



FINAL ASSESSMENT REPORT
Executive Summary
November 8, 2019
Bachelor of Science (Hons) in Chemistry
Program Review
Dean: Greg Crawford

Under Ontario Tech University's Quality Assurance Framework, all degree programs are subject to a comprehensive review every eight years to ensure that they continue to meet provincial quality assurance requirements and to support their ongoing rigour and coherence.

On the completion of the program review, the self-study brief together with the reviewers' report and the assessment team's response are reviewed by the appropriate standing committee of Academic Council, and are subsequently reported to Academic Council, the Board of Governors and the Quality Council.

In the 2017-2018 academic year a program review was scheduled for the Bachelor of Science (Hons) in Chemistry program. This is the second program review for this program and the internal assessment team is to be commended for undertaking this assignment in addition to an already challenging workload and within a very tight timeline. The following pages provide a summary of the outcomes and action plans resulting from the review, identifying the strengths of the program as well as the opportunities for program improvement and enhancement. A report from the program outlining the progress that has been made in implementing the recommendations will also be put forward in eighteen months' time.

External Reviewers: Alex Adronov (McMaster University) and Travis D. Fridgen (Memorial University)

Site Visit: February 25-26, 2019

Program Overview

The Bachelor of Science (Hons) in Chemistry program covers the main divisions of chemistry, including physical chemistry, analytical chemistry, organic chemistry, inorganic chemistry, and biochemistry. First year courses in calculus, biology, chemistry, and physics provide a sound and broad foundation in the core areas of science. Learning occurs via classroom lectures, tutorials, laboratories, computer simulations and via independent research. Learning and teaching is augmented by the integration of software available on students' personal computers. Students study in state-of-the-art laboratories and classrooms, and benefit from Science professors who are active in the frontier of research and teaching. Ontario Tech University (Ontario Tech) offers a BSc (Hons) in Chemistry, with the option of two specializations – Pharmaceutical Chemistry and Chemical Biology.

Similar to other Ontario Tech Science programs, the Chemistry program produces highly versatile graduates, equipped with a solid foundation for a wide variety of exciting careers. Chemistry graduates may find stimulating opportunities in industry, academia, government, and the private sector. Graduates can also pursue advanced degrees, including medicine, law, business, education, and research-based M.Sc and Ph.D programs in graduate schools.

Significant Strengths of the Program

- The specializations within the program have been relatively small, allowing students ready access to faculty, with relatively small class sizes.
- Faculty and staff expertise, the presence of active research groups with well-equipped labs, and good predisposition for supervising both undergraduate and graduate students are all significant strengths of the program.
- The existence of outstanding opportunities for undergraduate students to work on exciting research projects in the fields of chemical biology, organic, materials and/or pharmaceutical chemistry.
- Many of these undergraduates have received awards and participated in peer-reviewed publications.
- Exchange programs with China, Japan, and the United Kingdom open new opportunities for research placements overseas.
- Undergraduate labs provide training with state-of-the-art equipment and important chemistry-specific software.
- The instrumental analytical chemistry components allow students regular, hands-on exposure to sophisticated equipment.

Opportunities for Program Improvement and Enhancement

- Examine applying for accreditation with the Canadian Society for Chemistry (CSC).
- Revisit lab requirements in the curriculum to address the heavy student workload in the program, specifically in terms of the extent of lab report writing.
- Examine potential safety concerns regarding lab facilities including lab exits and fire escapes.
- Examine of the minimum admissions average and high school admission requirements for the program.
- Examine the possibility of increasing the course credits assigned to the thesis project course.
- Evaluate alternative experiential learning approaches.
- Understand better what the barriers are to engagement in the co-op program and to determine how best to improve participation.

The External Review

The site visit took place on February 25-26, 2019. Dr. Alex Adronon and Dr. Travis Fridgen met with members of the Faculty as well as key stakeholders at the University, including Dr. Robert Bailey – Acting Provost, Dr. Greg Crawford – Dean (by teleconference), Dr. Sean Forrester – Associate Dean, Dr. Liliana Trevani – Chemistry Program Director and members of the internal assessment team and a number of faculty, staff, and students.

The Faculty was grateful for the thoughtful and thorough review provided. The external reviewers recognized the high quality of the faculty, the rigorousness of the program, and the innovation in the content and delivery of the programs.

The reviewers identified twelve recommendations, some of which have multiple components. The Faculty values the recommendations and have been very thoughtful in their responses.

