

# Final Assessment Report

## Chemistry

### Undergraduate Program Review

#### A. Summary

1. The Department's Self Study was considered and approved by the Academic Review Committee of Senate on November 20, 2012.
2. The Review Committee consisted of two external reviewers: Davit Zargarian, University of Montreal and Stefan Siemann, Laurentian University and an internal reviewer, Shyamal Bose, Physics.
3. The site visit occurred on April 3-5, 2013.
4. The Reviewers' Report was received on May 14, 2013.
5. The Department's response was received on June 20, 2013.
6. The Dean of Mathematics and Science response from Ejaz Ahmed was received on July 11, 2013.
7. The Undergraduate Program Committee response was received on May 27, 2013.

The undergraduate programs offered by the Department which were examined as part of the review included:

BSc Pass and Honours in Chemistry  
BSc 4 Year with Major  
BSc Honours in Chemistry/BEd

This review was conducted under the terms and conditions of the IQAP approved by Senate on June 6, 2011.

The reviewers assigned to the program Outcome Category 2, "Good Quality".

## B. Strengths of the Program

The Reviewers' reported that in addition to the expected and standard components of a university chemistry program, the curriculum at Brock has some distinguishing features:

For instance, the Industrial Chemistry course offered to third year students is unique for the perspective it provides to students on how chemistry is practiced in industrial settings. In addition, the number of course-associated tutorials is high at Brock: tutorials are offered for all first-year courses, 4 out of 7 second-year courses and 6 out of 13 third-year courses. This feature is expected to facilitate delivery of course material. Another innovative approach implemented at Brock is the use of so-called clickers in all first and some second year courses. This technology complements traditional lecturing by providing direct feedback to the instructor on the absorption/retention of course-relevant material. It has been received with enthusiasm by chemistry students at Brock, and is gaining in popularity at other Canadian universities.

The Review Committee commends the chemistry teaching staff for the high quality of training they offer their students. We also applaud the professors for maintaining a very high level of research productivity despite the constraints of a fairly high teaching load. Indeed, we admire the attitude that teaching 2+2 or 3+1 undergraduate/graduate courses is a "normal" load; this allows a relatively small department to provide a good variety of courses for their undergraduate and graduate students. This is especially relevant when one considers that this department has many well-established and rising researchers who enjoy (or are gaining) international reputations in their fields of scholarly activity. In addition, the presence of two high-visibility Canada Research Chairs in the department is of immense value to the attractiveness of the Chemistry program. Not only do these Chairs enable Brock to compete for research funding and resources (infrastructure, facilities, and instrumentation), their high visibility symbolizes the achievements of the university and its commitment to excellence in all areas of endeavour including teaching, research, and service to the community. Thus, the Chairs serve as useful tools for attracting and recruiting faculty, staff, and students at both the undergraduate and graduate levels.

The Review Committee was particularly impressed with the degree to which undergraduate students are integrated into research activities of various research groups. In addition to the involvement of undergraduates in research studies in the context of the Experience Works program, some fourth-year students earn roughly 40% of their final year credits through their advanced thesis studies. This element of the curriculum, which amounts to about 20 hours/week of work over two semesters, offers a unique opportunity for chemistry undergraduates at Brock to get valuable hands-on experience in research laboratories. In addition to hands-on activities on an advanced topic, the students are required to meet frequently with their supervisors, and submit a 50-page thesis-type written report that must be defended at an oral examination. Students thus have a great opportunity to work closely with faculty and graduate students, and to see first-hand the interconnection between the notions

acquired in classes and practical experimentation in the laboratory. Furthermore, they also earn valuable experience that should help them find employment in industrial and research settings after graduation.

In addition to its normal course offerings, the chemistry department at Brock conducts a number of outreach-type and mentorship activities that serve to enhance the quality and experience of education for its undergraduate students as well as for the community at large. These initiatives include “Scientifically Yours”, a 2-day workshop dedicated to nurturing interest in a science-based career in grade 11 female students, “Niagara Regional Science and Engineering Fair”, “Wonders of Chemistry Show”, and “Brock Science Mentorship Program”.

## C. Opportunities for Improvement and Enhancement

The reviewers provided nineteen recommendations for the program.

1. We strongly recommend that the chemistry department be granted a regular annual capital budget to replenish and modernize the equipment so urgently needed in the undergraduate student laboratories.

