

# Final Assessment Report

## Biology (BSc/MSc/PhD)

### September 2018

---

#### **Summary of the Program Review**

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the programs (BSc, MSc, PhD) delivered by the Department of Biology. A self-study (Volume I) was submitted to the Associate Vice-President, Academic and Associate Vice-President, Graduate Studies and Postdoctoral Affairs on August 17, 2016. The self-study presented the program descriptions and learning outcomes, an analytical assessment of these three programs, and program data including the data collected from a student survey along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). Appended were the course outlines for all courses in the program and the CVs (Volume II) for each full-time faculty member in the Department.

Two arm's-length external reviewers (Volume III), (Dr. Jack Gray, Professor of Biology, University of Saskatchewan and Dr. Mark Bernards, Professor of Biology, University of Western Ontario) were ranked and selected by the Associate Provost, Graduate Studies and Postdoctoral Affairs, in addition one internal reviewer (Dr. Daniel Gorman, Associate Professor of History) was selected by the Associate Vice-President, Academic.

The external reviewers examined the self-study documentation and then conducted a site visit to the University on December 15-16, 2016. The visit included interviews with the: Associate Vice-President, Graduate Studies and Postdoctoral Affairs; Associate Vice-President, Academic; Dean of the Faculty; Chair of the Department; Associate Chairs of the Department; Faculty members; staff and laboratory technicians; as well as meetings with a group of current graduate and undergraduate students. The Review Team also had an opportunity to tour the Department facilities.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report and the program response.

#### **Program characteristics**

The Department of Biology was established in 1964 as an independent academic department in the Faculty of Science. In addition to the core Biology undergraduate program (starting in 1964, co-op in 1979), the Department oversees programs in Biochemistry (1985, regular and co-op;

Biology and Chemistry before 1985), Biomedical Sciences (regular only, 2005, previously Pre-Optometry/Pre-Health) and Environmental Science (2013 regular and co-op, previously Biology and Environment and Resource Studies).

The graduate program features MSc and PhD degrees that prepare students for careers in various academic, industry or government sectors related to the subject of Biology. Through thesis research and course work, students acquire advanced scientific research and analytical skills.

Biology has been heavily involved (e.g., represented on the steering committees) in the Centre for Bioengineering and Biotechnology, the Water Institute, the Waterloo Institute for Nanotechnology, and the Centre for Chronic Disease Prevention. Along with the Department of Chemistry, the Department of Biology jointly leads the Institute for Biochemistry and Molecular Biology. Close research collaborations, including shared instrumentation, exist with each of the schools and departments in the Faculty of Science.

### **Summary of strengths, challenges and weaknesses based on self-study**

#### **Undergraduate Program**

##### **Strengths:**

- The program continues to provide the breadth of basic Life Science education to the University at large, including pre-Professional preparation and elective courses for other Faculties
- Teaching quality is at a very high level, with numerous awards and recognitions
- Course instructors are highly engaged in developing and implementing new approaches such as active learning techniques
- Laboratory courses continue to be offered, some stand-alone and others embedded, and experiential opportunities are being welcomed as much as possible
- The co-op program continues to grow and is a major differentiating factor in undergraduate recruiting
- Strong collaborations have formed with other “bio-based” initiatives across campus

##### **Challenges:**

- While the Science Teaching Complex has helped, Biology is still handling huge numbers of students; more than half the students at Waterloo take at least one Biology course
- Enrolments continue to increase at higher levels proportionally to the University average with no accompanying increase in budget, stretching administrative and technical resources to their limits
- Enrolments in the co-op programs are increasing more quickly than the ability to identify relevant jobs, suggesting that either the number of required placements for the

co-op degree should be reduced and/or consideration should be given to unpaid placements if necessary

- Curriculum development is ongoing, reacting to changes in faculty complement and in the disciplines and techniques of Life Sciences

#### **Weaknesses:**

- The Biology programs have very few international students. There is interest in expanding joint programs (especially China 2+2), as, in addition to serving the University strategic area of internationalization, these students provide a mechanism for significant revenue generation

#### **Graduate Program**

##### **Strengths:**

- The graduate program has been enhanced over the review period by faculty renewal
- New research programs in Aquatic Biology, Computational Biology, Structural Biology, Cell Biology and Microbiology, in particular, have broadened the available training opportunities
- After two or three years of declining incoming enrolment, the numbers are starting to recover as these new programs grow
- Due to the breadth of research in the Department and the cohort that is built through a unified Graduate Student Association, seminar symposium and graduate course (“Scientific Communication”), students get exposed to more cross-disciplinary conversations and collaborations than in more specialized Departments

