. students to demonstrate mastery of the theoretical and methodological understandings that have been acquired during the course work.</p> |
|   | <p><b>New Course GLOB HT712/Global Health Practicum</b></p> <p>This half-course is designed to allow the student to tailor learning to a selected practicum in clinical, education, research or administration, which meets their specific educational needs. Students must work with an approved public or private organization working in the field of global health either locally or internationally. The placement links the theory, the concepts, and health research methods taught in the program to real life practices.</p>  |



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM  
- FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS /  
PROCEDURES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.
2. An electronic version of this form must be emailed to the Assistant Secretary and SynApps System Administrator (Email: *espiritu@mcmaster.ca*).
3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|   |                 |                   |  |            |             |                                      |                     |                 |
|---|-----------------|-------------------|--|------------|-------------|--------------------------------------|---------------------|-----------------|
| <b>DEPARTMENT</b>   |                 |                   |  |            |             |                                      |                     |                 |
| <b>NAME OF PROGRAM</b>  |                 | MSc Global Health |  |            |             |                                      |                     |                 |
| <b>PROGRAM DEGREE</b>   | Ph.D. ( )       | M.A. ( )          | M.A.Sc. ( )  | M.B.A. ( ) | M. Eng. ( ) | M.Sc. ( X )                          | Diploma Program ( ) | Other (Specify) |
| <b>NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)</b>  |                 |                   |  |            |             |                                      |                     |                 |
| <b>CHANGE IN ADMISSION REQUIREMENTS</b>   |                 | X                 | <b>CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE</b> |            |             | <b>CHANGE IN COURSE REQUIREMENTS</b> |                     |                 |
| <b>CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR</b>  |                 |                   | <b>EXPLAIN:</b>                                      |            |             |                                      |                     |                 |
| <b>OTHER CHANGES</b>  | <b>EXPLAIN:</b> |                   |  |            |             |                                      |                     |                 |
| <b>DESCRIBE THE <u>EXISTING</u> REQUIREMENT/PROCEDURE:</b>  |                 |                   |  |            |             |                                      |                     |                 |
| <p>Admission<br/>           Admission to the M.Sc. Global Health program requires an honours bachelor's degree with at least a B+ from an accredited university (equivalent to a McMaster 8.5 out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. All students entering the program must have completed a university level course in statistical analysis with a minimum grade of B-. Students with no background in health may be required to complete a make-up course in health before entering the program. Finally, applicants must have a strong interest in one of the fields offered in the program.</p> |                 |                   |  |            |             |                                      |                     |                 |

**PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE (*Attach additional pages if space is not sufficient.*)**

Admission

Admission to the M.Sc. Global Health program requires an honours bachelor's degree with at least a B+ from an accredited university (equivalent to a McMaster 8.5 out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. Applicants must have a strong interest in one of the fields offered in the program.

**RATIONALE FOR THE RECOMMENDED CHANGE:**

To more adequately reflect the interdisciplinary nature of the program we need a more flexible approach to the statistics requirement. During the last two years of the program a number of otherwise ideal candidates have been rejected because they did not meet the current requirements of having completed a statistics course.

**PROVIDE IMPLEMENTATION DATE: (*Implementation date should be at the beginning of the academic year*)**

September 2013 (for applicants applying for 2014 entrance)

**ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.**

No

**PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR:**

**Admission**

Admission to the M.Sc. Global Health program requires an honours bachelor's degree with at least a B+ from an accredited university (equivalent to a McMaster 8.5 out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. Students with no background in health may be required to complete a make-up course in health before entering the program. Finally, applicants must have a strong interest in one of the fields offered in the program.

**CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:**

Name: Christy Gombay    Email: gombayc@mcmaster.ca    Extension: 22206    Date submitted: Feb 2013

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM  
- FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS /  
PROCEDURES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.
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3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|   |                 |                   |  |  |             |                                      |                     |                 |
|---|-----------------|-------------------|--|--|-------------|--------------------------------------|---------------------|-----------------|
| <b>DEPARTMENT</b>   |                 |                   |  |  |             |                                      |                     |                 |
| <b>NAME OF PROGRAM</b>  |                 | MSc Global Health |  |  |             |                                      |                     |                 |
| <b>PROGRAM DEGREE</b>   | Ph.D. ( )       | M.A. ( )          | M.A.Sc. ( )  | M.B.A. ( )   | M. Eng. ( ) | M.Sc. ( x )                          | Diploma Program ( ) | Other (Specify) |
| <b>NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)</b>  |                 |                   |  |  |             |                                      |                     |                 |
| <b>CHANGE IN ADMISSION REQUIREMENTS</b>   |                 |                   | <b>CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE</b> |  |             | <b>CHANGE IN COURSE REQUIREMENTS</b> |                     |                 |
| <b>CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR</b>  |                 |                   | x  | <b>EXPLAIN:</b><br>MSc. by Coursework requirement change because of adding a new half course Global Health Practicum |             |                                      |                     |                 |
| <b>OTHER CHANGES</b>  | <b>EXPLAIN:</b> |                   |  |  |             |                                      |                     |                 |
| <b>DESCRIBE THE <u>EXISTING</u> REQUIREMENT/PROCEDURE:</b>  |                 |                   |  |  |             |                                      |                     |                 |
| The existing requirement for completing the MSc. by coursework states the following: "3. Completion of a 15-20 page written scholarly paper on a topic approved by the student's supervisor (GLOB HTH 711) and/or a thesis. |                 |                   |  |  |             |                                      |                     |                 |

**PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE (*Attach additional pages if space is not sufficient.*)**

3. Completion of a 15-20 page written scholarly paper on a topic approved by the student's supervisor (GLOB HTH 711) and a Global Health Practicum (GLOB HTH 712).

**RATIONALE FOR THE RECOMMENDED CHANGE:**

Course based students must complete a GH Practicum as part of the program requirements

**PROVIDE IMPLEMENTATION DATE: (*Implementation date should be at the beginning of the academic year*)**

September 2013

**ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.**

No

**PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR:**

3. Completion of a 15-20 page written scholarly paper on a topic approved by the student's supervisor (GLOB HTH 711) and a Global Health Practicum (GLOB HTH 712).

**CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:**

Name: Christy Gombay    Email: gombayc@mcmaster.ca    Extension: 22206    Date submitted: February 2013

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.

