FINAL ASSESSMENT REPORT

PERIODIC PROGRAM REVIEW (PPR)
Bachelor of Science (Honours)
Biology
Faculty of Science

In accordance with the Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the undergraduate Biology Program. This report identifies the strengths of the program, together with opportunities for program improvements and enhancements, and it sets out and prioritizes the recommendations that have been selected for implementation.

This report also includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the final assessment report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy, or governance that will be necessary to meet the recommendations, who will be responsible for leading those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

SUMMARY OF THE PERIODIC PROGRAM REVIEW OF BIOLOGY

Biology is a full-time, four-year or five-year Co-operative (Co-op) undergraduate degree program within the Faculty of Science. Offered by the Department of Chemistry and Biology, the program confers a Bachelor of Science (Honours) degree. Students can complete the regular program or opt to take one of the three options currently offered, i.e. Biophysics, Bioinformatics and Computational Biology, and Environmental Biology. The options give them the equivalent of a specialization in that field. The regular program and the options can all be taken with or without the co-op option (which adds another year to the program)

This document comprises The Faculty of Science's Dean's response to the Peer Review Team (PRT) Report and the School's response, in accordance with the directions of the 2018 and 2022 Periodic Program Review (PPR) Manual and with Section 8.2 of Senate Policy 126, Periodic Program Review of Graduate and Undergraduate Programs. The site visit by the external PRT for the Periodic Program Review was carried out between October 10 and 11, 2024. The School of Biology submitted a list of potential Peer Review Team (PRT) candidates to the Office of the Dean, who then selected

Dr. Fiona F. Hunter, Chair, Department of Biological Sciences Professor of Medical and Veterinary Entomology, Brock University
Dr. Marc Coppolino, Associate Professor, Molecular and Cellular Biology, University of Guelph
Dr. Michelle Dionne, Professor, Continuing Education Academic Coordinator, Department of Psychology, TMU

Overall, the PRT felt the Biology Program at TMU is a very strong program that is reliably delivering most of its prescribed degree-level learning outcomes in alignment with the TMU mission. The Biology Program has done this while experiencing substantial direct and indirect growth in student numbers over

recent years. The peer review team was impressed by the efforts of faculty and staff in the program to deliver a wide range of curricula in biological science and their commitment to providing students with opportunities for hands-on research experiences. Primary areas of potential improvement for the program were identified as follows: Enhancement of EDIA initiatives, curriculum revision, strategic hiring and resourcing for laboratory instruction.

The PRT Report offered the following eight critical recommendations, and the School has responded thoughtfully to each to generate their Implementation Plan. The Dean's Office is in full support of the School's responses to the PRT recommendations.

The School of Biology has submitted its response to the PRT report to the Dean of the Faculty of Science, to which the Dean responded on January 16, 2025.

The Academic Standards Committee completed its assessment of the School of Biology on February 27, 2025. The Committee indicated that a thorough, analytical and self-critical program review was conducted. The program provided a detailed plan for future growth and support for development.

The Academic Standards Committee recommends that the program continue, as well as provide a one-year follow-up report as follows:

The mandated One-Year Follow-up Report be submitted by June 30, 2026 to include:

1. **An update on the Implementation Plan**
2. **A progress report on the program's current periodic program review cycle**

Presented to Senate for Approval: March 25, 2025

Start date of next Periodic Program Review: 2028/29

SUMMARY OF THE REVIEWERS' RECOMMENDATIONS WITH THE PROGRAM'S AND DEAN'S RESPONSES

RECOMMENDATION ONE: Integrate knowledge of EDIA in the curriculum
We support the recommendation in the self-study that the program must work to integrate knowledge of EDIA as a form of professional competency within the Biology program curriculum. However, this work is long overdue and must be approached with more urgency. We suggest that a committee or working group should be organized to assess how to best integrate EDIA, and Indigenous scientific scholarship in particular, into the curriculum and the group should be tasked with delivering concrete strategies to action within the year.

PROGRAM RESPONSE:
We agree with the PRT recommendation #1 to accelerate implementation of EDIA and Indigenous Scientific Scholarship in the Biology curriculum. Recommendation #1 of our Self-study (SSR #1) aimed to implement EDIA Principles in the Biology Program Curriculum over a 3-5 year period, and ongoing therein, but we agree that we can and should accelerate this goal.

We will work with the Biology Curriculum Committee, the EDIA Departmental Committee, and the

Indigenous Advisor to the FOS Dean to recommend, develop, and implement EDIA and Indigenous scientific scholarship within the Biology Curriculum as appropriate and within the boundaries of Academic Freedom. TMU has centralized resources on EDIA that we will consult as well.

DEAN'S RESPONSE:
The Dean fully supports the purposeful incorporation of EDIA Principles and Indigenous scientific philosophy into the curriculum of the program.

RECOMMENDATION TWO: Expanding diverse representation in the study body and faculty/staff.
Perhaps in the context of the working group noted above, the program should enhance efforts to ensure the study body and the faculty and staff represent the communities they serve. One component of this is to expand recruitment for hiring so that equity deserving groups are better represented. This must be done in the context of recommendation 4 of a strategic hiring plan.