##### **Challenges:**

- Like many other departments, times-to-completion have been higher than desirable for MSc and PhD programs. The Associate Chair Graduate Studies has focused specifically on students beyond the expected time limits and, through personal coaching and mentoring, has succeeded in getting several long-term students to complete. There have also a more rigorous monitoring protocol put in place, for example through supervisory committee meetings
- Next steps will be a more structured curriculum with graduate courses offered more frequently, and a more active recruiting process to attract higher quality candidates
- While core facilities have been improved, the central support and instrumentation available to graduate students is a challenge compared to some of the competitor programs. The proposed Phase 2 building expansion will help to address this issue
- As in other institutions, research funding remains the primary long-term challenge in growing and maintaining a strong graduate program. Little internal support for graduate students is available

**Weaknesses:**

- As with the undergraduate program, there are few international students. There is a disincentive for accepting foreign graduate students because there is no provincial grant and tuition is higher.
- There are few studentships open to international students and each one takes a place that might otherwise be filled by a domestic student
- The curriculum of graduate courses is limited, especially for courses offered on a regular basis. A thorough review of course offerings is planned

**Summary of key findings from the external reviewers:****Undergraduate Program Recommendations**

The reviewers found the undergraduate program to be solid and firmly grounded in the discipline. However, since the Department of Biology is the only “Biological Sciences” department on campus, these programs are dependent on the maintenance of a broad-based faculty complement, with appropriate critical mass in each sub-disciplinary area. In addition, the Department faces very high enrolments, and does a lot of service teaching, which puts more pressure on faculty and instructors.

1. The external reviewers recommended that the Department review the criteria for continuance in their Honours programs. The minimum 60% average needed to continue seems low. Alternatives would be to increase the overall average required to continue in a program or require minimum grades (e.g., 70%) in key courses that define the program (e.g., plant course electives in the Plant Biology program, microbiology courses in the Microbiology program).

**Response**

Continuing averages in several programs have been the subject of consultation and discussion within the Department indicating strong support for higher continuing averages. However, the implementation of this plan faces some significant difficulties under the present program structure. The Department has looked at the impacts of raising the continuing average in the Biomedical Sciences program to 75%. This would result in the removal of 50% of the students enrolled in the program. Department data indicate that the students removed from the program would then likely shift to the Honours Science program, which has a lower continuing average. In the past, students who move to Honours Science then “mirror” the Biomedical Sciences program, continuing to take the same courses. This potential loss of students to Honours Science means the Department would no longer be advising students who are taking their courses.

The Department is considering several solutions that could be explored to facilitate increasing continuing averages in majors programs, contingent with our program renewal efforts. One option is to move towards a common first year for programs. This would reduce the number of specialized required-for-program courses, facilitating movement of students who do not meet the Honours Biomedical Sciences averages into Honours Biology. Another solution, as suggested by the reviewers, would be to require minimum grades (e.g., 70%) in key courses or combinations of courses that define the program. Another solution is to offer both Honours and non-Honours (general) degrees in Biology; an assessment of the resource requirements for this option would be required as would a recognition of the Faculty's desire to streamline the number of BSc academic plans. All three scenarios would assist the Department in retaining students not maintaining an Honours program average. They will remain in the Departmental curriculum and will obtain advising and normal course progression. This is a strategy used by several Ontario universities and allows for a more streamlined and efficient academic curriculum.

In light of discussions on several items in relation to our curriculum, the department has initiated a comprehensive review for our curriculum. Currently, we have tasked an ad hoc curriculum review committee with a terms of reference to undertake a 'broad strokes' review of our curriculum and to propose direction for the departments consideration. A report from this committee and consultation with the department should be completed by early fall 2018. Following this process, the department will task another group (perhaps the standing committee on curriculum) to propose specific changes to meet the goals of the proposal from the ad hoc committee and a means by which these can be implemented to minimize disruptions. Therefore, the department expects that the structure and direction of its offerings could change as a result of this process, and once decisions have been made changes may very well require several years to implement. As a result, we are currently in a 'hold' mode and do not expect to have any significant alterations in our offerings until this process is complete.

2. The external reviewers recommended that the Department consider including undergraduate representation on their Curriculum Committee (if it doesn't already exist), and to include student bodies such as the Biology Undergraduate Society in their curriculum decision making.

