

# Final Assessment Report

## Chemistry

### Graduate and Undergraduate Programs (reviewed 2017-19)

#### A. Summary

1. The Department's Self Study was considered and approved by the Senate Academic Review Committee on January 16, 2019.
2. The Review Committee consisted of two external reviewers: Daniel Leznoff (Simon Fraser University) and Maria De Rosa (Carleton University) and an internal reviewer, Martin Kusy (Brock University).
3. The site visit occurred on May 13-15, 2019.
4. The Reviewers' Report was received on June 26, 2019.
5. The Department's response was received on July 20, 2019.
6. The Senate Undergraduate Program Committee response was received on September 26, 2019.
7. The Senate Graduate Studies Committee response was received on October 2, 2019.
8. The Dean of Graduate Studies response was received on October 2, 2019.
9. The Dean of Mathematics and Science response was received on October 7, 2019.

This review was conducted under the terms and conditions of the IQAP approved by Senate on May 25, 2016.

The Reviewers rated the academic programs offered by the Department of Chemistry as follows:

Program(s)	Excellent Quality	Good Quality	Good Quality with Concerns	Non-Viable
BSc (Honours) Chemistry		X		
BSc (Honours) Chemistry Co-op		X		
BSc (Pass) Chemistry		X		
Minor in Chemistry		X		
Combined (Honours) with Computer Science		X		
Combined (Honours and Pass) with Biological Sciences, Earth Sciences, Mathematics, Physics		X		
MSc Chemistry		X		
PhD Chemistry	X			

## B. Strengths of the Program

The reviewers noted the following strengths:

The review team was very impressed with the quality, rigour and broad knowledge and training imparted over the course of the program, especially the Honours Chemistry program. The undergraduate program is very strong and provides students with significant exposure to the four traditional areas of chemistry but also allows for some training in biochem/biotech. The degree of experiential learning in the program is excellent; all current first and second year chemistry courses have always had a required laboratory component, as do the majority of the third year courses. The students graduating from this program will be very-well equipped for careers in chemistry. Furthermore, the department strives to help students to develop their transferable skills, setting them up for success more broadly in postgraduate and professional programs, and in industrial, government or academic careers in the natural and health sciences.

The research component for the undergraduate students is of very high quality and is a particular strength of the program. This includes the 0.5 credit undergraduate research courses CHEM 2P98 and 3P98 to allow students to participate in hands-on research, as well as the capstone research and thesis courses CHEM 4F90/4F91, in which students spend two terms working on original research under direct supervision by a faculty member. Adding more flexibility to the program could allow for more students to take advantage of the research courses (see recommendations).

Enrollment in the programs are small, however, the small-cohort in each program ensures that each student receives very extensive, personalized experience and substantial interactions with research-active faculty members, which is often not the case in larger institutions.

The faculty (both research and instructors) are clearly very passionate and highly dedicated to their students and the program, and this is a substantial strength in terms of attracting and retaining students.

At the graduate level, the research faculty mostly have NSERC Discovery funding and are thus mounting very high quality, original research programs that attract graduate students. In several cases, the faculty research programs are world-class and Brock should be proud of the high level of research being conducted by their faculty, graduate and undergraduate students as part of their very high quality M.Sc. and Ph.D. programs.

## C. Opportunities for Improvement and Enhancement

### Recommendation #1

Reduce the onerous load on the 2<sup>nd</sup> and 3<sup>rd</sup> year students in the Honours/Majors program by removing the two 2<sup>nd</sup> year Physics courses (two of PHYS 2P02, 2P20, 2P31, 2P50, 2P51) from the required curriculum.

In its response, the Department stated:

An undergraduate curriculum committee has been struck that will look how to adopt this recommendation.

The Faculty Dean stated that:

The Dean's Office agrees with the departmental response and supports the departmental initiatives taken to address the issues.

### ARC Disposition of the Recommendation

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

### Implementation Plan (1<sup>st</sup> Priority)

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

## Recommendation #2

Reduce the number of explicitly required 3<sup>rd</sup> year CHEM courses in the Honours program and replace them with choices/options.

In its response, the Department stated:

An undergraduate curriculum committee has been struck that will look how to adopt this recommendation.

The Faculty Dean stated that:

The Dean's Office agrees with the departmental response and supports the departmental initiatives taken to address the issues.

## ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted for consideration.

### Implementation Plan (1<sup>st</sup> Priority)

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

### **Recommendation #3**

We recommend instituting weekly laboratory instruction for the 2nd term of 1<sup>st</sup> year Chemistry (i.e., 1P92).

In its response, the Department stated:

We have previously tried to have a weekly lab for this course and it was deemed to be not effective. We currently have alternating labs and seminars, and this practice led to a better student performance. We intend to keep this practice.

The Faculty Dean stated that:

The Dean's Office agrees with the departmental response and supports the departmental initiatives taken to address the issues.

