

**Department of Chemistry
Final Assessment Report**

Faculty / Affiliated University College	Faculty of Science
Degrees Offered	BSc
Modules Reviewed	Honors Specialization, Specialization, and Major in Chemistry; Honors; Honors Specialization in Biochemistry and Chemistry
External Consultants	Dr. Alison Flynn, University of Ottawa; Dr. Brian Wagner, UPEI
Internal Reviewers	Dr. Susan Knabe, FIMS
Date of Site Visit	September 29, 2017
Evaluation	Good Quality
Approval Dates	SUPR-U: January 24, 2018 SCAPA: February 7, 2018 Senate: February 16, 2018

Executive Summary

The undergraduate programs in the Department of Chemistry took place over the course of one day in late September 2017. While the program was supposed to have been reviewed during the 2016-17 academic year, a cancellation of the originally scheduled review (February 14, 2017) due to bad weather resulted in the review being conducted early in the 2017-18 academic year. Reviewing the program early in the year meant that additional data (the most recent enrolments for the current year for instance) was able to be provided, but it also meant that we were meeting with students very early in the year, so Y4 students were not able to provide as much detail about their experience of their final year because they had only just started it and things like the Chemistry Club, which is organized on a yearly basis, were not yet underway.

The examiners found a program with robust enrollments (compared nationally) which provided students with a rigorous undergraduate chemistry education that prepared them well for both entry into the workforce and further study. They recognized the dedication and commitment that faculty members, laboratory and office staff, graduate TAs, and undergraduate students brought to the undergraduate chemistry modules and credited this dedication with the overall positive experience that most chemistry undergraduates at UWO experience. Specific highlights in terms of curricular innovation or high impact teaching practices included the unique authentic assessment practice of the "drivers test" in their 3rd year and the requirement that all Honors Specialization and Specialization students take Chem 4491E, a research based thesis course. As the reviewers noted, requiring all HSP and Spec students to complete a thesis course is both a wonderful opportunity for students and relatively unique within the landscape of undergraduate chemistry education in Canada. Other curriculum innovations include the development of two blended courses (one in Y1 and one in Y2) for large course sections, though as the reviewers observed, there does seem to be some reluctance to move away from more traditional, lecture based, teaching methods.

The reviewers observed that the department teaches a large number of first and second year students who are taking chemistry courses required to support non-chemistry modules, and that relatively large amounts of laboratory resources, including staff and TA time, as well as faculty and administrative resources and time are spent servicing these courses. This distribution of resources has led to some of the challenges that the reviewers identified and that the faculty and students in the program discussed.

The challenges that the reviewers found included concerns by both students and faculty related to the number and distribution of 4th year electives. Students expressed disappointment that electives in particular sub-disciplines were not offered on a regular basis, or were offered but then cancelled because of low enrollments, something that faculty members also identified as a concern. Both students and faculty identified some areas where they felt students' were unprepared for upper year work -- specifically students identified the transition between first and second year difficult in relation to preparing full lab reports, while faculty, particularly those teaching physical chemistry noted that students often lacked proficiency in the math required for these courses. Much of the impetus for teaching innovation in the department resides with the two limited term appointments, one of whom has recently been on leave. There is a need for greater buy in across the faculty complement for a constructive review of teaching practices. Laboratory resources, both in terms of personnel and space, also posed a challenge for the programs given the number of students enrolled in high enrollment first and second year courses.

The department response to the reviewers report indicates considerable agreement with the overall intent of the recommendations and suggestions for improvement, indicating where steps have already been taken to address some of the concerns raised by the reviewers.