### **Response**

The Departmental Curriculum Committee has already initiated contact with Biology Undergraduate Society (BUGS) in terms of decision-making. We have rejected having a full time undergraduate member on the Curriculum Committee due to the high turnover of students in BUGS and the changing focus of the society on an annual basis. However, there is broad

support for a consultative role. The Department also consulted with biomed students via a town hall to seek their input on our programs.

3. The external reviewers recommended that the degree credit level remain unchanged, and that the program not be forced to reduce the credit load to 20. The current number of lecture content courses is appropriate, and the “artificial” inflation of degree credits created by splitting some labs away from the lecture courses they were traditionally associated with does not represent additional work that students must complete to meet degree requirements. Removal of lecture content courses to accommodate lab credits would represent a reduction in program content, relative to similar programs at other Canadian universities.

### **Response**

The Department has made progress on workload associated with our programs by making some changes (e.g., eliminating tutorial sessions, reduced lecture contact hours for courses with integrated lecture and lab) and will continue to be mindful. Regardless, we are confident that the workload required to complete our programs are in line with the expectations of similar programs offered at peer institutions. As indicated by the reviewers the number of credits required for our program is “artificially” high due to the non-traditional assignment of credit units (e.g., separation of lab and lecture component of a course).

The department has ongoing discussion with this issue with the Associate Dean Undergraduate Studies and the Dean of Science. We seem to be in agreement that our ongoing curriculum review, as described above, will address issues regarding credit number of our programming, including examining ways to limit programs to 22.0 credits, without compromising the integrity of programs.

4. The external reviewers recommended that the Department find a way to incorporate a requirement for university level mathematics (e.g., calculus) into their degree programs, rather than leaving this as an option.

### **Response**

Several of the Department’s programs do have calculus as a requirement (e.g., Honours Biochemistry, Honours Environmental Science (Ecology specialization), Honours Life Physics (Biophysics specialization)). Most students (>75%) in the Biomedical Sciences program take calculus as an elective to meet admission requirements of various professional schools. The Department has recently modified math offerings in consultation with the Faculty of Mathematics and is now offering sections of its first year calculus course (Math 127) that are

framed in biological measurement and design for students in life sciences programs. This will make the courses more relevant and attractive to students enrolled in Biology programs. The Department's approach has been to ensure Biology students have mathematical numeracy/literacy that can be satisfied through diverse courses. All of the Biology programs require students to take math and/or statistics or physics courses that require numeracy as a primary measurement of success. The ongoing ad hoc curriculum review committee will be addressing this more thoroughly with their recommendations expected in September 2018.

5. The external reviewers recommended that program requirements be reviewed with an eye to requiring a minimum number of 400-level courses.

#### **Response**

The Honours Biology program requires a minimum five 400-level courses and Honours Environmental Science (Ecology specialization) requires a minimum of three 400-level courses. The Honours Biomedical Sciences program currently has no requirement for 400-level courses. As part of the restructuring of the undergraduate curriculum the inclusion of a minimum number of 400-level courses is expected for all programs. We have already completed this for the Biomedical Sciences program.

6. The external reviewers recommended that the Department, in conjunction with the Faculty of Science, explore mechanisms to increase the number and quality of Co-op placements for Biology students.

#### **Response**

The Department has consulted with Co-op Education and Career Action (CECA) on this issue. The lack of employment in Co-op does not always reflect a lack of employment opportunity. CECA feels that the quality of jobs available to Biology students is good and Biology has become a focus program in CECA receiving increased attention from Account Managers and Business Developers. The Faculty of Science has recently formed a Co-op committee under the guidance of the Associate Dean, Computing and Co-operative Education—that will address issues that surround Co-op employment in the Faculty of Science. The Department of Biology will work closely with this group to help improve workplace placement opportunities.

7. The external reviewers recommended that the Department make a concerted effort to more overtly expose undergraduate students to the breadth and extent of on-going research amongst Biology faculty. This could be achieved through an active "in-reach" program that includes promotional posters and the involvement of the Biology Undergraduate Society.

**Response**

About 15% of students enrolled in department-based programs engage in research opportunities. It is challenging to increase this percentage because of the very high student:faculty ratio that exists in our department relative to peer units. The department is hoping to receive support to increase our research faculty complement and funding to support our programming in the coming years to address this important issue.