SGS/Medy/2012





**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING COURSES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** course changes. All sections of this form **must** be completed.
2. An electronic version of this form must be emailed to the Assistant Secretary and SynApps System Administrator (Email: [espiritu@mcmaster.ca](mailto:espiritu@mcmaster.ca)).
3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|  |                                     |   |   |                             |
|--|-------------------------------------|---|---|-----------------------------|
| <b>DEPARTMENT/PROGRAM</b>  |                                     |   |   |                             |
| <b>COURSE TITLE</b>  |                                     | Global Health Practicum   |   |                             |
| <b>COURSE NUMBER</b>   | GLOB HTH<br>712                     | <b>COURSE CREDIT</b>  |   |                             |
|  |                                     | <b>FULL COURSE ( )</b>  | <b>HALF COURSE (X)</b>  | <b>QUARTER (MODULE) ( )</b> |
| <b>INSTRUCTOR(S)</b>   |                                     | Dr. Andrea Baumann and Dr. Christy Gombay   |   |                             |
| <b>PREREQUISITE(S)</b>   |                                     |   |   |                             |
| <b>NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)</b>   |                                     |   |   |                             |
| <b>NEW COURSE</b>  | <input checked="" type="checkbox"/> | <b>DATE TO BE OFFERED:</b><br>May 2014  | <b>WAS THE PROPOSED COURSE OFFERED ON DEAN'S APPROVAL?</b><br>IF YES, PROVIDE THE DATE: |                             |
| <b>WILL THE COURSE BE CROSS-LISTED WITH ANOTHER DEPARTMENT? NO</b> IF YES, ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S). <b>NOTE:</b> CROSS-LISTING OF COURSES REQUIRES WRITTEN APPROVAL FROM <u>EACH</u> DEPARTMENT AND FACULTY CONCERNED.  |                                     |   |   |                             |
| <b>CHANGE IN COURSE TITLE</b>  |                                     | <b>PROVIDE THE NEW COURSE TITLE:</b><br>Global Health Practicum   |   |                             |
| <b>CHANGE IN COURSE DESCRIPTION</b>  |                                     | <b>600-LEVEL COURSE (Undergraduate course for graduate credit) Please see #4 on page 2 of this form</b> |   |                             |
| <b>CHANGE TO FULL COURSE</b>   |                                     | <b>CHANGE TO HALF COURSE</b>  | <b>CHANGE TO QUARTER COURSE</b>   |                             |
| <b>COURSE CANCELLATION</b>   |                                     | <b>PROVIDE THE REASON FOR COURSE CANCELLATION:</b>  |   |                             |
| <b>OTHER CHANGES</b>   |                                     | <b>EXPLAIN:</b>   |   |                             |
| <b>BRIEF DESCRIPTION FOR CALENDAR - Provide a brief description (maximum 6 lines) to be included in the Graduate Calendar.</b><br>This half-course is designed to allow the student to tailor learning to a selected practicum in clinical, education, research or administration, which meets their specific educational needs. Students must work with an approved public or private organization working in the field of global health either locally or internationally. The placement links the theory, the concepts, and health research methods taught in the program to real life practices. |                                     |   |   |                             |
| <b>CONTENT/RATIONALE - Provide a brief description, i.e., outline the topics or major sub-topics, and indicate the principal texts to be used.</b><br>For non-thesis students, the Global Health practicum provides an opportunity to consolidate the learning acquired during the program and apply this knowledge in real world contexts. While some students may elect to complete practicums in a lower to middle-income country, many more will elect to complete this course in a local/regional setting working with marginalized communities.  |                                     |   |   |                             |

**1. STATEMENT OF PURPOSE (How does the course fit into the department's program?)**

This half-course promotes self-directed learning under the supervision of global health faculty at McMaster University. Students in the sub-fields of globalization and development, global diseases, and global health management will be encouraged to deepen their knowledge in their particular area of interest.

**2. EXPECTED ENROLMENT:**

All students in the course-based MSc of Global Health program

**3. DESCRIBE IN DETAIL THE METHOD OF PRESENTATION OF COURSE MATERIAL (i.e., lectures, seminars):**

Not applicable.

**4. DESCRIBE IN DETAIL THE METHOD OF EVALUATION (percentage breakdown, if possible): (For 600-level course, indicate the Extra Work to be required of graduate students, i.e., exams, essays, etc.)**

Students will submit a final report on their GH practicum and be graded on a pass/fail basis.

**5. TO PREVENT OVERLAP, IS A COURSE IN THE SAME OR A RELATED AREA OFFERED IN ANOTHER DEPARTMENT? IF YES, PLEASE ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S).**

No

**6. IF THE COURSE IS INTENDED PRIMARILY FOR STUDENTS OUTSIDE YOUR DEPARTMENT, DO YOU HAVE THE SUPPORT OF THE DEPARTMENT/PROGRAM CONCERNED?**

**PLEASE PROVIDE THE CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:**

Name: Christy Gombay    Email: gombayc@mcmaster.ca    Extension: 22206    Date submitted: February 2013

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.

SGS/Medy/2012



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING COURSES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** course changes. All sections of this form **must** be completed.
2. An electronic version of this form must be emailed to the Assistant Secretary and SynApps System Administrator (Email: [espiritu@mcmaster.ca](mailto:espiritu@mcmaster.ca)).
3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|                           |                 |   |                        |                             |
|---------------------------|-----------------|---|------------------------|-----------------------------|
| <b>DEPARTMENT/PROGRAM</b> |                 | MSc Global Health Program                 |                        |                             |
| <b>COURSE TITLE</b>       |                 | Scholarly Paper                           |                        |                             |
| <b>COURSE NUMBER</b>      | GLOB HTH<br>711 | <b>COURSE CREDIT</b>                      |                        |                             |
|                           |                 | <b>FULL COURSE ( )</b>                    | <b>HALF COURSE (X)</b> | <b>QUARTER (MODULE) ( )</b> |
| <b>INSTRUCTOR(S)</b>      |                 | Dr. Andrea Baumann and Dr. Christy Gombay |                        |                             |
| <b>PREREQUISITE(S)</b>    |                 |   |                        |                             |

**NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)**

|   |  |   |   |                                 |
|---|--|---|---|---------------------------------|
| <b>NEW COURSE</b>   | <b>DATE TO BE OFFERED:</b>                         | <b>WAS THE PROPOSED COURSE OFFERED ON DEAN'S APPROVAL?</b><br>IF YES, PROVIDE THE DATE:   |   |                                 |
| <b>WILL THE COURSE BE CROSS-LISTED WITH ANOTHER DEPARTMENT?</b> |  | <b>IF YES, ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S). NOTE: CROSS-LISTING OF COURSES REQUIRES WRITTEN APPROVAL FROM EACH DEPARTMENT AND FACULTY CONCERNED.</b> |   |                                 |
| <b>CHANGE IN COURSE TITLE</b>                                   | <b>PROVIDE THE NEW COURSE TITLE:</b>               |   |   |                                 |
| <b>CHANGE IN COURSE DESCRIPTION</b>                             | X  | <b>600-LEVEL COURSE (Undergraduate course for graduate credit) Please see #4 on page 2 of this form</b>   |   |                                 |
| <b>CHANGE TO FULL COURSE</b>                                    |  | <b>CHANGE TO HALF COURSE</b>  | X | <b>CHANGE TO QUARTER COURSE</b> |
| <b>COURSE CANCELLATION</b>                                      | <b>PROVIDE THE REASON FOR COURSE CANCELLATION:</b> |   |   |                                 |
| <b>OTHER CHANGES</b>  | <b>EXPLAIN:</b>                                    |   |   |                                 |

**BRIEF DESCRIPTION FOR CALENDAR - Provide a brief description (maximum 6 lines) to be included in the Graduate Calendar.**

711 / Scholarly Paper (For students in the M.Sc. by Course Work Option)  
 This half- course is designed as an opportunity for graduate course-based M.Sc. students to demonstrate in writing, their ability to integrate ideas that reflect current knowledge in Global Health. The scholarly paper is to determine integrative thinking at a general and abstract level. A student will identify a topic, and in consultation, with a faculty member with expertise in the area, develop a proposal that is individualized to the student's area of interest. The student will then develop the paper under the guidance of a faculty member. The paper must be 15 to 20 pages excluding references and appendices. The paper does not necessarily involve the collection or analysis of primary data or the conduct of research with subjects. It is a scholarly essay, not a thesis. It is critical to the course-based M.Sc. students to demonstrate mastery of the theoretical and methodological understandings that have been acquired during the course work.