The Department stated that it:

has been very proactive in pushing for exactly such a change to occur. This initiative began immediately upon FMS Dean Ejaz Ahmed's arrival in February 2012, when the Chair and [name withheld] (Senior Laboratory Coordinator) took the Dean on a tour of the teaching labs to indicate their poor state. As a result of this tour, the Department prepared a list of equipment needs and associated costs based on a five-year plan, which in September of 2012 became a blueprint that other Departments in FMS followed to prepare teaching lab equipment renewal needs under the Dean's direction. We wish to emphasize that the five-year lab renewal plan and anticipated budget was designed to address current deficiencies. A regular annual capital budget, as recommended by the External Reviewers in the amount of \$25,000-30,000 per year for undergraduate laboratory infrastructure, would enable the Department to replenish and modernize the equipment without having to go the Dean "cap-in-hand" every year. The current operating budget line of \$5,000 for equipment purchases is ludicrously insufficient; as noted in the External Reviewer's Report, the Department of Chemistry and Biochemistry at Laurentian receives \$30,000 per annum to maintain and upgrade their undergraduate teaching laboratories. Related to the equipment issue is the physical state of the teaching labs in Chemistry. Many are in need of renovation and require, at minimum, a fresh coat of paint to look clean and modern. Annual requests for such infrastructure renovations usually amount to nothing.

The Dean responded by saying:

This recommendation is inconsistent with the way in which equipment budgets are currently treated at Brock. It would be ideal to provide departments with adequate funding for maintaining modern equipment for teaching and research but the current fiscal realities of Brock make this recommendation impossible to adopt without additional funding to the Faculty.

In its report, UPC noted that the list of the recommendations in the Reviewers' Report would require "important resource investments. The budgeting issues are critical for undergraduate students in their lab experiences and we feel students should be receiving the most up-to-date learning opportunities in a safe environment."

ARC considers this recommendation to be not accepted as it lies outside of the Committee's jurisdiction. **However, the Committee believes this recommendation exposes an urgent issue that has immediate implications for safety as well as the delivery of the program.** It is ARC's view that a consultation should take place without delay at the appropriate levels of oversight to address this issue. **The Committee will refer this issue to the attention of the Senate Planning, Priorities and Budget Advisory Committee.**

**Implementation Plan**

Recommendation NOT accepted.

2. The chemistry department should quickly revisit and update the “Five-year lab renewal plan” included in the Self-Study to reflect the above recommendations with regards to safety issues and other considerations for modernizing laboratory instrumentation. Faculty, lab instructors and technicians should work together to prepare an updated, relevant and realistic plan and communicate it to the Dean’s Office as soon as possible.

The Department responded:

In accordance with this recommendation, the five-year renewal plan has been updated. Reflected in the changes is the removal of recent equipment purchases facilitated by a combination of funds from the Dean FMS, and revenue generation from the Department’s own Analytical Services ([name withheld]). The purchase of equipment to reflect recommendations regarding safety issues (heating mantles to replace Bunsen burners) has been prioritized. The renewed plan ... has been forwarded to the Dean. Considering one year has passed and some items were procured in the past year (autotitrator, polarimeter, IR spectrometer, one of two UV-Vis spectrometers), the re-prioritized list now spans four years rather than five.

The Dean responded:

We look forward to receiving the department’s Strategic Plan in the near future and we hope that it sets reasonable expectations given the constraints to be imposed by the University’s budgetary situation.

ARC considers the recommendation to be accepted and implemented.

#### **Implementation Plan**

No further action required.

3. We recommend that purchase of heating mantles, analytical balances and pH meters be given top priority for the department's acquisitions. Heating mantles must be purchased immediately and used in undergraduate laboratories whenever heating is required, except in manipulations for which other modes of heating are deemed more appropriate. Analytical balances and pH meters should be acquired as soon as feasible for use in first year laboratories.

The Department responded:

At this point, we have obtained quotes for this equipment and they are listed as top priority in the revised renewal plan. Heating mantles with temperature controllers will cost \$12,000, pH meters will cost \$6,000, and analytical balances will cost \$22,500. It is our understanding that the Faculty of Math and Science has been given a budget of \$15,000 to cover undergraduate laboratory upgrades across all programs. There is clearly a disconnect between the REAL costs and the funds made available for supplying undergraduate teaching laboratories with the equipment required to train the next generation of scientists. We continue to advocate for realistic and sustainable funds for our teaching labs.