Summary of Reviewer Recommendations and Faculty Responses

Recommendation 1

Seek accreditation from the Canadian Society for Chemistry (CSC).

Response

The Chemistry Faculty and Dean agree this is a high priority. Accreditation was identified as an important step forward in the last UPR, although no progress has yet been made. Furthermore, a recent survey by the Dean revealed the vast majority of other Ontario universities have their undergraduate Chemistry programs accredited. It is important for our program's credibility, to our students and prospective students, to seek accreditation. The Dean has already assigned one faculty member to gather preliminary information on requirements, timelines, and costs associated with accreditation.

Recommendation 2

Revisit the minimum admissions average and high school admission requirements for first year chemistry, with the specific recommendation that high school chemistry be a prerequisite.

Response

The Faculty will work with the Office of Institutional Research and Analysis to examine what percentage of the majors do not enter the program with high school Chemistry and to determine if that is a useful predictor for determining program success. At the earliest, new admission standards would affect students who enrol for fall 2021.

Recommendation 3

Reduce the workload requirement in the laboratory components of the Chemistry program. For example, focus on lab skills, some simplifications to lab write-ups, and opportunities for students to revise their writing based on feedback provided.

Response

The preliminary goal of the Faculty will be to start a pilot project in one of the third-year courses, as early as January 2020, and based on the results, expand to the other lab courses over the next few years. We will also consult the chemistry education research literature, colleagues at Ontario Tech University's Teaching and Learning Centre (TLC), and the Canadian Chemistry SLI lab coordinators group to identify best/emerging practices.

Recommendation 4

Make a number of changes to the curriculum program (details in the External Review).

Response

Some changes are likely to be relatively easy (e.g., the laboratory for CHEM 4040U will be eliminated; some of those labs might be reworked into in other 3rd year courses). Other suggestions, however, have significant implications (e.g., reasonable student workloads across all 4 years; the appropriate sequencing of information presentation across the curriculum). The faculty will sit down and review the

program as a whole, including the reviewers' recommendations, then make thoughtful changes to improve the curriculum over the next few years.

Recommendation 5

Increase social/educational events, outside the classroom, to increase student and faculty engagement, including the resurrection of the undergrad student society.

Response

The faculty will reflect on what extracurricular activities might be the most valuable, given the available resources, and determine how best to prioritize efforts. The faculty agree that it would be beneficial to see the Chemistry Student Society resurrected and are happy to attempt promote this, but note that such an organization is ultimately 'owned' and run by students.

Recommendation 6

The faculty should have a budget for maintenance and repair of equipment.

Response

The Chemistry faculty supports this recommendation. However, the Dean notes that the overall relatively small size of the Chemistry program and Faculty of Science budgets, coupled with an inconsistent ability to be able to carry forward funds from one year to another, means it makes more sense to hold the budget centrally at the Faculty level.

Recommendation 7

It is strongly recommended that lab renovations be undertaken to install two exits in every undergraduate lab.

Response

The Chemistry faculty are strongly in agreement and some solutions have been proposed. The Dean has agreed to bring the specific concerns identified by the external reviewers and the Chemistry faculty to the Health and Safety Officer.

Recommendation 8

Create a teaching faculty position in the unit to greatly decrease reliance on sessional instructors and create at least one tenure track appointment in the unit.

Response

These two recommendations are roughly consistent with two hiring priorities identified by the Chemistry faculty in their self-study. The Dean also notes that both of these requests were identified in the Faculty of Science unit plan, developed for September 2018. The Dean's goal was to hire the teaching faculty position for summer 2019 (and two more tenured and tenure-track (TTT) faculty between 2020 and 2023), but institutional budget cuts ensued.

Even with the reduction in student enrolments, the practical need for, and value of, a teaching faculty member is clear, particularly in support of the undergraduate labs. Thus, an additional TTT faculty member is a slightly longer term priority, requiring additional office and lab space. We suspect this may have to wait until the budget environment improves and possibly program enrolment increases.

Recommendation 9

The reviewers recommend that the university adopt an open process for granting Canada Research Chairs (CRC) and other similar research chairs, which includes a committee composed of faculty from various units in the university that is tasked with making selections.

Response

This recommendation is a partial response to the desire expressed in the Chemistry self-study regarding a CRC position in that program, “to reflect the above-average contribution of the Chemistry division to research grants in the Faculty of Science.” The Dean believes that the reviewers’ recommendation is outside the purview of the program review, but that it is valuable advice. As a new Associate VP Research and Innovation has recently been hired, the time is opportune to share this perspective.