PROGRAM RESPONSE:
We agree with PRT Recommendation #2, and we will integrate this into Recommendation #5 of the Self-Study (SSR #5), which highlights the need to hire additional full-time faculty members to support the pedagogical and experiential learning environment of the Biology Program and its students. The Program Self-Study and the PRT review make a compelling case that we need more tenure-track and research-active faculty given the number of LTF and contract faculty members currently teaching Biology courses – unfortunately, these faculty members do not typically support experiential learning of our students, nor promote currency in the field as they are typically not research active, and thus do not enhance the SRC reputation of the Program, of our students, and student excitement of the field.

While we note that PRT #2 and SSR#5 recommendations are beyond the control of the Biology Program itself and require external resources, we will interface with respective hiring committees of the Department to continue using language that welcomes and encourages applications from equity-deserving groups in hiring ads and to use best practices in hiring, such as avoiding gendered-language and using rubrics to reduce biases.

DEAN'S RESPONSE:
The Dean support the Department's efforts to increase the opportunities for their students to engage in authentic experiential learning. The Biology Curriculum committee is encouraged to engage with the curriculum design specialists in the Centre for Excellence in Teaching and Learning (CELT) to explore pedagogical approaches that incorporate experiential learning opportunities into the core curriculum that do not exclusively rely on an increase in faculty complement to increase student participation in experiential learning activities. While additional resource requests are not directly related to Quality Assurance review process, the Dean will continue to work with the Department and the University to ensure that the Department receives sufficient resources and support to deliver a quality program.

RECOMMENDATION THREE: Review and Revise Courses, Curriculum, and "Options"
It is recommended that the Biology program undergo substantive revision to its curriculum. This recommendation stems primarily from three themes that emerged through review of the self-study and during the site visit. (1) The Biology Program has far too many courses to offer given the number of full-time faculty in the program. (2) Input from students and alumni reveals a degree of dissatisfaction with the content of the program, including the nature and quality of some courses. Related to (1), there were also some concerns expressed about lack of access to some courses because they were not offered consistently. (3) Recent data indicate that very few students are completing the curricular Options

(sometimes referred to as optional specializations in the self-study; i.e., Biophysics; Bioinformatics and Computational Biology; or Environmental Biology) in their current form.

In undertaking such a revision, it is important that the Department take the time to define what they want their "Departmental identity" to be in the future and what types of programs they want to be known for in the landscape of biology programs in Ontario.

Currently the Biology program has a "Regular Biology" stream and three curricular "Options". The review team suggests the Department reconfigure this aspect of the program and develop new options that focus on areas of faculty strength and of clear interest to students. To capitalize on the current Biology faculty's strengths, one potential Option could be Biochemistry (in line with the Department's own Recommendation 3c). This would then allow some of the upper-level Biochemistry courses to be removed from the regular Biology stream, making room for other biology-focused courses. Additional specializations can be developed in accordance with the envisioned Departmental identity in place. For example, an Option in Ecology, Evolution and/or Environmental Biology may be appropriate. The department (in their self study, Recommendation 3) suggested that they would consider developing a new program in such an area. The review team felt this might be premature (given existing resource challenges) and that development instead of an Option in this area is strategically a better course of action at this point.

PROGRAM RESPONSE:
The PRT noted that the Biology program lists a very large number of courses compared to the number of full-time faculty in the program. The PRT recommends that the Biology program undergoes a curriculum revision due to oversaturation of courses, student and alumni dissatisfaction with some course content, lack of access to certain courses, and a low completion rate of optional specializations like Biophysics, Bioinformatics, Computational Biology, and Environmental Biology. This recommendation aligns with the Recommendations #2 and #3 in the Self Study (SSR#2 and SSR#3). We agree with the PRT that a restructuring of the curriculum being offered is a necessity. Consequently, some of these courses are rarely being offered, and there are even certain Core Elective courses that have never been offered. In addition, a few specialized courses are being taught by sessional instructors, which may lead to variations of the course content in different years. The curriculum committee will engage in a thorough examination of the courses currently available within the program, with the objective of identifying any courses that share overlapping content.

The revision of the curriculum will also consider the suspension of courses that exhibit low enrollment and do not constitute essential components of the curriculum. In conjunction with the removal of certain courses, the program will actively pursue the creation of new courses aimed at enhancing professional skills and knowledge pertinent to professional practice. This initiative aligns with SSR#2 and addresses concerns raised by the PRT, which highlighted feedback from students and alumni expressing dissatisfaction with the program's content, particularly regarding the nature and quality of specific courses. The low enrollment figures in the existing optional specializations raise questions about the necessity of maintaining these options. Presently, the Biology curriculum is transitioning away from optional specializations that differ in required coursework, moving instead towards the establishment of distinct concentrations.

