Two-Year Progress Report
Chemistry (BSc)
June 2020

Background

The Undergraduate Chemistry program was reviewed in 2016-17, following the procedures described in the University Institutional Quality Assurance Process, with a self-study document submitted in September 2016, a site visit by two external reviewers with an internal reviewer accompanying them in January 2017, and a final assessment report was completed in May 2017.

The external reviewers' report indicated that the University of Waterloo offers its students a range of accredited Chemistry programs that is unmatched by any Canadian university. Recent curriculum review and planning processes, coupled with the open and effective leadership within the Department of Chemistry, have strategically positioned the Department to face the future in an increasingly competitive environment.

The Department of Chemistry at Waterloo is one of the most research-active chemistry departments in Canada. Students benefit from learning in a research intensive environment in multiple ways: they gain hands-on research experience by completing fourth-year research projects; they can join a research group as part of a work term in the co-op program; they can work or volunteer in the research groups (e.g., NSERC Undergraduate Student Research Awards); and, finally, they have the opportunity to learn from the Department's faculty and to select upper year (year 3 and 4) courses that align with their interests.

Progress on Implementation Plan

Recommendations

1. Self-study reports should contain the detailed program requirements for all degree programs under review.

   Status – complete
   Completed by Quality Assurance Office

2. The Dean of Science and the senior administration should ensure that the upgrades of Building C2, in particular the ventilation system upgrade, are to be completed as soon as possible.

Status – complete
After extensive review and engineering consulting, a contractor was retained and rehabilitation of the ventilation system was completed in summer 2019.

3. The Department should review the existing laboratory facilities and develop a plan for space management and upgrade, to align with ongoing equipment/infrastructure renewal.

   Status – complete
   Space planning and renovations are now part of the new annual budget planning process. Currently no renovations are planned, but will be undertaken with faculty renewal as needed. The Faculty is working on a modernization plan for the oldest buildings that may commence in the next 3-5 years.

4. The future plans of the Department of Chemistry should include a dedicated study space/resource center for Chemistry students.

   Status – complete
   Student space within the Department is available through the ChemClub room in C2. The Department judges that this as well as the large amount of study and student life space now available in the STC building is sufficient.

5. The Department of Chemistry should review its safety procedures at regular intervals.

   Status – ongoing
   This is and has always been reviewed annually under Policy 34 by the Chair and Safety Committee. An online system of safety inspection monitoring has been in place for several years.

6. The Department should review the coordination of multi-section courses. Course coordinators (if applicable) and instructors should place a high priority on following an agreed-upon timeline for delivering the course content, as students are distressed when sections are out of sync.

   Status – complete
   Course coordinators, in place for multi-section courses in first year, are responsible for ensuring sequencing and timing of courses is consistent. This team-based approach to multisection courses has removed any issues with syncing of course content.

7. The Department should review the coordination and grading of CHEM 494 projects. Reminders with respect to the expectations for the time devoted to the project should be

widely circulated, information about projects and the course should be circulated to students in a timely manner, and a greater emphasis on grading by reviewers should be considered.

Status – complete
The Chem 494 Coordinator has implemented orientation sessions for all students at the beginning of each term. 60% of the final grade is completed by faculty reviewers. A LEARN site has been created for students to access information, be informed of timelines, and submit reports throughout their projects.

8. The Department should review the coordination of joint programs.

   Status – complete
   Coordinating committees are now in place for each of our joint programs: Biochemistry, Materials and Nanosciences, and Nanotechnology Engineering.

9. The Department should review the list of required courses for the Materials and Nanoscience program to ensure that required core courses meet the students' needs and that pre-requisites adequately prepare students for upcoming courses.

   Status - ongoing
   Program changes have been completed and approved, and implementation is underway. Issues around sequencing of courses were addressed first, then progressive and related learning outcomes applied to each course and its content.

10. The Department should continue to support initiatives that strengthen the library-department relationship.

    Status – complete
    The Chemistry Liaison Librarian is invited annually to department meetings to provide updates and receive feedback. Instructors are reminded of the availability of the library to enhance the program and courses delivered. Upper year courses and the fourth year research project now include library tools and often visits from the liaison librarian.

11. The Department should review placement information to ensure that co-op students receive a breadth of experiences throughout their co-op program.

    Status – complete
    A Co-op liaison has been appointed with the specific aim of educating co-op students on the placement process and helpful tips to ensure success with placements. This provides

a point of contact to students as well as consistent communication from Coop Education and the Faculty of Science on changes and supports for coop programs.

12. We recommend that the Department develop a long-term plan for the sustainability of the 2+2 and 2+1+1 initiatives and that the issue of resources and support be discussed with the Faculty of Science and the University.

