Cyclical Review
Follow-up Report

Cyclical Review of the Graduate Program in Biomedical Engineering

Master of Applied Science in Biomedical Engineering

Submitted to:

Graduate Program Evaluation Committee
Faculty of Graduate and Postdoctoral Studies

[Date]

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Graduate Program in Biomedical Engineering
Cyclical review year 2012-2013
Outcome categorization - Good Quality with Report, July 2016

Follow-up Report approved by the Graduate Program Evaluation Committee
Faculty of Graduate and Postdoctoral Studies
Meeting of (DATE OF MEETING)

In accordance with the University's Institutional Quality Assurance Process (IQAP)**,** following the completion of the cyclical review, a program is given an outcome categorization. The following template and guidelines are for programs that received an outcome categorization of 'good quality with report'. The recommendations to be addressed in the Cyclical Review Follow-up Report are listed in the Final Assessment Report and Executive Summary of the most recent cyclical review.

Name of Program Reviewed	Biomedical Engineering
Degrees	• Master of Applied Science in Biomedical Engineering
Responsible academic units	• Ottawa-Carleton Institute of Biomedical Engineering (OCIBME)
Fields	There are four fields in the program: • Medical Instrumentation • Biomedical image processing • Biomechanics and biomaterials • Medical informatics and telemedicine
Outcome categorization	Good quality with report, to be submitted in July 2016
Recommendations	1. Clarify its position on admission guidelines for non-engineering students and, as necessary, address the need to teach basic engineering skills to non-engineering students to grant them status as biomedical engineers. 2. Provide a clear plan for faculty retirements including commitments to replace retiring members with new positions in the designated fields of biomedical engineering. 3. Endeavor to find additional physical space for its students, enhanced program counseling and support to students, and improved communications between the member institutions. 4. Improve student preparation for professional activities and career possibilities through increased opportunities for cooperative and experiential leaning, and through by tracking the professional experiences of students by developing an ongoing exit survey of graduates. 5. Enhance the operation and administration of the program by developing a new program website, by providing common, coordinated, and centralized administrative support for the MASc program with emphasis on sharing registration information, and by establishing a students' program advisory committee. 6. Examine the teaching relief status of both the Director and the Associate Director so that both institutional leaders may

	receive equal relief in order to facilitate and enhance student contact. 7. Develop a membership renewal process to facilitate tracking faculty involvement in the program. 8. Develop closer collaboration with the Faculty of Medicine of the University of Ottawa. 9. Consider extending the MASc to include new programs such as a professional (nonthesis) MEng, and a new PhD program in biomedical engineering.
As stipulated in the Final Assessment Report, recommendations 1 and 2 have been addressed and are reported on below. The remaining recommendations will be addressed at the time of the next cyclical evaluation which will be completed by 2020-2021.	

Recommendations for follow-up

1) Clarify its position on admission guidelines for non-engineering students and, as necessary, address the need to teach basic engineering skills to non-engineering students to grant them status as biomedical engineers.
We have had students from non-engineering backgrounds that have successfully completed the M.A.Sc. BME program. For students with non-engineering background, we have given extra scrutiny to such individuals prior to admitting, so that we are doing our best to ensure student success. All students, including these non-engineering students, complete at least three BIOM/BMG engineering courses for their M.A.Sc. degrees. As a result, all students from our BME program are very familiar with engineering principles and practice. In addition, a draft policy has been developed and sent to the OCIBME BoM for discussion at their next meeting. The core of this policy is, for each non-engineering student admitted to the program, to create a committee of three members (including the supervisor) which are tasked with assessment and, if necessary, remediation of any gaps in required, essential, engineering skills. This committee will meet with the student at least twice, with the first meeting before the start of program. The committee can address missing skills by assigning additional courses or other work.

2) Provide a clear plan for faculty retirements including commitments to replace retiring members with new positions in the designated fields of biomedical engineering.
Since the external site visit for the cyclical program review, seven new biomedical engineering faculty have been hired, while there has been one retirement and one faculty that has left Carleton -- a net increase of five faculty members in the past four years. This demonstrates the active commitment of the two universities to biomedical engineering. Positions include: • Andrew Speirs (MAE, Carleton, hired 2013) • Sangetta Murugkar (PHYS, Carleton, hired 2013) • Emily Heath (PHYS, Carleton, hired 2014) • Sreeraman Rajan (SCE, Carleton, hired 2015) • Eran Ukwatta (SCE, Carleton, hired 2016) • Jeongwon Park (EECS, uOttawa, hired 2016)

- Jean-Philippe St-Pierre (CHG, uOttawa, hired 2017)

Additional

In addition to reporting on the two recommendations required for this follow-up report, the academic unit it pleased to provide the following status update on the additional seven recommendations.

3) Endeavor to find additional physical space for its students, enhanced program counselling and support to students, and improved communications between the member institutions.

Physical Space

Carleton now has excellent space in the Canal Building in which students desk/ labs and professors offices are located close to each other on the 6th and 7th floors.

uOttawa students have access to student desks/lab space at SITE and CBY buildings. Currently most of the thesis based students have student office spaces. This situation will be further enhanced once the planned STEM building is completed by Fall 2018.

Program counselling

For counselling related to academic issues, both Carleton and uOttawa have graduate program assistants (shared with other programs) to deal with student admissions, registrations, and other related matters.

For counselling related to thesis related issues, students will be able to seek guidance and support from their supervisors or thesis committee members.
Furthermore, two new 0.5 FTE positions have been approved at both universities in 2016 to provide additional support to OCIBME and its students.
In addition, both Director and Associate Director of the OCIBME are always available to provide student support.

