Final Assessment Report

Biology (BSc, MSc, PhD, Minor), Biochemistry – Joint with Chemistry (BSc, Minor), Biomedical Sciences (BSc), Environmental Sciences/ Ecology (BSc), Bioinformatics (Option), Medical Physiology (Minor)

December 2024

Executive Summary

External reviewers found that the Biology (BSc, MSc, PhD, Minor), Biochemistry – Joint with Chemistry (BSc, Minor), Biomedical Sciences (BSc), Environmental Sciences/Ecology (BSc), Bioinformatics (Option), and Medical Physiology (Minor) programs delivered by the Department of Biology were in good standing.

"The programs reviewed as part of this cyclical review are of high quality, with faculty and staff who are skilled in pedagogical methods and care deeply about the quality of the educational experience of their students. Students at both the undergraduate and graduate levels that were interviewed were mostly satisfied with the quality of their education and opportunities to train for future education and employment."

A total of six recommendations were provided by the reviewers, regarding program transfers, governance and curriculum review, graduate student research activities, transferable student skillset, lab offerings, and departmental community. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2030-2031.

Enrollment over the past three years

	Biology (BSc)	Biology (BSc) – Co-op	Biochemistry (BSc)	Biochemistry (BSc) – Co-op	Biomedical Sciences (BSc)	Environ. Sciences (BSc)	Environ. Sciences (BSc) – Co-op
2024-2025 (CURRENT YR)	132	425	41	303	593	13	56
2023-2024 (LAST YR)	149	433	43	289	634	12	67
2022-2023 (THREE YRS)	147	432	41	312	708	16	65

	Bioinformatics Option	Minors	Biology (MSc)	Biology (MSc) – Water	Biology (PhD)	Biology (PhD) – Water
2024-2025 (CURRENT YR)	45	232	54	4	55	4
2023-2024 (LAST YR)	50	252	51	7	56	5
2022-2023 (THREE YRS)	57	252	47	7	58	5

*Based on Active Student extract from Quest on December 5, 2024.

Background

In accordance with the University of Waterloo's Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Biology (BSc, MSc, PhD, Minor), Biochemistry – Joint with Chemistry (BSc, Minor), Biomedical Sciences (BSc), Environmental Sciences/Ecology (BSc), Bioinformatics (Option), and Medical Physiology (Minor) programs delivered by the Department of Biology. A self-study (Volume I, II, III) was submitted to the Associate Vice-President, Academic and Associate Vice-President, Graduate Studies and Postdoctoral Affairs on January 4, 2024. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the data collected from a student survey, along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for each faculty member with a key role in the delivery of the program(s) were included in Volume II of the self-study.

From Volume III, two arm's-length external reviewers were selected by the Associate Vice-President, Academic and Associate Vice-President, Graduate Studies and Postdoctoral Affairs:

Professor David Hansen, Department of Biological Sciences, University of Calgary; and Professor Robert Tsushima, Department of Biology, York University.

Reviewers appraised the self-study documentation and conducted a site visit to the University on April 15-17, 2024. An internal reviewer from the University of Waterloo, Professor David Saunders, Department of Statistics and Actuarial Science, was selected to accompany the external reviewers. The visit included interviews with the Associate Vice-President, Faculty, Planning & Policy (on behalf of the Vice-President, Academic and Provost); Associate Vice-President, Academic (on behalf of the Associate Vice-President, Graduate Studies and Postdoctoral Affairs); Dean of the Faculty of Science; Faculty Associate Deans of Undergraduate and Graduate Studies; Chair of the Department, as well as faculty members, staff and current undergraduate and graduate students. The Review Team also had an opportunity to tour the facilities and meet with representatives from the library.

Following the site visit, the external reviewers submitted a report on their findings, with recommendations. Subsequently, the program responded to each recommendation and outlined a plan for implementation of the recommendations. Finally, the Dean responded to the external reviewers' recommendations, and endorsed the plans outlined by the program.