Despite the limitations, we do have in-reach programs inviting undergraduates to participate in research activities in the department through Biol 499 Senior Honours projects, summer NSERC USRAs, volunteer opportunities as well co-op employment. Further, Departmental seminars are advertised through posters that are routinely posted around the department. There is an active twitter feed and substantial Facebook presence. Professors announce seminars in lectures that are pertinent to the material being covered in that course. The Faculty and Department work with various science societies to promote events. There is a recently mounted digital display screen in the Biology department that is now utilized for advertising research-focused events.

8. At risk of interfering with internal university personnel structure, we strongly recommend that consideration be given to converting “Instructor” roles in the Department into “Lecturer” (i.e., faculty) positions. The current instructors are carrying out a lot of what are traditionally faculty roles.

**Response**

The job description for our instructors were reviewed and updated in January 2015 and the instructors have expressed satisfaction with their current role in the department.

9. We recommend that the Department put in place a clear communication strategy to ensure lab equipment needs are coordinated between course instructors/lecturers and the technical staff in place to support them.

**Response**

The composition of the curriculum committee has been altered recently to include substantial representation of technical staff. The current curriculum committee consists of research and teaching faculty representing major programs. The instructors are well represented and there are two technicians who participate. The committee meets monthly and all members of the department are welcome to submit items to the agenda. Input is requested from all members of the committee and any changes to labs are cleared through both instructor and technicians. The associate Chair Undergraduate Studies now meets with technicians once a semester. Our impression is that system works well and that lines of communication are open.



## **Graduate Program Recommendations**

The Department delivers a robust graduate program with a strong national and international reputation. Many of the reviewers' observations showed a general satisfaction amongst graduate students and faculty and the collegiality of all departmental members was clear. All members were attuned to the strengths and weakness of the graduate program and there are positive efforts being made to maintain the strengths and address the weaknesses.

10. The external reviewers recommended that clarity on prioritizing domestic or international graduate student recruitment would be beneficial to articulate a common goal understood by the Department and administration.

### **Response**

The Department agrees with the recommendation and looks forward to clarity coming from upper administration and the faculty dean on the balance between the desire for internationalization and the need for domestic financial return.

11. The external reviewers recommended that supervisory committees have authority to recommend waiver of one or more PhD course requirements, for approval by the Graduate Chair, following assessment of courses completed in a previously completed MSc program, including programs completed at another institution.

### **Response**

There is currently a mechanism in place to waive PhD course requirements, which requires approval at the departmental level through the Associate Chair (Graduate Studies) and approval at the faculty level through the Associate Dean (Graduate Studies). While this option is available to students it has not been widely used or promoted within the Department.

12. The external reviewers recommended that supervisors and students draft an agreement of mutual expectations and timelines soon after the student enters the program and that timelines be updated in each progress report presented to the supervisory committee and that these timelines be approved by the committee.

### **Response**

This has already been enacted in the Department. Students present a proposal within two (MSc) to three (PhD) terms of starting their program that outlines their research, course work, as well as timelines to completion. This is approved by the supervisory committee and reported to the departmental graduate office in writing. Student progress is then assessed on an annual basis in a supervisory committee meeting and a report on progress is submitted to the departmental graduate office. The Associate Chair (Graduate Studies) reviews all student reports (proposal, committee meeting, comprehensive). The Department is working hard to bring increased responsibility and engagement from graduate students enrolled in the Biology program by providing students with letters that note the milestone that is overdue. The student must then determine a date that the milestone will be completed and this letter is returned to the Associate Chair (Graduate Studies). If that date is not met, there is a follow up meeting with the Associate Chair (Graduate Studies).

13. The external reviewers recommended that the comprehensive exam procedure be reviewed, and consideration given to alternative models such as inclusion of a literature review or a mock grant proposal (such as a NSERC Discovery Grant) that is evaluated by the examination committee (written and oral components).

#### **Response**

The Biology Graduate Studies Committee (BGSC), which also includes graduate student representative, has examined this issue and has proposed to retain the present comprehensive exam procedure, as it is a useful exercise that had positive academic benefits. This has been discussed at a recent departmental meeting (April 2017). To assist students with their comprehensive exams graduate student orientation will now include discussion on the expectations and the process for the comprehensive exam. A fall workshop is being planned for incoming PhD candidates that includes student experiences for this particular milestone. The Graduate Studies and Post Doctoral Affairs Office (GSPA) is also currently examining the comprehensive exam milestone.

14. The external reviewers recommended that a committee meeting in the later stages of the student's program be designated to determine if the student has completed data collection and be given formal permission to begin writing a thesis. At this meeting, the student could submit a table of contents of the proposed thesis.