The Dean responded by stating:

While these are relatively small items they amount to a cost of \$40,500 which is not available from the FMS budget. If the University hopes to maintain strength in Chemistry programs additional funds must be found from outside of the current Faculty of Mathematics and Science budget. One possibility is for the Department to increase the number of lab courses for which ancillary fees are collected and used to fund equipment for teaching labs. This has worked out very well for the Department of Biological Sciences. The purchase of heating mantles (\$12,000) is of premier concern due to the safety hazards associated with continuing with current practice. We propose that the Department use its current equipment allocation of \$9,000, along with a one-time amount of \$3,000 (from the Office of the Dean), to purchase the heating mantles. Funds for other equipment will have to be requested from the new central equipment budget by way of a Schedule 5 request.

ARC considers this recommendation to be not accepted as it lies outside of the Committee's jurisdiction. The Committee recognizes that progress is being made on the "Five-year lab renewal plan", but **wishes to raise the concern that the program is vulnerable to liability because of a lack of these resources.** The Committee understands that further advocacy for funds would take place through the Dean's budget submission to the University Budget Committee.

#### Implementation Plan (Priority)

Recommendation NOT accepted.

4. The department of chemistry should obtain the Dean's approval for recruiting an external candidate for the position of a department chair. This candidate should be charged with bringing an energized leadership and implementing the needed reforms and improvements in order to further strengthen this department and lead its strategic development. In addition, the new chair will also contribute to alleviating the dire needs in the area of teaching and research in analytical or physical chemistry.

The Department responded:

The Department of Chemistry discussed recommendation 4 at a Department meeting (June 14, 2013). There are pros and cons to hiring an external candidate for Department Chair. On the positive side, the Department agrees that an external Chair would bring "energized leadership" to the Department, as well as an elevated research presence to the University. On the other hand, the attendant cost of hiring an external Chair at the associate or full professor level would be substantial; the start-up costs for an established experimental chemist would be well over \$200K, not to mention salary. The pool of qualified and potentially interested individuals for such a position would also be relatively small, which would be very restricting to the Department in a search for a suitable candidate. It may be more feasible to use the resources that would have to be allocated for the hire of an external Chair towards a tenure track faculty member at the assistant professor level, and additional administrative support staff for the Chemistry Chair. The latter scenario would in all likelihood be cheaper and have a longer-term positive influence on the Department than hiring a temporary late career external Chair who would not necessarily be any more effective without dedicated administrative support.

The Department has received permission to mount a search for a tenure-track faculty member in analytical chemistry, for which a search is currently underway with a start date of July 2014. However, the Department also needs to hire an additional faculty member in physical chemistry to replace Stuart Rothstein who is retiring. Discussions with the Dean, FMS will be conducted to address this faculty replacement and how this fits in (or not) with the recommendation for an external Chair appointment. A second appointment at the assistant professor level will fulfill the need to rejuvenate and grow the research reputation of the Department as well as address our long-term teaching requirements in analytical and physical chemistry. In addition, the hiring of additional administrative support for Chemistry would support any future Chair, whether selected from external or internal candidates.

The Dean responded that:

This recommendation is beyond the means of the Faculty budget and we are surprised by it because we are not aware of any concerns regarding leadership in the Department of Chemistry; it is our opinion that the successive Chairs of the Department have been successful leaders. We are surprised that the reviewers raise the issue of current and future leadership.

ARC considers this recommendation to be not accepted as it lies outside of the Committee's jurisdiction.

**Implementation Plan**

Recommendation NOT accepted.

5. The chemistry department and the faculty should devise a plan for the timely renewal of the two chemistry research chairs (CRC). The direct involvement of the Dean and the department chair in the implementation of this plan will be the key element of success in this undertaking.

In its response, the Department stated:

The Chair of the Department of Chemistry has already addressed this issue with Dean Ahmed and VP Research Gary Libben. A letter outlining timelines and a number of anticipated scenarios ... for renewal of both the Tier I and Tier II CRC positions was sent to both parties on April 22, 2013. Dean Ahmed is supportive of maintaining these CRC Chairs within Chemistry, but the Department has yet to hear back from the University regarding its plans. Maintenance of both CRC Chairs in Chemistry may obviate the need to hire a research active external Chair as per recommendation four.