In line with the curricular structure approved by the TMU Senate, these concentrations will enable students to cultivate in-depth knowledge in a sub-specialization or emphasis within the core of their degree program. Such concentrations will allow students to select specific courses from the core

electives list, thereby facilitating a deeper understanding of desired sub-disciplines within biology. Examples of concentrations that may be included in the biology program are Chemical Biology and/or Biochemistry, as well as Ecology, Evolution, and/or Environmental Biology. These concentrations were suggested in the recommendations #3a and #3c of the Self Study. The selection of themes for these concentrations also responds to the review team's recommendation to realign the program with faculty strengths and student interests.

DEAN'S RESPONSE:
The Dean supports the Department's efforts to engage in updating the curriculum structure and in communicating to students the many career pathways that a degree in Biology can lead towards. As a part of this process, the Department is encouraged to collaborate with Departments/Schools from the Faculty of Science, as well as other Faculties, to identify opportunities for collaborative program specializations that meet societal needs. It is anticipated that at the conclusion of the restructuring, there are fewer courses, but those being offered will be of the highest impact to students.

RECOMMENDATION FOUR: Establish sustainable course offerings
With a strategic plan for how the Biology program will be shaped, and with related Options defined, it is recommended that course offerings be mapped and planned accordingly. This needs to include an assessment of how many courses can be offered, primarily by full-time faculty, in a sustainable manner. This will directly address issues around courses not being consistently offered and quality issues arising from many courses being taught by instructors who are not regular faculty members. Courses that are essential to the delivery of the revised program (core and elective) can then be revised (in the case of existing courses) or developed as necessary. Courses that are not required for the delivery of the revised program can then be removed from the calendar.

PROGRAM RESPONSE:
The PRT recommends mapping course offerings, assessing sustainable offerings by full-time faculty, and addressing inconsistent course delivery and quality issues. Essential courses can be revised or developed, while non-essential courses can be removed from the calendar. This will address quality issues and ensure consistent program delivery. This recommendation is in accordance with Recommendations #6 and #8 outlined in the Self Study (SSR#6 and SSR#8). We concur with the necessity for a comprehensive analysis of the courses offered, including their prerequisite structure. It is crucial to create diverse pathways for students, enabling them to complete their degrees within the recommended four-year timeframe while also allowing them the option to gain in-depth knowledge in specific sub-disciplines. Currently, the program is identifying courses that can be offered as small optional groups of required courses, thereby enhancing students' ability to select biological sub-disciplines for further study. For instance, an Advanced Biochemistry required course could be replaced with a choice among three courses: Advanced Biochemistry, Environmental Modeling, or Advanced Chemical Methods in Biology. Although all three courses within this small group will meet the same degree-level expectations for curriculum mapping, they will provide students with choices that align more closely with their interests.

DEAN'S RESPONSE:
The Dean supports the program's efforts to ensure that courses in the TMU Undergraduate Course Calendar reflect the courses that have a realistic chance of being offered on a predictable basis and clearly communicates a variety of pathways that prepare students for careers in their fields. As part of this process, the Department should prepare a hiring strategy where consideration is given to supporting the teaching needs of the program's sub-disciplines. Additionally, if possible, synergies and efficiencies with other programs should be sought. Has the existing curriculum overlap with the Biomedical Sciences

program been fully assessed?

RECOMMENDATION FIVE: Development of a strategic hiring plan
In accordance with Recommendations 2, 3 and 4, it is recommended that the Department of Chemistry and Biology develop a strategic hiring plan with the primary goal of establishing a staff complement (including regular full-time faculty, full-time staff, and contractual instructors) that can sustainably meet the needs of the undergraduate Biology Program, alongside other programs in the department, into the future. This recommendation is consistent with the self-study Recommendation #5. It is essential that this plan is developed coherently with the revision of the Biology Program curriculum (as per Recommendations #3 and #4) to create a coherent program of study with a few areas of focus that are appropriately aligned with identified curricular Options. The faculty and staff complement will then be well positioned to meet the needs of the revised program.

It is important to note that faculty strength in specific areas of biology is crucial to foster strength in the related area of the curriculum within the Biology program. This takes several faculty members for each area and would be difficult to achieve across a large number of different areas without a large-scale recruitment program. Thus, it is recommended that the Biology program select a few areas (3 or 4) centred around what are determined to be strengths, or emerging strengths, among the current group of faculty. Future faculty and staff recruitment can then be targeted appropriately. As well, this can be done while taking into consideration the need for diversity and representation in departmental personnel.

PROGRAM RESPONSE:
We agree with the PRT Recommendation #5. We will integrate a strategic hiring plan into our existing Self-study Recommendation #5, which asks the University to hire additional tenure-track faculty to support the Biology Program. This plan will be integrated with related recommendations such as increased representation of equity-deserving groups.

The Department of Chemistry and Biology has initiated a Strategic Plan to be completed by mid-2025. We will use this process to identify areas of existing and potential areas of strength and develop a Strategic Hiring Plan for tenure-track faculty to support the Biology Program in these areas. This will involve consultation of various stakeholders in the Department, including but not exclusively, with the Biology, Biomedical, and Chemistry Undergraduate Curriculum Committees, Graduate Councils in Molecular Science and Environmental Science and Management, EDIA Committees, and Research and Graduate Studies Committee. We do note that this strategy is highly dependent on various stakeholders in our Department, Faculty of Science, and TMU, including the provision of external resources.

