

Implementation Report on the 2016-2017 Cyclical Review of the programs in the Department of Chemistry and Biochemistry

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INTRODUCTION

This is the first implementation report for the Chemistry and Biochemistry cyclical review that took place in 2016-2017. For each recommendation, the full language from the External Reviewers' Report has been included, along with the corresponding information about implementation from the Final Assessment Report. For each recommendation, the unit has provided an update on the progress or action made toward the implementation of that recommendation, followed by comments from the relevant dean(s) and the Program Review Sub-Committee. Taking into account the updates provided by the unit and the comments from the dean(s), the Program Review Sub-Committee will review the report and determine if all recommendations have been implemented satisfactorily or if a subsequent report will be required.

RECOMMENDATIONS PRIORITIZED FOR IMPLEMENTATION IN FINAL ASSESSMENT REPORT

| Full Recommendation from External Reviewers' Report: The Department should develop its own strategic academic plan that is consistent with that of the University and the Faculty of Science. A clear mission statement for the Department should be included in this document (2a-2). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2a-2: Development of Strategic Plan for Department. | Department | September 2018 |

Unit Update: Departments in the Faculty of Science have more than one strategic plan with which to align goals and activities: the Strategic Academic Plan (2015-2020), the Faculty of Science Strategic Plan (2017-2022), and the Laurier Strategy 2019-2024. In addition, a new Strategic Research Plan for the University is currently under development. In this context, at the Departmental level, a tactical, action-oriented plan that aligns with each of these institutional plans is appropriate. Although the Department has not yet formalized a strategic academic plan and mission statement, many of our activities, as expressed throughout this implementation report, are consistent with elements of the existing Faculty and University plans, e.g., advancing excellence in teaching and learning, expanding research activities in support of application of new ideas, and increasing experiential learning opportunities. In addition, the Provost's Office has just initiated an Integrated Planning exercise, which is intended to focus unit-level planning and integrate and align it with Faculty-level planning and the Laurier

Strategy. The Integrated Planning process is beginning in February 2020, and the departmental planning document will be submitted to the Dean in May of 2020. The intent is for this planning document to be reviewed and updated on an annual basis to track progress. The Department will use this Integrated Planning exercise as a template for its own strategic planning. Thus, although this recommendation has not been formally implemented at this point, many Departmental activities are currently aligned with Faculty and University strategic plans, and this alignment will be increased and articulated through the upcoming Integrated Planning exercise and annual reviews to follow.

FOS Decanal Comments: Indeed, the Department will have the opportunity to develop their strategic plan during the development of their Integrated Plan, which has been delayed by the COVID-19 pandemic until the Fall'21 semester.

Program Review Sub-Committee Comments: Although the specific recommendation to create a departmental-level strategic plan has not yet been completed, the committee recognizes that the university's upcoming Integrated Planning process will provide them with an opportunity to achieve this. The department is encouraged to complete this recommendation through Integrated Planning, but believes that the Dean of Science is in the best position to continue to monitor this. No further reporting is required.

Full Recommendations from External Reviewers' Report: Math requirements for undergraduate programs need to be revised both at the university entry level and within program curricula. The Department should revise math requirements to be more consistent with what is typically offered at other Canadian Chemistry and Biochemistry Departments and with CSC criteria (2c-1).

Remove the Linear Algebra math course requirement, and revisit overall the math and other non-departmental requirements of the Honours programs (2g-1).

| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
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| Recommendation 2c-1; 2g-1: Math Requirements | Department, in consultation with Mathematics | May 2018 |

Unit Update: In response to this recommendation, linear algebra (MA122) was dropped as a requirement for both the BSc Honours Chemistry and BSc Honours Biochemistry & Biotechnology programs, effective September, 2017. In September 2018, a more appropriate math course, Mathematical Models for Natural Sciences (MA287), covering selected topics in linear algebra, differential equations and multivariate calculus, was introduced as a replacement. Of the 25 BSc Honours Chemistry and BSc Honours Biochemistry & Biotechnology students who completed the first offering of this course in Fall 2018, 88% received passing grades, with 44% achieving grades of B- or higher and 24% achieving grades of A- or higher. The current combination of required Math courses for these programs – 1.0 credit of calculus (MA100 + MA101 or MA102 + MA103), MA287 and 0.5 credit of statistics (ST230 or ST231) is consistent with other Canadian Chemistry and Biochemistry programs and is in line with the CSC accreditation requirements of “at least 2.5 credits in two or more of mathematics (algebra, calculus, statistics), physics, computer science and biology.” Based on these changes, the Department believes that this recommendation has been fully implemented.