### **ARC Disposition of the Recommendation**

ARC considers the recommendation to be accepted for consideration. The Committee expects that the Department is best-positioned to determine the frequency of laboratory instruction and/or other experiential opportunities for students.

#### **Implementation Plan (1<sup>st</sup> Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

#### **Recommendation #4**

Re-inaugurate an Undergraduate Chemistry Club, with some Departmental financial support and mentorship for student-organized social and professional events.

In its response, the Department stated:

This is a good idea and the Department is happy to support it if the students can organise themselves.

The Faculty Dean stated that:

The Dean's Office agrees with the departmental response and supports the departmental initiatives taken to address the issues.

The Dean of Graduate Studies stated:

While this is not within the purview of the Dean, Faculty of Graduate Studies, I support the recommendation and further encourage graduate students to participate.

#### **ARC Disposition of the Recommendation**

ARC considers the recommendation to be accepted for consideration. The Committee recognizes that the formation of a Student Club will require both initiative from the students and support from the Department. The Department is encouraged to work with the new Communications Outreach Officer in the Faculty.

#### **Implementation Plan (2<sup>nd</sup> Priority)**

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2020/21

## Recommendation #5

Reduce the # of courses required for Ph.D. by one, and remove the sub-disciplinary course requirements at the Ph.D. level.

In its response, the Department stated:

This recommendation needs a thorough discussion at the faculty level which will be carried out at the next Departmental meeting in September.

The Faculty Dean stated that:

The Dean's Office agrees with the departmental response and supports the departmental initiatives taken to address the issues.

The Dean of Graduate Studies stated:

The exact number and composition of required courses was approved when the program was initially introduced. As the Dean, Faculty of Graduate Studies, I note that the overall number of required courses for the PhD in Chemistry is higher than the norm for doctoral programs at Brock. To the extent that a reduction in the number of courses would align the program more with other doctoral programs at Brock and other Chemistry programs elsewhere, I support the recommendation. Additionally, removal of the subdisciplinary course requirements might support both student and faculty recruitment efforts.

The Senate Graduate Studies Committee stated:

SCGS agrees that the number of courses required for the PhD should be comparable to other programs in the discipline, and that sub-disciplinary requirements should be removed to increase the flexibility of the program.

## ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted for consideration.

### Implementation Plan (1<sup>st</sup> Priority)

Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20



### **Recommendation #6**

We recommend that the University continue to pursue funding for a substantial renovation of the Mackenzie teaching laboratory space.

In its response, the Department stated:

The Chemistry Department strongly supports these recommendations [6-9].

The Faculty Dean stated that:

These [recommendations 6-8] relate to resource allocation issues currently beyond the control of the Dean's Office, and will be considered when the required resources become available, the details of which cannot be stipulated at this time.

The Dean of Graduate Studies stated:

As Dean, Faculty of Graduate Studies, I support appropriate laboratory space for graduate and undergraduate students.

### **ARC Disposition of the Recommendation**

ARC considers the recommendation to be not accepted as it lies outside of the Committee's jurisdiction. The Committee expects that the Department will proceed through normal channels of advocacy for the renovation of these space resources.

### **Implementation Plan**

Recommendation not accepted.

### **Recommendation #7**

Upon retirement, the Tier I CRC Research Chair currently in the Chemistry Department should remain allocated to the Department, in order to help maintain its international research profile and to assist in continuing to attract top students.

In its response, the Department stated:

The Chemistry Department strongly supports these recommendations [6-9].

The Faculty Dean stated that:

These [recommendations 6-8] relate to resource allocation issues currently beyond the control of the Dean's Office, and will be considered when the required resources become available, the details of which cannot be stipulated at this time.

The Dean of Graduate Studies stated:

While this is not within the purview of the Dean, Faculty of Graduate Studies, high calibre supervisors are important for both attracting and educating graduate students.

### **ARC Disposition of the Recommendation**

ARC considers the recommendation to be not accepted as it lies outside of the Committee's jurisdiction. However, the Committee recognizes the importance of the Department maintaining its international research profile and attracting top students to its programs.

### **Implementation Plan**

Recommendation not accepted.

### **Recommendation #8**

We strongly recommend that the two Physical Chemistry faculty that are due for retirement be replaced expediently with new faculty with expertise in Physical Chemistry, and that this intention be clearly communicated to the Department.

In its response, the Department stated:

The Chemistry Department strongly supports these recommendations [6-9].

The Faculty Dean stated that:

These [recommendations 6-8] relate to resource allocation issues currently beyond the control of the Dean's Office, and will be considered when the required resources become available, the details of which cannot be stipulated at this time.

The Dean of Graduate Studies stated:

Faculty resource allocation decisions are not within the purview of the Dean, Faculty of Graduate Studies. However, in order [for] the program to continue to attract high quality graduate students, there is a need for excellent supervisory capacity.

### **ARC Disposition of the Recommendation**

ARC considers the recommendation to be not accepted as it lies outside of the Committee's jurisdiction. The Committee expects that the Department will proceed through normal channels of advocacy for faculty renewal.

