

FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

Biomedical Engineering, M.A.Sc. and Ph.D.

Date of Review: March 2nd and 3rd

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the graduate programs delivered by Biomedical Engineering. This report identifies the significant strengths of the program, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

The report includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the Final Assessment Report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy or governance that will be necessary to meet the recommendations and who will be responsible for acting on those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the Review

In accordance with the Institutional Quality Assurance Process (IQAP), the School of Biomedical Engineering submitted a self-study in January 2021 to the Vice-Provost and Dean of Graduate Studies to initiate the cyclical program review of its graduate programs. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis. Appendices to the self-study contained all course outlines associated with the program and the CVs for each full-time member in the department.

Two arm's length external reviewers and one internal reviewer were endorsed by the Deans, Faculty of Engineering and Health Sciences, and selected by the Vice-Provost and Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted a remote review on March 2nd and 3rd, 2021. The review included interviews with the Provost and Vice-President (Academic); Vice-Provost and Dean of Graduate Studies, Deans of the Faculties, Associate Deans Grad Studies and Research (Engineering and Health Sciences), Co-Directors of the School and meetings with groups of current students, full-time faculty and support staff.

The Co-Directors of the School and the Deans of the Faculties of Engineering and Health Sciences submitted responses to the Reviewers' Report (June and July 2021). Specific recommendations were discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

- An excellent innovative interdisciplinary Biomedical Engineering program, with milestones which are consistent with most research-intensive engineering graduate programs in Canada
- High-achieving student population with excellent calibre of faculty
- Excellent core courses along with other options for elective courses
- Excellent annual BME symposium
- A unique and excellent communication retreat for students
- Very strong research productivity and grant funding of the participating faculty
- Students adequately meet publications criteria expected from Masters and PhD students
- Uniformly positive assessments of the Co-Directors' dedication to program success

Areas for Enhancement or Improvement

- Expansion of supervisory committee membership to include FHS members
- Increase funding for student activities to enhance interactive environment
- Review courses, including the core courses, based upon students' feedback
- Increase the base budget of the program
- Other recommendations are outlined in the table 1

Summary of the Reviewers' Recommendations with the Department's and Dean's Responses

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
Review the content and format of the core courses with consideration of the feedback received from the students.	The program will meet with the instructors of these two courses to discuss the findings from the student survey and come up with changes to the delivery and content. They will continue to survey students on a periodic basis – once every 3 years - for continuous improvement	Co-Directors of BME	Meeting with the instructors in the fall to identify opportunities to improve the course offerings and format for implementation in 2022

<p>Continue to explore opportunities to encourage additional Health Sciences faculty to contribute to the BME program.</p>	<p>The program agrees with this recommendation. Over the past year they have had renewed interest from Health Sciences faculty members to join the school. They have formalized the approval process for Associate Members with a clear expectation of their involvement and participation in supervision, co- supervision and in teaching activities. They will continue to engage with institutes and centers in Health Sciences to enhance research collaborations which will facilitate increased participation.</p>	<p>Co-Directors of BME</p>	<p>Ongoing over the next six years, until the next IQAP review</p>
<p>Consider adding a requirement, at least at the PhD level, that supervisory committees include members from both Engineering and Health Sciences.</p>	<p>Currently, all supervisory committees are interdisciplinary. That is, they consist of faculty members from two or more different disciplines – either within Engineering or from the faculties of Sciences and Health Sciences.</p> <p>They are in the process of identifying opportunities for increasing participation from Health Sciences members of the school.</p> <p>The first step is to increase the number of Associate Members from Health Sciences through outreach to them. This will increase the diversity of the expertise present and enable identification of suitable members with the right expertise for</p>	<p>Co-Directors of BME</p>	<p>Gradual implementation over the next three years</p>

	<p>a supervisory committee.</p> <p>The next step will be to ensure that the committees for students whose research has a health sciences component have a suitable member. This will be done at the time of approval of the committee through gentle encouragement and suggestion.</p> <p>They believe that some of the research within the school requires expertise that is present outside the faculty of Health Sciences and therefore think that a case-by-case assessment rather than a requirement would be more suitable.</p>		
<p>Address sources of mismatch between students' expertise and TA assignments, including inviting students to self-identify mismatched assignments, helping students seek TA opportunities outside the Faculty of Engineering, and, if possible, increasing the number of TA opportunities within the iBME program.</p>	<p>They are aware of the issue identified with a few students. Currently, the students are given the opportunity to choose departments in which they would like to TA, and 80% of our students get either their 1st or 2nd choice.</p> <p>They believe that students with Health Sciences backgrounds may not be able to get the department of their 1st choice as the Faculty of Health</p>	<p>BME Admin Staff</p>	<p>Revisit each year and reassess</p>