The Dean responded by saying, "We have received the Department's proposal and we are in discussions with the VP Research regarding the matter."

ARC considers this recommendation to be accepted and in the process of implementation.

#### **Implementation Plan (First Priority)**

Responsible for approving:	Department, Dean of Math & Science, Vice-President, Research
Responsible for resources:	Department, Dean of Math & Science, Vice-President, Research
Responsible for implementation:	Department, Dean of Math & Science, Vice-President, Research
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

6. The chemistry department must commit to implementing measures aimed at improving the quality of service offered by teaching assistants, in particular the TAs serving as demonstrators in undergraduate laboratories. All demonstrators must be required to attend a mandatory workshop, held prior to the beginning of lab sessions, in order to inform them of their duties and faculty/lab instructor expectations. The department should then monitor the effectiveness of these workshops and follow the progress of each TA. By working closely with the Dean's Office and Human Resources, the department should lead the timely introduction of performance appraisals for TAs.

The Department stated that it:

agrees with the recommendation. A meeting at the beginning of the fall term of all TAs with the Chair, Senior Lab Coordinators, and the Graduate Program Director will be arranged, at which responsibilities and expectations for TAs will be clearly communicated. This initiative will also include discussion of the university's RWLEP, among other considerations. Human Resources have forwarded to us a Performance Evaluation Form (attached) and we will commence using it to provide appropriate feedback to each teaching assistant.

The Dean responded by stating that:

We encourage the department's plan to more clearly explain expectations to TAs and we hope that they will consult with the Centre for Pedagogical Innovation (CPI) regarding possible workshops that would be of benefit to Chemistry TAs.

ARC considers this recommendation to be accepted and in the process of implementation.

#### **Implementation Plan (First Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

7. A concerted effort must be made to update laboratory manuals by correcting all minor errors and where necessary introducing theoretical notions needed for understanding the experimental work.

The Department stated that it:

is confident that those lab courses under the supervision of Senior Lab Coordinators have lab manuals that are up-to-date and contain introductions addressing the theoretical underpinning of the experiments. A number of third-year courses do not have Senior Lab Coordinators and the Chair will ask the faculty members responsible for those courses to address any deficiencies of the type mentioned in this recommendation. The Undergraduate Curriculum Committee will set up a schedule to review all lab manuals, revised or otherwise.

The Dean responded by saying that:

The department's response is reasonable and the proposed review of all laboratory manuals will be particularly valuable in leading to improvements in these internal learning resources.

ARC considers this recommendation to be accepted and in the process of implementation.

<b>Implementation Plan (Second Priority)</b>	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

8. A study group consisting of chemistry faculty (and perhaps senior student representatives) should be charged with identifying the most appropriate innovative ways to deliver course material to students. An action plan should be prepared and discussed with the faculty administration for implementation. The latter should recognize the importance of this type of initiative and help put in place infrastructure and other necessities to accomplish this objective.

The Department stated that an, “ad hoc committee will be struck to investigate the feasibility of new modes of delivery and which courses would stand to benefit from them.”

The Dean responded, “In addition to the actions described the department should seek advice from CPI prior to developing their action plan.”

ARC considers this recommendation to be accepted and in the process of implementation.

**Implementation Plan (Second Priority)**

Responsible for approving:	Department
Responsible for resources:	Department, Centre for Pedagogical Innovation
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

9. Chemistry professors and laboratory instructors should be encouraged to discuss ways of redressing the insufficient synchronization between the theory and laboratory components of their courses with a view to ensuring that the theoretical notions required for comprehension of the experiments are discussed in class.

The Department stated that:

The structure of some of the laboratories is such that it is impossible to perfectly synchronize experiments with the lecture material (for example, in second year physical chemistry laboratories, students rotate through a bank of experiments due to equipment limitations). That being said, all course instructors will be encouraged to review the laboratory experiments to ensure that they are consistent with the lecture material, and vice-versa. A “blueprint” of desired topics will be established within each of the sub disciplines (inorganic, organic, physical, and analytical chemistry) so that there is complete coverage with minimal duplication of material across courses. Subsequently, the course instructor(s) will be encouraged to appropriately modify their lecture material so that the relevance to the lab is strengthened.

The Dean responded by saying that the “department’s response is reasonable and will lead to improvements with the limitations that are noted.”