#### **Response**

The present system has a "permission to defend" committee meeting at the end of the students' programs. This recommendation has been made in the revised regulations for PhD

defences from the Graduate Studies and Postdoctoral Affairs (GSPA) office. The Associate Chair (Graduate Studies) has been recommending to all students that they have a committee meeting a term (MSc) or two (PhD) prior to defence and this has been occurring more frequently. In April 2017, a Pre-Defence Advisory Committee Report form has been developed by the Biology Graduate Studies Committee to be implemented immediately. This form has a check box for whether or not the student can proceed towards completion of their thesis. The form also has a required comments box to provide students with feedback from their committee. Currently, the Department is recommending that this meeting take place to be in line with the recommendations for the PhD defence from the GSPA.

15. The external reviewers recommended that the graduate course curriculum more accurately map to the research fields and that courses be modified to provide a balance between specific training with their programs and broad training within the field (possibly through common graduate courses in the subfields) and for professional development.

#### **Response**

The Department is currently undergoing program renewal and will be examining courses and the program to ensure they map to the new research fields. There are currently professional development courses on academic teaching offered through the Centre for Teaching Excellence (CTE) and the GSPA offers resources in professional development through [GRADventure](#). The BGSC and the Department will be examining options for Biology-specific professional training and development through our program renewal.

16. The external reviewers recommended that a human resource appointment within the Faculty of Science be attached to the Department to provide support related to graduate student TA appointments, files for postdoctoral positions, etc.

#### **Response**

In the Department there is a full-time graduate administrative assistant and a part-time position in support of the administrative assistant. These positions provide direct liaison with faculty level management. There is a Graduate Management System that is currently being developed at the faculty level. This will help to automate some of the administrative work around teaching assistant appointments in terms of generating letters and payment information. However, there is likely going to be significant change in TA administration across the entire Faculty of Science due to the impact of the new budget model. Postdoctoral appointments are now being managed through the Chairs Office Department of Biology as well as through the GSPA.

17. The external reviewers recommended that the Vice President Research commit to a subsidy to support a renovated aquatic facility, which could be included in a potential CFI application.

**Response**

The Dean of Science and the Office of Research have both committed \$750,000 each to renovate the aquatic facility. An animal care technician that is presently working part time in the aquatic facility will be dedicated to the management and running of the facility.

18. The external reviewers recommended that the Department work with the Faculty of Science to provide matching funds to support a CFI proposal to improve the aquatics facility.

**Response**

The Faculty of Science now has a group of research fellows that receives and assesses such proposals and makes recommendations to the Dean of Science. For CFI grants the funding formula is 40% CFI, 40% Ontario Research Fund, and 20% vendor in-kind discounts. In cases where the vendor in-kind does not reach the 20% level, the Faculty of Science will consider making up the shortfall following assessment by the Research Fellows. The Department of Biology will help facilitate these discussions and recommend proposals for support from the Dean of Science.

19. The external reviewers recommended that the Committee of Research Fellows create clear and transparent guidelines for provision of equipment maintenance funds.

**Response**

The Department has requested further clarification on this point from the Associate Dean Research and is encouraged by the response. The Faculty of Science is presently working to address researcher access to equipment maintenance funds. For common equipment Chairs/Directors will ask for maintenance funding in their yearly budget requests to the Dean. For equipment located in individual labs once a term calls for proposals for maintenance funding will be made, with the Research Fellows adjudicating the requests and recommending which ones to fund to the Dean. There is a mechanism in place already for the repair and maintenance of eligible CFI equipment. Annual proposals are submitted to the research fellows for evaluation and funding is awarded based upon decisions recommended to The Office of Research.

20. The external reviewers recommended that the Department work with the Faculty of Science to firmly establish a risk-funding program for faculty facing grant renewal. If this funding was guaranteed, it would allow researchers to develop longer term plans for their programs.

**Response**

The University has instituted an Internal UW NSERC Discovery Grant Research Incentive Fund (RIF) that provides \$15,000 to researchers that have lost NSERC Discovery funding. The Faculty of Science has instituted discussions on providing backstop funding for graduate students that have not completed their degrees and are in a lab that has lost funding. Both programs offer support for both researchers and graduate students to develop long term research plans.

21. The external reviewers recommended that the Department work with the Graduate Studies Office to determine campus-wide quota system for scholarships that doesn't disadvantage strong departments, such as Biology.

