I. Programs

- Doctorate in Philosophy (Ph.D.) in Biomedical Engineering
- Doctorate in Philosophy (Ph.D.) in Biomedical Engineering and Specialization in Bioinformatics (uOttawa only)
- Master of Applied Science (M.A.Sc.) in Biomedical Engineering
- Master of Applied Science (M.A.Sc.) in Biomedical Engineering and Specialization in Bioinformatics (uOttawa only)
- Master of Applied Science (M.A.Sc.) in Biomedical Engineering and Specialization in Data Science (CU only)
- Master of Engineering (M.Eng.) in Biomedical Engineering
- Master of Engineering (M.Eng.) in Biomedical Engineering and Concentration in Clinical Engineering
- Master of Engineering (M.Eng.) in Biomedical Engineering and Specialization in Data Science (CU only)

II. Evaluation Process (Outline of the visit)

This Final Assessment Report on the above programs was prepared from the following documents: 1) the self-study report produced by the academic units; 2) the report of the external evaluation following the virtual visit; 3) the responses prepared by program leadership, Fabio Variola (uOttawa) and Yuu One (Carleton) and responses by Michel Labrosse, Interim Dean, Faculty of Engineering (uOttawa) and Larry Kostiuk, Dean, Faculty of Engineering (Carleton).

The site visit took place on 14 and 15 September 2023, covering graduate programs and was conducted by the following external evaluators: 1) Maud Gorbet, University of Waterloo and 2) Kibret Mequanint, Western University.

During the site visit, the external evaluators met with Marc Charron, at that time Associate Vice-Provost, Graduate and Postdoctoral Studies and Andrew Sowinski, Vice-Dean of Graduate Studies (uOttawa), Pauline Rankin, Provost and Vice-President (Academic), Dwight Deugo, Vice-Provost and Associate Vice-President (Academic), and Patrice Smith, Dean of Graduate and Post Doctoral Affairs (Carleton), as well as Jacques Beauvais, at that time Dean of the Faculty of Engineering (uOttawa) and Larry Kostiuk, Dean, Faculty of Engineering (Carleton). External evaluators also met with the chairs of academic units, faculty members, support staff, and students from both universities.
III. Summary of Reports on the Quality of Programs

Strengths and Challenges

1. Since OCIMBE is cross-institutional, diversity is one of the strengths of the program, and there is evidence that diversity enhances the overall objectives of the program.

2. The partnership between the two Universities allows for increased access to resources such as the library, course offerings, and breadth of expertise.

3. The faculty involved in OCIBME cover the breadth of biomedical engineering applications, all academic ranks, and diverse professional background (engineers, clinicians, etc), which is excellent. There are several junior members as well as mid-career and senior members across the seven participating units. This balance is very good for the sustainability of the program.

4. The OCIBME structure promotes cross-appointment between departments, increasing the potential for collaboration, and the possibility of being associated with/have access to the teaching hospital is a strength.

5. The Department Chairs (especially at UOttawa) recognize the workload and supervision of OCIBME students by a faculty member, which encourages faculty to supervise BME students. The Departments have a commendable culture of assigning research space based on the students a faculty supervises and not based on which program the student is registered in. We found this practice to be very good and worthy of preservation.

6. The Clinical Engineering MEng Program is very distinctive and perhaps a unique feature of OCIBME, training excellent clinical engineers who have competed and won awards internationally (e.g., the ACCE). With the University of Toronto’s Masters in Clinical Engineering suspended, OCIBME has a unique opportunity to expand and grow this stream. During the visit, we heard from hospital partners that getting Clinical Engineering stream students for internship placement is very challenging and some of them are recruited by US hospitals in nearby US States. Thus, OCIBME could benefit from the “Universal” Clinical Engineering curriculum within North America as graduates can easily work not only in Canada but also in the US.

7. Several courses are being taught by sessional/contract instructors, and students felt that some of these courses lacked in quality and depth. Additionally, there appears to be a lack of support and an onboarding process for these instructors. While some contract professors did not see the need for an office space, others do for office hours and to be used before and after class.