ARC considers this recommendation to be accepted and in the process of implementation. The Committee realizes that absolute synchronization for every student is impossible and recognizes the on-going efforts being made by the Department to address this issue.

#### **Implementation Plan (Second Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

10. The curriculum and program committee of the chemistry department should review the weight of laboratory reports in the overall marking scheme of a course. We recommend that laboratory reports be given greater importance in view of the considerable effort required for their preparation. Moreover, the faculty/laboratory instructors should consider performance in the lab as part of the students' evaluation. Finally, it is important to review the required styles of laboratory reports with the objective of developing a coherent and uniform style of report writing that contains as many common features of style as possible within the accepted norms of each sub-discipline.

The Department stated that:

The Curriculum Committee will conduct a survey of the weighting of the laboratory components in other Chemistry Departments in Ontario to determine what is considered appropriate. The Senior Lab Coordinators will be consulted as to how to best incorporate a performance evaluation in the lab as part of the students' grades. It is important that this measure be consistently applied across the student cohort. The Senior Lab Coordinators and course instructors in charge of labs will be tasked with reviewing the instructions for writing laboratory reports and laboratory notebooks, with a view to reconciling the formats, where appropriate.

The Dean responded by saying that:

The response of the department is reasonable and will likely address the recommendation. We hope that the department includes behaviour related to laboratory safety as part of the bases for evaluation of student performance in the lab.

ARC considers the recommendation to review the weighting, assessment and consistency of laboratory reports to be accepted and in the process of implementation. The Committee believes the Department is best positioned to determine strategies to move forward on these issues.

#### **Implementation Plan (Second Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2014/15

11. As part of its strategic plan, the department should discuss with the administration the replacement of departing/retiring laboratory instructors and the analytical services manager.

The Department stated that it:

has made the FMS Dean's office and Administration (e.g. the Research Office) aware of the imperative to replace [name withheld], the current Analytical Services Manager, at least 6 months before his retirement, so as to ensure seamless transition of the responsibilities of the position. The Analytical Services Manager supports not only the researchers and graduate students within the University, but also coordinates revenue generation from regional industry (e.g. Cytec Inc.) that is used for repair and maintenance of some of the Department's major instrumental infrastructure (Mass Spectrometers and NMR) for teaching and research purposes.

The Dean responded:

The Dean's Office will do its best to ensure that funds are available for the replacement of staff in the Chemistry department. Replacement of the Analytical Services Manager will likely require support from ORS and the Dean will discuss this need with the Provost and the VP Research.

ARC considers this recommendation to be accepted pending budget decisions.

**Implementation Plan (First Priority)**

Responsible for approving:	Department, Dean of Math & Science, VP Research
Responsible for resources:	Department, Dean of Math & Science, VP Research
Responsible for implementation:	Department, Dean of Math & Science, VP Research
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

12. Professors should review their involvements in the instruction of laboratory sections with the objective of increasing their presence in this important pedagogical aspect of a chemistry degree.

The Department responded that, “Faculty will be asked to consider how best to increase their physical presence and participation in the labs associated with their courses.”

The Dean stated:

The department’s response is reasonable. This recommendation should be considered in relation to the department’s statement of Normal Departmental Workload Standards.

ARC considers this recommendation to be accepted and in the process of implementation.

**Implementation Plan (First Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

13. [Name withheld]'s Industrial Inorganic Chemistry course is an important and unique course in term of its material and mode of delivery. The department should find a suitable instructor to ensure the continuation of this offering.

In its response, the Department stated that:

The unique aspect of CHEM 3P60 (Industrial Chemistry) stems from the site visits to local industries. The Department will explore the feasibility of incorporating this component of CHEM 3P60 into another course. For example, it is possible that this could be done in ... CHEM 3P61 (Organic Chemistry in Industry), which was developed to eventually replace of ... CHEM 3P60.

The Dean responded by saying, "The response described will likely lead to implementation of this recommendation."

ARC considers this recommendation to be not accepted as it lies outside of the Committee's jurisdiction. However, the Committee recognizes that the Department has developed a plan to address this issue.

#### **Implementation Plan**

Recommendation NOT accepted.

