



**Proposed Undergraduate Program in Biomedical Engineering  
Final Assessment Report**

<b>Faculty / Affiliated University College</b>	Faculty of Engineering
<b>Degrees Offered</b>	Bachelor of Biomedical Engineering
<b>Modules Reviewed</b>	
<b>External Consultants</b>	<b>Dr. Robert Linsenmeier</b> – Professor, Biomedical Engineering Northwestern University <b>Dr. Robert Kearney</b> – Professor, Professor & Chair of Biomedical Engineering, McGill University
<b>Internal Consultants</b>	<b>Dr. Douglas L. Jones</b> – Professor, Departments of Physiology & Pharmacology and Medicine and Vice-Dean, Basic Medical Sciences, Schulich School of Medicine & Dentistry, Western University
<b>Date of Site Visit</b>	October 5 – 6, 2017
<b>Evaluation</b>	Approved to Commence
<b>Approval Dates</b>	SUPR-U: January 24, 2018 SCAPA: February 7, 2018 Senate:

**Executive Summary**

The onsite visit began at 8:30 am meeting with Dr. Andy Hrymak, Dean of Western Engineering, Dr. Mike Bartlett, Associate Dean, Undergraduate Studies, Western Engineering and Dr. Jim Lacefield, Director, Biomedical Engineering Program. Dr. Lacefield led off with the description of the projected plans for the degree and the longer term plans for a School of Biomedical Engineering and how this program would fit into the longer term plans. Dr. Hrymak also included the information on significant new hires by the Faculty and specifically a “teaching intensive workload” position for this program as well as the development of some new courses and revisions to existing courses to be applicable to the program. Dr. Lacefield further described the intention to offer a dual degree including this new program with the existing 3 Engineering programs in a 5 year stream similar to what is currently being offered with the Honors Business Administration. Due to the processes at Western, the Biomedical Engineering program must be in place before such a “dual degree” program can be offered.

The consultants were particularly interested in specifics of the program, who would be teaching what, and the financial model as well as clarifying that their review would be restricted to this Biomedical Engineering program, and not either the “School” or the dual degree.

The consultants next met with Dr. John Doerksen, Vice-Provost (Academic Programs) and Dr. Karen Campbell, Vice-Provost (Academic Planning, Policy & Faculty). Dr. Doerksen provided an overview of the need for learning outcomes to meet the external focus and the perceived opportunity to enhance the ratio of female engineering students in a biomedical engineering stream. Dr. Campbell clarified that the concept of the School would need to go through the University’s Government structure for approval.

Over the two days, the consultants also had full meetings with members of the Academic Administration, (Dr. Jim Lacefield, Director Biomedical Engineering, and Dr. Mike Bartlett, Associate Dean, Academic, Western Engineering), student advising, (Lesley Mounteer, Director of External Services, Kelly Sexsmith, Engineering Career Services Officer, Christine Ellwood, Biomedical Engineering Graduate Program Coordinator, Clare Tattersall, Manager, Undergraduate Services and Nicole Sansone, Upper Year

Academic Coordinator), decanal members of the 4 schools which would be interfacing with the Biomedical Engineering program (Dr. Lauren Briens, Assistant Dean, First Year Studies, Dr. Greg Kopp, Associate Dean, Graduate & Postdoctoral Studies, Western Engineering; Dr. Pauline Barmby, Acting Dean, Dr. Ken Yeung, Acting Associate Dean, Academic, Jisuo Jin, Associate Dean, Graduate Studies, Western Science; Dr. Jayne Garland, Dean, Dr. Karen Danylchuk, Associate Dean, Undergraduate Programs, Western Health Sciences, and Dr. Doug Jones, Vice Dean, Basic Medical Sciences, Dr. Andy Watson, Associate Dean, Graduate & Postdoctoral Studies, Schulich School of Medicine & Dentistry). There were also meetings with additional faculty members who will teach courses and/or be research mentors (Drs. Aaron Fenster, Jim Johnson, Emily Lalone, Tamie Poepping, Andrew Pruszynski, Abbas Samani, and Ana Luisa Trejos), and Chairs of complementary Engineering Departments (Dr. Ajay Ray, Chair of Chemical and Biochemical Engineering; Dr. Jose Herrera, Associate Chair, Undergraduate, Chemical and Biochemical Engineering; Dr. Anestis Dounavis, Associate Chair, Undergraduate, Electrical and Computer Engineering; Dr. Tony Straatman, Chair of Mechanical Engineering, and Dr. Michael Naish, Director of Mechatronic System Engineering), as well as Western Libraries (Jennifer Robinson, Associate Chief Librarian, Academic and Sahwn Hendrikx, Research & Instructional Services Librarian). These meetings reinforced the consistent support for the program moving forward. The Consultants also had tours of the Wolf Orthopaedic Biomechanics laboratory, Fowler Kennedy Sport Medicine Clinic, and the Rapid Prototyping Facility, Robarts Research Institute.