8. OCIBME also encounters challenges due to the cross-institution nature of the institute. One of these challenges faced by OCIBME is that it has no focal/central point as it is spread across the two institutions. This affects students’ experience as well as faculty members involved, there is an underlying feeling of being isolated. Additionally, the current lack of shuttle buses between the two institutions can be challenging for students with course offerings and attendance at seminars while also juggling their research.

9. The process around curriculum changes student’s requests around non-BME courses can also be challenging and are further discussed with suggested recommendations in this report.

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1 According to all the documents prepared during the cyclical review process, frequently quoted verbatim.
IV. **Opportunities for Program Improvement**

The external evaluators’ recommendations are contained in the Unit’s Response and Action Plan, in the appendix.

V. **Summary and Assessment of the Proposed Action Plan**

The External Reviewer’s recommendations were addressed by program leadership via an action plan that was considered by the Graduate Program Evaluation Committee (GPEC) on May 1, 2024.

The program leadership adopted all recommendations: 1 and 4 in principle, 2 and 5 unconditionally, and 3, 6 and 7, if additional resources permit. The actions to be taken and the timetable are clearly defined and have been endorsed by the Dean’s Office. The GPEC is satisfied with the program leadership’s response and action plan.

VI. **Conclusion**

The review exercise confirmed the strength and stability of the programs offered, and it identified recommendations for their ongoing improvement. The members of the GPEC would like to thank the external evaluators for their detailed assessment, as well as all the stakeholders involved in this cyclical program review process.

VII. **Schedule and Timelines**

The next cyclical review will take place in 2025-2026 and will be led by Carleton University. A progress report that outlines the completed actions and subsequent results should be included in the self-study.

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2 Reproduced verbatim from the External Evaluation Report.
Unit Response and Action Plan

Faculty:
• Faculty of Engineering

Department:
• Ottawa-Carleton Institute for Biomedical Engineering (OCIBME)

Programs evaluated:
• Doctorate in Philosophy (Ph.D.) in Biomedical Engineering
• Doctorate in Philosophy (Ph.D.) in Biomedical Engineering and Specialization in Bioinformatics (uOttawa only)
• Master of Applied Science (M.A.Sc.) in Biomedical Engineering
• Master of Applied Science (M.A.Sc.) in Biomedical Engineering and Specialization in Bioinformatics (uOttawa only)
• Master of Applied Science (M.A.Sc.) in Biomedical Engineering and Specialization in Data Science (CU only)
• Master of Engineering (M.Eng.) in Biomedical Engineering
• Master of Engineering (M.Eng.) in Biomedical Engineering and Concentration in Clinical Engineering
• Master of Engineering (M.Eng.) in Biomedical Engineering and Specialization in Data Science (CU only)

Cyclical review period:
• 2013-2019

Date:
• January 17, 2024

General comments:
On November 28, 2023, the Biomedical Engineering program was made aware of the External Review Report produced in the context of the cyclical program evaluation. We were extremely pleased with the positive evaluation of our graduate program. Given that the biomedical engineering graduate program has committed to providing an outstanding training and research experience, we were gratified to see that the external reviewers found that “the cross-institutional nature of the OCIBME enhances the overall objectives of the program, the partnership between the two Universities allows for increased access to resources (e.g. library, course offerings, and breadth of expertise), there the Institute incorporates an excellent breadth of biomedical engineering applications, all academic ranks and diverse professional background, he OCIBME structure promotes cross-appointment between departments, increasing the potential for collaboration, the Departments have a commendable culture of assigning research space based on the students a faculty supervises and not based on which program the student is registered in, the Clinical Engineering MEng Program is very distinctive and perhaps a unique feature, training excellent clinical engineers who have competed and won awards internationally, the OCIBME mandate is well-aligned with the mission and strategic plans of both Universities, the graduate-level courses are relevant to the program, and they appear to be diverse enough.”