FOS Decanal Comments: This recommendation has addressed appropriately and thus no further action is required.

Program Review Sub-Committee Comments: The department has outlined several action steps that they have taken in support of the implementation of this recommendation, and the committee considers it completed.

Full Recommendations from External Reviewers' Report: The Department should endeavour to have additional programs offered, including non-thesis based programs, accredited by the Canadian Society for Chemistry (CSC) (2a-1).

The Department should develop lab components for courses where students receive lab hours prescribed by CSC Accreditation. This will require adequate teaching lab space to be made available (2c-2).

The Department should investigate ways of accessing required resources to allow for an increase in the number of lab contact hours for non-thesis students to meet accreditation requirements (2e-3).

| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
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| Recommendations 2a-1; 2c-2; 2e-3: Laboratory hours and CSC Accreditation. | Department | May 2019 |

Unit Update: Undergraduate programs offered by the Department of Chemistry & Biochemistry are up for review by the Canadian Society for Chemistry in 2020. Given current space and resource constraints, we will be applying for re-accreditation of the BSc Honours Chemistry and BSc Honours Biochemistry & Biotechnology “with Thesis” programs only. However, a recent curriculum change from the Department of Health Sciences to remove Organic Chemistry II (CH203) and Introductory Biochemistry (CH250) as requirements for the BSc in Health Sciences program effective September 2020 will free up the space and resources required to increase laboratory hours for Chemistry and Biochemistry & Biotechnology majors. A tentative plan that involves adding hours to current lab courses and developing new senior lab courses has been devised with the goal of securing CSC accreditation for all programs offered through the Department of Chemistry & Biochemistry. Thus, it has not been possible to implement this recommendation until recently, but it will be implemented in time for the next CSC accreditation review. Since the Department will request that this accreditation review coincide with the next Departmental cyclical review, a practice recently promoted by the CSC Accreditation Committee, this recommendation should be revisited at that time.

FOS Decanal Comments: The residual action required to address this recommendation should be included in the Department’s Integrated Plan.

Program Review Sub-Committee Comments: The committee recognizes that the department completed and submitted their Implementation Report prior to the COVID-19 pandemic, which presumably has delayed plans to implement this recommendation. However, comments provided by the department indicate that implementation of this recommendation is underway. No additional reporting on this recommendation is required.

Full Recommendations from External Reviewers' Report: The department should continue to explore and implement innovative assessment methodologies, which assess higher cognitive skills and abilities, and are relevant to various types of learners (2d-1).

Current lab assessment approaches should be re-evaluated, to make sure that lab skills and theory are being assessed appropriately (2d-3).

| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
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| Recommendations 2d-1; 2d-3: Learning assessment methodologies. | Department | May 2019 |

Unit Update: Efforts to implement evidence-based assessment methodologies in the Department of Chemistry & Biochemistry are ongoing. In recent years, an increase in the application of formative assessments, including use of clickers and on-line homework, the Immediate Feedback Assessment Technique (IFAT[®]) for multiple choice testing and 2-stage collaborative testing has been observed. Chemistry & Biochemistry faculty are also frequent users of active learning classrooms (ALCs). The Chemistry Education Committee (CEC) also continues to play a pivotal role in promoting innovative assessment methodologies. In the fall term of 2018, we implemented monthly "Paper of the Month" coffee breaks to engage students, staff and faculty in discussions regarding innovative teaching pedagogies and assessments.

As for lab assessments, these were reviewed based on Recommendation 2d-3, and recent efforts have focused on ensuring lab skills and theory are being assessed appropriately. This has been made possible, in part, by the hiring of a new lab coordinator in September, 2017. Recently implemented assessments include:

- CH110: Optional lab skills training sessions prior to first experiment
- CH110/CH111: Online prelab quizzes, marked immediately upon submission
- Online lab reports marked with Feedback Studio
- Students write a portion of the procedure for 5/12 experiments (instead of being given procedure)
- CH203: Practical lab exam implemented in winter term of 2018
- CH261: Introduction of skill and confidence building experiments with formative accuracy assessment
- CH301: Semester long project requiring students to research, write and execute their own procedure
- NMR and ATR-FTIR use and product analysis
- CH357: Several experiments with partial or entirely student-designed procedures; lab exam/skills testing
- CH452: Progression from well-structured experiments to student designed experiments (1st 4 weeks); inquiry-based experiments designed entirely by students (last 8 weeks)

Thus, we have taken a number of steps since the cyclical review toward implementation of these recommendations and we will continue to do so.