    Status – complete
    Coordination of the program with external partners was formalized, and a sustainable teaching plan for the additional courses was devised. Out of that plan, a full-time lecturer with specific responsibility for the MNS program and teaching in Beijing was appointed in May 2018.

13. The Department should consider discontinuing programs with chronic low enrolments, such as geochemistry and chemical physics.

    Status – complete
    The Chemical Physics program and Materials specialization of the Chemistry program have been inactivated, effective September 1, 2020 and September 1, 2019 respectively. Geochemistry is awaiting action from the Department of Earth and Environmental Science, which currently holds administrative leadership of the program.

14. We recommend that the Department continue to assess its programs, ensuring that all accredited programs provide outstanding training in chemistry while, at the same time, balancing workload and accommodating diverse student interests.

    Status – ongoing
    The Department, through its Undergraduate Affairs Committee, will continue to review its programs. Since the curriculum has undergone significant changes over the last three years, student success and outcomes will be monitored annually over the next five years to identify any ongoing or new weaknesses. Continued investment in the lab components will remain a high priority. A full assessment will be presented as part of our next program review.

15. The Department should consider the implementation of annual Department-level review of the suite of experiments for the labs, with the goal of identifying issues with current experiments and selecting potential new experiments. The external reviewers

recommended that the Department explore means, such as assistance from students, to support the lab instructors in updating and developing experiments.

Status – ongoing
The Chair, along with the Dean and Undergraduate Affairs Committee will plan to adjust workloads so instructors have time for lab updates and development. Revisions to terms of offering has permitted more lab development time for instructors to update lab curriculum. In addition, replacement of some aging lab equipment has permitted new experiments and better student experience.

16. The Department should review its website to ensure that potential students can easily identify the many programs offered.

Status – complete
The Faculty of Science has undertaken a reorganization of all web information on Science programs to ensure information is available in a coherent and accessible manner.

17. The Department should review its mechanisms for communicating with successful graduates.

Status – ongoing
The Department will continue to run its exit survey of graduating students and will work with the Science Alumni Office to facilitate ongoing communication with them. Special events to invite alumni back to campus for Chemistry focused activities have occurred, such as the unveiling of our Timeline of the Elements in October 2019, and more are planned but unfortunately these have been delayed due to the pandemic.

18. The Department should explore opportunities for including student members on committees.

Status – complete
Students are regularly invited to faculty interviews which now include teaching seminars and asked to provide feedback with our latest faculty hires. The Undergraduate Affairs committee now includes as non-voting members one CHEM undergraduate and one BIOCHEM undergraduate as student representatives.

19. The Department should explore opportunities to include more discussion and group work into the curriculum.

Status – ongoing

Second (254), third (360) and fourth year (430) courses have added group activities to their curriculum, particularly team-based learning exercises where students first work alone on a problem, then come together in groups to solve a related but more involved problem. In addition, peer review has been introduced, including coaching on how to give constructive feedback in Chem 430. Compilation of the many efforts involving group work is ongoing and will be shared throughout the Department for information.

Implementation Plan:

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	Self-study reports should contain the detailed program requirements for all degree programs under review.	Include program requirements in future templates and instructions	Quality Assurance Office	Report templates updated in Fall 2017
2.	The Dean of Science and the senior administration should ensure that the upgrades of Building C2, in particular the ventilation system upgrade, are completed as soon as possible.	Upgrade of ventilation system to extend life of equipment by ten years.	Dean's Office	Upgrades completed summer 2019
3.	The Department should review the existing laboratory facilities and develop a plan for space management and upgrade, to align with ongoing equipment/infrastructure renewal.	Space planning and renovations will be part of new annual budget planning process	Department Executive Committee and Chair	Space needs and renovations reviewed annually during budget planning. Modernization plans for older buildings received in 2019.
4.	The future plans of the Department of Chemistry should include a dedicated study space/resource center for Chemistry students.	Short-term: make seminar room available for students	Chair	ChemClub space available since 2017; STC study space an additional resource.
5.	The Department of Chemistry should review its safety procedures at regular intervals.	Review at least annually under Policy 34	Chair and Safety Committee	Reviewed annually
6.	The Department should review the coordination of multi-section courses. Course coordinators (if applicable) and instructors should place a high priority on following an agreed-upon timeline for	Review with course coordinators in CHEM 120 & 123	First-year Coordinator, UG Affairs Committee and Associate Chair, UG programs	Completed Fall 2017 –focus in all upcoming offerings.