The report makes seven (7) recommendations, of which one (1) is considered “Urgent” (high priority), two (2) are “Important” and four (4) are “Advised”. We take all the recommendations seriously and feel confident that by addressing them, our graduate program will be even stronger. The recommendations and our responses are included below.
<table>
<thead>
<tr>
<th>Recommendation 1: Harmonize and strengthen the graduate student funding package.</th>
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<tbody>
<tr>
<td><strong>Unit response:</strong> Agreed in principle</td>
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<tr>
<td><strong>uOttawa decanal response:</strong> I agree with the actions identified by the unit.</td>
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<tr>
<td><strong>Carleton decanal response:</strong> I agree with the actions identified by the unit.</td>
</tr>
<tr>
<td><strong>Priority Level</strong>: 1</td>
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<tr>
<td><strong>Actions to be undertaken:</strong> We would like to respectfully point out that the format and wording of the admission letters, regardless of whether are issued by uO or CU, are regulated by the respective FGPA guidelines and procedure, and are consistent for all graduate programs, including BMG/BIOM. We believe that the details regarding the funding package offered to a given graduate student are clearly explained in the letters, and further clarifications may not be needed at this level. It could be conceived, however, that certain students may find the terms and conditions presented in the letter unclear, and this aspect has surfaced during the interviews with the students during the virtual visit. It should also be noted that the letters themselves reiterate the fact that the funding package should be discussed with the supervisor. Students are also reminded by the FGPA that they should carefully review the financial package indicated in the letter. Information of the living expense in Ottawa area is provided in the uO and CU websites. Therefore, to eliminate any potential doubt, we will ensure that in the relevant communications prior to the admission it will be remarked that the funding package should be discussed thoroughly between the student and the supervisor prior to the acceptance of the offer. At this stage, the Directors can also request the FGPA to remind the financial implications associated with the terms included in the letter of admission, which should be honored by the supervisor. We understand that a competitive funding package is essential to recruit, retain and train high quality students though it is a challenging task, considering the limited funding of the supervisors and budget at universities. The FGPA regularly provides grant information and provides a support to the supervisors to apply for research grants. The Directors will also work closely with the FGPA to enhance the funding package and financial support to the students.</td>
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<tr>
<td><strong>Assigned to:</strong> OCIBME Directors, Supervisors</td>
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<tr>
<td><strong>Timeline:</strong> Immediate</td>
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<tr>
<td><strong>Curriculum change?</strong> No</td>
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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
<table>
<thead>
<tr>
<th><strong>Recommendation 2:</strong> Streamline BME course offerings and policy approval process.</th>
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<tbody>
<tr>
<td><strong>Unit response:</strong> Agreed to unconditionally</td>
</tr>
<tr>
<td><strong>uOttawa decanal response:</strong> I agree with the actions outlined by the unit.</td>
</tr>
<tr>
<td><strong>Carleton decanal response:</strong> I agree with the actions outlined by the unit.</td>
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<tr>
<td><strong>Priority Level</strong>: 2</td>
</tr>
<tr>
<td><strong>Actions to be undertaken:</strong> We would like to point that courses are offered by the departments composing the OCIBME, and not by the OCIBME itself as an independent unit. In this framework, the approval of a new course by the specific department is the first necessary step. To include a new course as part of the BMG/BIOM programs, the Directors are in constant contact with the department chairs to determine whether a new course could be added to the OCIBME’s offering. At times, a faculty member who believes their course could be of benefit to the OCIBME contacts the Directors to propose its incorporation in the BMG/BIOM course list. A new course is first offered as “Advanced Topics” course. After a few years, the course becomes a regular course upon approval by the BoM. Regarding changes in policy, we propose a step-wise process which starts with the approval by the BoM. Successively, if the motion was approved, it moves up to a graduate committee at uO and CU, which consists of all full time professors having the OCIBME membership in one of the OCIBME units. With the support of this committee, the request (which at this point has been endorsed by the BoM and the graduate committee) is then presented to the relevant uO and CU departments which have the voting authority to move it up to the respective Senate for final approval.</td>
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<tr>
<td><strong>Assigned to:</strong> OCIBME Directors</td>
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<tr>
<td><strong>Timeline:</strong> 12-18 months</td>
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<td><strong>Curriculum change? No</strong></td>
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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
<table>
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<tr>
<th>Recommendation 3: Provide a small yearly operating budget for OCIBME (30K)</th>
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<tbody>
<tr>
<td><strong>Unit response:</strong> Agreed to if additional resources permit</td>
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</table>

**uOttawa decanal response:** Unfortunately, in the current difficult budgetary situation, the Faculty is unable to provide OCIBME with a yearly operating budget. For context, the Faculty is involved with at least five institutes similar to OCIBME, like OCIMAE, OCIENE, etc. While, out of fairness to everyone, it would be arguably desirable to provide all of them with a yearly operating budget, it is simply not feasible. Fortunately, this has not prevented the emergence of great initiatives to showcase the institutes’ research or promote networking in the past. For instance, the Faculty organizes a yearly competitive event for graduate students to present research posters, and get awards from a review panel of experts in the field.