**Response**

Previously when students competed directly through funding agencies, Biology was receiving the benefit of 15-20 post-graduate scholarships a year. Under the present University of Waterloo quota system based upon Tri-council funding, Biology has limited access to MSc level scholarships. In the past few years there has been a steady decline in availability to scholarships such that we presently have a maximum number that is 40% of previous awards. This decrease in scholarship funds has been concurrent with a decline in graduate enrollment as research labs find themselves pressed for funds to support students. The lack of access to scholarships makes the Department less competitive when recruiting students, it limits the number of students in the Department as a whole and as such has a direct impact on our research activities and consequently ability to attract and hold tri-council funding. At this time this is outside of departmental governance.

22. The external reviewers recommended that the number of Special Topics (i.e., targeted) courses could be reduced.

**Response**

Currently there are two special topics courses, MSc (BIOL 680) and PhD (BIOL 681). The reason for the apparent large number of special topics (targeted) courses is that the GSPA requires departments to provide a title for each course. As these are target courses for a low number of

students and are often specific to the field of study, it results in a large number of titled courses. The BGSC has examined this and is considering that for each of the Department's identified research fields that there be a special topics course for MSc and PhD programs but that there will be no titles associated with these. While this will result in 12 new courses, this will dramatically reduce the visual impact of the number of special topics courses while retaining the course flexibility that a diverse department needs.

23. The external reviewers recommended that common courses could be offered in the Department's newly identified research fields.

### **Response**

Graduate curriculum is presently under reform with an aim to increase enrollment in research-field specific courses. The aim is to build cohorts of students, increase interaction between students and reduce the number of graduate courses offered. The Department has currently examined our course offerings and inactivated eight courses that have not been taught recently. In addition, the course descriptions for three courses have been updated. Going forward in the graduate curriculum reform, the Department will be examining the number of courses taught in our fields of study as well as the special topics courses noted in the previous recommendation. This is currently being addressed and should be complete within two years followed by approvals for calendar changes.

24. The external reviewers recommended creation of a modular-based graduate course that could be tailored across research fields and allow for breadth and flexibility for each student. As an example, this course could contain six modules, of which the student would be required to complete three for credit. Incorporation of the existing BIOL 690 – Scientific Communication into this model could better insure that students attain important communication skills without making it a full course requirement.

### **Response**

The BGSC has discussed the potential for a modular graduate course and this proposal will be continued further.

25. The external reviewers recommended that the Department could regularize when new faculty are expected to begin to teach grad courses, and how they will fit their courses into the program.

### **Response**

The Department is enforcing the teaching of courses at the graduate level through activities of the Associate Chair Graduate Studies and through the departmental merit committee. At this time most faculty are consistently offering graduate courses in their area of specialization. The Department has worked on consolidating course offerings and has removed many defunct courses from the calendar. Due to the diverse nature of our department, consolidation of our courses is challenging due to the diverse needs of our students. Regardless, this is being addressed through targeted hiring and long range plans addressing faculty recruitment to build strength in core research areas.

**Recommendations that were not selected for implementation:**

**Recommendation 7.** The external reviewers recommended that the Department make a concerted effort to more overtly expose undergraduate students to the breadth and extent of ongoing research amongst Biology faculty. This could be achieved through an active “in-reach” program that includes promotional posters and the involvement of the Biology Undergraduate Society.

**Response**

The Department already has substantial in-reach programs inviting undergraduates to participate in research activities in the Department through Biol 499 Senior Honours projects, summer NSERC USRA’s, volunteer opportunities as well co-op employment. Departmental seminars are advertised through posters that are routinely posted around the Department. There is an active Twitter feed and substantial Facebook presence. Professors announce seminars in lectures that are pertinent to the material being covered in that course. The Faculty and Department work with various science societies to promote events. There is a recently mounted digital display screen in the hallway outside the Biology General Office that is used for advertising research-focused events.

**Recommendation 8.** At risk of interfering with internal university personnel structure, the external reviewers strongly recommended that consideration be given to converting “Instructor” roles in the Department into “Lecturer” (i.e., faculty) positions. The current instructors are carrying out a lot of what are traditionally faculty roles.

**Response:**

The job description for instructors were recently reviewed (January 2015) and updated and the instructors have expressed satisfaction with their current role in the Department. Regardless, as the department considers its curriculum in the coming years we will be mindful of the appointment details of hires in this area.

**Recommendation 9.** The external reviewers recommended that the Department put in place a clear communication strategy to ensure lab equipment needs are coordinated between course instructors/lecturers and the technical staff in place to support them.