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

Program Characteristics

Undergraduate Programs

Regular:

- Biology
- Biochemistry
- Biomedical Sciences
- Environmental Science (Ecology)

Co-operative:

- Biology
- Biochemistry
- Environmental Science (Ecology)

Minors:

- Biochemistry minor
- Biology minor
- Medical Physiology minor (Shared Department of Kinesiology and Health Sciences)

Options:

- Bioinformatics option

Graduate Programs

Programs offered for the graduate program:

- Master of Science (MSc) in Biology
- Master of Science (MSc) in Biology – Water
- Doctor of Philosophy (PhD) in Biology
- Doctor of Philosophy (PhD) in Biology – Water

Fields offered for graduate programs:

We have five fields that are currently listed on the Biology webpage, for our graduate students:

A. Ecology and Environmental Biology
B. Bioinformatics, Systematics and Evolution
C. Physiology, Cell and Developmental Biology
D. Molecular Genetics
E. Microbiology

In the 2016 review cycle, we had proposed modifications to these fields to reflect new and evolving research areas that were partly reflective of new faculty hires at that time. Unfortunately, these new fields (listed below) were never put forward for approval at the Faculty and Senate levels:

A. Aquatic Ecology and Environmental Biology
B. Computational Biology and Genomics
C. Physiology, Cell and Developmental Biology
D. Biodiversity and Evolution
E. Microbiology
F. Biochemistry and Molecular Biology

In the Fall of 2022, the department had an afternoon hybrid retreat, which was attended by faculty, graduate staff and graduate student representatives, to discuss the graduate curriculum. As part of this, we also discussed whether the research fields proposed in 2016 were still applicable, given the changes in research faculty in the department over the last 7 years. Based on the discussions, a new slate of fields was proposed and subsequently approved at the January 2023 departmental meeting:

A. Ecology & Evolution
B. Physiology & Cell Biology
C. Microbiology
D. Computational Biology
E. Biochemistry

If this revised slate of research fields is recommended by the review committee, these would require approval at the Faculty and Senate levels and the Chair of Biology will ensure that this process occurs.

Summary of Strengths, Challenges and Weaknesses based on Self-Study

Undergraduate Programs

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

- Enrolments in Biology courses is very large and a large number of students from the Faculty of Health take courses within our department (e.g. cell biology, human anatomy).
- Enrolments continue to increase at higher levels proportionally to the University average, stretching administrative and technical resources to their limits (some hires have been approved recently at the technical levels).
- 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 changes in the Life Sciences.

Weaknesses

- The Biology programs have very few international students. There is interest in expanding joint programs, such as 2 + 2 programs with countries other than China. In addition to serving the University strategic area of internationalization, these students provide a mechanism for significant revenue generation.
- Enrolments in courses is very high from first to fourth year, while this brings considerable revenue to the faculty, there are numerous challenges in such large classes.

Graduate Programs

Strengths

- The graduate program has been enhanced over the review period by both faculty renewal and some initial, but likely impactful, changes in the graduate curriculum.
- The advent of new research infrastructure, such as the new WATER facility, and a change in the management structure of the core facility, has improved the available training opportunities.
- The development of a new TA application form and overhaul of the TA assignment process have resulted in a more graduate student-centric process that has vastly improved the outcomes for both the students and the administration.

- The collegial collaborations between the BGSA and the Graduate Officer/Graduate Studies Committee have improved relations and communications between the two bodies with the goal of optimally supporting the graduate students in their individual programs.

Challenges

- Like many other Departments, times-to-completion have been higher than desirable for both MSc and PhD programs, a significant proportion of which is a direct impact of the pandemic.
- The institution of a more structured curriculum, with graduate courses offered more frequently, will be a challenge. This will be supported by the current messaging from the Departmental Chair, which makes clear that teaching in the graduate program is a valued part of our teaching.
- While core facilities have been improved, the central support and instrumentation available to graduate students, especially in the area of molecular and cell biology, is a challenge compared to some of our competitors.
- As in other institutions, research funding remains the biggest long-term challenge in growing and maintaining a strong graduate program. Comparatively little internal support for graduate students is available.