**CONTENT/RATIONALE - Provide a brief description, i.e., outline the topics or major sub-topics, and indicate the principal texts to be used.**

Existing Description:  
 711 / Scholarly Paper (For students in the M.Sc. by Course Work Option)  
 This full course is designed as an opportunity for graduate course-based M.Sc. students to demonstrate in writing, their ability to integrate ideas that reflect current knowledge in Global Health. The scholarly paper is to determine integrative thinking at a general and abstract level. A student will identify a topic, and in consultation, with a faculty member with expertise in the area, develop a proposal that is individualized to the student's area of interest. The student will then develop the paper under the guidance of a faculty member. The paper must be 15 to 20 pages, excluding references and appendices. The paper does not involve the collection or analysis of primary data or the conduct of research with subjects. It is a scholarly essay, not a thesis. It is critical to the course-based M.Sc. students to demonstrate mastery of the theoretical and methodological understandings that have been acquired during the course work.  
 Proposed course changes are: 1. Changed from full course to half course. and 2. adding the word 'necessarily' to the sentence 'The paper does not involve....'



|   |
|---|
| <p><b>1. STATEMENT OF PURPOSE (How does the course fit into the department's program?)</b></p> <p>The course provides an opportunity for students to demonstrate that they have understood the constituent elements of global health and are able to express them in a written academic format.</p> |
| <p><b>2. EXPECTED ENROLMENT:</b></p> <p>All those students in the Global Health program who are not doing theses - approximately 90% of those enrolled to date.</p>   |
| <p><b>3. DESCRIBE IN DETAIL THE METHOD OF PRESENTATION OF COURSE MATERIAL (i.e., lectures, seminars):</b></p> <p>Self-directed learning of students supervised by faculty of the Global Health program</p>  |
| <p><b>4. DESCRIBE IN DETAIL THE METHOD OF EVALUATION (percentage breakdown, if possible): (For 600-level course, indicate the <u>Extra Work</u> to be required of graduate students, i.e., exams, essays, etc.)</b></p> <p>Evaluation of scholarly papers is done on a pass/fail basis</p>          |
| <p><b>5. TO PREVENT OVERLAP, IS A COURSE IN THE SAME OR A RELATED AREA OFFERED IN ANOTHER DEPARTMENT? IF YES, PLEASE ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S).</b></p> <p>No</p>  |
| <p><b>6. IF THE COURSE IS INTENDED PRIMARILY FOR STUDENTS OUTSIDE YOUR DEPARTMENT, DO YOU HAVE THE SUPPORT OF THE DEPARTMENT/PROGRAM CONCERNED?</b></p>   |
| <p><b>PLEASE PROVIDE THE CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:</b></p> <p>Name: Christy Gombay    Email: gombayc@mcmaster.ca    Extension: 22206    Date submitted: February 2013</p>   |

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.

SGS/Medy/2012



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING COURSES**

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|                           |                 |   |                        |                             |
|---------------------------|-----------------|---|------------------------|-----------------------------|
| <b>DEPARTMENT/PROGRAM</b> |                 |   |                        |                             |
| <b>COURSE TITLE</b>       |                 | Global Health Symposium/Field Orientation |                        |                             |
| <b>COURSE NUMBER</b>      | GLOB HTH<br>710 | <b>COURSE CREDIT</b>                      |                        |                             |
|                           |                 | <b>FULL COURSE ( )</b>                    | <b>HALF COURSE (X)</b> | <b>QUARTER (MODULE) ( )</b> |
| <b>INSTRUCTOR(S)</b>      |                 | Dr. Andrea Baumann and Dr. Christy Gombay |                        |                             |
| <b>PREREQUISITE(S)</b>    |                 |   |                        |                             |

**NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)**

|   |   |   |  |                                 |
|---|---|---|--|---------------------------------|
| <b>NEW COURSE</b>   | <b>DATE TO BE OFFERED:</b>                  | <b>WAS THE PROPOSED COURSE OFFERED ON DEAN'S APPROVAL?</b><br>IF YES, PROVIDE THE DATE:   |  |                                 |
| <b>WILL THE COURSE BE CROSS-LISTED WITH ANOTHER DEPARTMENT?</b> |   | <b>IF YES, ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S). NOTE: CROSS-LISTING OF COURSES REQUIRES WRITTEN APPROVAL FROM EACH DEPARTMENT AND FACULTY CONCERNED.</b> |  |                                 |
| <b>CHANGE IN COURSE TITLE</b>                                   | PROVIDE THE NEW COURSE TITLE:               |   |  |                                 |
| <b>CHANGE IN COURSE DESCRIPTION</b>                             | X   | <b>600-LEVEL COURSE (Undergraduate course for graduate credit) Please see #4 on page 2 of this form</b>   |  |                                 |
| <b>CHANGE TO FULL COURSE</b>                                    |   | <b>CHANGE TO HALF COURSE</b>  |  | <b>CHANGE TO QUARTER COURSE</b> |
| <b>COURSE CANCELLATION</b>                                      | PROVIDE THE REASON FOR COURSE CANCELLATION: |   |  |                                 |
| <b>OTHER CHANGES</b>  | EXPLAIN:                                    |   |  |                                 |

**BRIEF DESCRIPTION FOR CALENDAR - Provide a brief description (maximum 6 lines) to be included in the Graduate Calendar.**

All students in the Master of Science in Global Health program are required to complete a Global Health Learning Symposium/Field Orientation in India. The objective of the course is to consolidate collaboration and decision-making in transcontinental teams. In the Symposium students are required to present abstracts of their scholarly paper/thesis research project in a real life, peer reviewed environment. It is interactive in nature where the students are challenged to integrate critical feedback from interdisciplinary faculty members and other experts in the global health field.

The field orientation is designed to deepen critical thinking and research methods in a real life setting. It provides the opportunity to enhance assessment skills and cross-cultural intuition in a diverse complex setting. The experience includes field visits, small group discussions and final group presentations based on the findings from the field visits.

Students unable to participate in the India Global Health Symposium because of disabilities or travel causing them undue hardship will have to fulfill the course requirements locally. The curriculum expectations including field orientation and grading will be the same.

**CONTENT/RATIONALE - Provide a brief description, i.e., outline the topics or major sub-topics, and indicate the principal texts to be used.**

The current description in the graduate catalogue does not adequately address the objectives of the course. Which have been narrowed to focus on learning in a cross-cultural complex setting of a lower or middle-income country. The alternative setting for the Global Health Learning Symposium and Field Orientation for those students unable to attend the planned one in India focuses on local settings working with marginalized communities in the Hamilton region.