DEAN'S RESPONSE:
The Dean supports the creation of a Strategic Hiring Plan being developed in parallel with the curriculum review being proposed by the Department. The Dean encourages the Department to plan a regular review of such a plan (perhaps mirroring the 5-year cycle of the University Academic Plan) to reflect any changing needs within the Department.

RECOMMENDATION SIX: Increase resource support for laboratory courses (requires external action)
Stakeholders in the Biology program are doing an excellent job of delivering the program's curricula given current resource allocations. There has been substantial growth in student enrolment in the Biology program, along with that in the Biomedical Science program, and resources now appear to be stretched to their limits, particularly for laboratory courses. While it may be possible to find efficiencies, the Biology program is currently at a point that requires careful and detailed assessment of what

laboratory components are essential to its curricula (and perhaps that offered to other departments through service teaching), in accordance with program revisions as per Recommendation 3. These components play a foundational role at the core of the program, allowing it to meet its objectives and TMU's degree-level expectations. With this determination, they can then assess the resources currently available to them and identify points where resources need to be increased. This could include, for example, access to additional laboratory teaching space and laboratory demonstrator personnel. If additional resources cannot be secured, other options can be considered – e.g. removing some laboratory courses from the program, limiting access to laboratory courses (capping student number) based on a prioritization plan.

Ultimately, if the institution's and the Biology Program's goal is to increase the number of graduates it produces to help meet societal needs for technical expertise in biological sciences, this will require investment. Existing physical space in Kerr Hall will not currently support expansion, and if laboratory instruction is to be expanded later into evenings and into weekends additional positions for full-time laboratory demonstrators will need to be created. Alternatively, the program should consider if large service courses could be modified so that enrolment in lab sections is capped and prioritized for Biology majors.

PROGRAM RESPONSE:
The PRT recognizes that the Biology program is effectively utilizing the resources at its disposal. However, the program is experiencing resource limitations due to a rise in student enrollment and an expansion of course offerings. The PRT advises that the program should pinpoint specific areas where an increase in resources is essential, such as additional teaching facilities and staffing. To address the societal demand for technical expertise in biological sciences, the PRT underscores the necessity of investing in physical space and hiring more full-time demonstrators.

These recommendations are consistent with Recommendation #2 of the Self Study. The Biology Curriculum Committee, in conjunction with the department's Technical Manager, will ensure the program continues to incorporate applied laboratory components into courses, and continue to offer and expand on the field biology courses that enhance theoretical understanding and cultivate vital practical skills necessary for success in both academic and professional contexts. These initiatives align with TMU's mission to promote applied knowledge that meets societal needs. Should securing additional resources prove unfeasible, alternative strategies may involve the removal of certain courses or restricting access based on a prioritization framework. Furthermore, it is suggested that large service courses be adjusted to give priority to Biology majors in laboratory sections.

DEAN'S RESPONSE:
The Department is encouraged to include consideration for applied laboratory components in their curriculum review and strategic planning processes. The Dean will work with the University Planning Office, University Advancement and the Department to help identify resources that can be used to support the undergraduate laboratory components and provide students with the practical skills required for their future careers. Moreover, an external needs assessment should be carried out to examine the capacity of society to employ the graduates of the Biology Program. The Dean will help fund such a study.

RECOMMENDATION SEVEN: Continue to prioritize student access to hands-on research activities
The faculty and staff of the Department of Chemistry and Biology are clearly committed to providing students with opportunities for hands-on/experiential training in biological science and opportunities for

independent research. Their efforts in this regard are highly commendable, and the PRT fully recommends the Biology Program to continue to prioritize this aspect of the training they offer and expand upon it as much as possible.

PROGRAM RESPONSE:
The PRT acknowledges the commitment of the faculty and staff within the Department of Chemistry and Biology to offer students practical training and opportunities for independent research, and it advocates for the ongoing prioritization and expansion of these initiatives. We are in full agreement with this recommendation. As outlined in Section 4.1 and in Recommendation 2 of the Self Study, the program will ensure the continuation of support for existing experiential learning opportunities while exploring strategies to broaden these offerings, such as capstone and research-based courses. To achieve this, the program will seek to strengthen support systems to guarantee that sufficient mentorship, resources, and training programs are available to facilitate engagement with postdoctoral researchers and advanced graduate students who can serve as primary advisors or mentors for undergraduate research projects. Additionally, the program may contemplate providing further support and appropriate recognition for faculty members supervising undergraduate students, particularly in relation to the BLG40 honors thesis project course. This could involve exploring mechanisms to assist with the procurement of research reagents and consumables necessary for students participating in these research opportunity courses.

DEAN'S RESPONSE:
As part of the curriculum review and modernization process, the Dean supports Departmental efforts to incorporate more experiential learning opportunities into the core curriculum of the Biology program.

