

Faculty / Affiliated University College	Faculty of Engineering
Participating Programs by Faculty	Chemical and Biochemical Engineering Electrical and Computer Engineering Mechanical and Materials Engineering
Date of Last Review	First review
External Consultants	None –desk audit
Internal Reviewer	Cheryle Séguin, Associate Professor Physiology and Pharmacology
Date of Site Visit	July 15, 2019, July 23, 2019
Date Review Report Received	September 18, 2020
Date Specialization/ Faculty Response Received	November 12, 2020
Evaluation	Good Quality
Approval Dates	SUPR-G: February 22, 2021 SCAPA: March 3, 2021 Senate March 12, 2021
Year of Next Review	Year of next cyclical review 2025-2026

Overview of Western’s Cyclical Review Assessment Reporting Process

In accordance with Western’s Institutional Quality Assurance Process (IQAP), adopted on May 11,2011, revised June 22, 2012, this Final Assessment Report (FAR) provides a summary of the cyclical review, internal responses and assessment and evaluation of the **Engineering in Medicine Colaborative Specialization** delivered by the Faculty of Engineering and the Schulich School of Medicine & Dentistry.

This report considers the following documents:

- the self-study
- the internal consultants’ report
- the response from the Director of the Specialization

The Final Assessment Report identifies the strengths of the specialization, opportunities for the specialization’s enhancement and improvement, and details the recommendations of the 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 Specialization /School/Faculty and SUPR-G.

Defining a Collaborative Specialization at Western¹

A Collaborative Specialization is an intra-university graduate field of study that provides an additional multidisciplinary experience for students enrolled in and completing the degree requirements for one of a number of approved masters and/or PhD programs. Students meet the admission requirements of and register in the participating (or "home") program but complete, in addition to the degree requirements of that program, the additional requirements specified by the Collaborative Specialization. The degree conferred is that of the home program, and the completion of the collaborative program is indicated by a transcript notation and/or adjunct qualifications to the degree.

Students are registered in the participating degree program, meeting the requirements of the participating program as well as those of the collaborative program.

A Collaborative Specialization must have:

- At least one core one-semester course that is foundational to the specialization and does not form part of the course offerings of any of the partner programs.

This course must be completed by all students from partner programs registered in the specialization and provides an opportunity for students to appreciate the different disciplinary perspectives that can be brought to bear on the area of specialization. This course may serve as an elective in the student's home program.

- Clear and explicit requirements for each Collaborative Specialization.

In programs requiring a major research paper, essay, or thesis, the topic must be in the area of the collaborative specialization. In course-only Master's programs, at least 30% of the courses must be in the area of specialization including the core course described above. Courses in the area of specialization may be considered electives in the home program.

¹ Description retrieved from <http://oucqa.ca/framework/1-6-definitions/>.

- core faculty who are the faculty members in the participating home programs who have an interest and expertise in the area of the collaborative specialization (this may include faculty appointed 100% to an interdisciplinary academic unit).
- appropriate administrative and academic oversight/governance in place to ensure requirements associated with the specialization are being met.

Executive Summary (from the Self-Study – Volume 1)

Engineering in Medicine was formally approved as a collaborative M.Eng. program by the Ontario Council of Graduate Studies in 2011. It was established as one of the program options available to students who enroll through the existing M.Eng. programs. The specialization provides a unique learning experience for graduate engineers and scientists and contributes to Western’s Strategic Plan to achieve excellence on the world’s stage.

The collaborative specialization is offered jointly by the graduate programs in the Departments of Chemical & Biochemical Engineering (CBE), Electrical & Computer Engineering (ECE), and Mechanical & Materials Engineering (MME). The specialization capitalizes on the interdisciplinary expertise of 21 faculty members at Western Engineering who have recognized research strengths in biomechanics, biomedical instrumentation, medical imaging, microfluidics, medical device design and fabrication, biomaterials, health informatics, and surgical robotics. The collaborative specialization was also designed to complement the MEdSc/PhD research programs offered through Western’s Biomedical Engineering Graduate Program.

The degree provides practicing engineers with an opportunity to upgrade their knowledge to meet the demands for technological advancements in their field and is also an effective tool to address the need for education and integration of internationally trained Engineers. It provides new Canadians who are trained in Engineering outside Canada with a venue to update their knowledge in accordance with the needs of the Canadian technology sector. The dominant method used to achieve these goals is through course-work instruction and a significant project (full course equivalent).

The Learning Outcomes show how the curriculum is designed to enable Engineering and qualified Science graduates with an undergraduate degree to develop an in-depth understanding about the role of engineers in modern medicine and healthcare, explore innovative technologies that impact medical advancements, and recognize opportunities for product development and commercialization.

The program enrolls from three to eight students per year. Successful graduates from the collaborative specialization are employed in Canada’s emerging medical devices industry, public sector organizations, NGOs, clinics and hospitals, sales and marketing, establish their own technology companies, or enhance their opportunity for further advanced training in the field of biomedical engineering.

Review Process

For a Graduate Collaborative Specialization, an internal review is required consisting of a knowledgeable arm’s-length reviewer from within the University. In this case the reviewer, Dr. Cheryl Seguin from the Department of Physiology and Pharmacology, Schulich School of Medicine and Co-Director Collaborative

Specialization in Musculoskeletal Health Research, reviewed the Program's Self-Study brief and met with faculty and students.

Over the course of this review, the internal reviewer met with

- Dr. Peter Simpson, Associate Vice Provost, SGPS
- Dr. George Knopf, Director, M.Eng. Engineering in Medicine
- Dr. Emily Lalone, Mechanical & Materials Engineering
- Dr. Vijay Parsa, Associate Chair for Electrical and Computer Engineering
- Dr. James Lacefield, Director of the School of Biomedical Engineering
- Dr. Kibret Meqanint, Department of Chemical and Biochemical Engineering
- Whitney Barrett, Graduate Officer
- Dr. Haojie Mao, Mechanical & Materials Engineering
- Graduate Students
- Dr. Shahzad Barghi, Associate Chair for CBE
- Dr. Greg Kopp, Associate Dean (Graduate), Engineering

Following the onsite review, the reviewer submitted a comprehensive report of the findings which was sent to the Program Director for review and response.

These formative documents, including Volumes I and II of the Self-Study, the Internal Report, and the Program Response have formed the basis of this summative assessment report of this report.

EXTERNAL REVIEW – EXECUTIVE SUMMARY

The Engineering in Medicine Collaborative Specialization is a strong offering that addresses a clear market need for students. ...The Collaborative Specialization engages faculty supervisors and course instructors from a diversity of disciplinary backgrounds relevant to Engineering in Medicine. Many of the participants have established impressive records of accomplishment with national/international reputations in their fields of research and/or practice.

Strengths of the Specialization (Identified by the Reviewer)

- Interdisciplinarity of faculty and program
- Internationally recognized faculty
- Learning Outcomes are consistent with and address Western's Graduate Degree Level Expectations.
- Curriculum mapping demonstrates how the Learning Outcomes are achieved.

Areas of Concern Identified (Identified by the Reviewer)

- Little evidence of collaboration between the Collaborative Specialization and the participating departments beyond the ability of the students to enroll in their courses

- No independent budget or dedicated administrative/technical staff to support its daily operations.
- Would benefit with partnership with both the new School of Biomedical Engineering and the Schulich School of Medicine and Dentistry
- Lack of program identity for students
- Lack of a core course for the program focusing on the biomedical or biological aspects of Engineering in Medicine

Reviewer’s Recommendations & Departmental Response

REVIEWER’S RECOMMENDATIONS	DEPARTMENTAL RESPONSE
Ensure that the Engineering in Medicine Collaborative Specialization has access to the necessary resources to secure a Program Administrator (part time) to better support it and the development of its programming.	<ul style="list-style-type: none"> • Acknowledged as an issue • Ongoing current discussions about staffing in the organization of the new School of Biomedical Engineering,
Pursue opportunities to integrate the Engineering in Medicine Collaborative Specialization into the School of Biomedical Engineering.	<ul style="list-style-type: none"> • Discussions underway
Focus on the ‘identity’ of the Collaborative Specialization; create opportunities for trainees within the program to interact as a cohort and increase the visibility of the program (and its benefits) for both applicants and faculty members willing to supervise a project.	<ul style="list-style-type: none"> • Students currently required to take existing core course and undertake a project in the area of medical/assistive device design, biomedical engineering, or healthcare technology • Students now involved in a weekly seminar
Consider developing a core course for the Collaborative Specialization, focused on the biomedical or biological aspects of “Engineering in Medicine” - a program offering that could differentiate it from the other M.Eng programs offered by participating Departments	<ul style="list-style-type: none"> • Students enrolled in the collaborative specialization are required to take the core graduate course Medical Device Design. It provides a unique multidisciplinary experience to the students enrolled in the specialization. This course is not a required course in any other graduate program at Western. However, students enrolled in other programs from the participating Departments (CBE, ECE or MME) and BME are permitted to take the course as an elective as per the Quality Assurance Framework Guidelines.
Consider opportunities to partner with other Collaborative Specializations at Western that may have offerings (i.e. professional development content, graduate level courses) that could be of benefit to trainees in this Specialization.	<ul style="list-style-type: none"> • Currently exploring opportunities to enhance professional development opportunities
Expand the group of faculty supervisors that are engaged in curriculum development and oversight to better engage faculty within	<ul style="list-style-type: none"> • Much interest among faculty but workloads limit participation

REVIEWER'S RECOMMENDATIONS	DEPARTMENTAL RESPONSE
participating Departments and adapt the Collaborative Specialization to meet future challenges/address changing market needs.	<ul style="list-style-type: none"> • Could improve with relationships developed with Schulich partners.

Implementation Plan

The Implementation Plan provides a summary of the recommendations that require action and/or follow-up. The Collaborative Graduate Specialization Chair/Director 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	PERSONNEL RESPONSIBLE	TIMELINE
1. <i>Ensure that the Engineering in Medicine Collaborative Specialization has access to the necessary resources to secure a Program Administrator (part time) to better support it and the development of its programming.</i>	Include line items in budget to staff the program appropriately	<ul style="list-style-type: none"> • Program Director • Chairs of Participating Departments • Director of the School of Biomedical Engineering • Associate Dean (Graduate) • Dean 	Complete - Fall 2021
2. <i>Pursue opportunities to integrate the Engineering in Medicine Collaborative Specialization into the School of Biomedical Engineering.</i>	Continue negotiations re integration process	<ul style="list-style-type: none"> • Program Director, School of Biomedical Engineering Director • Associate Dean (Graduate) 	Fall 2022
3. <i>Focus on the 'identity' of the Collaborative Specialization; create opportunities for trainees within the program to interact as a cohort and increase the visibility of the program (and its benefits) for both applicants and faculty members willing to supervise a project.</i>	Faculty discussions to discuss ways to promote identity of students in program, such as: <ul style="list-style-type: none"> - Professional development – meeting with employers - Bi-weekly meetings with students 	<ul style="list-style-type: none"> • Program Director • Chairs of Participating Departments • Faculty members 	Fall 2022

Other Opportunities for Specialization Improvement and Enhancement

None received

Personnel Issues (Confidential and If Applicable)

None received