FOS Decanal Comments: The Department has made significant progress toward addressing this recommendation and is entrusted to continue investigating and testing approaches and means to apply additional evidence-based assessment methodologies.

Program Review Sub-Committee Comments: The committee commends the department on undertaking this assessment review, and appreciates the level of detail provided on the outcomes of this review. The committee concurs with the dean about entrusting the department to continue its implementation, and does not require further reporting on this recommendation.

| Full Recommendation from External Reviewers' Report: Increase opportunities for co-op or internship placements in the undergraduate curriculum (2g-3). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2g-3: Addition of co-op programming. | Department, in consultation with Dean and Co-Operative Education | September 2018 |

Unit Update: For reasons previously stated (lack of availability of work placements for students, relatively small cohort of students which makes attracting potential employers challenging), the co-op office is not able to support the development of accredited co-op programs in Chemistry & Biochemistry at this time. In addition, the Department does not deem this a priority given that many undergraduate students have on-campus opportunities to gain career-relevant hands-on experience. Having said that, continued efforts will focus on developing contacts and strengthening the summer co-op structure that is currently in place until such a time that the addition of an accredited co-op option is prioritized by the Department and facilitated by the Faculty of Science.

FOS Decanal Comments: The Department recognizes the pragmatic realities and limitations of this recommendation. Nonetheless, their continued attention to enhancing the summer co-op structure is recognized and appreciated.

Program Review Sub-Committee Comments: The committee believes that the department is the best judge of whether or not it is practical or feasible to expand co-op opportunities for its students, and supports the assessment of the department and the Dean of Science that focusing on its current summer co-op structure should be the priority at this time. No further reporting on this recommendation is required.

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| <p>Full Recommendations from External Reviewers' Report: The Department should develop stand-alone graduate level courses for M.Sc. level students. Where senior undergraduate level courses must be cross-listed, separate evaluation tools (i.e. Assignments, tests, examinations, etc.) distinct from those of the undergraduate level should be developed (2c-3).</p> <p>Ensure in cross-listed courses that the different undergraduate and graduate learning outcomes are clearly communicated and assessed (2d-4).</p> |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
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| Recommendation 2c-3 & 2d-4: Cross-listed courses | Department | May 2018 |

Unit Update: This recommendation has been completed. Each of the cross-listed courses (CH600, CH640, and CH645) in the M.Sc. program has a separate syllabus with a different evaluation scheme from its twinned undergraduate course. Typically, the graduate students have advanced projects or assignments, and oral presentations that are in addition to components from the undergraduate course. The offering of a stand-alone graduate course is possible when the number of graduate students interested is sufficient. This is the case with CH622, which is offered on a fairly regular schedule (alternating years). Furthermore, directed studies courses (CH685x) are offered each year and on a student-by-student basis.

FOS Decanal Comments: The Department is thanked for its attention to this recommendation and for addressing it appropriately.

FGPS Decanal Comments: FGPS supports the use of separate syllabi and higher expectations of graduate students in twinned courses whenever resources are not sufficient to offer standalone classes.

Program Review Sub-Committee Comments: The committee recognizes that there are enrolment situations in which an undergraduate and graduate level course needs to be cross-listed, but agrees with the review committee's recommendation that there should be separate syllabi and learning outcomes for students at each degree level. The comments above indicate that the reviewers' recommendations have been implemented and no further reporting is required.

| Full Recommendation from External Reviewers' Report: The Department should work with the Faculty of Graduate and Postdoctoral Studies to provide ASPIRE workshops at alternative times that are more suited to the other demands upon the department's graduate students (2c-5). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2c-5: ASPIRE program offerings. | ASPIRE is coordinated by FGPS. | May 2019 |

Unit Update: This recommendation has been implemented. Students in the MSc in Chemistry program are required to complete four ASPIRE or professional development sessions/workshops. The FGPS revised the ASPIRE program in Fall 2019. It now has 5 pillars: career, teaching, professional, research, and wellness. There is now ample choice of ASPIRE sessions for graduate students in both the fall and winter semesters (over 30 sessions). In addition, students may attend professional development workshops at chemistry conferences, within the department (and the Department of Biology), or on-line through MITACS Edge programming.