RECOMMENDATION EIGHT: Foster engagement of departmental staff and faculty
Recommendation #8 from the self-study states, "Establish an annual Departmental discussion to review courses and set curriculum priorities." This is an excellent idea and is reinforced here with the recommendation that this be expanded upon. Increased interactions between faculty and staff, in discussing curricula and other departmental matters, is essential to building and maintaining engagement in the Department and enhancing a sense of community. This is particularly true for CAB, as members are spread across several physical sites. Ultimately, increased faculty and staff engagement will contribute directly to improved student experience. It is recommended that the Department plan an annual departmental retreat-type meeting (this could be a simple day or 1⁄2 day meeting on campus) along with regular (at least semesterly) departmental meetings to support further discussion and interaction.

Related to this, members of the department need reliable access to spaces over which they have some control, in which to hold meetings such as teaching team meetings, research lab meetings, etc. While this will likely require external support, these are essential activities for science programs and an important aspect of meeting programmatic and institutional goals.

PROGRAM RESPONSE:
We agree with PRT Recommendation #8, which aligns with the Self-study Recommendation #8 (SSR8). We will engage with the ongoing Departmental Strategic Plan to develop and/or build on existing avenues to foster engagement between Departmental Staff, Faculty, and students. This may include joint meetings of the Biology, Biomedical, and Chemistry Undergraduate Curriculum Committees, the Annual Departmental Symposium, and a renewal of the Departmental Retreat to discuss curricular issues, SRC activities and strategies, and develop collegiality and camaraderie in the Department, which are essential for healthy, inclusive, and diverse Programs supporting students in Biology and beyond.

DEAN'S RESPONSE:
The Department agrees with the recommendation for the Department to hold regular meetings and curriculum review retreats as a part of the overall strategy supporting the delivery of the Biology program and other Departmental programs.

IMPLEMENTATION PLAN: SCHOOL OF BIOLOGY

Priority Recommendation #1 Integrate knowledge of EDIA as a form of professional competency in the curriculum (PRT 1, PPR1, PPR4)
Rationale: It is important to consider whether and how the curriculum integrates important strategies to identify and address barriers to Equity, Diversity, Inclusion, and Accessibility (EDIA). Few courses explicitly address the specific learning outcomes related to the principles of EDIA and how these can be implemented in STEM fields and in professional practice. Two other important learning outcomes are aiming at teaching our students to understand the value of integrating Indigenous scientific scholarship with Western scientific scholarship by including different perspectives from the First Nations, Métis and Inuit in the research process, and how to Identify barriers that lead to underrepresentation of equity-seeking groups in STEM fields and develop a professional practice that aims to mitigate these challenges
Implementation Actions: i) Developing new courses that consider EDIA as it relates to Biology and related disciplines, and/or to incorporate the discussion and consideration of EDIA principles in existing courses. ii) Incorporation into the curriculum the consideration of factors that systematically exclude some individuals and their perspectives from Biology and related disciplines, and develop strategies to ensure that individuals from historically excluded or underrepresented groups can contribute to Biology and related disciplines, iii) Encourage training for faculty members in inclusive teaching practices, culturally responsive pedagogy, and strategies to address implicit bias, using resources available from OVPECI and CELT. iv) Ensuring contributions from diverse individuals to the advancement of Biology and related disciplines are acknowledged and highlighted in the curriculum. v) It is also important for the Biology program to consider how existing courses can be modified so that some of their activities, exercises, and evaluation methods include First Nations, Metis, and Inuit perspectives, two-eyed seeing approaches that will ideally enable more integrative scientific approaches. This initiative will begin with building relationships with Indigenous scholars and groups within TMU that may advise on how best to approach integration of these Knowledges into the Biology curriculum.
Timeline: Start immediately and finalize within 2 years implementation of the recommendation at the level of the curriculum committee. Apply the recommendation to any future curriculum development.
Responsibility for: **a) leading initiative:** Biology curriculum committee; Chemistry and Biology Department EDIA standing committee for consultations **b) approving recommendation, providing resources, and overall monitoring:**

Toronto Metropolitan University

Departmental Chair, Program Director, Departmental Council

Priority Recommendation #2

Expanding diverse representation in the study body and faculty/staff (PRT 2, PPR4, PPR5)

Rationale:

The demographic composition of students and faculty within the Biology program, based on student and faculty EDI Self-ID data identifies specific Equity-Deserving Groups (EDGs) that are underrepresented in the student population within the Biology program relative to the surrounding community, including FNMI People, 2SLGBTQ+ People, and Persons with Disabilities. This suggests that barriers exist to the recruitment of students into the Biology program from these specific EDGs. It should be noted that representation of individuals from EDGs within the faculty population was also identified as one of the key recommendations from the Anti-Black Racism Campus Climate Survey Report. Of note, there are certain EDGs that are under-represented within the Faculty complement of the Department of Chemistry and Biology

Implementation Actions:

i) Consider the specific barriers that exist for the recruitment of students from these EDGs, and look to address these barriers. To do so, the Biology program may consult with the Advisor to the Dean in Indigenous Education in the Faculty of Science to identify how to make the Biology program more accessible, inclusive, and equitable for FNMI students.