Significant Strengths of the Program

- Faculty members are passionate, dedicated researchers who are committed to the health of the undergraduate program
- Undergraduate students who are highly engaged with the program and excited about chemistry
- A large and healthy graduate program which supports the undergraduate program through TAs
- Well trained and dedicated staff (both administrative and lab) to support the delivery of the various undergraduate modules
- excellent preparation for students going into the workforce or on to further study
- healthy enrolment in chemistry modules with the exception of the module in Chemical Biology
- curriculum provides a strong foundation in the core chemistry disciplines with electives at the 3rd and especially 4th year
- authentic laboratory experience offered to all Hons Spec and Spec students through the thesis research projects under the auspices of Chem 4491E and through the "driver's test" in 3rd year analytical chemistry, in which students demonstrate their ability to use a range of different pieces of analytical equipment
- partnership with WISc program
- support within Department for need for continued pedagogical innovation

Suggestions for Improvement & Enhancement

- continue to work on ensuring high level learning outcomes are linked to both course instruction and assessment, with attention to both ensuring that expected outcomes are taught throughout the curriculum and think through how some of the WDO (especially those like resilience and life-long learning, critical thinking, global and community engagement) might be addressed and assessed in the program; engage students to improve learning experiences across the curriculum
- continued development of opportunities for offering an innovative and dynamic learning experience for students particularly through mentorship for instructors who are interested in innovative pedagogy, by encouraging champions to share experiences with pedagogical and curricular innovation, by making use of the resources offered by the wider university (TSC programs, WALs facilities), and by hiring a faculty member whose specialty is in Chemistry Education Research (CER) or the Scholarship of Teaching and Learning (SoTL) as applied to chemistry).
- identify strategies to ensure a wide range of electives across the different subfields in Y4 – the Faculty response to the reviewers report indicated running courses as grad/undergrad split courses or offering some courses as alternative year courses (with 3rd and 4th year students in these courses) might be a solution, as would increasing enrollments in the modules in order to simply have more students in the modules and thus more bodies in Y4 electives. I note that this

solution is not a guarantee that courses will not be cancelled because of low enrollment, because the distribution across electives in various subfields is also an issue. Further, increased enrollments in the Hons Spec and Spec might put additional pressure on resources in years 2 and 3, but this does not seem to be a concern at this point. Identifying specific subfields that are under enrolled at the Y4 level might permit a more targeted recruitment and retention of students into this subfield at the 2nd and 3rd year levels, particularly if these courses could draw on pedagogical innovations to reanimate interest in the area. However, it is important to recognize that the lack of upper year electives in a subfield may itself have a negative effect on fostering interest in the subfield and hence on recruitment into that subfield. This becomes a kind of a vicious circle. One way out of this impasse, the reviewers suggest, would be for the Faculty to permit the Department of Chemistry to offer a limited number of fourth year electives with low enrollment. Given that Chemistry Department is engaged in a large amount of service teaching at the first and second year levels and further, that it has not set up subfields as separate modules which would require these courses, it would seem reasonable to provide the unit with the opportunity to offer a limited number of courses per year (this could be as low as 1 or 2) that have an enrollment below a specific threshold. As a further incentive to address issues around recruitment and retention into different subfields, this “get out of jail free card” for a limited number of Y4 courses could be linked to pedagogical innovations at the Y2 and Y3 courses in particular subfields.

- Develop a plan to address critical and deferred maintenance in some labs and lab prep areas
- Develop a plan to address the issues related to lab staffing, both in terms of the need for more staff and in terms of planning for succession in lab staff as several members of staff are close to retirement

Recommendations Required for Program Sustainability

Recommendation	Responsibility
Continued attention to curriculum development, learning outcomes, and assessments	Undergraduate Education Committee, Acting Associate Chair, Undergraduate Chair
Enhance pedagogical innovation in the unit through: a) mentorship, sharing of effective teaching practices and b) review and enhance faculty capacity in CER and SoTL	a) Acting Associate Chair, Undergraduate Chair, TSC b) Dean, Faculty of Science, Chair,
Offer Y4 elective courses to ensure subfields are covered	Associate Dean, Faculty of Science, Chair, Acting Associate Chair, Undergraduate Chair
Consider adding an additional full time sessional lab staff member	Dean, Faculty of Science, Chair