\*710 / Learning Symposium and Field Orientation

All students in the Master of Science in Global Health program are required to complete a Global Health Learning Symposium/Field Orientation, working in an approved public or private organization engaged in the prevention of disease, health promotion, health service delivery, health policymaking, or research in a global context. The placement provides the opportunity to become familiar with the kinds of organizations that put into practice the theory, concepts, and methods taught in the Master's program. This course will take

place through field visits, small group discussions and the presentations of the conclusions from project work undertaken during the placement. After three weeks, students will also present their research findings, in order to receive feedback from peers.

**1. STATEMENT OF PURPOSE (How does the course fit into the department's program?)**

This course synthesizes knowledge gained by students in the three streams of global health and challenges students to present in a written and verbal form during the course. The introduction to field work is designed to test students' knowledge of health research methods. It is a precursor to their own individual research for their scholarly papers or their theses.

**2. EXPECTED ENROLMENT:**

All students in the MSc of Global Health

**3. DESCRIBE IN DETAIL THE METHOD OF PRESENTATION OF COURSE MATERIAL (i.e., lectures, seminars):**

Course materials will consist of lectures, seminars, field site visits, small group work & presentations.

**4. DESCRIBE IN DETAIL THE METHOD OF EVALUATION (percentage breakdown, if possible): (For 600-level course, indicate the Extra Work to be required of graduate students, i.e., exams, essays, etc.)**

Students will be graded on a pass fail basis.

**5. TO PREVENT OVERLAP, IS A COURSE IN THE SAME OR A RELATED AREA OFFERED IN ANOTHER DEPARTMENT? IF YES, PLEASE ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S).**

No

**6. IF THE COURSE IS INTENDED PRIMARILY FOR STUDENTS OUTSIDE YOUR DEPARTMENT, DO YOU HAVE THE SUPPORT OF THE DEPARTMENT/PROGRAM CONCERNED?**

**PLEASE PROVIDE THE CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:**

Name: Christy Gombay    Email: gombayc@mcmaster.ca    Extension: 22206    Date submitted: February 2013

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.

SGS/Medy/2012





**School of Graduate Studies**

1280 Main Street West  
Hamilton, Ontario, Canada  
L8S 4L8

Phone 905.525.9140  
Ext. 23679  
<http://graduate.mcmaster.ca>

To: Graduate Council

From: Christina Bryce

Assistant Secretary and SynApps Systems Administrator

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At an email ballot conducted on March 18, 2013, the Faculty of Engineering Graduate Curriculum and Policy Committee approved the following items.

Please note that these recommendations were approved at the April 16<sup>th</sup>, 2013 meeting of the Faculty of Engineering.

**FOR APPROVAL OF GRADUATE COUNCIL:**

**School of Engineering Practice** – Change in Course Requirements

**FOR INFORMATION OF GRADUATE COUNCIL:**

**Computing & Software**

-New Course \*766 Concurrent Programming



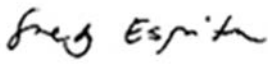
School of Graduate Studies

1280 Main Street West  
Hamilton, Ontario, Canada  
L8S 4L8

Phone 905.525.9140  
Ext. 23679  
<http://graduate.mcmaster.ca>

March 22, 2013

To : Dr. A. Heidebrecht  
Acting Dean  
Faculty of Engineering

From : Medy Espiritu   
Assistant Secretary & SynApps System Administrator

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At an email ballot conducted on March 18, 2013, the Faculty of Engineering Graduate Curriculum and Policy Committee approved the following items:

- 1) Proposal from the School of Engineering Practice to change the course requirements for the Master of Engineering Entrepreneurship and Innovation, Master of Technology Entrepreneurship and Innovation, Master of Engineering Design, and Master of Engineering and Public Policy
- 2) New course proposal from the Department of Computing and Software,  
\*766 – Concurrent Programming

These proposals are now forwarded to the Faculty of Engineering for approval.

Please note that these documents will also be submitted for approval as appropriate at the Graduate Council meeting on April 23, 2013.

Attachments



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM  
- FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS /  
PROCEDURES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.
2. An electronic version of this form must be emailed to the Assistant Secretary and SynApps System Administrator (Email: *espiritu@mcmaster.ca*).
3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|  |                 |  |  |            |                          |                                      |                     |                                     |
|--|-----------------|--|--|------------|--------------------------|--------------------------------------|---------------------|-------------------------------------|
| <b>DEPARTMENT</b>  |                 | Walter G. Booth School of Engineering Practice     |  |            |                          |                                      |                     |                                     |
| <b>NAME OF PROGRAM</b>   |                 | All program in SEP: MEEI, MTEI, M.Eng.Design, MEPP |  |            |                          |                                      |                     |                                     |
| <b>PROGRAM DEGREE</b>  | Ph.D. ( )       | M.A. ( )   | M.A.Sc. ( )  | M.B.A. ( ) | M. Eng. (X)              | M.Sc. ( )                            | Diploma Program ( ) | Other (Specify) MTEI                |
| <b>NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)</b>   |                 |  |  |            |                          |                                      |                     |                                     |
| <b>CHANGE IN ADMISSION REQUIREMENTS</b>  |                 | <input type="checkbox"/>                           | <b>CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE</b> |            | <input type="checkbox"/> | <b>CHANGE IN COURSE REQUIREMENTS</b> |                     | <input checked="" type="checkbox"/> |
| <b>CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR</b>   |                 |  | <b>EXPLAIN:</b>                                      |            |                          |                                      |                     |                                     |
| <b>OTHER CHANGES</b>   | <b>EXPLAIN:</b> |  |  |            |                          |                                      |                     |                                     |
| <b>DESCRIBE THE <u>EXISTING</u> REQUIREMENT/PROCEDURE:</b>   |                 |  |  |            |                          |                                      |                     |                                     |
| No change - addition of seminar series course only change  |                 |  |  |            |                          |                                      |                     |                                     |
| <b>PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE (Attach additional pages if space is not sufficient.)</b>  |                 |  |  |            |                          |                                      |                     |                                     |
| Addition of the following paragraph in the course requirements for these SEP programs: Master of Engineering Entrepreneurship and Innovation, Master of Technology Entrepreneurship and Innovation, Master of Engineering Design, Master of Engineering and Public Policy:   |                 |  |  |            |                          |                                      |                     |                                     |
| Students registered in this program are required to attend SEP *771 - Walter G. Booth School of Engineering Practice Seminar Series. This is a seminar series presented by guest speakers invited by the School of relevance to all Centres. All full time students are required to take this course in both fall and winter terms. Course grades are either 'pass' or 'fail'. In order to pass the course the student must attend a minimum of 80% of the seminars. |                 |  |  |            |                          |                                      |                     |                                     |

**RATIONALE FOR THE RECOMMENDED CHANGE:**

This seminar series is intended to enhance the student's experiential learning by exposing the student body to innovative thinkers and practitioners in the areas of: Engineering Entrepreneurship and Innovation, Engineering Design, Engineering and Public Policy or Technology Entrepreneurship and Innovation. It should be considered a networking event to bring together our students, faculty and staff in a community atmosphere centred around learning initiative.