Weaknesses

- As with the undergraduate program, there are few international students. There is a disincentive for taking foreign graduate students, as there is no provincial grant and tuition is three times higher than for domestic students. While there is some central support to cover the tuition differential for PhD students, there is only very limited access to funding for international Master's students.
- The graduate curriculum has significant room for development, and increasing the regular frequency of graduate course offerings presents a valuable opportunity for growth and improvement. It is hoped that the current focus on the curriculum by the GSC will result in significant improvements within the coming academic year.
- The mismatch between the expertise of the majority of Biology graduate students (Ecology & Evolution) and the expertise required for the majority of TA positions (Biomedical Sciences) is an Achilles heel for the graduate program and requires us to

rely on a large number of undergraduate students to meet the TA needs for our undergraduate programs.

Summary of Key Findings from the External Reviewers

Undergraduate Programs

"The co-op program, as well as the EDGE program, provide students with the opportunity to utilize the understanding and skills acquired in their coursework, develop additional skills that will benefit them in their future occupations, and establish connections that can support them in future endeavors. We consider the breadth of the programs to be a strength as it provides students with diverse opportunities to pursue their interests. Additionally, it allows for transdisciplinary learning and research. However, care should be taken that there is sufficient depth in a specific area so that there are enough faculty members to teach in this area, and that there are areas of research strengths in which research programs benefit from collaboration, shared instrumentation, and strategic funding opportunities… All of the programs in this review offer students an excellent educational experience. However, students enter the programs directly out of high school. For some, this means they are entering programs prior to being sufficiently exposed to the potential disciplines to allow them to make an informed decision."

Graduate Programs

"The graduate programs appear to be quite strong with excellent researchers and supervisors. We suggest that more training could be provided to develop soft and transferable skills... Also, making the skills course (BIOL 690 Scientific Communication) mandatory. An in-house graduate statistics course should be developed so students do not have to go to Laurier University. Finally, there is a disparity between the large number of researchers and graduate students in the Environmental Sciences and Ecology disciplines, and the substantial number of undergraduate students in the Biomedical Sciences and related fields. This results in graduate students being Teaching Assistants in courses where they have little expertise and misaligned faculty resources for teaching in various programs."

Program Response to External Reviewers' Recommendations

1. We recommend changes be made to all of the biology undergraduate programs and not only to the Biomedical Sciences program. This may allow students to transfer between programs more easily, at least after the first year. The Department of Biology should explore increasing the incentives for students to remain in more specialized programs, reduce disincentives to remain in specialized programs-- but rather transfer to more general programs, and to ensure

students are in the programs that best match their interests. Undergraduate students wishing to transfer between programs can be difficult for some and easier for other programs. Students may not always know what they are interested in when they first start their undergraduate education and may change their minds once they start. Structure the programs so that early transfer between programs is possible and not just limited to certain programs (e.g. Honours Science). To achieve this recommendation, the Department of Biology can explore having a common first year program or common first-year Biology courses (BIOL 110 and BIOL 130) for all their students. The new Curriculum Facilitator will be beneficial in this process.

Program Response

We acknowledge the need for improved design in our programs to better leverage the strengths of our curriculum and reduce impediments to students remaining in our programs. A hurdle for our curriculum is the significant flexibility of the Honours Science program. Students transferring programs, for example out of Honours Biochemistry, can avoid making up the differing required introductory courses between programs, often resulting in lacking these pre- requisite courses when they reach upper year. Additionally, many upper-year students swap programs to Honours Science strategically to avoid courses that are perceived as onerous or difficult in more specialized programs.

We agree with the suggestion to focus curricular development on incentives for students to remain in the program. One mechanism for this is following enrollment numbers in popular upper-year courses and strategically offering reserved spots for students in our programs. In the past two years the department has invited student groups (Biology - and Biomedical Sciences undergraduate societies) to share feedback with our curriculum committee. Much of this feedback has been concerning assessment workload, in both lecture and laboratory courses, and requests to place more emphasis on application of concepts in lecture courses. This has instigated conversations with targeted course and lab instructors, highlighting issues with course design and pushing for redevelopment. This feedback, and the entire process of welcoming these student representatives, will continue to provide needed feedback and be incorporated in the upcoming review of our courses in 2025. Additionally, this relationship with the student community can help to better explain desired upper-year courses and engage first- and second-year students about their programs. By interacting with students, we can better help them identify the program that best suits their needs and give them a better idea of what to expect in subsequent classes. This relationship with the student community can also help to engage students in first and second year about their programs and communicate desirable courses in upper year more effectively. Engaging with students

will better inform them as to what they may look forward to in future courses and help us to better guide students to find the program that is right for them.

The recommendations suggest changes to our programs broadly that focus on improving possibilities for transferring after at least the end of the first year. The Biomedical Sciences proposed changes in the cyclical program review will be revisited with more emphasis on mobility into the program from Biochemistry, and highlighting incentives in upper-year course choices. Biochemistry, a joint program with the Chemistry Department, will also be a focus for the curriculum committee to work with the Biochemistry curriculum committee, to offer more options for electives in this program. We know that many students move into Biomedical Sciences from Biochemistry, or from either of these programs to Honours Science. Transfer from the two programs to Honours Biology is currently hampered by the requirement of Biodiversity, Biomes and Evolution (BIOL 110; required in Hons. Biology but not the other two programs). While the suggestion of a true "common first year" across all our programs is logical, it is an idea that has met with numerous setbacks in discussions in the department in the past, and the challenges of infrastructure and wide appeal to health-focused students will need to be overcome. The Faculty of Science recently hired Anna Natoli, who is our Faculty Curriculum Facilitator and we have begun working with her on curriculum and program development, especially with our new Master's of Applied Biomedical Sciences (MABS) program. Iimproving mobility in our programs will be a primary focus of the curriculum committee as they review our programs, particularly Biomedical Sciences.

Absent, thus far, in this discussion is Environmental Sciences: Ecology. This program is closely aligned with two other Environmental Sciences specializations that are overseen by the Earth Sciences department. This Ecology program was designed during a period before the Biology department had introductory lab experiences in our Ecology area of focus courses. These programs have a common first-year that includes numerous EARTH courses. In the Fall of 2024, the Department passed a series of changes to update the Environmental Science: Ecology program that better incorporated updated biology courses and improved the ability for students to transfer into Honours Biology by including BIOL 130, a common course to all other programs in Biology. These changes incorporated feedback from fourth year students in the program, academic advisors and from faculty members in the area of focus within the department. We hope these changes will make the program more desirable for students and grow enrollment significantly, and better position students in the Environmental Sciences: Ecology program to move easily into Honours Biology if they desire or capture environment-focused students more easily from other Biology programs.

Dean's Response

The Faculty of Science supports the response of the program and the approach the Department of Biology plans to take to address the recommendation.

2. The Chair of the Department of Biology should have the authority to decide which courses should be offered in an academic year using a transparent process. This decision can be made with a departmental senior leadership team or the Curriculum Committee and in consultation with the course instructors. The development of new courses should be undertaken only when a dedicated Curriculum Committee or equivalent structure has determined the courses are needed to meet the needs of the students, are aligned with the learning outcomes of the program, and the department has the faculty complement available to teach the courses. A complementing analysis should be performed of existing courses to determine if certain courses should be expired, combined, or offered less often. The department should stop the practice of allowing faculty hires to develop new courses unless they have been approved as described above. The program has too many courses, especially at the 300- and 400-levels. The department should review, condense, and/or amalgamate the courses. With this said, there is the need for more big data and statistical training that could also be incorporated as part of many courses and laddered throughout all years of the program.

Program Response

We agree with all points of this recommendation and have begun efforts to meet some of the individual points included herein. Specifically, better directed course creation and reducing numbers of courses. For clarity, Departmental Chairs have the authority to assign courses in consultation with the AC undergrad, and determine what is offered from one term to the next. Coinciding with a recent email from the Dean on meeting challenging budgetary realities, the Department was advised that courses not exceeding 15 enrolled students by one month prior to the start of term should be carefully reviewed for cancellation. A draft Department Addendum to the Memorandum of Agreement Faculty Performance Evaluation includes the following statement, which will be voted on for inclusion at an upcoming departmental meeting:

- Undergraduate courses below 15 students are not counted as course credit and are typically cancelled at the discretion of the department chair. To have such a course recognized as credit requires written permission from the department chair.

As courses are highlighted, the Chair, Associate Chair Undergraduate and Undergraduate Program Manager will discuss the enrollment demographic of these courses and programs

requiring it. The final decision weighs the needs of our students, the department and our service teaching responsibilities to ultimately cancel or run the course. Course instructor teaching responsibilities will be moved to meet needs in the department and to reduce the department's requirements for sessional hirings in that academic year.

For developing new courses, the curriculum committee consults with the Chair and faculty to determine need, and the past routine of offering newly hired faculty opportunities to create boutique courses has been ended. Unofficially the most recent two Associate Chairs Undergraduate have taken the approach to inactivating a course if a new one were to be created - and any new course will list the proposed course instructor and term of offering when moving for approval at the department level. Only courses that have been identified as filling an unresolved gap in our programs will be proposed. The curriculum committee has also worked in earnest to decrease the number of courses to the 300- and 400-level over the past number of years. Since the start of 2024 the department has approved the cancelation of five courses (one at the 300-level; four at the 400-level), and these efforts will become a more emphasized focus for the curriculum committee in the upcoming calendar year.
To further these efforts, and coincide with curricular reforms suggested in other program review recommendations, a broad review of our curriculum will begin in 2025 that is focused on impacts of new courses initially offered in 2024-2025 (i.e. new 200-level laboratory courses in molecular biology and ecology, and a lecture-based cell biology course) and resulting changes to existing courses based on these new experiential opportunities for junior students. This review will help guide cancelation/amalgamation of existing courses and help redefine our service teaching. This will ultimately help to meet the final element of Recommendation 2, the incorporation of scaffolded big data and statistical training in our curriculum. Again, this effort has begun in earnest with the combination ("held with") of an Advanced Statistics course with a pre-existing graduate level course (Statistical Methods in Ecology) to add better aligned training for both our undergraduate and graduate students in statistical analysis.

Dean’s Response
The Faculty of Science supports the response and approach planned by the Department of Biology.

3. The Department of Biology should reintroduce mandatory attendance of graduate students at the department seminar series. Participation by graduate students, as well as faculty, was viewed as low based on feedback. Required attendance can be based on a minimum number of seminars attended, rather than requiring students to attend all the academic year.

Consideration should be given to bringing back the graduate research conference. This will allow graduate students to highlight their research and progress, practice their presentations before conference season, provide them with an opportunity to communicate their research and receive feedback from their peers, and be used as a major recruitment event by the department. The graduate students can be tasked to organize the conference, which will provide them with professional skills such as leadership, organization, teamwork, and time management. These valuable skills are essential for employment and are evaluation criteria for scholarship and fellowship applications.

Program Response

We acknowledge that attendance at departmental and graduate seminars, particularly among faculty, has been low in the years following COVID. To address this, we have implemented stronger encouragement for new graduate students to participate in these seminars as part of BIOL 690. This course focuses on science communication and dissemination through oral and poster presentations, making seminar attendance an integral component. While mandatory attendance could further improve participation, this can be effectively achieved by requiring BIOL 690 as a mandatory course for all new graduate students, ensuring consistent engagement. This semester (Fall 2024), we have informed the incoming grad students that seminar attendance is strongly recommended, with the implementation of mandatory attendance as a component of BIOL 690 starting in the Fall of 2025. This includes both graduate and departmental seminars for that semester. As we have maintained our seminar time to Thursday's at 3pm, we are hoping that this will become habitual after BIOL 690 has ended for each cohort and they will continue to willing attend seminars on their own, with encouragement from their supervisors, and of course, free snacks. As part of BIOL 690, attendance will be tracked. Additionally, Outlook calendar invites have been sent to all grad students and faculty members so there is a continual placeholder in their calendars as a reminder of the seminar time and who will be presenting. We additionally are planning a short retreat as a department for the Fall of 2025 to assess the grad seminar and address any departmental concerns.

As for the graduate research conference, we have opted to retain the graduate seminar milestone, but additionally include an Annual General Meeting (AGM) that the Biology Graduate Student Association (BGSA) will participate in organizing that will showcase award winners, potentially guest speakers, and events on the day that will allow the BGSA students to increase their organizational and leadership skills. The first planned event is aimed for the spring of 2025, and the BGSA has already taken this on and is planning events for the spring that include highlights from the year, a lunch/poster social, awards, invited internal speaker,

and highlighted lightning presentations from grad students. This style of meeting is aimed at uniting the department and re-energizing connections within.

Dean's Response
The Faculty of Science supports the response and approach planned by the Department of Biology.

4. We recommend more soft and transferrable skills and potential employment information be incorporated into the undergraduate and graduate programs. At the graduate level, this could be achieved by making the skills course (BIOL 690 Scientific Communication) mandatory for all new graduate students. Develop an in-house graduate statistics course so students do not have to go to Laurier University.

Program Response
We do agree that these skills are necessary for the development and growth of graduate students in biology. As above, we are moving towards making BIOL 690 a mandatory class for all new, incoming graduate students by the Fall of 2025. In the Fall of 2024, all new graduate students were emailed with the course syllabus and encouraged to register, and we received a record number of enrollments for the semester (30). This procedure of providing the syllabus to incoming grad students with subsequent mandatory enrollment should bolster their skills in science communication and dissemination to a broad audience.

Soft skills at the undergraduate level have been included in the 4th year labs and thesis courses, which includes oral or poster presentations(Biol 447 - oral presentation, group work, critical evaluation of research, problem solving; Biol 345 - optional group project, work in pairs for labs, problem solving; Biol 475 - writing for general audience, group work, critical evaluation; Biol 449 - group work, problem solving; Biol 239 - problem solving, group work in tutorials; Biol 483 includes group work and group oral presentations Biol 451 – oral presentations) and a poster day for 499 students. Further encouragement of faculty teaching these courses will help develop these opportunities in upper level, undergraduate courses.
The BGSA has also proposed to have ''Lunch & Learn" sessions where the department, working with the BGSA can invite industrial partners to discuss alternate career pathways over a lunch time session and network with industrial, government, and private sector employers. This can also include scientific company workshops, such as Illumina or Bio-Rad, which can provide lunch time workshops for sequencing, qPCR, protein detection techniques, in effort to ensure the latest technology and techniques are offered to our graduate students

We are currently working with faculty members with strengths in statistics to offer an in-house biostatistics course, with the intention of offering this course on a yearly basis in the winter semester. Currently there are on-going discussions in the graduate committee on the nature of the course and which faculty are available to teach this course, as it would be heavily prescribed by students due to high interest. This course will likely be developed and implemented in Winter 2026.

Dean's Response

The Faculty of Science supports the response and approach planned by the Department of Biology.

5. Undertake a process to review and update laboratory offerings continually. The Laboratory Instructors' and Technicians' time are fully committed to delivering the current labs. There are limited opportunities to improve and modernize the labs to maintain relevancy to current practices and changes in scientific technologies. The current state of many of the teaching and research laboratories reflects the aging infrastructure. The University should prioritize investing in capital projects to renovate and update teaching and research laboratories. The investments will lead to compliance with current building codes, improve the research and teaching environment, and provide the Department of Biology with the opportunity to explore offering new undergraduate courses and attract world-class scientists.

Program Response

We agree that a review of our undergraduate laboratory curriculum is both timely and integral to modernizing laboratory activities and manage the changes occurring in our department teaching complement. The department has experienced a turnover in our laboratory instructor team, replacing two of three long-serving laboratory instructors due to retirements and adding a fourth member to the team, since fall of 2022. Hirings on the technician side have also brought new experience to our technical staff. A suite of two new lab-focused 200-level courses (BIOL 235 - Foundations of Molecular Biology and BIOL 251 - Fundamentals of Ecology) will run for the first time in the 2024-2025 academic year. This recommendation will better prepare us to take advantage of the new opportunities brought on by these changes.

Lab curriculum is under the purview of the undergraduate curriculum committee and a systematic review of the learning outcomes for our laboratory offerings and outcomes of the programs across campus requiring our laboratory courses, will be produced through 2025.

The committee will work with the Faculty's Centre for Teaching Excellence liaison and campus experts on program review for this systematic review of laboratory offerings in our courses. The document will be widely circulated to the department so faculty, instructors and technicians will have a clear view of where students are developing experiential skills in our curriculum. The curriculum committee will then highlight upper-year courses for revision based on where the new 200-level laboratories have created redundancies in hands-on skill development (for example, our senior Molecular Biology techniques laboratory, BIOL 335L, is planned to be significantly revised). Senior courses can also benefit from this process by establishing better pre-requisite pathways that ensure students have the necessary training to participate in advanced laboratory courses. Lastly, many of our laboratory courses have become service teaching responsibilities to other units and this document will allow the Associate Chair undergraduate to suggest changes to programs across campus and direct out-of-Faculty students into courses that can support the larger enrollment. This process will begin in early 2025 and is expected to be completed by the end of the calendar year.

To address the shortfall in instructor and technician's time and resources for development, laboratory course assignments will ensure multiple individuals have the experience to run our larger laboratory courses. Through this redundancy we will create opportunities to schedule development time for laboratory revision. Currently our largest laboratory course, BIOL 130L - Cell Biology Laboratory, is piloting a distribution of lab instruction duties between two instructors. While a course of this size (~1200 students) will continually require both instructors, it provides a model for distribution of work that can allow for more capacity for development if adopted in smaller enrollment labs. Addressing the infrastructure and equipment challenges with revising laboratory courses is partially impeded by the developing budgetary issues affecting the entire sector, however the department has successfully made use of Faculty funding from student endowment agencies (WATSEF) on a routine basis, purchasing equipment including micropipettes, microtomes, virology visual models, microplate readers, pH meters and field sampling equipment. The curriculum committee's highlights for course development resulting from program review will be communicated to representatives in the department that prepare these funding requests to better make use of available funds. Communication to the department that funding requests will be expected to have a rationale firmly stating the connection to a curricular need will be the expectation.

Dean's Response

The Faculty of Science supports the response and approach planned by the Department of Biology.

6. Increase a sense of community within the department. Since returning from COVID-19 lockdowns, many students, staff, and faculty stated that they do not see or visit other members of the department as often as they did pre-lockdowns. This has resulted in a decreased sense of community and a relatively small number of individuals performing a large proportion of the service. Efforts should be made to encourage people to be on campus and interact more with each other. Regular and informal events, such as a coffee chat, can be scheduled. An enhanced sense of community will encourage others to be involved to increase the quality of the programs and educational experience for both undergraduate and graduate students.

Program Response

We agree with this recommendation and are striving to continue to work to build community within the department and this requires everyone to participate. In 2022, the Chair created an online message board where faculty, staff, graduate students and postdoctoral fellows could comment on some of the ways that we can increase the sense of community in the department. We have been acting on some of these including continuing to have open departmental meetings where all members of the department are able to attend, including postdoctoral fellows. The Biology Graduate Student Association (BGSA) along with the Chair and Associate Chair (Graduate Studies) have been discussing elements such as a fun run (Spring 2025) and other activities that are sponsored by both the chair and the BGSA. The BGSA continues to hold their monthly coffee hours, and the annual Fall welcome BBQ and faculty were encouraged by the Chair to attend. The Biology Social Committee (consisting of the Chair, AO and Administrative Assistant) continue to look at ways to engage the department in activities, including the departmental lunch held just before the winter break. All of these approaches are in effort to create a sense of belonging and togetherness between the students, faculty, and staff.

The Chair also meets each term with the Biology Undergraduate Student group for coffee hours and Student/Prof nights. While this is not within our ability, it would be beneficial to have more suitable community space for faculty, students and staff to interact.

The chair recognizes that the service load is not evenly distributed across faculty members in the department, and we are currently undergoing an examination of the service load across all committees that also connects with the Biology Faculty Performance Evaluation Addendum. An ad hoc Addendum committee was struck in the Spring of 2024, and that committee is currently completing the final draft of the addendum that has had input from faculty members. In that document, it outlines clearly the expectations around satisfactory service which includes attending departmental recruitment and awards events, attending

departmental meetings, participating in graduate student seminars and Biology 499 poster sessions among others. It is expected that this addendum will go forward to the faculty for approval in November through our collegial governance structure. In addition, there will be an analysis completed with the Biology EDI committee regarding the service loads across the department to address the uneven distribution.

Dean's Response

The Faculty of Science supports the response and approach planned by the Department of Biology.

Recommendations Not Selected for Implementation

N/A

Implementation Plan

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	Changes be made to all of the biology undergraduate programs and not only to the Biomedical Sciences program to facilitate easier transfers between programs.	Revise Hons. Biomedical Sciences with emphasis on upper-year incentive development. Revise our programs to remove hurdles for students to transfer after their first year. Hire a Curriculum Facilitator	Associate Chair Undergraduate Studies; Undergraduate Curriculum Committee; Biochemistry Curriculum Committee (joint with Chem. Dept.)	Environmental Sciences: Ecology revisions approved Sept 2024. Revise Biomedical Science and Biology programs at the end of 2025. Revise Biochemistry programs by Fall 2026. Anna Natoli was hired in Fall 2024 as our Curriculum Facilitator, and we have already begun engaging with her on program development, especially with our new MABS programming.
2.	The Chair of Biology should have the authority to decide which courses should be offered in an academic year	Formalizing Chair oversight on course cancellations. Analysis of courses for inactivation, combination, revision.	Chair of Biology; Associate Chair Undergraduate Studies; Undergraduate Curriculum Committee	Department Addendum drafted and to be approved by department by November 2024. (Ongoing)

	using a transparent process. New courses should only be developed if a dedicated committee thinks them necessary to meet student needs, align with program learning outcomes, and the department has the faculty complement available to teach the courses.	Strategy document with implementation plant to scaffold big data and statistical training at multiple points in each of the department's programs.		Courses recommended for inactivation/ combination/ revision; presented to the department in Fall 2025. Big data and statistics strategy presented to department by end of 2025.
3.	The Department should mandate graduate student attendance at a minimum number of department seminars to increase participation. Graduate students should organize the conference to gain professional skills, essential for employment and scholarship applications.	Make seminar attendance a mandatory component of BIOL 690. Work with the BGSA to help organize an AGM in the spring that would celebrate awards, have invited speakers, and other events. Have a broader departmental discussion regarding the Graduate Student Symposium.	Chair of Biology; Associate Chair Graduate Studies; Biology Seminar Committee,	Biol 690 seminar component inclusion by fall 2025. AGM implementation by spring 2025.
4.	More soft and transferrable skills and potential employment information	Make BIOL 690 mandatory, with the inclusion of attendance at departmental and graduate	Associate Chair Graduate Studies, Associate Chair Undergraduate Studies	Biol 690 as a mandatory course implemented by Fall 2025.

	should be incorporated into the undergraduate and graduate programs	seminars. Continued incorporation of transferable skills in upper year (3rd & 4th) undergraduate courses.	Specific faculty with interest in course-based MSc program.	Continued, on-going support and implementation of soft skill development activities in undergraduate courses In-house, yearly offering of a biostatistics grad course likely Winter 2026. Course based MSc are on-going processes that require upper administrative approvals. We are hoping to have these implemented in the next 2-3 years. (By 2027)
5.	Undertake a process to review and update lab offerings continually.	Review laboratory course learning outcomes. Revision of laboratory course pre-requisites and laboratories, reflective of new 200-level course. Review of laboratory staff workload and revised lab assignments for instructors.	Chair of Biology; Associate Chair Undergraduate Studies, Laboratory Instructors; CTE liaison and program review expert; Faculty program review facilitator	Review complete by end of spring term 2025. Revised lab pre-requisites by spring 2025.

6.	Increase a sense of community within the department.	Continue to seek ways to increase community within the department through attendance of events, creating special events to engage all members of the department. This also requires the engagement of faculty, staff and students.	Departmental Chair, Associate Chairs	Ongoing

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

Date of next program review 2030-2031
Date

Signatures of Approval

Jan 20,2025

Chair/Director Date

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

June 2, 2025

Faculty Dean Date

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

Jan. 15, 2025

Associate Vice-President, Academic Date
(For undergraduate and augmented programs)
On Behalf of the Associate Vice-President, Graduate Studies and Postdoctoral Affairs