**Carleton decanal response:** OCIBME crosses four departments and two faculties at Carleton. The Faculty of Engineering and Design is currently unable to provide OCIBME a separate budget outside of what is provided to the departments. In addition, similar considerations would have to be made for the other joint institutes, including OCIMAE, OCIECE, OCICE, and OCIENE, who also rely on department budgets for any activities.

<table>
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<tr>
<th>Priority Level*: 2</th>
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**Actions to be undertaken:** The Directors are going to discuss a budget of $15,000/year with their respective Deans or FGPA at each of uO and CU (total $30,000/year). These funds will be used to organize workshops and networking events (e.g. OCIBME Research Day). For example, we could host an “evening of excellence” where OCIBME professors and the most promising undergraduate students are invited as an opportunity to showcase the OCIBME research and attract students to graduate school. These funds would also cover a stipend for two graduate students (e.g. the student representatives at the BoM) who would be in charge of the organization of the events, under the supervision of the Directors. The funds can be also used for the Directors to attend a Canadian BME and BioE Chairs Meeting which is usually held during an annual conference of the CMBES.

<table>
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<tr>
<th>Assigned to: OCIBME Directors</th>
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<tr>
<td>Timeline: Immediate</td>
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Curriculum change? No

* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
**Recommendation 4:** Develop support material for grad students and sessional instructors.

<table>
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<tr>
<th>Unit response:</th>
<th>Agreed to in principle</th>
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**uOttawa decanal response:** I agree with the actions outlined by the unit. In addition, significant restructuring of services offered by the Graduate Studies is underway, and will ultimately contribute to shoring up counselling and support to graduate students, to help them progress smoothly through their milestones and studies.

**Carleton decanal response:** I agree with the actions outlined by the unit. Carleton also has a policy on surveying students that would need to be considered before OCIBME student representatives would be permitted to launch a survey. Note that EDC in the response should instead refer to the Educational Development Centre (now Teaching and Learning Services) at Carleton.

**Priority Level**: 3

**Actions to be undertaken:** For sessional instructors, we would like to respectfully point out that it is the department’s responsibility to give a proper guidance and support to them since the department hires the sessional instructors. The Directors may talk to the department (and the Engineering Design Center – EDC – at CU) about what support is provided to sessional instructors, also supported by the workshops for new instructors offered by the EDC. The Directors can also contribute to address this aspect by providing new instructors with direction about what supports are available and from where. Also, the Directors are always available to answer any questions from sessional instructors.

For graduate students, it should be pointed out that the program requirements are given in detail in the University Calendar and OCIBME website. Generally, PhD milestones are linked to the student’s file, and doctoral candidates can assess them via the student portals. The detailed timeline and milestones result from the discussion between the supervisor and the student, within the regulatory framework outlined by the FPGA.

The Directors will also request the department chairs and course instructors to ensure that the course syllabus includes the learning outcomes to provide the students what they can expect to learn from the course.

To improve the programs in various aspects, the OCIBME student representatives will conduct a yearly feedback survey from OCIBME students regarding courses, seminars, supervision, administration, under the guidance of the Directors.

**Assigned to:** OCIBME Directors, Department Chairs, Course instructors

**Timeline:** 1-2 years

**Curriculum change? No**

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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
**Recommendation 5:** Establish an Advisory Committee structure for research-based students.