14. The chemistry department should seek funds for purchasing much needed computational infrastructure/software. The purchase of a software license for Gaussian or Spartan would greatly benefit students enrolled in the Molecular Spectroscopy and Quantum Chemistry classes. Since such software might also be beneficial to other departments/programs (e.g., Physics, Life Sciences, Biotech), it might be prudent to seek collaboration and a pooling of resources with other departments with the view to securing a University-wide software license.

The Department responded:

The Physical chemists will draft a software needs list with quotes for site licenses that would contribute towards the pedagogical content of the whole program. The Department will advocate for the acquisition of such software.

The Dean stated, "The department should approach ITS for significant funding of such software. We will support the department's efforts to acquire this additional funding."

ARC considers this recommendation to be accepted and in the process of implementation.

#### **Implementation Plan (Second Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of Academic year 2014/15

15. The department of chemistry should put in place a well-defined committee structure in order to distribute and facilitate the various tasks it has to implement. The department chair should be a member of each committee, which will have in addition at least two other faculty members.

The Department responded that it, “will review its subcommittee structure and appointments.”

The Dean stated, “The department’s response is reasonable.”

ARC considers this recommendation to be under review by the Department. The Committee believes that the Department is best positioned to determine strategies to move forward with this issue.

#### **Implementation Plan (Second Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2014/15

16. We recommend that the department consider integrating courses focusing on emerging areas in the Chemical Sciences into its curriculum. Such new course offerings (e.g., Green Chemistry, Chemistry and Properties of Solid State Materials, Biosensors and Nanomaterials) will improve the program's attractiveness.

The Department responded that:

A balance needs to be struck between introduction of new courses and normal faculty teaching load. The Department as a whole will discuss the design of new courses including the subjects proposed above. Ordinarily, these courses would be elective in nature and would be offered at the upper year level, which may ultimately supersede other senior courses.

The Dean stated that:

While such courses would certainly enhance the Chemistry department's programs it may be that the current faculty cohort is not sufficient to introduce new courses in addition to the courses that are necessary to satisfy program requirements which are, in turn, required for external accreditation.

ARC considers this recommendation to be accepted and in the process of implementation.

#### **Implementation Plan (Third Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by end of academic year 2015/16

17. We encourage the department to pay closer attention (and find acceptable solutions) to the issues faced by co-op students (e.g., difficulties with placement and course selection) with a view to increasing the attractiveness and value of the co-op program.

The Department responded that it:

The Department of Chemistry Co-op Advisor will determine from the Co-op Office the past and recent ability of Chemistry Co-op students to obtain work placements. Furthermore, all required courses for the Honours and Co-op program are offered annually. Occasionally, there may be difficulties for Co-op students in scheduling their laboratories, but that is dealt with, usually with positive results, on a case-by-case basis.

The Dean stated that, “The department will work with the Co-op Office to implement this recommendation.”

ARC considers this recommendation to be accepted and in the process of implementation.

**Implementation Plan (First Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2013/14

18. The chemistry department should obtain the 10-point list supplied to us by the librarians, and enter into discussions with them about strengthening the partnership between the library and the department in order to improve the student learning experiences and outcomes.

The Department responded that it “has obtained this list ... from ... (Chemistry Librarian) and will provide this information in due course.”

The Dean stated, “The department has accepted and implemented this recommendation.”

ARC considers this recommendation to be accepted and completed.

**Implementation Plan**

No further action required.

19. We recommend that the department consider increasing/encouraging attendance of the research seminars by fourth-year thesis project students using either one of the approaches outlined in the “Learning Outcomes’ section or by alternative means.

The Department responded that:

The Department of Chemistry Fourth Year Coordinator will be tasked with devising a feasible approach to enabling senior undergraduate students to attend seminars, given scheduling constraints.

The Dean stated that, “The department has accepted this recommendation and is seeking a means of implementation.”

ARC considers this recommendation to be accepted and in the process of implementation.

**Implementation Plan (Second Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Math & Science to report by end of academic year 2014/15

## **D. Recommendations that will be Implemented**

The IQAP requires that ARC “set out and prioritize the recommendations that are selected for implementation.”

First Priority:

Recommendations 5,6,11,12,17

Second Priority:

Recommendations 7,8,9,10,14,15,19

Third Priority:

Recommendation 16

## **E. Recommendations that will not be Implemented**

Not Accepted:

Recommendations 4,13

Already Implemented:

Recommendations 2,18

## **F. Recommendations not accepted but follow-up required**

Recommendations 1,3