	<p>Sciences has a considerable number of their own TA's and as such do not have sufficient opportunities for BME students.</p> <p>However, not only do the majority of BME students receive TA assignments in their department of choice, but most departments also do everything possible to accommodate our students' preference of courses.</p>		
<p>Consider increasing the very modest budget available to the co-directors to support events which include the annual symposium.</p>	<p>They agree with this recommendation and will schedule a discussion with the Deans and Associate Deans on programming and support that they envision for our students over the next 3 years, and seek additional support for those initiatives which will enhance collaborative, communication and outreach activities.</p>	<p>Co-Directors of BME</p>	<p>Discuss with Deans in summer of 2021 and fall of 2021.</p> <p>Implement events and activities in 2022</p>
<p>Explore options to equalize the cost-to-supervisor between FHS and Engineering as a means to reduce the barrier to FHS participation.</p>	<p>The cost to supervisor is determined largely by the respective faculties. It requires discussion between the two Associate Dean's.</p> <p>They think that the school offers students with a unique skill set and interests that are</p>	<p>Associate Deans</p>	<p>N/A</p>

	not available in the various departments in Engineering or Health Sciences. Therefore, cost parity should not be an issue as the skill set of students in SBME is different from those in FHS and may be well suited to technology relevant projects.		
The co-directors might consider a regular meeting with the Associate Deans at least twice per year to review progress and help program growth. These meetings might include the leaders of each of the 3 research themes.	They agree with this recommendation and were already discussing implementing these regular meetings and will do so in the coming academic year	Co-Directors of BME	Fall 2021
A fundraising and development strategy would be helpful to clarify the expected roles and responsibilities of BME and the two Deans' offices.	This is within the purview of the Dean's office	Deans of Engineering and Health Sciences	N/A
There might be a disproportionate benefit from a small investment to increase the frequency of the very popular student events.	The program agrees with this recommendation, and they will increase the social activities budget available to BMEGA (student association) from \$1500 to \$5000 to carry out more activities over the year.	Co-Directors of BME	Fall 2021

Faculty Response

As an interdisciplinary program associated with the Faculties of Engineering and Health Sciences, the response below was crafted and mutually agreed upon by both Faculties.

The reviewers have provided a very complementary report on the graduate program in the School of Biomedical Engineering, highlighting excellence in student engagement and a strong focus on research. The program has built up a substantive list of course topics and regularly oversees several unique and excellent initiatives, like its symposium and newsletter, that significantly foster skills development beyond scientific exploration in its students. The intersection of two strong Faculties in the School gives its students unique access to expertise from two dissimilar but complementary fields. They are confident that the program will respond constructively to the recommendations.

The reviewers raise questions about the extent of involvement of Health Sciences faculty. The Faculties remain steadfast in our commitment to exposing students to both fields throughout their studies. They support the reviewers' suggestion that students should have at least one member of both Faculties on their supervisory committees. They agree with the program's response that the first consideration should be appropriate expertise, but encourage them to consider the requirement for a clear justification when forming committees that do not reflect this criterion, and also to monitor and evaluate the committee composition over time. Although they support the program's suggestion to encourage cross-faculty involvement through engagement with research centres and institutes, they would like to see more balanced student recruitment from the two Faculties in the future, with a possible review of whether elements of the program could be adjusted to help.

The reviewer's report deviates significantly from the intended scope of an IQAP review and delves into matters of employments, finance and even hiring recommendations, which the Faculties feel are beyond its purview to improve the academic mission of the program. They recognize the guidance of the School of Graduate Studies in this matter and will overlook the majority of these issues from the report but must address some that have been brought up in the program's response. Most notably, the Faculty of Engineering has reviewed the budget of the program and finds that its funding compares favourably to other programs of its size in Engineering.

While specific proposals for funded initiatives related to events, student stipends, and TA hiring have varying degrees of merit, all program costs must be resourced from program revenues. In the same vein, fund-raising initiatives must arise from the enthusiasm, initiative, and activity of the program leaders and participating faculty, with institutional support where this activity aligns closely with the Faculties' fund-raising priorities.

In relation to funding, governance and collaborative connections, the Faculties again encourage the School to re-establish the industrial advisory board mentioned in the terms of reference for the School to better connect its associated research work with interested funding partners; and follow through with the directors' plan to pursue larger strategic research initiatives (ORF-RE, CREATE, etc) that would involve a substantial number of its associated faculty.

The Faculties were uncertain about the meaning of reviewer's comments about the cost difference for supervisors between Faculties. A student in the program receives the same remuneration whether their supervisor is from Engineering or Health Science, and the Dean of Engineering provides a bursary to those students, in addition to funding from the School of Graduate Studies. In Health

Sciences, any additional support provided to individual faculty members is a department matter. They also understand that the amount of financial support to BME students is comparable to other programs in Engineering and Health Sciences with similar research missions.

Finally, two points of clarification. Some sections of the program's implementation plan have been erroneously assigned to the Deans/Associate Deans. The responsibilities for these goals remain with the program, though the Faculties remain committed to providing support and assistance as they endeavor to make these improvements. Finally, although students are encouraged to publish their research during their graduate training, there is actually no program requirement for them to do so, despite any allusion to this point in the report.

Quality Assurance Committee Recommendation

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation and the committee recommends that the program should follow the regular course of action with a progress report and subsequent full external cyclical review to be conducted no later than 8 years after the start of the last review.