As the program is not yet in place, there were no enrolled students with whom to meet, but the consultants did meet with 5 graduate students in the biomedical engineering program.

Additional details will not be included in this summary as they relate to the stated strengths and recommendations. It is relevant to mention that in the programs response to the recommendations, each of the stated recommendations and queries by the consultants has been accepted and some plans have been provide to address the comments and recommendations.

### **Significant Strengths of the Program**

The consultants commented that they *"...were impressed by the collegiality and cooperation that was evident in all of our discussions about this program, and it appeared that this results from a general culture of cooperation at Western."*

The consultants commented that the most unique and innovative aspect of the proposed program is the ability to have a combined dual degree program, with the Biomedical Engineering combined with either Chemical, Electrical or Mechanical Engineering.

They felt that the proposed program fulfilled all of the 7 Western Degree outcomes with appropriate program design, being comparable to programs at other universities. Also, as biomedical engineering is recognized as an interdisciplinary field externally, having an undergraduate program that could also feed the graduate program was consistent with values and academic plans of Western. The mandatory full year research project for all students was thought to be unique provide an excellent opportunity for experiential learning.

The consultants also felt that the relatively small size (30) is appropriate to meet the program objectives and was not expected to have much impact on overall Engineering enrolments or class sizes.

Thus they stated that they believed that the overall the proposed four-year, stand-alone undergraduate program *"... is of very good quality"* and the program should be approved.

### **Suggestions for Improvement & Enhancement**

1. outline what course options would be appropriate for students interested in specific areas of biomedical engineering and students will need specialized counselling to design the program appropriate for their interests.
2. consider supplementing the engineering ethics course with material related to human medical and research ethics.

3. students will not have the experience of working as a team on a major project. Secondly, the reduced design content will make it difficult for the program to become an accredited engineering program as required for its graduates to be immediately eligible for registration as professional engineers. This might be addressed by adding a design project to the final year – perhaps by allowing students to select two of the three final year systems courses and requiring a design course instead of the third one.
4. there might be opportunities to incorporate imaging to some extent in the biomedical systems engineering courses
5. The absence of any biomedical laboratories was a concern. The consultants strongly suggested additional laboratory sessions in which students could explore issues related to the acquisition of bio-electric signals (i.e. ECG, EMG, EOG), images (e.g. ultrasound, optical), and cellular signals. This could be accomplished within the biomedical systems courses.
6. Given the importance to the new program of the research project, the description of its delivery is too vague and needs more detail with more specific goals and timelines. Thought should be given to preparing students for their research experience – perhaps through an intensive “boot camp” session prior to the start of the research experience. Clear milestones, and description of the nature of presentations and reports that will be produced through this 12 month experience are needed. The biomedical engineering group could use as a model the research project courses elsewhere in the University, which have well developed and proven structures.

**Recommendations Required for Program Sustainability**

<b>Recommendation</b>	<b>Responsibility</b>
supplement the engineering ethics course with material related to human medical and research ethics.	Program Committee
add a design project to the final year	Program Committee
add laboratory sessions in which students could explore issues related to the acquisition of bio-electric signals, images, and cellular signals.	Program Committee, faculty and Dean
the research project the description needs more detail with specific goals, timelines, clear milestones, and description of the nature of presentations and reports.	Program Committee