ii) The Biology program will also consider coordinating outreach activities for the purpose of recruitment of students from under-represented communities. To accomplish this, the Biology program can consider meaningful collaboration with SciXchange within the TMU Faculty of Science.

iii) Reviewing existing undergraduate awards and further promote/expand on those that support underrepresented students.

iv) Currently, the DHC is hiring two faculty members to replace recent retirements. For these positions, as well as for potential future hires in the Department, best practices for inclusive and equitable recruitment from a diverse group of qualified applicants are followed. Hiring committees of the Department will continue using language that welcomes and encourages applications from equity-deserving groups in hiring ads. OVPECI Recruiting & Hiring Diverse Faculty Guidelines are being followed by all members of DHCs, and best practices in hiring are being used.

Timeline:

Immediate and ongoing

Responsibility for:

a) leading initiative:

Biology program director ; DHC

b) approving recommendation, providing resources, and overall monitoring:

Chemistry and Biology Chair, Biology Program Director

Priority Recommendation #3

Review and Revise Courses, Curriculum, and Establish Sustainable Course Offerings (PRT3, PRT4, PPR2, PPR6 PPR7)

Rationale:

The Biology Program offers courses that span the breadth of biological sciences – from biologically-relevant molecules to ecosystems. Nevertheless, there may be some courses that are

either redundant or do not align with the current expertise of tenure and tenure-track faculty. As a result, the PRT and our self-study has noted that some courses have not been offered, or have run inconsistently, or require contract faculty. To address these issues, we will review and identify courses to remove or offered in alternate years (reduced, but predictable offering), and to identify strategic future hires.

In addition, the Biology Program curricular structure has not been repositioned with the revised Senate Policy 2 that governs Undergraduate Curriculum at TMU and which introduced Open Electives (in lieu of Professional Electives) and Concentrations (in lieu of Options). As per the PRT and PPR recommendations, we will revise the Biology Curriculum within the context of Policy 2. Finally, a key goal of the PRT and self-study is to develop a Biology Curriculum that is relevant to society.

Implementation Actions:

i) Review course offerings to identify redundancies and/or gaps. Redundant courses will be eliminated or merged to streamline offerings and enhance predictability of offerings. This will include creation of BLG290 Orientation in Biological Sciences
ii) Rebalance the Biology Curriculum to reduce the over-representation of core Biochemistry courses and mitigate the under-representation of core ecology courses. This will include the introduction of a BLG XXX Advanced Ecology Lab
iii) Integrate the Molecular Biology (BLG307) and Biochemistry courses (BCH361 and BCH463) to reduce gaps and redundancies in essential biological concepts related to the central dogma: nucleic acids (DNA, RNA, replication, repair, transcription in BLG 307 Molecular Biology), proteins and enzymes (BCH 361 Advanced Biochemistry I), and metabolism and energetics (BCH 463 Advanced Biochemistry II).
iv) Increase core elective courses from 4 to 6 to enhance professionalism, career-ready training, and discipline competitiveness in the program, while reducing the open electives from 6 to 4 (10% as per Policy 2). This still enables the most popular minors to be completed within the 40-credit degree since Liberal Studies are permitted in the completion of many Minors (e.g. Psychology), or because specific courses that could be counted towards a Minor are already part of the core Biology curriculum (e.g. Physics).
v) We aim to review the Biology Minor and update the list of required courses to increase interest and/or facilitate completion of the Biology Minor. This is important to increase scientific literacy among the wider members of society given the implications of Biological Sciences for infectious diseases, biotechnology, medicines, ethics, and the challenge of misinformation for society.
vi) Essential courses will be revised or developed, while non-essential courses will be removed from the calendar. This will address quality issues and ensure consistent program delivery. This recommendation is in accordance with Recommendations #6 and #8 outlined in the Self Study.
vii) The prerequisite structure will be revised to remove all prerequisites which are not essential in providing foundational knowledge for the course.

Timeline: 1-4 years

Responsibility for:

a) leading initiative:

i, ii, iii, vi, and vii) UPDs, Biology, Biomedical, and Chemistry Curriculum committees in consultation with instructors.

Iv and v) UPDs and Biology Curriculum Committee

b) approving recommendation, providing resources, and overall monitoring:

Toronto Metropolitan University

Departmental Council

Priority Recommendation #4
Review and Revise Concentrations (PRT 3, PPR2, PPR3)

Rationale: PPR2 PPR3 PPR6 PPR7
The SWOT analysis identified Optional Specializations as Strength of the Biology program, which can attract potential applicants and stand out to employers looking for specific competencies. However, existing Optional Specializations (Biophysics, Computational Biology and Bioinformatics, and Environmental Biology) show low enrollment numbers over the years.

The Environmental Biology specialization has garnered the most interest from students, but with only 5-10 students selecting this specialization annually. Nevertheless, when taking into account the enrollment numbers for Biology courses that are fundamental to the Environmental Biology Option, such as BLG401 Ecotoxicology, the enrollment averages around 25-50 students per year. This data underscores a substantial student interest in the course content associated with the Environmental Biology Optional Specialization, despite the limited formal enrollment in this specialization.

