[Biomedical Engineering or BME] Final Assessment Report & Implementation Plan

Faculty / Affiliated University College	Faculty of Engineering (with Health Sciences, Science, Schulich)		
Degrees Offered	MESc, PhD		
Approved Fields	Current:	• Biomaterials • Biomechanics, • Imaging and Robotics	
	Proposed:	• Biomaterials, • Biomechanics, • Imaging • Mechatronics	
External Consultants	Dr. Zarah Moussavi Director, Biomedical Engineering Program University of Manitoba CRC, Professor of Electrical and Computer Engineering		Dr. Michael Noseworthy Co-Director, School of Biomedical Engineering McMaster University Professor of Electrical and Computer Engineering
Internal Reviewer	Dr. Catherine Nolan Associate Dean (Faculty of Music) Professor of Music Theory		N/A
Date of Site Visit	April 23-24, 2019		
Evaluation	Good Quality		
Approval Dates	SUPR-G: September 16,2019 SCAPA: October 2, 2019 Senate (FYI only): October 11, 2019 This section will be completed by SGPS or Associate University Secretary		
Date of Next Review	Year of next cyclical review 2026-2027		

In accordance with Western's Institutional Quality Assurance Process (IQAP), the Final Assessment Report provides a summary of the cyclical review, internal responses and assessment and evaluation of Graduate Program delivered by the School of Biomedical Engineering (as of Fall 2019). This report considers the following documents: the program's self-study, the external consultants' report and the responses from the Department/School and Faculty. The Final Assessment Report identifies the strengths of the program, opportunities for program enhancement and improvement and details and prioritizes the recommendations of the external consultants and prioritizes those recommendations that are selected for implementation.

The Implementation Plan details the recommendations from the Final Assessment Report that are selected for implementation, identifies who is responsible for approving and acting on the recommendations, any action or follow-up that is required and the timeline for completion.

The Final Assessment Report and Implementation Plan is sent for approval through SUPR-G and SCAPA, then for information to Senate and the Ontario Universities' Council on Quality Assurance and is made available on a publicly accessible location on Western's IQAP website The Final Assessment Report and Implementation Plan is the only document resulting from the Graduate cyclical review process that is made public, all other documents are confidential to the Program/School/Faculty and SUPR-G.

Executive Summary

The site visit took place on April 23-24, 2019, and was well designed to expose the reviewers to the myriad components of this interdisciplinary program that crosses boundaries of four Faculties: Engineering, Health Sciences, Science, and Schulich School of Medicine & Dentistry. The reviewers were delighted by the tours of representative labs of BME faculty members in the Spencer Engineering Building and the Robarts Research Institute. They commented on the impressive array of research areas, all with direct implications to patients. The reviewers also commented on the high quality of the BME graduate seminar they attended, at which two BME students gave research presentations.

The meetings with faculty were well attended and engaging, and reflected the strong interest in the interdisciplinarity of BME. One broad concern came out of the meetings: membership of faculty in the BME program and the challenge of monitoring workload issues with faculty who have a wide variety of academic home departments, and monitoring the varying degrees of their involvement with BME. (This is reflected in the recommendations below.)

The meetings with students were also engaging. The students were in general happy to be in the program, but they expressed concern about consistency in requirements for core BME courses and the timeline for comprehensive exams. Students expressed some concern about redundancy between the material of "Communications I" (BIOMED 9550A/B) and the BME Seminars and about the use of examinations as assessments in Foundations of Biomedical Engineering, BIOMED 9508A. (These concerns are also reflected in the recommendations below.)

The program's self-study was meticulously prepared. The reviewers commented in particular on the excellent organization of the program learning outcomes. The self-study includes a proposal to redefine the current three fields of study (biomaterials, biomechanics, and imaging & robotics) to become four: biomaterials, biomechanics, imaging, and mechatronics, separating the former fields of imaging and robotics and renaming "robotics" to "mechatronics." When the original "imaging and robotics" field was named, the name expressed the linkage between the fields. More recently, with the increase in number of BME researchers at Western, the increased range of research studies justifies separating the two fields. The term "mechatronics" is more inclusive of research in assistative and rehabilitative devices and surgical simulators. The redefinition of fields in the program reflects the internal thinking of the program and is expected to improve BME's ability to recruit.