**Response:**

The composition of the Curriculum Committee has been altered recently to include substantial representation of technical staff. The current curriculum committee consists of research and teaching faculty representing major programs. The instructors are well represented and there are two technicians who participate. The committee meets monthly and all members of the Department are welcome to submit items to the agenda. Input is requested from all members of the committee and any changes to labs are cleared through both instructor and technicians. The Associate Chair Undergraduate Studies now meets with technicians once a semester. Our impression is that system works well and that lines of communication are open.





**Implementation Plan**

	External Reviewer Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	The Department review the criteria for continuance in their Honours programs. The minimum 60% average needed to continue seems low. Alternatives would be to increase the overall average required to continue in a program or require minimum grades (e.g., 70%) in key courses that define the program (e.g., plant course electives in the Plant Biology program, microbiology courses in the Microbiology program, etc.).	The Department is undergoing a comprehensive review and renewal of our undergraduate curriculum. The Department is considering several solutions that could be explored to facilitate increasing continuing averages in majors programs.	Department Chair and Associate Chair Undergraduate Studies	Our approach has multiple steps with a first 'broad strokes' report to be finalized in early fall 2018. Detailed proposals with implementation plan to follow in 2019. Implementation may take multiple years.
2.	The Department consider including undergraduate representation on their Curriculum Committee (if it doesn't already exist), and to include student bodies such as the Biology Undergraduate Society in their curriculum decision making.	The Department has engaged BUGS in decision making through the Curriculum Committee.	Associate Chair Undergraduate Studies	Enacted and ongoing
3.	The degree credit level remain unchanged, and that the program not be forced to reduce the credit load to 20. The current number of lecture content courses is appropriate, and the "artificial"	This issue has been resolved, for the time being at least. This point will be more	Department Chair and Associate Chair Undergraduate Studies	Our approach has multiple steps with a first 'broad strokes' report to be finalized in



	inflation of degree credits created by splitting some labs away from the lecture courses they were traditionally associated with does not represent additional work that students must complete to meet degree requirements. Removal of lecture content courses to accommodate lab credits would represent a reduction in program content, relative to similar programs at other Canadian universities.	thoroughly addressed as we review and revise our curriculum.		early fall 2018. Detailed proposals with implementation plan to follow in 2019. Implementation may take multiple years.
4.	The Department find a way to incorporate a <u>requirement</u> for university level mathematics (e.g., calculus) into their degree programs, rather than leaving this as an option.	The curriculum renewal process will consider making calculus a requirement in most programs.	Associate Chair Undergraduate Studies	We are currently evaluating this and through our ad hoc curriculum review committee we expect to address this within 3 years.
5.	Program requirements be reviewed with an eye to requiring a minimum number of 400-level courses.	Our curriculum renewal will include required 400 level courses in all programs.	Associate Chair Undergraduate Studies	Partially enacted 2017 (will be in 2018-9 calendar). Ongoing 2-3 years
6.	The Department, in conjunction with the Faculty of Science, explore mechanisms to increase the number and quality of Co-op placements for Biology students.	Faculty of Science has formed a Co-op Committee and Biology will work closely to assist in developing work placements.	Associate Chair Undergraduate Studies and Chair of Department.	Ongoing

7.	The Department make a concerted effort to more overtly expose undergraduate students to the breadth and extent of ongoing research amongst Biology faculty. This could be achieved through an active “in-reach” program that includes promotional posters and the involvement of the Biology Undergraduate Society.	The Department has substantial channels of engagement and feels these are adequate at this time.	Broad departmental responsibility	Ongoing
8.	Consideration be given to converting “Instructor” roles in the Department into “Lecturer” (i.e., faculty) positions. The current instructors are carrying out a lot of what are traditionally faculty roles.	The Department rejects the reviewers’ interpretation of the instructors roles. Following thorough consultation with our instructors their job descriptions were reviewed and updated in 2015. They have expressed satisfaction with their roles and job descriptions.	Chair of Department	Rejected the recommendation
9.	The Department put in place a clear communication strategy to ensure lab equipment needs are coordinated between course instructors/lecturers and the technical staff in place to support them.	We have altered the composition of our curriculum committee and management structure such that	Associate Chair Undergraduate Studies	Enacted