The SWOT analysis also identified opportunities for growth in Course Concentrations. It is important that any such growth be aligned with the strategic priorities and specific personnel and resource strengths of the Department of Chemistry and Biology. The Department is unique in that it houses within a single Department what are typically distinct disciplines, specifically Chemistry and Biology. There is thus a unique opportunity to develop a Course Concentration in Chemical Biology, a unique discipline at the interface of chemistry and biology.

Implementation Actions:

i. To comply with the new Senate Policy 2, we will eliminate all Options and we will introduce four Concentrations: 1) Molecular Cell Biology, 2) Ecology, Evolution, and Environmental Biology, 3) Chemical Biology, and 4) Biology and Society.
ii. Make the Ecology, Evolution, and Environmental Biology offerings more visible to the biology students by creating a Concentration that addresses environmental biology curriculum such as ecology, limnology, toxicology, conservation and data systems.
iii. Develop a new Chemical Biology Course Concentration within the Biology program, as a key strategic area for expansion.
iv. Develop a new Biology and Society Course Concentration within the Biology program, as a key strategic area for expansion
v. Explore creating a small number of new courses for the Chemical Biology Course Concentrations, taught jointly by experts in each of Biology and Chemistry disciplines within the Department. These new courses can also serve a similar Chemical Biology Course Concentration that is being considered in the Biomedical Science program. By serving both programs, this offers a unique strategic opportunity to expand curriculum options while also considering resource availability within the Department of Chemistry and Biology.

Timeline:
2-5 years

Responsibility for:
a) leading initiative:
Biology Program Director, Biology Curriculum Committee

b) approving recommendation, providing resources, and overall monitoring:
Chemistry and Biology Chair, Chemistry and Biology Departmental Council

Priority Recommendation #5
Development of a strategic hiring plan (PRT5, PPR5, PPR7)

Rationale:
The PRT recommendation 5, as well as the analysis of the Self Study Section 6 highlights a shortage of tenure-track faculty members to offer the curriculum of the Biology program. There is a significant increase in the number of course sections that have been taught by non-permanent instructors. This has limited the stability of course offerings and has also limited the ability of the program to keep some courses current or to use innovative teaching practices.

PRT identifies issues related to courses not being consistently offered and quality concerns arising from too many courses being taught by instructors who are not regular faculty members. Such issues were raised in the Self Study by SWOT analysis, feedback from faculty, and student feedback. There are several Core Elective courses that often don't run, as an example BLG607 has never been offered. This inconsistency in course offering has to do with the difficulty of securing instructors for these courses, as each requires specialized professional expertise.

There is also a critical shortfall of faculty members to support the experiential learning opportunities for students in the Biology program, as discussed in PPR Recommendation 2.C. The demand for research-based courses such as SCI999, BLG481, and BLG40 far exceeds the current capacity of research-active faculty members to support these programs.

We do note that this strategy is highly dependent on various stakeholders in our Department, Faculty of Science, and TMU, including the provision of external resources.

The Dean supports the creation of a Strategic Hiring Plan being developed in parallel with the curriculum review being proposed by the Department.

Implementation Actions:

i. Complete the Strategic Hiring Plan that the Department of Chemistry and Biology has already initiated. This plan will be integrated with related recommendations such as increased representation of equity-deserving groups.
ii. Perform consultation of various stakeholders in the Department, including but not exclusively, with the Biology, Biomedical, and Chemistry Undergraduate Curriculum Committees, Graduate Councils in Molecular Science and Environmental Science and Management, EDIA Committees, and Research and Graduate Studies Committee.

Timeline:
1 year

Responsibility for:
a) leading initiative:
Biology UPD, CAB Chair
b) approving recommendation, providing resources, and overall monitoring:
FOS Dean,

Priority Recommendation #6

Increase resource support for laboratory courses (requires external action) (PRT6, PPR2 a and b)

Rationale:

Biological Sciences require professionals with the technical and methodological skills to design and perform experimental tests and interpret experimental data to generate data to support evidence-based decision making. Laboratory courses are uniquely positioned to expose students to the methods, instruments, and tools used to acquire and apply new knowledge in Biological Sciences.

This experiential learning avenues however are resource intense typically requiring lab space, lab support rooms, equipment, materials, teaching assistants, technical staff, and ancillaries like chemical and biological waste disposal. The PRT and PPR both comment on the importance of laboratory courses, and the need and challenges to support these courses. To achieve the goals of this recommendation, we will do the following.

Implementation Actions:

i) Review current laboratory courses and their laboratory exercises to determine i) labs that are essential for basic skill development, ii) labs that promote student competitiveness, iii) labs that are outdated or offer no competitiveness to students, and iv) labs that are redundant with no reinforcement value.

ii) To assess and seek efficiencies in space, person, materials, and/or financial resources to reinvest in essential and priority lab courses and/or lab exercises

iii) Identify partnerships within and external to TMU to support laboratory courses and exercises including bioinformatics, databases, fieldwork, and community engagement.