**PROVIDE IMPLEMENTATION DATE: (Implementation date should be at the beginning of the academic year)**

September 2013

**ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.**

No

**PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR:**

Add the following paragraph in the course requirements for these SEP programs: Master of Engineering Entrepreneurship and Innovation, Master of Technology Entrepreneurship and Innovation, Master of Engineering Design, Master of Engineering and Public Policy:

Students registered in this program are required to attend SEP \*771 - Walter G. Booth School of Engineering Practice Seminar Series. This is a seminar series presented by guest speakers invited by the School of relevance to all Centres. All full time students are required to take this course in both fall and winter terms. Course grades are either 'pass' or 'fail'. In order to pass the course the student must attend a minimum of 80% of the seminars.

**CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:**

Name: S. Chidiac

Email: chidiac

Extension: 26558

Date submitted: March 18, 2013

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.



**SCHOOL OF GRADUATE STUDIES**

**RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING COURSES**

**PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:**

1. This form must be completed for **ALL** course changes. All sections of this form **must** be completed.
2. An electronic version of this form must be emailed to the Assistant Secretary and SynApps System Administrator (Email: [espiritu@mcmaster.ca](mailto:espiritu@mcmaster.ca)).
3. A representative from the department is required to attend the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

|                           |         |   |                        |                             |
|---------------------------|---------|---|------------------------|-----------------------------|
| <b>DEPARTMENT/PROGRAM</b> |         | Computing and Software  |                        |                             |
| <b>COURSE TITLE</b>       |         | Concurrent Programming  |                        |                             |
| <b>COURSE NUMBER</b>      | CAS 766 | <b>COURSE CREDIT</b>  |                        |                             |
|                           |         | <b>FULL COURSE ( )</b>  | <b>HALF COURSE (X)</b> | <b>QUARTER (MODULE) ( )</b> |
| <b>INSTRUCTOR(S)</b>      |         | Emil Sekerinski   |                        |                             |
| <b>PREREQUISITE(S)</b>    |         | Registration in one of Computing and Software graduate programmes or permission of instructor |                        |                             |

**NATURE OF RECOMMENDATION (PLEASE CHECK APPROPRIATE BOX)**

|  |                                     |   |  |                                 |
|--|-------------------------------------|---|--|---------------------------------|
| <b>NEW COURSE</b>  | <input checked="" type="checkbox"/> | <b>DATE TO BE OFFERED:</b><br>Fall 2013   | <b>WAS THE PROPOSED COURSE OFFERED ON DEAN'S APPROVAL? NO</b><br>IF YES, PROVIDE THE DATE: |                                 |
| <b>WILL THE COURSE BE CROSS-LISTED WITH ANOTHER DEPARTMENT? IF YES, ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S). NOTE: CROSS-LISTING OF COURSES REQUIRES WRITTEN APPROVAL FROM EACH DEPARTMENT AND FACULTY CONCERNED.</b> |                                     |   |  |                                 |
| <b>CHANGE IN COURSE TITLE</b>  |                                     | <b>PROVIDE THE NEW COURSE TITLE:</b>  |  |                                 |
| <b>CHANGE IN COURSE DESCRIPTION</b>  |                                     | <b>600-LEVEL COURSE (Undergraduate course for graduate credit) Please see #4 on page 2 of this form</b> |  |                                 |
| <b>CHANGE TO FULL COURSE</b>   |                                     | <b>CHANGE TO HALF COURSE</b>  |  | <b>CHANGE TO QUARTER COURSE</b> |
| <b>COURSE CANCELLATION</b>   |                                     | <b>PROVIDE THE REASON FOR COURSE CANCELLATION:</b>  |  |                                 |
| <b>OTHER CHANGES</b>   |                                     | <b>EXPLAIN:</b>   |  |                                 |

**BRIEF DESCRIPTION FOR CALENDAR - Provide a brief description (maximum 6 lines) to be included in the Graduate Calendar.**  
 Processes and Synchronization, Atomicity, Mutual Exclusion, Locks and Barriers, Semaphores, Monitors, Message Passing, Parallel Programming, Patterns for Concurrency, Transactional Memory, Linearizability, Consensus, Lock-free Algorithms, Multi-core Processors, Heterogeneous Computing with GPU and FPGA, Applications.

**CONTENT/RATIONALE - Provide a brief description, i.e., outline the topics or major sub-topics, and indicate the principal texts to be used.**

Basics: Processes and Synchronization, Atomicity, Mutual Exclusion, Locks and Barriers, Semaphores, Monitors, Message Passing  
 Theory: Linearizability, Correctness Proofs, Consensus  
 Patterns: Map, Reduce, Fork/Join, Pipeline, Scatter, Gather, Master/Worker  
 Efficiency: Transactional Memory, Lock-free Algorithms  
 Implementations: Parallel Programming, Multi-core Processors, GPU's and FPGA's  
 Applications: Scientific Computing, Sorting, Compression, Encryption, etc.

Herlihy, Shavit, The Art of Multiprocessor Programming, Morgan Kaufmann, 2008.  
 McCool, Reinders, Robison, Structured Parallel Programming: Patterns for Efficient Computation, Elsevier, 2008  
 Andrews, Foundations of Multithreaded, Parallel, and Distributed Programming, Addison-Wesley, 2000.  
 Lea, Concurrent Programming in Java: Design Principles and Patterns, Addison-Wesley, 1999.  
 Michel Raynal, Concurrent Programming: Algorithms, Principles, and Foundations, Springer, 2013.  
 Mordechai Ben-Ari, Principles of Concurrent and Distributed Programming (2nd Edition), Addison-Wesley, 2006.  
 Further literature on GPU and FPGA programming as needed.

|  |
|--|
| <p><b>1. STATEMENT OF PURPOSE (How does the course fit into the department's program?)</b></p> <p>Concurrency manifests itself in numerous form, historically first within operating systems, then with distributed and parallel computing, more recently with multi-core processors, and soon with many-core processors and heterogenous computing. There exists also a rich theory of concurrency, e.g. models of concurrency and verification (model-checkers). The topic is too broad to be covered by a single course. CAS 703 Software Design covers only the basic principles of concurrency. CAS 724 Concurrency Theory covers the theoretical aspects. This course would be on the principles, methods, and implementations, with focus on multit-core and heterogeneous computing.</p> |
| <p><b>2. EXPECTED ENROLMENT:</b></p> <p>10</p>   |
| <p><b>3. DESCRIBE IN DETAIL THE METHOD OF PRESENTATION OF COURSE MATERIAL (i.e., lectures, seminars):</b></p> <p>About 2/3 of the course will be lectures and 1/3 presentations by students.</p>   |
| <p><b>4. DESCRIBE IN DETAIL THE METHOD OF EVALUATION (percentage breakdown, if possible): (For 600-level course, indicate the <u>Extra Work</u> to be required of graduate students, i.e., exams, essays, etc.)</b></p> <p>Two assignments (20% each), one seminar (20%), one research paper with presentation (40%)</p>   |
| <p><b>5. TO PREVENT OVERLAP, IS A COURSE IN THE SAME OR A RELATED AREA OFFERED IN ANOTHER DEPARTMENT? IF YES, PLEASE ATTACH TO THIS FORM ANY RELEVANT CORRESPONDENCE WITH THE OTHER DEPARTMENT(S).</b></p> <p>No</p>   |
| <p><b>6. IF THE COURSE IS INTENDED PRIMARILY FOR STUDENTS OUTSIDE YOUR DEPARTMENT, DO YOU HAVE THE SUPPORT OF THE DEPARTMENT/PROGRAM CONCERNED?</b></p> <p>N/A</p>   |
| <p><b>PLEASE PROVIDE THE CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:</b></p> <p>Name: Antoine Deza      Email: deza@mcmaster.ca      Extension: 23750      Date submitted: 13 March 2013</p>   |

If you have any questions regarding this form, please contact Medy Espiritu, Assistant Secretary and SynApps System Administrator, School of Graduate Studies, extension 24204.

SGS/Medy/2012

## 1.1 Programs of Study

McMaster University offers graduate programs that lead to one of the following degrees:

Master of Arts in Anthropology, Classics, Communication and New Media, Cultural Studies and Critical Theory, Economics, Economic Policy, English, French, Gender Studies and Feminist Research, Geography, Globalization, Health and Aging, History, Philosophy, Political Science, Religious Studies, Sociology, and Work and Society;

Master of Business Administration;

Master of Applied Science in Biomedical Engineering, Chemical Engineering, Civil Engineering, Computational Engineering and Science, Electrical and Computer Engineering, Engineering Physics, Materials Engineering, Mechanical Engineering, Software Engineering;

Master of Communications Management;

Master of Engineering in Chemical Engineering, Civil Engineering, Computational Engineering and Science, Computer Science, ADMI Design and Manufacturing, Electrical and Biomedical Engineering, Electrical and Computer Engineering, Engineering Physics, Manufacturing Engineering, Mechatronics, Nuclear Engineering (UNENE), Software Engineering; Software Engineering and Virtual Systems Design;

Master of Engineering Design;

Master of Engineering Entrepreneurship and Innovation;

Master of Engineering and Public Policy;

Master of Finance;

Master of Health Management;

Master of Science in Biochemistry, Biology, Chemical Biology, Chemistry, Cognitive Science of Language, Computational Engineering and Science, Computer Science, Earth and Environmental Sciences, eHealth, Geography, Global Health, Health and Radiation Physics, Health Research Methodology, Health Science Education, Kinesiology, Materials Science, Mathematics, Medical Sciences (Blood and Vasculature; Cancer and Genetics; Infection and Immunity; Metabolism and Nutrition; Neurosciences and Behavioural Sciences; Physiology/Pharmacology), Neuroscience, Nursing, Occupational Therapy, Physics and Astronomy, Physiotherapy, Psychology, Radiation Sciences, Rehabilitation Science, and Statistics;

Master of Social Work;

Master of Technology Entrepreneurship and Innovation;

MD/Ph.D. in Medicine and Biochemistry; Medicine and Medical Sciences.

Doctor of Philosophy in Anthropology, Biochemistry, Biology, Biomedical Engineering, Business Administration (Finance; Human Resources; Information Systems; Management Science), Chemical Biology, Chemical Engineering, Chemistry, Civil Engineering, Classics, Cognitive Science of Language, Computational Engineering and Science, Computer Science, Earth and Environmental Sciences, Economics, Electrical and Computer Engineering, Engineering Physics, English, French, Geography, Health Policy, Health Research Methodology, History, Kinesiology, Materials Engineering, Materials Science, Mathematics, Mechanical Engineering, Medical Sciences (Blood and Vasculature; Cancer and Genetics; Infection and Immunity; Metabolism and Nutrition; Physiology/Pharmacology), Neuroscience, Nursing, Philosophy, Physics and Astronomy, Political Science, Psychology, Radiation Sciences, Rehabilitation Science, Religious Studies, Social Work, Sociology, and Software Engineering.

### 2.1.2 Admission Requirements for Ph.D. Degree

Applicants may be admitted to a regular Ph.D. program at one of three stages in their academic work. **First, entry after completion of** ~~Often they will have completed~~ a Master's program. ~~In some cases, they will be admitted~~ **Second, admission** to Ph.D. studies from a Master's program at McMaster without completing the Master's degree. Students still enrolled in a Master's with thesis program beyond 22 months must complete the degree requirements including the thesis prior to admission to the Ph.D. program. **And third, in** ~~in exceptional cases, they may be admitted~~ **admission may be** directly from a bachelor's degree.

1. For applicants who hold a Master's degree, the primary requirements are distinction in their previous graduate work (equivalent to at least a McMaster B+), and strong letters of reference.
2. Students enrolled in a Master's program at ~~this~~ **McMaster** University may be transferred to the Ph.D. program prior to completion of the Master's degree. Not sooner than two terms **and no later than 22 months** after initial registration in the Master's program ~~here~~, students may request to be reclassified as Ph.D. students. After proper review, the department will recommend one of the following:
  - (a) admission to Ph.D. studies following completion of the requirements for the Master's degree;
  - (b) admission to Ph.D. studies without completion of a Master's program;
  - (c) admission to Ph.D. studies but with concurrent completion of all requirements for a Master's degree within two months from the date of reclassification;
  - (d) refusal of admission to Ph.D. studies.

For students in (b), the recommendation for admission to Ph.D. must identify which if



any courses taken as a Master's student can be credited toward the requirements for the Doctoral program.

A student in (b) may re-register as a candidate for the Master's degree, provided that work to date has met the standards for the Master's program.

Students in (c) who do not complete the requirements for the Master's degree within the two months will lose their status as a Ph.D. candidate and be returned to Master's status.

3. In certain programs, applicants with a first degree only, may be admitted directly to Ph.D. studies. Such students must show sufficient promise, including at least an A average. Within one calendar year the progress of students admitted to Ph.D. studies directly from a Bachelor's degree will be reviewed by their supervisory committee and the program. The program then will recommend one of the following:
  - (a) proceed with Ph.D. studies;
  - (b) not proceed with Ph.D. studies but re-register as a Master's candidate;
  - (c) withdraw from the University.

A student admitted to a Ph.D. program who re-registers as a candidate for a Master's degree must meet all of the requirements for the Master's degree in order for it to be awarded.

### 2.1.3 Admission Requirements for Part-Time Ph.D. Degree

Admission to a part-time Ph.D. program is possible only for an individual holding a Master's degree whose circumstances preclude uninterrupted full-time doctoral studies. Because of the divergent nature of academic disciplines, part-time doctoral work is not feasible in some areas. Accordingly, no Department or Program is obligated to offer part-time doctoral work. As part of their applications prospective part-time students are required to provide a plan of study, including a clear account of when and where the thesis research is to be conducted. If facilities at the place of employment are to be used for the research, the signed agreement of the employer, recognizing the conditions surrounding graduate work, is also required. In addition, departments may have other requirements for admission to a part-time doctoral program. A part-time doctoral student must be geographically available on a regular basis, and must be able to participate regularly in departmental seminars and colloquia.

### 2.1.3 Admission of Students to a Cotutelle Ph.D. Degree

A cotutelle is a single Ph.D. awarded by two post-secondary institutions, typically from different countries. A cotutelle degree is a unique way to promote and structure research collaborations, and allows students access to a broader range of research supervision than would be available at a single institution.