		there is increased communication with technicians.		
10.	Clarity on prioritizing domestic or international graduate student recruitment would be beneficial to articulate a common goal understood by the Department and administration.	The Department seeks clarity from upper administration on this issue.	Associate Chair Graduate Studies	Ongoing
11.	Supervisory committees have authority to recommend waiver of one or more PhD course requirements, for approval by the Graduate Chair, following assessment of courses completed in a previously completed MSc program, including programs completed at another institution.	Mechanism already exists. No action needed.	Associate Chair Graduate Studies	No action needed
12.	Supervisors and students draft an agreement of mutual expectations and timelines soon after the student enters the program and that timelines be updated in each progress report presented to the supervisory committee and that these timelines be approved by the committee.	This has already been enacted in the Department	Associate Chair Graduate Studies	Enacted
13.	The comprehensive exam procedure be reviewed, and consideration given to alternative models such as inclusion of a literature review or a mock grant proposal (such as a NSERC Discovery Grant) that is evaluated by the Examination Committee (written and oral components).	BGSC has met and rejected the recommendation. Students and Faculty are happy with present system.	Associate Chair Graduate Studies	Rejected the recommendation
14.	A committee meeting in the later stages of the student's program be designated to determine if the student has completed data collection and be	This is now part of our supervisory	Associate Chair Graduate Studies	Enacted spring 2017



	given formal permission to begin writing a thesis. At this meeting, the student could submit a table of contents of the proposed thesis.	committee meeting report		
15.	The graduate course curriculum more accurately map to the research fields and that courses be modified to provide a balance between specific training with their programs and broad training within the field (possibly through common graduate courses in the subfields) and for professional development.	Our curriculum is under review and renewal and will be mapped to research fields. Professional development is widely available across campus	Associate Chair Graduate Studies	Ongoing with up to a 4-5 year timeline for completion
16.	We recommend that a human resource appointment within the Faculty of Science be attached to the Department to provide support related to graduate student TA appointments, files for postdoctoral positions, etc.	Outside of Department governance	Dean of Science and Department	Outside of Department governance
17.	The Vice President Research commit to a subsidy to support a renovated aquatic facility, which could be included in a potential CFI application.	Completed	Dean of Science and Office of Research	2017
18.	The Department work with the Faculty of Science to provide matching funds to support a CFI proposal to improve the aquatics facility.	Ongoing	Aquatic Facility Users Group, Department Chair	Ongoing 2017- 18
19.	The Committee of Research fellows create clear and transparent guidelines for provision of equipment maintenance funds.	Outside of Department Governance	Department Chair, Associate Dean Research	Ongoing
20.	The Department work with the Faculty of Science to firmly establish a risk-funding program for faculty facing grant renewal. If this funding was	Existing	Associate Dean Research	Ongoing



	guaranteed, it would allow researchers to develop longer term plans for their programs.			
21.	We recommend that the Department work with the Graduate Studies Office to determine campus-wide quota system for scholarships that doesn't disadvantage strong departments, such as Biology.		Associate Chair, Graduate Studies	Under the present University of Waterloo quota system based upon Tri-council funding, Biology has limited access to MSc level scholarships. At this time this outside of departmental governance.
22.	We recommend that the number of Special Topics (i.e., targeted) courses could be reduced.		Associate Chair, Graduate Studies	The reason for the apparent large number of special topics (targeted) courses is that the GSPA requires departments to provide a title for each course.
23.	We recommend that common courses could be offered in the Department's newly identified research fields.		Associate Chair, Graduate Studies	This is currently being addressed and should be complete within two years followed by approvals for calendar changes.



24.	We recommend creation of a modular-based graduate course that could be tailored across research fields and allow for breadth and flexibility for each student. As an example, this course could contain six modules, of which the student would be required to complete three for credit. Incorporation of the existing BIOL 690 – Scientific Communication, into this model could better insure that students attain important communication skills without making it a full course requirement.		Associate Chair, Graduate Studies	The BGSC has discussed the potential for a modular graduate course and this proposal will be continued further.
25.	We recommend that the Department could regularize when new faculty are expected to begin to teach grad courses, and how they will fit their courses into the program.		Department Chair Associate Chair, Graduate Studies	We now have clarified direction on this.

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



Date of next program review: \_\_\_\_\_ 2023  
Date

**Signatures of Approval:**

\_\_\_\_\_  
Chair/Director Date  
26 Sept 2018

\_\_\_\_\_  
AFIW Administrative Dean/Head (For AFIW programs only) Date

\_\_\_\_\_  
Faculty Dean Date  
26-9-18

\_\_\_\_\_  
Date  
September 28, 2018

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

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