	delivering the course content, as students are distressed when sections are out of sync.			
7.	The Department should review the coordination and grading of CHEM 494 projects. Reminders with respect to the expectations for the time devoted to the project should be widely circulated, information about projects and the course should be circulated to students in a timely manner, and a greater emphasis on grading by reviewers should be considered.	Additional Orientation with 494 students; Highlight website; New LEARN site as student resource	CHEM 494 coordinator (Chair)	Completed Fall 2017
8.	The Department should review the coordination of joint programs.	Establish Coordinating Committees for joint programs	Chair and Chairs of Biology and Physics and Astronomy	Biochem/Biol Coordination completed Winter 2017. MNS/Physics coordination completed Fall 2017
9.	The Department should review the list of required courses for the Materials and Nanoscience program to ensure that required core courses meet the students' needs and that pre-requisites adequately prepare students for upcoming courses.	Course changes and sequencing to be reviewed	MNS Coordinating Committee	Curriculum review completed Fall 2017 with course changes implemented by Spring 2019
10.	The Department should continue to support initiatives that strengthen the library-department relationship.	Explore opportunities to include library in courses and programs within the department.	UG Affairs Committee	Librarian involved in course and department meetings annually. New course CHEM 200 and existing CHEM 494 and many upper year CHEM courses now involve librarian.
11.	The Department should review placement information to ensure that co-op students	Hold information sessions for students,	Co-op Coordinator, Chair, instructors.	Coop liaisons established, information regularly shared

	receive a breadth of experiences throughout their co-op program.	establish coop liaison responsibilities and mentoring by second year instructors		with students particularly as they approach first work term process
12.	The Department should develop a long-term plan for the sustainability of the 2+2 and 2+1+1 initiatives and that the issue of resources and support be discussed with the Faculty of Science and the University.	Develop a plan with the Dean's Office. Consult with Department. New dedicated faculty lecturer position to be filled	Chair, Associate Chair (UG programs) and Dean; Chemistry Executive Committee, Department of Physics & Astronomy	Sustainable teaching plan developed Fall 2017. Dedicated lecturer hired in May 2018.
13.	The Department should consider discontinuing programs with chronic low enrolments, including geochemistry, chemical physics and materials specialization in Chemistry.	Review enrolments and sustainability of specializations.	UG Affairs Committee	Geochemistry – referred to EES department; Chemical Physics and Materials Specialization in Chemistry inactivated in Winter 2019
14.	We recommend that the Department continue to assess its programs, ensuring that all accredited programs provide outstanding training in chemistry while, at the same time, balancing workload and accommodating diverse student interests.	Additional plan flexibility to be introduced as part of new curriculum beginning September 2019.	UG Affairs Committee	Complete Sept 2019, success and adjustments made as necessary as students move through new plan.
15.	The Department should consider the implementation of annual Department-level review of the suite of experiments for the labs, with the goal of identifying issues with current experiments and selecting potential new experiments. We recommend that the Department explore means, such as assistance	Plan to adjust workloads so instructors have some time for lab updates and development	Chair with Dean on resources; UG Affairs Committee on priorities and implementation.	2018 and annually as part of teaching schedule planning.

	from students, to support the lab instructors in updating and developing experiments.			
16.	The Department should review its website to ensure that potential students can easily identify the many programs offered.	Reorganize information regarding programs in partnership with the Science Undergraduate Office website changes	UG Affairs Committee, Associate Chair (UG programs), and Dean's Office	Website has been revised, completed Summer 2017
17.	The Department should review its mechanisms for communicating with successful graduates.	Alumni events to be held	UG Affairs and Grad Affairs Committees and Science Alumni Office	Alumni events now held regularly, recent graduates celebrated at each convocation
18.	The Department should explore opportunities for including student members on committees.	To be added as additional members when appropriate	Chair and Executive Committee	Summer 2017 for current and future hiring committees and ongoing with curriculum changes.
19.	The Department should explore opportunities to include more discussion and group work into the curriculum.	To investigate, implement and share different approaches to incorporating group work into curriculum	UG Affairs Committee, Teaching Fellow	Second (254), third (360) and fourth year (430) courses have added group activities to their curriculum, completed 2017. Further incorporation ongoing.

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.

UNIVERSITY OF WATERLOO

Date of next program review: **2023-24**

Date

Signatures of Approval:

Chair/Director — 01/05/19 Date

AFIW Administrative Dean/Head (For AFIW programs only) — Date

Faculty Dean — 6-5-19 Date

Note: AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

Dan DeVidi — February 11, 2020

Associate Vice-President, Academic
(For undergraduate and augmented programs) — Date

Associate Vice-President, Graduate Studies and Postdoctoral Affairs
(For graduate and augmented programs) — Date