Students interested in a cotutelle Ph.D. degree must have finalized arrangements completed within the first 12 months of their Ph.D. study. Partner university arrangements may vary and students must investigate what is required to fulfill that institution's cotutelle requirements. For information on how to apply please view the Cotutelle Policy available at: [www.mcmaster.ca/.....](http://www.mcmaster.ca/.....)

## 2.4 Registration

### 2.4.1 Procedures

All graduate students, in both the regular and part-time programs, are required to register and pay fees annually in September until they graduate or withdraw. If they fail to do so they do not retain the status of graduate student and must apply for re-admission if they wish at a later date to continue their studies. If the department approves, a student may be allowed to begin graduate work in the winter or summer term (January or May), in which case they will first register at the start of that term, but in any following years will register in September.

It is the joint responsibility of the student and program to determine the appropriate program of study.

~~At the time of registration, students declare their program of studies as approved by their advisor (supervisor) and the chair of the department.~~

### 2.5.1 Averaging of Letter Grades

Grades in graduate courses are reported as letter grades. However, instructors may record grades for individual components of the course either as letter or numerical grades. The averaging of letter grades assigned to individual components of a course must be done by using the McMaster 12-point scale, as follows: A+ = 12, A = 11, A- = 10, B+ = 9, B = 8, B- = 7, C+ = 6, C = 5, C- = 4, D+ = 3, D = 2, D- = 1, F = 0. Further, all .5 marks should be rounded up. The passing grades for courses at the graduate level are A+, A, A-, B+, B, and B-. Graduate students enrolled in undergraduate courses will be subject to ~~some~~ the same set of passing grades as courses at the graduate level.

### Graduate Student Grading Scale:

| Grade | Points | Pass/Fail |
|-------|--------|-----------|
| A+    | 12     | P+        |
| A     | 11     | P         |
| A-    | 10     | F         |
| B+    | 9      |           |
| B     | 8      |           |
| B-    | 7      |           |
| F     | 0      |           |

Note: Grades in graduate courses are reported as letter grades. Averaging of letter grades must be done using the McMaster 12-point scale.

Example of Weighted Average Calculation, using the grade points and units for courses completed:

| Course Grade                              | Grade Points |   | Course Units |      |
|---|--------------|---|--------------|------|
| A-  | 10           | x | 6            | = 60 |
| B   | 8            | x | 6            | = 48 |
| B+  | 9            | X | 3            | = 27 |
| F   | 0            | X | 3            | = 0  |
| Total                                     |              |   | 18           | 135  |
| To calculate Average: $135 \div 18 = 7.5$ |              |   |              |      |

Note: 6-unit course is equivalent to a full course  
3-unit course is equivalent to a half course

Note: McMaster University's Policy on Graduate Course Outlines is available at:  
<http://www.mcmaster.ca/policy/faculty/Conduct/GraduateCourseOutlines.pdf>

### 3. REGULATIONS FOR MASTER'S DEGREES

Master of Applied Science, Master of Arts, Master of Communications Management, Master of Engineering, Master of Engineering Design, Master of Engineering Entrepreneurship and Innovation, Master of Engineering and Public Policy, Master of Health Management, Master of Science, Master of Social Work, Master of Technology Entrepreneurship and Innovation. Regulations for the M.B.A. program may be found in the M.B.A. Calendar, available from the DeGroote School of Business.

#### 3.3 Thesis

A thesis may be submitted at any time. The final date for submitting a thesis to the department for Fall or Spring Convocation is found in the Sessional Dates Section. The thesis will be examined by a committee of not fewer than three members (including the supervisor and an

examiner external to the supervisory committee) who will be appointed by the department/program chair; the thesis will be defended by the candidate in an oral examination before this committee. The Associate Vice-President & Dean of Graduate Studies may appoint members to these committees. The time of the defense will be set by the department/program chair; normally this will be about two weeks after the completed thesis (as an electronic file; see section 2.7 above) has been submitted to the department for examination.

After a successful examination and all requested changes have been made, the student will upload the final e-thesis to Digital Commons (see section 2.7). The student may wish to have printed copies of the final thesis suitably bound for personal use or for presentation. The student will be responsible for the cost and distribution of any bound copies.

**Tuition fees continue to be assessed until all degree requirements are met, including the successful submission of the final approved thesis to Digital Commons.**

### **3.6 Program Duration**

The amount of work in a regular (full-time) Master's program for a student with good preparation varies across the campus, but generally, programs involving a thesis are designed to take longer than those without a thesis. Programs with a thesis typically take sixteen to twenty months. Twelve-month non-thesis programs occur in Anthropology, Classics, Cultural Studies and Critical Theory, Economics, Economic Policy, English, French, History, Physics, Political Science, and Sociology.

For students in a regular program, the permissible time for completion of a Master's degree program is limited to three years from their initial registration in the program. For those students admitted to a part-time Master's program, and who complete all degree requirements while registered part-time, the permissible time is limited to five years from their initial registration.

Each student's progress is reviewed annually by the department and on a more frequent basis by the supervisor. A student whose work is unsatisfactory may at any time be required to withdraw from the University. In those cases in which a student does not manage to complete the degree before the end of the time limit specified above, the University has no further obligation to provide supervision. Upon consultation with the department and on its recommendation, the student will be shown as having been "withdrawn in good standing due to time limit".

In the case of a student in a thesis program, if a completed thesis is submitted, and is acceptable to the department, the student can be readmitted in order to defend the thesis. However, thesis program students who have been withdrawn in good standing should be aware that they may be required to complete additional course work before being permitted to proceed to a defense of the thesis. In all cases, the department must first declare that the submitted thesis is ready for defense before the student will be readmitted.

A student enrolled in a course work or project program may also be readmitted if this is deemed acceptable by the student's department. However, course work and project program students who have been withdrawn in good standing should be aware that they may be required to retake courses in which the content is judged by their department to have changed significantly since first completion and/or may be required to take additional courses that are necessary to fulfill current program requirements.

At the time of readmission, the student will be required to pay a fee (equivalent to one term's tuition **at the current part-time level 5 rate – see section 5.1**) ~~at the rate paid when the student last enrolled,~~ to compensate for the costs of the defense and subsequent processing of the thesis.

### **4.3 Examinations**

All Ph.D. candidates at McMaster are expected to acquire, during the course of their studies, a comprehensive knowledge of the discipline or sub-discipline to which their field of research belongs. The Comprehensive Examination is designed to test students for this breadth of knowledge and the ability to integrate ideas. The form of the exam and its administration are the responsibility of the department in which the student is registered, not of the student's supervisory committee. The outcome will be reported to the School of Graduate Studies as "pass with distinction", "pass", or "fail."

**If the Comprehensive Examination consists of multiple components, a second failure on any single component will constitute a second failure of the Comprehensive Examination.**

If the result of the **Comprehensive** Examination is "fail", the student must be given a second opportunity to take the examination, or those portions on which the failure occurred. This second opportunity is given in place of any 're-read' of a comprehensive exam, which is explicitly excluded from the Student Appeal Procedures, and in recognition of the fact that the failure may occur on the oral part of the examination. If a student chooses to withdraw from the program prior to that second opportunity, the result "fail" will remain on the student's record. A second failure will result in the student being withdrawn by the beginning of the following month.