Recommendation 10

The reviewers recommend a Chair administrative role should be established with at least a 50% reduction in teaching load.

Response

This is in alignment with the Chemistry’s self-study, which speaks to concerns about the Undergraduate Program Director’s (UPDs) role being to essentially act as a Chair with one course release. In particular, it was noted that this is particularly “problematic due to the size and complexity of the chemistry program.”

The Dean notes that course releases for program directors are defined in the Collective Agreement. Furthermore, the course release for the few Department Chairs the university has is exactly the same as that for Program Directors. The Dean is, however, prepared to discuss with the Chemistry Program Director the workload of that role, in contrast to the workload of other UPDs in the Faculty of Science, and to determine if and where it is appropriate to alleviate some of the Chemistry UPD responsibilities.

Recommendation 11

Increase the amount of TAing done by senior undergrads in the program (as opposed to long-term, “contract” TAs).

Response

We will reflect on this suggestion, but note that TAs are unionized positions and there are built-in requirements for how such positions get hired.

Recommendation 12

The reviewers also recommended allowing students to volunteer in research labs.

Response

A draft volunteer policy has been developed and piloted on a few occasions (there are roughly 5 volunteers in the Faculty of Science for the spring/summer of 2019). The Faculty will work with Human Resources to get this policy approved through the university’s formal processes.

Plan of Action

The table below presents a timeline of the actions planned to address the recommendations from the external report.

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow Up*	Timeline	Resources/Support Needed
Pursue Accreditation	(a) Investigate process, requirements, timelines, costs (b) Develop a plan and associated timelines for accreditation application	Chemistry Faculty / Dean Chemistry Faculty / Dean / Advisors / Academic Planning Specialist / Other stakeholders as required	September 2019 September 2019 -January 2020	
Re-examine Admission Requirements	Determine what, if any, changes will be made for Fall 2020 admissions	Chemistry UPD / Dean / Chemistry Faculty / Registrar	December 2019	
Review Student Workload in Laboratories and Modify as appropriate	(a) Pilot changes in at least one lab course and assess consequences (b) Implement changes in other lab courses as deemed appropriate	Chemistry Faculty (esp. lab-based TFs) Chemistry Faculty (esp. lab-based TFs)	April 2020 September 2020 – April 2022	
Review Chemistry Curriculum and Implement Appropriate Changes		Chemistry Faculty	September 2019 – September 2023 (potentially ongoing)	
Enhancing Student-Faculty and Student-Student Engagement Outside the Curriculum	Review Options, Pilot One-Two Events, and Assess Next Steps	Chemistry Faculty	April 2020	
Address Laboratory Infrastructure Concerns	(a) Review concerns brought forward by reviewers and faculty; assess the relative	Dean / Chemistry Faculty (esp. lab-based TFs) / H&S Officer / OCIS / Other Stakeholders as Necessary	June 2019 – February 2020	

	importance and urgency of each (b) develop plan to address urgent issues and prioritize those item	Dean / Chemistry Faculty (esp. lab-based TFs) / H&S Officer / OCIS / Other Stakeholders as Necessary	September 2019 – December 2020 (potentially ongoing)	
Staffing	(a) Seek Permission to Hire Chemistry TF for Summer 2020 (b) Seek Permission to Hire Chemistry TTT for 2022 (c) Review Options for Hiring Senior Undergrad TAs	Dean / Provost Dean / Provost UPD / Chemistry Faculty	June 2019 – January 2020 June 2021 – January 2022 June 2019 – June 2020	
Adopt an open process for granting CRC and other similar research chairs	Convey Faculty and Reviewer Perspective on CRC to Senior Management	Dean	October 2019	
Formalize Volunteer Policy	(a) Seek to establish a committee and review current version of draft policy and make any preliminary revisions (b) Submit draft policy to institutional policy approval process	HR (policy owner) / Dean / Executive Director, ORS / a few faculty representatives (consultation) / other stakeholders as required HR / other stakeholders as required	July 2019 – December 2019 July 2019 – December 2019	

*The Dean of the Faculty, in consultation with the Program Review Chair shall be responsible for monitoring the Implementation Plan. The details of progress made will be presented to Academic Council and the Board of Governors and filed in the Office of the Provost and Vice-President (Academic).

Due Date for 18-Month Follow-up on Plan of Action: December 10, 2020

Date of Next Cyclical Review: 2024-2026