Data on student publication and activities of graduates after completing their degrees were exceptionally well presented, showing that MESc graduates went on to work as industry engineers (29%), research assistants in labs (29%), and that the remainder went on to dental, medical, or law school, or to work in non-profit organizations. PhD graduates went on to postdoctoral training (71%). The reviewers were surprised that publication outputs by students were not higher.

The program response to the review, like the brief, was meticulously prepared. The program addressed every recommendation expressed in the review, and prepared a table showing all proposed actions.

The review took place shortly before the inauguration of the School of Biomedical Engineering This structural change, in tandem with the introduction of a new five-year undergraduate concurrent degree program (two BESc degrees, a BESc in Chemical, Mechanical, or Mechatronic Engineering and a BESc in Biomedical Engineering) will bring new attention to biomedical engineering at Western. During their site visit and in their report, the external reviewers commented on the energy and strength of the BME graduate program. Anticipation of the inauguration of the new School of Biomedical Engineering undoubtedly added to the excitement about BME that was experienced by all during the review.

To conclude this executive summary, I will quote the following statement from the reviewers' report that effectively (and poetically) summarizes their positive view of the program: "Biomedical engineering *should* be the application of engineering to the human condition, be it normal or diseased. The faculty and their students unquestionably strive for such work."

Significant Strengths of the Program

The following program strengths are identified in the self-study and the External Consultants' Report

- High priority placed on interdisciplinary knowledge and oral and written communication skills
- Faculty research excellence
- Outstanding, state-of-the-art lab facilities
- Clarity of program learning outcomes
- Energy for patient outcomes in various fields of BME research

Summary of the Reviewers' Key Recommendations and Department/Faculty Responses

	Reviewers' Recommendation	Program/Faculty Response
1. Recommendations requiring implementation	Review faculty membership in BME program on a regular basis.	Establish an Appointments Committee and procedures for reviewing graduate program membership.
	Review content and assessments for core BME courses.	Review policies for courses required to fill gaps in BME knowledge.
	Make comprehensive exam timelines transparent and consistent.	Review communication of timeline for comprehensive exams.
	Students should complete TCPS-2 research ethics training.	TCPS-2 or similar training will become a required program milestone.
2. Supplementary recommendations for program improvement	Create new faculty positions in BME.	Director of BME works closely with the Dean of Engineering to cultivate possible funding sources to accelerate the growth of the School of BME.

	Reviewers' Recommendation	Program/Faculty Response
	Add learning outcomes to website and student handbook.	Learning Outcomes will be added to graduate program updates on the new School of BME website.
	Faculty member websites should consistently include links to publications.	Encourage faculty members to include a link to a publication database on their personal web pages.
	Increase administrative assistance by hiring a second, part-time, graduate program coordinator	Recruit and hire the already approved part-time program coordinator.

Implementation Plan

The Implementation Plan provides a summary of the recommendations that require action and/or follow-up. The Graduate Program Chair and/or Department Chair/Director, in consultation with SGPS and the Dean of the Faculty will be responsible for enacting and monitoring the actions noted in Implementation Plan. The details of progress made will be presented in the Deans' Annual Planning Document.

Recommendation	Proposed Action and Follow-up	Responsibility	Timeline
Review faculty membership in BME program on a regular basis.	Establish an Appointments Committee and procedures for reviewing graduate program membership	Director and School Operations Committee	December 2019
Review content and assessments for core BME courses.	Review and revise content and outcomes of BIOMED 9550A/B and 9560B, Communications I and Communications II in terms of their learning outcomes. Review and revise the scope and assessments of BIOMED 9508A in terms of balance of factual knowledge and application or synthesis of concepts.	Associate Director, Graduate and Curriculum Committee	May 2020
Make comprehensive exam timelines transparent and consistent.	Recommend a minimum interval between planning and completion of the comprehensive exam to supplement the	Associate Director, Graduate and Program Coordinator	September 2019

Recommendation	Proposed Action and Follow-up	Responsibility	Timeline
	existing maximum interval		
Students should complete TCPS-2 research ethics training.	TCPS-2 or similar training will become a required program milestone.	Associate Director, Graduate and Curriculum Committee	December 2019

Other Opportunities for Program Improvement and Enhancement
In addition to the recommendations noted above, the review process may have identified other considerations to enhance or enrich the program. List any such considerations.

- The review process also brought out some concern about faculty attendance at the BME seminars. This is a challenge because of the proliferation of biomedically themed research centres and institutes across Western. The program plans to ensure that each student presenter has one or more supervisors or advisory committee members in attendance, and to enhance email promotion of the events.