FGPS Decanal Comments: The Department is thanked for implementing this recommendation for the benefit of their graduate students.

FGPS Decanal Comments: ASPIRE programming has added new topics and increased offerings. Across a wide range of delivery dates and times. We are happy that graduate students from this program participate in the ASPIRE program.

Program Review Sub-Committee Comments: The committee was pleased to read that a satisfactory solution to this recommendation had been achieved through consultation between the department and the Faculty of Graduate and Postdoctoral Studies. This recommendation has been completed and no further reporting is required.

| Full Recommendation from External Reviewers' Report: Provision of a word template for the MSc thesis would help ensure that theses meet the rigorous standards and requirements for such documents (2c-6). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2c-6: MSc Thesis template. | Department | May 2018 |

Unit Update: All MSc students (and faculty supervisors) have access to the CH699 MyLearningSpace page. This course site is updated continually. Information for each of the seminar courses (CH671, CH672, CH673, and CH674) is available. Other folders include MSc Program Info (contains the Handbook), Forms, Thesis Proposal, and Thesis. In the Thesis folder, there are Thesis Style and Format Guidelines, a link to the ACS Style Guide, and two sub-folders (Resources and Previous Theses). Although a word template for the MSc thesis is not made available to students, the noted resources do significantly more than a word template would to achieve the goal of this recommendation of ensuring theses meet the rigorous standards and requirements for such a document. The Graduate Coordinator continually updates the CH699 MyLearningSpace page and students have direct access to the latest information. Posting of documents to the Departmental website is a much slower process and the website is not updated as regularly. MyLS is the best repository for this purpose and students are fully aware of what is available to them there.

FGPS Decanal Comments: FGPS is very supportive of current students having access to multiple previous theses (in the Previous Theses folder). Looking through a collection of theses provides more information on what elements are similar across theses. As importantly, it provides examples of how different approaches may be appropriate for a particular thesis. While not developing Thesis template, the Department has surpassed the aim of this recommendation.

Program Review Sub-Committee Comments: While it is unclear why the department has chosen not to provide MSc students with a thesis template, they have provided ample information about the resources available to graduate students to ensure they understand the style and formatting expectations of their thesis. The Dean of the Faculty of Graduate and Postdoctoral Studies indicates that the intent of this expectation has been surpassed; therefore, no further reporting is necessary.

| Full Recommendation from External Reviewers' Report: Establishment of a Science Resource Centre, or other central resource where CAS and TAs may hold office hours or otherwise be available to undergraduate students (2e-1). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2e-1: Space for CAS and TAs to hold office hours. | Department, Dean of Science | May 2018 |

Unit Update: The following changes have taken place since the cyclical review to satisfy this recommendation. Chemistry & Biochemistry Contract Teaching Faculty (CTF; formerly CAS) have newly renovated space (BA405) in the Bricker Academic Building that is shared with CTF in Biology. Currently, there are enough carrels in BA405 so that each CTF member has their own assigned space. A separate nearby office (BA406) can also be booked for up to 2h/week for 1-on-1 interactions with 1-2 students at a time. If larger meeting rooms are required, the Administrative Manager for the Department of Chemistry & Biochemistry assists in booking these.

A room in the Science Building (N3013) has recently been renovated with study carrels designated for graduate students, such that all graduate students now have designated space, including a desk and locker, in either the Science Building or the Science Research Centre. Undergraduate students are free to meet with graduate TAs in these spaces. These students also have easy and regular access to lab coordinators who have offices in the same office pod.

FOS Decanal Comments: The Department has adequately addressed this recommendation; no further action is required.

FGPS Decanal Comments: FGPS agrees that the Department has adequately addressed this recommendation; no further action is required.