Communications

- At least two BoM meetings/year
- Annual OCIBME Research Day: this will be a one day event featuring student poster and podium presentations and external guest speakers. This will also provide a good opportunity for the OCIBME community to showcase their research and establish collaborations with Ottawa Hospitals.
- An OCIBME newsletter will be set up to circulate, within the OCIBME, including student and faculty news, scholarship opportunities, employment opportunities (related to biomedical engineering), and conference announcements.

4) Improve student preparation for professional activities and career possibilities through increased opportunities for cooperative and experiential leaning, and through by tracking the professional experiences of students by developing an ongoing exit survey of graduates.

There are a significant number of opportunities already available through graduate schools

Carleton: Grad Navigate and Preparing to Teach Certificate
uOttawa: Altitude, MyGradSkills courses (www.mygradskills.ca), and the Mitacs Step workshops

Students are also given good support for student clubs including CU@EMBS and new CMBES student

club (formed in 2015), which has put on networking events with industry, and hosted the 2016 IEEE International Student Conference. For uOttawa, there is a Canadian Society for Biomaterials Ottawa student chapter that organizes student events and provides opportunities for students to interact with local industry.

At uOttawa, the Graduate Office of the Faculty of Engineering organizes a yearly two-day workshop on Professional Development and Career planning which is open to all graduate students in the Engineering Faculty at uOttawa, including MEng students. This initiative has been introduced for many years now to improved student professional and career opportunities.

5) Enhance the operation and administration of the program by developing a new program website, by providing common, coordinated, and centralized administrative support for the MASc program with emphasis on sharing registration information, and by establishing a students' program advisory committee.

Program website was completed revised in 2014, and is being updated continuously.

Admin support is done centrally for applicants to the OCIBME programs, but somewhat dispersed for graduate students.

Two new 0.5 FTE positions have been approved at both universities in 2016 to provide additional support to OCIBME.

6) Examine the teaching relief status of both the Director and the Associate Director so that both institutional leaders may receive equal relief in order to facilitate and enhance student contact.

At Carleton, teaching relief (one course) is only available to Director, not Associate Director
At uOttawa, teaching relief (one course) is available to both Director and Associate Director
It should be noted that with the introduction of new M.Eng completion option (course work only, and course work plus project) there is a 0.5 course credit for an M.Eng co-ordinator.

7) Develop a membership renewal process to facilitate tracking faculty involvement in the program.

A membership renewal process was implemented in 2016. Membership is for 3 years and must be renewed. For membership renewal, member should demonstrate commitment to teach OCIBME courses and/or supervise students, and conduct research related to Biomedical Engineering field. Memberships are approved by the Director and Associate Director with the OCIBME BoM being informed of membership changes.

8) Develop closer collaboration with the Faculty of Medicine of the University of Ottawa.

- Dr. Natalie Baddour (MCG) and Dr. Edward Lemaire (TRC): wearable mobility monitoring using a smartphone-based approach
- Dr. Isabelle Catelas (MCG) and Dr. Paul Beaulé (OHRI/TOH): hip implant arthroplasties: prospective database and study
- Dr. Xudong Cao (CHG) and Dr. Eve Tsai (Civic Hospital): recruiting endogenous stem cells for the

repair of spinal cord injuries

- Dr. Adrian Chan (SCE) and Dr. David Grynspan (CHEO): objective and subjective measures of the distal villous hypoplasia pattern in placentas
- Dr. Adrian Chan (SCE) and Dr. Homer Yang (TOH): perioperative ischemia reduction study
- Dr. Hanspeter Frei (MAE) and Dr. Paul Beaulé (TOH): effect of surgical correction on acetabular labrum seal
- Dr. Hanspeter Frei (MAE) and Dr. Eugene Way (TOH): patient specific spinal fusion cages
- Dr. Rafik Goubran (SCE) and Dr. Frank Knoefel (Elisabeth Bruyère Hospital): technology to support and monitor ageing, including the AGE-WELL National Centres of Excellence
- Dr. Michel Labrosse (MCG), Dr. Munir Boodhwani (UOHI), Dr. Vincent Chan (UOHI), and Dr. Benjamin Sohmer (UOHI): development of computational tools for patient-specific aortic valve repair simulation
- Dr. Sangeeta Murugkar (PHYS), Dr. Libni Eapen (TOH), Dr. M. Niedbala (TOH), Dr. Balazs Nyiri (TOH), and Dr. Barbara Vanderhyden (CMM, U Ottawa): characterization of radioresistance in human ovarian cancer cells using Raman techniques
- Dr. Andrew Speirs (MAE) and Dr. Paul Beaulé (TOH), Dr. Greg Cron (TOH), and Dr. Wade Gofton (TOH): osteochondral permeability and the role of cartilage-bone cross talk in osteoartritis.
- Dr Andrew Speirs (MAE), Dr. Paul Beaulé (TOH), and Kawan Rakhra (TOH): subchondral bone changes in femoroacetabular impingement

In addition, OCIBME also actively seeks opportunities for collaborations with medicine. For example, OCIBME has participated in the annual OHRI Research Day for the past two years, including having a booth.

9) Consider extending the MASc to include new programs such as a professional (non-thesis) MEng, and a new PhD program in biomedical engineering.

MEng in Biomedical Engineering (course work only, and course work plus project) was created in 2016 including:

- Specialization in Bioinformatics
- Specialization in Data Science (CU)
- Concentration in Clinical Engineering

New program PhD in Biomedical Engineering is being developed. External site visit took place in early September 2016 and the program is expected to launch in Fall 2017.