The Comprehensive Examination for full-time students will normally take place between 12 and 20 months after the student has begun Ph.D. work at McMaster, with an upper limit of 24 months. Individual exceptions require the approval of the appropriate Faculty Committee on Graduate Admissions and Study. Programs which offer part-time Ph.D. programs must require such students to take the Comprehensive Examination by the end of the 36<sup>th</sup> month.

Departments may hold qualifying or entrance examinations at the beginning of a student's doctoral studies.

There is no University-wide foreign language requirement for Ph.D. students. Many departments, however, do have such a requirement (see departmental regulations).

All departmental examination rules and practices are subject to approval by the Faculty Committee on Graduate Curriculum and Policy, which may refer questions to Graduate Council.

#### **4.4 Thesis**

A candidate must present a thesis which embodies the results of original research and mature scholarship. In the case of sandwich theses, mature scholarship specifically includes substantial and significant contributions to the composition of text in papers with multiple authors. The student must be authorised by a majority of the supervisory committee before producing the final version of the thesis for oral defense. Normally the thesis will be distributed to committee members and examiners in an electronic format (see Section 2.7 - Theses).

When a majority of the supervisory committee have approved the final version of the thesis, it may be submitted to the School of Graduate Studies for examination. The oral defense will not be arranged by the Thesis Coordinator until a majority of the supervisory committee has submitted a report approving the thesis for defense and an agreed date of defense has been received.

#### **Selection of the Examining Committee**

Selection of an external examiner is the responsibility of the Associate Vice-President & Dean of Graduate Studies. To aid in that selection, the supervisory committee is required to provide, through the Chair of the Department (or equivalent), the names and contact information for three potential examiners, at least one month prior to the submission of the thesis. The nominees must not have primary appointments at McMaster University, and they must be at arm's length\* from all members of the supervisory committee and the student. To maintain this distance, all communication with a potential or selected external examiner that is related to the examination and defense of the student must originate only from the School of Graduate Studies. The external examiner will provide a written report to the Associate Vice-President & Dean of Graduate Studies judging whether the written thesis is satisfactory for defense or not. The external examiner will provide this assessment regardless of their ability to be present at the defense.

The examining body will consist of the following members: the student's supervisor, two representatives of the department selected by the chair (normally from the supervisory committee), and an external examiner. If the external examiner cannot attend the oral defense, either in person or through tele- or video-conferencing, one additional representative of the faculty at large will be selected as an attending external examiner. In unusual situations where the supervisor is not available to participate in the defense for an extended period, the program Chair may designate a different faculty member to serve on the examining committee in place of the supervisor.

\*The definition of 'arm's length' is as follows: The nominees should not have been a research supervisor or student of the supervisor or the student within the last 6 years; should not have collaborated with the supervisor or the student within the past 6 years, or have made plans to collaborate with these individuals in the immediate future. There also should be no other potential conflicts of interest (e.g., personal or financial). External examiners should not have been employed by or affiliated with the student's or supervisors' Department within the past 6 years, nor expect to become employed in the Department in the immediate future.

### Scheduling and Conducting the Oral Examination (Oral Defense)

If the external examiner approves the thesis for oral examination, an oral defense will be convened by the Associate Vice-President & Dean of Graduate Studies, chaired by herself or her delegate and conducted by all members of the examining committee. Quorum for the examination will be the Chair of the examining committee plus four examiners. At the discretion of the student, the oral defense will be open to members of the university community and the public who wish to attend as observers. The examination proper will be conducted only by the members of the examining committee. When they have completed their questions, the Chair may permit a few minutes of questioning by visitors. Normally the student will attempt to answer visitors' questions, but these are not to be considered part of the examination for the degree. Observers will withdraw prior to the committee's deliberations on the student's performance at the defense.

If the external examiner does not approve the thesis for an oral defense, the appropriate Associate Dean will convene a meeting with the student's supervisory committee to discuss the external examiner's report. The supervisory committee and student will make every effort to address the concerns of the examiner, and the revised thesis may be re-assessed again by the external examiner. In rare cases, a new external examiner may be appointed by the Associate Vice-President and Dean of Graduate Studies.

After a discussion of the examination, the Chair will ask for a vote on each of the two questions, the acceptance or rejection of the **written document** and the success or failure of the **defense**. If the examiners approve both the written thesis and the defense, the Chair will ask the examiners to complete the Examination Report by initialling appropriately. The student will be invited back to the examination room for congratulations by the committee. In the event the written thesis is approved conditionally, the Chair of the examination committee is responsible for ensuring that (1) the candidate is advised of the conditions in writing, (2) the candidate receives and understands the 'Final Thesis Submission form' to be used by the Supervisor to confirm that the conditions have been met, and (3) the supervisor is also aware of the form. The Chair will complete and sign the Examination Report and return it to the School of Graduate Studies.

However, if there are two or more negative or abstaining votes on either question, with at least one of these votes being from a member of the supervisory committee, the candidate will be

deemed to have failed the defense, and a reconvened oral defense must be held at a later date. The candidate should be told as clearly as possible by the Chair and the examining committee what he/she must do to improve the written thesis and/or the defense of it. The reconvened defense is the candidate's final opportunity to complete the degree. Membership on the reconvened examining committee should be the same as that for the original defense, except that one or two substitutions are permitted in order to expedite scheduling of the reconvened defense. If the written thesis, or the defense of it, fails a second time, that decision is final, and is not open to appeal.

After a successful defense, the candidate must correct any errors detected by the readers to the satisfaction of the Supervisor and then submit an electronic copy to the School of Graduate Studies via Digital Commons (see Section 2.7.3 - Publication of Electronic Theses at McMaster University). The fee for archiving the thesis is paid by the student.

**Tuition fees continue to be assessed until all degree requirements are met, including the successful submission of the final approved thesis to Digital Commons.**

#### **4.6 Program Duration**

The minimum time in which to complete a Ph.D. program at McMaster is three calendar years beyond the bachelor's level or two calendar years beyond the master's level. However, the minimum time may be reduced by up to one year for graduate work beyond the Master's level taken in a university or research institution approved by the Faculty Committee on Graduate Admissions and Study.

Completion of the Ph.D. degree is normally limited to six years from initial registration in a regular doctoral program at McMaster. The time for completion of the Ph.D. program for those admitted to a part-time program is normally limited to eight years from initial registration at McMaster as a Ph.D. student.

Each student's progress is reviewed annually by the department and on a more frequent basis by the supervisory committee. A student whose work is unsatisfactory may at any time be required to withdraw from the University.

In those cases in which a student does not manage to complete the degree requirements before the end of the time limit specified above, the University has no further obligation to provide supervision. Upon consultation with the department and on its recommendation, the student will be shown as having been "withdrawn in good standing due to time limit".

If a completed thesis is submitted, and is acceptable to the department, the student can be readmitted in order to defend the thesis. Students who have been withdrawn in good standing should be aware that they may be required to complete additional course work before being permitted to proceed to a defense of the thesis. In all cases, the department must first declare that the submitted thesis is ready for defense before the student will be readmitted.



At the time of readmission, the student will be required to pay a fee (equivalent to one term's tuition **at the current part-time level 5 rate – see section 5.1**) ~~at the rate paid when the student last enrolled,~~ to compensate for the costs of the defense and subsequent processing of the thesis.