Program Review Sub-Committee Comments: The committee is pleased to hear that there have been spaces allocated for CTF and TAs to hold office hours for undergraduate students. This recommendation is considered to be completed.

| Full Recommendations from External Reviewers' Report: Investigate the possibility of developing a new Biotechnology or other program within the Department of Chemistry to be established at the new Milton campus (2e-2). Develop new programs that are well matched to student interests and career goals, such as Biotechnology (2g-4). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2e-2, 2g-4: Investigate possibility of graduate program offerings at Milton site. | Department, Dean of Science | May 2018 |

Unit Update: Implementation of Recommendation 2e-2 is not an option at this point in time. After a number of years of planning for a new Laurier campus in Milton, the provincial government pulled funding and the planning stalled. In the fall of 2019, the possibility of a Milton campus was reintroduced and Laurier is currently seeking government funding. Science will have a presence on the Milton campus but, for the immediate future, Chemistry & Biochemistry programs are not an option owing to a lack of wet lab space.

As for Recommendation 2g-4, we feel that Recommendations 2a-1; 2c:2; 2e-3 are a much higher priority and, thus, our primary goal at this point is to focus on improving our current programs in Chemistry, including joint programs with the Departments of Biology, Math and Physics, and Biochemistry & Biotechnology by increasing laboratory hours for majors with an eye toward achieving CSC accreditation for all programs. In addition, on February 19, we will hold the first of several meetings focused on curriculum renewal in all undergraduate programs to consider changes that may, in addition to other things, be better suited to student interests and career goals.

FOS Decanal Comments: Whereas Biotechnology is not included as a proposed new program for implantation in Milton, the Department will be expected to contribute to the delivery of other planned programs. The Department is encouraged to continue investigating opportunities with other departments in the Faculty, and plans should be articulated in their Integrated Plan.

Program Review Sub-Committee Comments: The committee recognizes that plans for a Milton campus and details about the potential programming that would be offered there continues to be a ‘moving target,’ and that decisions about which programs would be offered in Milton is not decided at the department level. The committee supports the commitment to curriculum renewal processes that have been (and presumably will continue to be) undertaken in support of this recommendation, recognizing that they may not have been completed yet due to interruptions associated with the COVID-19 pandemic. Because the status of Milton programming is unknown at this time, and the Dean of Science suggests that Recommendation 2g-4 be built into the department’s Integrated Plan, no further reporting on this recommendation is required.

| Full Recommendation from External Reviewers’ Report: The Department should ensure that it takes advantage and makes full use of all available funding programs, both internal and external, to increase the numbers of undergraduate and graduate students working in the research labs (2e-4). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2e-4: Increase number of students working in research labs. | Department | May 2018 |

Unit Update: The Department of Chemistry & Biochemistry believes that this recommendation has been implemented as it continues to engage larger numbers of undergraduate and graduate students in research. For the last few years, the Department has been allocated 4 NSERC USRAs which have been used to introduce students across all years of Chemistry and Biochemistry & Biotechnology programs to the research lab. In addition to these, the Dean of Science Office introduced supplementary summer research awards in 2019. Nine of these Science USRAs were awarded across the Faculty with two awarded to students in the Department of Chemistry & Biochemistry. Additional undergraduate students are provided paid research opportunities through

faculty members' NSERC Discovery and other grants. Undergraduate students also have access to volunteer research opportunities and research for credit via enrollment in a Directed Studies course (CH495). To provide earlier research opportunities to undergraduates, we have begun to waive the 4th year status requirement for enrolment in CH495. In 2021-2022, we will formalize these earlier research experiences through introduction of 2nd and 3rd year Directed Studies courses (i.e., CH295, CH395). That the Department is doing well of late in providing research opportunities to undergraduates is reflected in the >40 undergraduate HQP that have been trained over the past 3 years.

M.Sc. student numbers in the Department of Chemistry & Biochemistry remain healthy, with an average of 13 M.Sc. in Chemistry students over the past three years, and enrolments of Chemistry & Biochemistry students in the Ph.D. in Biological and Chemical Sciences program have increased from a yearly average of 4-5 students up to the time of the cyclical review to 8-9 students per year since then. These students have been successful in accessing a variety of scholarships and awards over the past 3 years including NSERC Canada Graduate Scholarships – Masters (1) and Doctoral (2), an NSERC Postgraduate Scholarship – Doctoral (1), Queen Elizabeth II Graduate Scholarships in Science & Technology (3), an Ontario Trillium Scholarship (1), Ontario Graduate Scholarships (3), William Nikolaus Martin Scholarships – internal (5), a Laurier Graduate Fellowship – Doctoral (1) and Laurier Student Travel Awards (21). This amounts to >\$375,000 in student-awarded funding over the past three years. In addition, faculty members in the Department of Chemistry and Biochemistry have been awarded >\$5.8 million in external operating grants and >\$2.4 million in external infrastructure funding over the past 7 years, clearly indicating a commitment to and recognition of high calibre research and a capacity to train graduate HQP.