### **Implementation Plan**

Recommendation not accepted.

### **Recommendation #9**

We strongly recommend that the “four-courses per year” teaching load include the teaching of seminar-type courses and the teaching and supervision of graduate and undergraduate research students, as is the norm at other universities (including the institutions of the reviewers), in recognition of the very substantial time and teaching effort required to provide this type of experiential instructional learning.

In its response, the Department stated:

The Chemistry Department strongly supports these recommendations [6-9].

The Faculty Dean stated that:

The department members should discuss how and to what extent to implement this recommendation, while following BUFA regulations as well as the requirement of a timely delivery of their curriculum to both undergraduate and graduate students. They are free to revise their Normal Workload Standard in order to reach agreement within the Departmental Committee.

### **ARC Disposition of the Recommendation**

ARC considers the recommendation to be not accepted as it lies outside of the Committee’s jurisdiction and has implications with respect to the Brock University/Faculty Association Collective Agreement. The Committee recognizes the importance of integrating experiential elements into the Department’s programs and the commitment required to provide this type of instructional learning.

### **Implementation Plan**

Recommendation not accepted.

## **Recommendation #10**

We very strongly recommend that an overall minimum graduate student stipend aggregated from all sources be clearly delineated for the entire two-year M.Sc. and four-year Ph.D. period of study, as is the norm at other schools.

In its response, the Department stated:

These two recommendations [10 and 11] require a thorough discussion at the faculty level which will be carried out at the next Departmental meeting in September.

The Faculty Dean stated that:

The Dean's Office would like to leave it to the department and the Office of Graduate Studies to determine when and to which extent these two recommendations [10 and 11] can be implemented.

The Dean of Graduate Studies stated:

Graduate student funding is typically comprised of a fellowship (determined by the Dean, Faculty of Graduate Studies) and TAs (under the control of the Chair of the Department and in accordance with resource allocation decisions made by the Dean of the (teaching) Faculty). Insofar as the fellowship is concerned, the Faculty of Graduate Studies (like all other units on campus) operates on a one-year forward budget, not a multi-year budget. In our offer letters, students are clearly told that they will receive a fellowship from the university for the funded length of their program. However, they are further told that the specific amount of the annual fellowship will be determined in accordance with the University's budget cycle and communicated early in the new year. Other sources of funding may include entrance scholarships (offered by the Faculty of Graduate Studies) that are for the year of entry only and funding from individual supervisors. The Faculty of Graduate Studies has no authority over individual supervisor contributions.

The Senate Graduate Studies Committee stated:

SCGS supports the recommendation to establish a standard aggregated stipend for all graduate students during the full length of their program (i.e., two years for MSc and four years for the PhD) and encourages the Dean of Graduate Studies and Associate Deans of each Faculty to work on achieving this goal.

## **ARC Disposition of the Recommendation**

ARC considers the recommendation to be not accepted as stated. The Committee understands that the funding available from various sources is subject to change over the course of the student's period of study. The Committee suggests that communication with

the student should be as clear as possible about the base and additional funding possibilities available to them over the period of their program.

<b>Implementation Plan</b> Recommendation not accepted.
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## **Recommendation #11**

Graduate students who win external scholarships should gain a significant monetary benefit from them and not have their awards completely (or nearly completely) clawed back by a combination of the University and the Supervisor.

In its response, the Department stated:

These two recommendations [10 and 11] require a thorough discussion at the faculty level which will be carried out at the next Departmental meeting in September.

The Faculty Dean stated that:

The Dean's Office would like to leave it to the department and the Office of Graduate Studies to determine when and to which extent these two recommendations [10 and 11] can be implemented.

The Dean of Graduate Studies stated:

The offer letter clearly states that a student who wins an external scholarship will not be eligible for a Faculty of Graduate Studies fellowship. Instead, in addition to the external scholarship, the student will receive a smaller amount of fellowship. This will still leave the student with a higher amount of overall funding than in the absence of an external scholarship.

The Senate Graduate Studies Committee stated:

SGSC supports the recommendation that a graduate student who receives an external scholarship should not be financially penalized. There should be a financial overall gain for the student, but this must be an equitable gain that does not place these students to a much higher stipend than all other students. The receipt of external scholarships should also be used to allow the admission and support of more students in the program.

## **ARC Disposition of the Recommendation**

ARC considers the recommendation to be not accepted as stated. The Committee recognizes the underlying complexity of funding and possible inequitable outcomes for graduate students. The Committee suggests that communication with the student should be as clear as possible about the procedures associated with external scholarships and any implications they might have on other sources of funding.

## **Implementation Plan**

Recommendation not accepted.

## **D. Summary of Recommendations:**

First Priority:

Recommendations 1,2,3,5

Second Priority:

Recommendations 4

Not Accepted:

Recommendations 6,7,8,9,10,11