**Unit response:** Agreed to unconditionally

**uOttawa decanal response:** I agree with the unit’s response.

**Carleton decanal response:** I agree with the actions outlined by the unit.

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<tr>
<th>Priority Level*</th>
<th>3</th>
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**Actions to be undertaken:** We would like to respectfully point out that a thesis advisory committee (TAC) already exists for the PhD program. However, this committee is formed at the thesis proposal stage, and carries over to the thesis defense. As stated in the OCIBME’s guidelines (available online):

*The Thesis Advisory Committee (TAC) should normally consist of the Thesis supervisor(s) (voting member), a member of OCIBME from Carleton University (voting member), a member of OCIBME from the University of Ottawa (voting member), a Committee chair (not a voting member and does not need to be a member of the OCIBME)*

As per the committee for the comprehensive exam, as stated in the OCIBME’s guidelines (available online):

*The Comprehensive Examination Committee should normally consist of the Thesis supervisor(s) (voting member), a member of OCIBME from Carleton University (voting member), a member of OCIBME from the University of Ottawa (voting member), and a Chair of the Comprehensive Examination Committee (not a voting member and does not need to be a member of the OCIBME)*

As can be seen, the committee for the comprehensive proposal in principle could be the TAC. However, since the comprehensive exam is focused on general knowledge on biomedical engineering while the thesis proposal and defense are focused on a specific research field, we generally let the 2 committees differ. In fact, we believe that the expertise required for the TAC may not necessarily be the same required to test students on general aspects of the biomedical field.

All committees are approved by the Director (at uO) and by the Department Graduate Chair (at CU), prior to FGPA approval, who ensure that the composition of these evaluations group complies with the OCIBME and FGPA guidelines. The Directors will advise the supervisors to discuss the milestone and timeline with the students and to form the TAC in a timely manner.

**Assigned to:** OCIBME Directors, Supervisors

**Timeline:** Immediate

**Curriculum change?** No

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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
**Recommendation 6:** Increase professional development opportunities for students.

**Unit response:** Agreed to if additional resources permit

**uOttawa decanal response:** I agree with the actions outlined by the unit. In addition, a leadership program for graduate students is about to be launched by the uOttawa Office of the Vice-Provost, Graduate and Postdoctoral Studies. Students will be able to access the program on a voluntary basis.

**Carleton decanal response:** I agree with the actions outlined by the unit.

**Priority Level**: 3

**Actions to be undertaken:** The Directors are going to advertise the professional workshops/programs offered by UO and CU via email, LinkedIn and the OCIBME website. Events and opportunities such as conferences, IEEE seminars, CMBES seminars, PEO workshops, among others, can be a great opportunity for professional development. In addition, the Directors will also discuss with their respective students centers the possibility of opening the existing institutional professional development workshops and courses to students of the other institution.

**Assigned to:** OCIBME Directors, Students Centers

**Timeline:** 1-2 years

**Curriculum change?** No

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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
**Recommendation 7:** Increase the capacity of the M. Eng in Biomedical Engineering and Concentration in Clinical Engineering.

**Unit response:** Agreed to if additional resources permit

**uOttawa decanal response:** I agree with the actions outlined by the unit.

**Carleton decanal response:** I agree with the actions outlined by the unit.

**Priority Level**: 3

**Actions to be undertaken:** The main constraint to grow the Clinical Engineering (CE) program is the availability of internships under the supervision of a clinical engineer at partner hospitals and healthcare institutions, since these are a mandatory component for graduation. Therefore, CE students must be guaranteed one. All the current partner hospitals exist in Ottawa, including The Ottawa Hospital, University of Ottawa Heart Institute, and Children’s Hospital of Eastern Ontario. Since these partner hospitals have limited resources to accept the internship students each year, the number of positions per hospital is generally one per year. Therefore, we are considering adding new partner hospitals to expand the CE program.

In 2023-2024, we have added the University Health Network in Toronto as a new partner. Since the CE student may have to take a course during their internship to fulfill the program requirements, a new system of credit transfer will also be implemented to allow students to spend 8 months away from Ottawa while taking equivalent courses in a different institution. Once implemented, students could go anywhere in Canada (and US) for their internship, without being limited by the requirement of being present in Ottawa for the courses. As a matter of fact, there is already a strong interest by the Massachusetts General Hospital in US to join the list of partners and contribute to the CE program.

**Assigned to:** OCIBME Directors

**Timeline:** 2-3 years

**Curriculum change?** No

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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)