FOS Decanal Comments: This recommendation has been addressed adequately. Nonetheless, the Department is encouraged to address increased research activity and engagement in their Integrated Plan.

FGPS Decanal Comments: This recommendation has been addressed. The department should continue to look for research and experiential opportunities wherever possible.

Program Review Sub-Committee Comments: The committee echoes the comments of the deans of Science and Graduate and Postdoctoral Studies that this recommendation has been satisfactorily addressed, and appreciates the level of detail provided by the department in outlining the steps that it has taken to implement it.

| Full Recommendation from External Reviewers' Report: The Department should make better use of their students as teaching and research resources (2e-7). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2e-7: Better use of students as teaching and research resources. | Department | May 2019 |

Unit Update: Our current and potential capacity to utilize undergraduate and graduate students as *research* resources was addressed in the previous section. With respect to their use as *teaching* resources, both undergraduate and graduate students have played an expanding role in the Department of Chemistry &

Biochemistry in recent years. From as early as Year 2, undergraduate students have always been involved in teaching as lab instructional assistants (IAs), but in recent years, they have become involved in championing academic integrity in this role by sharing experiences with students, reinforcing ethical behaviour in the lab and helping to detect plagiarism via Turnitin. In addition, we have started hiring 2nd, 3rd and 4th year undergraduate students to hold office hours, primarily during midterm and final exam weeks, to assist students in our biggest service courses (CH110, CH111, CH202 and CH203). Finally, many student members of our Laurier Chemistry Association (LCA) run study sessions during midterm and final exam weeks.

We continue to support and nurture our graduate students as junior teachers. Several of our PhD students have completed the Teaching & Learning “University Teaching Course for Doctoral Students” and other teaching certificates. Over the past few years, these PhD students have, under Contract Teaching Faculty (CTF) exempt positions, taught undergraduate courses (CH111, CH202, CH261) for the Department. Graduate students have also been involved recently in lab development and TA manual writing (e.g., CH203, CH452), delivering pre-lab talks (e.g., CH111), running tutorials (e.g., CH213, CH404), and, in one case, being assigned to run a lab section without the assistance of lab coordinators (CH202/CH203).

Overall, we are currently utilizing undergraduate and graduate students effectively as research and teaching resources in line with this recommendation, but we will continue to encourage them to engage in teaching-related activities to the mutual benefit of the students and the Department.

FOS Decanal Comments: The Department has successfully implemented this recommendation.

FGPS Decanal Comments: The department has successfully implemented this recommendation.

Program Review Sub-Committee Comments: The comments provided by the department outline several ways in which students are currently being engaged as teaching resources. The committee would encourage the department to continue to identify ways that undergraduate and graduate students can gain pedagogical training through their contribution to the department’s teaching. No further reporting on this recommendation is required.

| Full Recommendation from External Reviewers’ Report: Need to engage outstanding or promising undergraduate students early in their careers in research groups of faculty, perhaps through an Outstanding Student award only available to those in the relevant program (2g-2). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2g-2: Engage promising undergraduate students. | Department | May 2019 |

Unit Update: The current yearly allotment for NSERC USRAs, together with the newly created Faculty of Science USRAs, now allows us to engage a respectable number of undergraduates in research fairly early in their programs. Additional students are hired using faculty members’ NSERC Discovery grants. We believe that these mechanisms satisfy the intent of this recommendation, but we will, nevertheless, expand research opportunities for undergraduates through introduction of 2nd and 3rd year directed studies courses in 2021-2022.

FOS Decanal Comments: The Department has addressed this recommendation, and its ongoing attention to the issue is recognized and appreciated.

Program Review Sub-Committee Comments: The committee concurs with the Dean of Science that sufficient examples have been given by the department about the steps have been taken to implement this recommendation, which are providing students with valuable research experience. No further reporting is required.

| Full Recommendation from External Reviewers' Report: The research and graduate profile of the department could be raised by requiring or providing financial support to graduate students to attend at least one national/international level conference within Canada (e.g., the annual Canadian Society for Chemistry Conference). This in turn would aid recruitment efforts by showcasing graduate research at Wilfrid Laurier University (2h-1). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2h-1: Financial support for graduate students to attend conferences. | Department | May 2019 |

Unit Update: Most of our graduate students participate in at least one large conference per year. Over the past three years, they have collectively made 38 local, 38 national and 25 international conference presentations. Recent national/international conferences that our students have attended include the Canadian Chemistry Conference and Exhibition, Annual Meeting of the Biophysical Society, and Society of Environmental Toxicology and Chemistry Annual Meeting. From the MSc in Chemistry budget, students can apply for a \$300 travel award per year. From the Biological & Chemical Science program budget, each PhD student has a maximum total of \$1500 available as a travel award. Students can use increments over the 4 years of their program or use all \$1500 in one year for one conference. The Faculty of Graduate and Postdoctoral Studies also has travel funding available; \$250 for travel within Ontario and \$500 for outside of Ontario. The Graduate Students Association has a Professional Development Opportunity Fund that can cover up to 50% of the registration cost of conferences. Furthermore, the Campus Experience and Enhancement Fund administered by the Dean of Students Office can be applied to for travel to conferences. Students are given this information via email and in the MSc in Chemistry Handbook. Overall, we believe that our graduate students have sufficient opportunities and funding avenues to showcase their research.

FOS Decanal Comments: The Department has adequately addressed this recommendation, but as with other recommendations addressed above, they are encouraged to further enhance their research profile.

FGPS Decanal Comments: The Department has adequately addressed this recommendation. FGPS is hoping to increase the amount of financial support available for graduate students to participate in scientific meetings, symposia, and outreach activities (knowledge mobilization).

Program Review Sub-Committee Comments: The department has identified the ways in which they are promoting student participation in research conferences through both internal and central funding opportunities. No further reporting on this recommendation is required.

| Full Recommendation from External Reviewers' Report: Industry personnel and alumni could be invited to give Departmental seminars, either formal or informal (2h-2). | | |
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| Recommendation to be Implemented (from Final Assessment Report) | Responsibility for Implementation | Anticipated Completion Date |
| Recommendation 2h-2: Inviting industry personnel and alumni to departmental seminars. | Department | May 2018 |

Unit Update: We have several updates to report with regard to the implementation of this recommendation. In the summer of 2019, The Chair of Chemistry & Biochemistry established a connection with a new Alumni Relations Officer, Lauren Judge. Our desire to engage more Chemistry and Biochemistry alumni as speakers in our Departmental Seminar Series, as guests at annual Laurier Chemistry Association (LCA)-hosted alumni nights and, potentially, as contacts for placing students in work-integrated learning opportunities was expressed. Although an effort was made to bring in alumni for our 2019-2020 seminar series, we were not successful. With an earlier start this year, we are hopeful that we can attract Chemistry and Biochemistry alumni for our 2020-2021 seminar series and we will continue to work with Alumni Relations on an ongoing basis to increase participation of alumni in our seminars. Currently, our LCA executive is working with Alumni Relations to engage Chemistry and Biochemistry graduates in an LCA Alumni Night to be held on February 26. This will be a yearly event that will allow us to build more and better connections with our alumni.

FOS Decanal Comments: The Department has implemented this recommendation.

Program Review Sub-Committee Comments: The department has articulated several concrete steps that they have taken since the cyclical review to implement this recommendation, and a commitment to continuing to find ways to leverage alumni networks for the benefit of current students. This recommendation is considered to be completed.

ADDITIONAL COMMENTS

FOS Dean: Given the level of response to the recommendations, a subsequent Implementation Report would not be expected.

FGPS Dean: As far as Graduate Studies is concerned, no subsequent report is needed.

Program Review Sub-Committee: The committee appreciates the level of detail provided by the department in outlining the steps that it has taken since the cyclical review to implement the recommendations that were prioritized by the deans in the Final Assessment Report and Implementation Plan. The committee is also grateful for the clarity in the deans' responses around whether or not, from their perspective, a recommendation was considered to be completed. Based on the updates provided by the department, the committee concurs with the deans that no further reporting on these recommendations is required, and congratulates the department on successfully completing this cyclical review.

Subsequent Report Required: No

Next Cyclical Review: 2023-2024