Timeline: Within the first three years

Responsibility for:

a) leading initiative:

i. UPD, Biology Curriculum Committee, and "typical" Instructors of relevant courses to review pedagogical and scientific merit of lab courses and exercises.

ii. Technical Manager, Technical Staff, Chair, and Resources and Budget Committee to review resources

iii. UPD and Biology Curriculum Committee to consult and explore partnerships.

b) approving recommendation, providing resources, and overall monitoring:
Chair, Biology Curriculum Committee, and Dept. Council.

Priority Recommendation #7

Continue to prioritize student access to hands-on SRC activities (PRT7, PPR2, PPR7)

Rationale:

Experiential learning in the form of hands-on activities, both as prescribed activities and as original SRC activities, is invaluable to promote expertise in the biological sciences and to develop evidence-driven critical thinking. As denoted by the PRT, the Biology Program values and prioritizes these experiences through at least four avenues. First, and arguably the premier avenue for hands-on SRC experience, is the two-term BLG040 Undergraduate Thesis Research and the one-term BLG481 Biology and Chemistry Project courses. These typically depend on SRC-active faculty members to mentor the student and typically requires external funding to support the SRC activities. Second, SCI999 is a non-credit course that allows a student to work with a faculty member on a defined question or research task – this course significantly boosted the number of opportunities available to students to experience hands-on SRC. Third, BLG888, BCH880, BLG 720, BLG721, and BLG806 are lab/field-based courses that can be taken as Core or Open Electives and offer technical development

using prescribed exercises. Fourth, and lastly, there are many courses that offer pre-designed lab exercises for experiential learning. To achieve this recommendation, our goal is to promote, support, and expand experiential and SRC-based activities as follows:

Implementation Actions:

- <u>To promote awareness of existing SRC-based and experiential-learning opportunities</u>:

i) we will formalize communication with the student body through annual electronic communication about the opportunities, mechanisms to enroll/secure a position, and how to make use of core and open-electives to get the most of these opportunities.

ii) We will update Dept. and Program Website and make use of social media to raise awareness of these SRC- and experiential-learning opportunities and their value for professional development.

iii) With the advent of BLG290 Orientation in Biological Sciences, we will promote research-based and experiential-based courses, raise awareness of their value in learning and professional development, and suggested paths to use core and open-elective courses to earn SRC experience.

- <u>To support existing research-based and experiential-learning opportunities</u>:

iv) The Department will review resource allocations in experiential and SRC-based learning activities to encourage faculty members to accept additional students in these SRC/experiential existing courses. This may take the form of non-financial incentives such as service recognition to the faculty and/or post-doctoral fellows and graduate students who train and work with undergraduate Biology students. For example, we could look into a Merit Award for outstanding mentoring.

v) The Department will provide support to develop novel SRC-based learning activities in lab courses such as the use of Alphafold to predict structures of poorly studied proteins and known mutations, genetic and drug screening activities of uncommon model invertebrate organisms, and use of machine learning tools.

- <u>To develop new SRC-based and/or experiential-learning opportunities</u>:

vi) BCH880 Advanced Biochemistry Lab and BCH888 Molecular Biology Lab are lab-based courses. We aim to develop a BLGXXX Advanced Ecology Lab course to teach students methods and approaches used in ecology-focused SRC questions. Students would be required to take one of these three courses, while the remaining can be taken as electives.

Timeline: 1-2 years

Responsibility for:

a) **leading initiative:**

I, ii, and iii) Communications to be done by Biology UPDs and website staff.

iv) Resource review: Chair and Technical Manager

v) Development of SRC-based components in courses: Biology Curriculum Committee, Technical Manager, Technical Staff, and Course Instructors

vi) BLG XXX Advanced Ecology Lab course development: Biology Curriculum Committee

b) approving recommendation, providing resources, and overall monitoring:

Dept. Council and Chair.

Priority Recommendation #8

Foster engagement of departmental staff and faculty (PRT8, PPR8)

Toronto Metropolitan University

Rationale:

The PRT (Recommendation 8), as well as feedback from faculty and staff members summarized in PPR Recommendation 8, identifies the need for increased interactions between faculty and staff, in discussing curricula and other departmental matters. This is also essential in building and maintaining engagement in the Department and enhancing a sense of community.

Implementation Actions:

i) Engage with the ongoing Departmental Strategic Plan to develop and/or build on existing avenues to foster engagement between Departmental Staff, Faculty, and students.
ii) Schedule joint meetings of the Biology, Biomedical, and Chemistry Undergraduate Curriculum Committees,
iii) Continue organizing the Annual Departmental Symposium
iv) Renewal of the Departmental Retreat, located off or on campus depending on resource availability, to discuss curricular issues, SRC activities and strategies, and develop collegiality and camaraderie in the Department, which are essential for healthy, inclusive, and diverse Programs supporting students in Biology and beyond.

Timeline:

within 1-2 years, and ongoing

Responsibility for:

a) leading initiative:

CAB Chair, CAB program directors

b) approving recommendation, providing resources, and overall monitoring: