FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

BIOLOGY PROGRAM (UG)

Date of Review: February 27 and 28, 2024

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

The report 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 and who will be responsible for acting on those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the Review

In accordance with the Institutional Quality Assurance Process (IQAP), the Faculty of Science submitted a self-study in December 2023 to the Vice-Provost Teaching and Learning to initiate the cyclical program review of the Biology program. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis.

Two arm's length external reviewers and one internal reviewer were endorsed by the Dean of Faculty of Science and selected by the Vice-Provost Teaching and Learning. The review team reviewed the self-study documentation and then conducted an in-person site visit on February 27 and 28, 2024. The visit included interviews with the Vice-Provost Teaching and Learning, Deputy Provost, Dean of Faculty of Science, Associate Dean of Undergraduate Studies, Department Chair of the program, and meetings with groups of current students, full-time faculty, and support staff.

The Dean of Faculty of Science, the Chair and the Associate Chair of the Biology program submitted responses to the Reviewers' Report in June 2024. Specific recommendations were discussed, and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

The reviewers recognized our diversity as a primary strength. The Department of Biology delivers curricula rich in its diverse research areas – bioinformatics and functional genomics, cell and developmental biology, ecology and evolution, environmental physiology, genetics and molecular biology, and microbiology and plant biology – through six Biology Honours BSc degree programs (with one having a Co-operative Education and Work-Integrated Learning/Co-Op option) and seven interdisciplinary Honours BSc degree programs. Reinforcing strengths highlighted by the reviewers included (i) governance within the department – with the Biology Undergraduate Steering (BUGS) Committee receiving specific recognition; (ii) supports available to our students (with academic advising being offered virtually or in-person at the Faculty of Science level through the Office of the Associate Dean, Undergraduate Studies, and departmentally through extensive drop-in hours offered by the Academic Program Assistant (Undergraduate) as well as program faculty representatives); (iii) career development and co-op/internship placements through the Faculty's Student Career and Cooperative Education Centre and McMaster's Student Success Centre as well as peer mentoring through the student run Biology Society (BioSoc); and (iv) the manner in which our Biology programs align with university and faculty priorities.

The reviewers applauded a major response to the previous IQAP review: reorganizing and streamlining our program structure into conceptual 'core' and experimental 'research specialization' programs. Our students now receive training in broad biological disciplines, or more focused training in physiology, or molecular biology & genetics. Within these offerings, students can then choose whether to pursue more in-depth hands-on training including completing a senior undergraduate research thesis (as required within our research specializations). Students appreciate the flexibility offered by this program structure. This organizational structure also allows us to better prepare for and accommodate the demand for thesis opportunities. These changes took effect as of September 2023, and we are closely monitoring enrollment in the programs and will adjust enrollment caps for the research specializations as needed (e.g., when dealing with multiple faculty retirements and an associated reduced capacity to accommodate thesis students). The interdisciplinary Honours BSc degree offerings are functioning well and are attracting students that have shared interests with other academic units. Students in all our programs increasingly continue to enrich their undergraduate education through experiential learning opportunities, including courses in laboratory-based learning, community-engaged learning, fieldwork, and work-integrated learning or co-op opportunities.

Reviewers appreciated that the department continues to recruit and inform students through a variety of outreach events, including Level II Welcome Night for second year students in the Fall term, alongside a Research and Thesis Information Night for third-year students considering experiential opportunities in their senior year. The Department further participates in the Faculty of Science What to Do in Level II information sessions for students nearing the end in their first year, and additionally offers Biology-specific information sessions for these students.

A specific strength identified by reviewers was our first-year courses BIOLOGY 1A03 - Cellular and Molecular Biology and BIOLOGY 1MO3 - Biodiversity, Evolution and Humanity, which engage students from all Faculty of Science direct-entry programs and first-year gateways. These courses provide foundational biology concepts, skills, and training to over 1400 students each year, indicating healthy high school recruitment by the University. The reviewers appreciated the Faculty of Science's proactive role in student retention, in which students experiencing challenges in their gateway courses are identified and supported. The Office of the Associate Dean, Undergraduate Studies requests mid-term grades from first-year course instructors for review, and arranges meetings with students who are performing poorly, with the intention of providing support and assistance. Reviewers characterized this centralized support as a tangible demonstration of the Faculty of Science's dedication to retaining students who are enrolled in the two BIOLOGY gateway courses.

A final key strength noted by the reviewers centred around the Strategic Plan developed by the Department of Biology, which comprises four focal areas: (i) to provide "innovative and flexible curricula and programming"; (ii) to include "students as partners in teaching and learning"; (iii) to embrace "inclusivity in teaching, learning and outreach"; and (iv) to provide "hands-on experiential and work-integrated learning" opportunities. The reviewers noted that the plan aligns well with both McMaster University's Institutional Priorities and Strategic Framework, as well as the Learning Pillar of the Faculty of Science's Strategic Plan (2020-2025).

Opportunities for Improvement and Enhancement, including appropriateness of resources –

The reviewers made eight broad recommendations, which could be grouped into four categories: (1) Departmental capacity at faculty and staff levels; (2) faculty workload; (3) undergraduate laboratory infrastructure; and (4) communication within the Department. They also provided a number of specific recommendations in response to specific prompts from our IQAP office, which are summarized in the Table below. Within the **departmental capacity** recommendations, the reviewers noted a need for faculty renewal in both teaching-track and research-stream positions, given both recent and imminent faculty retirements. They also noted that our instructional staff (Instructional Assistants and Laboratory Technicians) complement is **very** lean, and that they considered our Department to be under-staffed in this regard.

With respect to **faculty workload**, the reviewers had two recommendations. The first was to consider giving teaching credit for undergraduate project and thesis course supervision, in lieu of graduate teaching (as most faculty members are not doing 3 units of graduate teaching each year). The second was that pedagogical scholarship be considered as a part of the academic workload of our teaching professors, and that this be considered in both annual assessments and in promotion applications.

Within the **undergraduate laboratory infrastructure** recommendation, the reviewers recognized the importance of modern instrumentation in our undergraduate laboratories and recommended that we work to maintain momentum on this front by developing a prioritization plan for future equipment investment.

The **communication** recommendations all fell under the 'Other Areas for Potential Enhancement' area and included enhancing the communication with our students regarding the process of securing thesis positions, establishing stronger communication lines between instructors who teach in courses that are offered in multiple terms to ensure greater consistency between offerings, and improved communication between the Departmental Chair and our Instructional Assistants and Laboratory Technicians.

The complete recommendations are provided within Appendix 2, and our response to these recommendations are summarized within the 'Implementation Table' below.

Note: We would like to correct an error in the self-study. The self-study incorrectly states that students in Honours Integrated Science level 2 complete the equivalent of BIOLOGY 2C03 in their course, ISCI 2A18. The students instead complete the equivalent material covered in BIOLOGY 2B03 and BIOLOGY 2F03.

Responses to Recommendations

Recommendation #1: Program Recommendations – The external reviewers had no major program recommendations.
Department's Response and Actions to be Taken: The Department of Biology will continue to monitor its programs, including course complement, course, and program enrollment to uphold excellence in teaching and ensure that student needs are met.
Dean's Response: The Faculty applauds the creative core and experimental programming options that have been introduced into the Biology curriculum. The Office of the Associate Dean, Undergraduate Studies (ADUG) will continue to work with the Department of Biology (and all Science Departments and Schools) to ensure that Level 1 intake is sustainable and aligns with Level 2 enrolment constraints.

Recommendation #2: Admission Requirements – The external reviewers felt that the admission requirement was appropriately aligned with the program learning outcomes and degree level expectations of the programs. The department's ongoing efforts to map its course learning outcomes to its PLOs and to ensure their alignment with Ontario's UDLEs are commendable. **The only recommendation is to continue these efforts to ensure that the PLOs are fulfilled as the courses offered in Biology continue to evolve.**
Department's Response and Actions to be Taken: The Department of Biology will continue to map its course learning outcomes to its Program Learning Outcomes (PLOs) to ensure that the admission requirements remain appropriately aligned with program learning outcomes, degree level expectations, and Undergraduate Degree Level Expectations for the province. The Department already is proactively considering including a PLO mapping exercise in each course as a new component in the 'teaching team template' (as described in the self-study report; this document allows all course contributors – instructors, Instructional Assistants, Technicians and Teaching Assistants – to establish and clarify expectations around course communication and responsibilities).
Dean's Response: The ADUG will support the Department during the evaluation of its courses and programming and will help facilitate any required calendar changes through the governance approval process. Integrating the PLOs within the teaching team template will be a good opportunity for all

instructional team members to revisit the PLOs for each course on an ongoing basis. In Fall 2024, the ADUG will strike a working group to assist all Departments and Schools in Science with incorporating professional skills/career- related learning outcomes across our Science program PLOs as well.

Recommendation #3: Curriculum – The Department of Biology provides an excellent set of degree programs that were recently reimagined and structured to address challenges identified in the previous IQAP review. Although these newly imagined programs were launched in 2023, by all accounts they seem to be functioning well and provide a cutting edge, yet flexible biology curriculum. **Given the newness of these programs, we recommend that the department continue to engage with students to ensure that the program goals are being realized**. Further, the **department should continue to actively inform students about its programs and experiential opportunities through the many student-focused events that are currently held and should consider ways of enhancing its messaging to students; for example, McMaster's LMS platform, Avenue, could be leveraged as an additional means to engage students by creating an undergraduate-focused Biology communications site.**

Department's Response and Actions to be Taken: The Department of Biology will continue to seek student feedback and input to ensure that our program goals are being met. We have already set a meeting with the undergraduate Biology Society (BioSoc) to discuss best practices for sharing information (e.g., identifying the most effective social media platforms) and the possibility of initiating and promoting International Student representation on the BioSoc. The Associate Chair (Undergraduate) intends to meet with the BioSoc before the start of the academic year and monthly throughout the Fall and Winter terms. The department will continue to share information with our students through in person outreach events (e.g., Level II Welcome Night, Research and Thesis Information Night), and contribute to events organized by the Faculty of Science (e.g., What to Do in Level II, May at Mac, Fall Preview). The Associate Chair (Undergraduate) and Undergraduate Program Assistant have also discussed using 'Avenue to Learn' (McMaster's learning management platform) to communicate with students about undergraduate-focused Biology events, activities, and opportunities. We will launch this initiative starting in Fall 2024 and will monitor student access and use of the information share within this site.

Dean's Response: We applaud the Department for their involvement of students as they continue to innovate their curriculum and programming. We encourage program leads to continue with monitoring of the student experience and overall satisfaction across programs. The collaboration with the Biology Undergraduate Society (BioSoc) is a natural first step as this student group will be able to consult with their constituency, and hopefully with students that represent all biology programs. Additional collaboration with the Office of Undergraduate Research (OUR) and the Science Career and Cooperative Education (SCCE) Office, may be able to provide students with additional on-campus/off-campus research and experiential opportunities, especially as the Department navigates the turnover between retirements and faculty renewal.

Recommendation #4: Teaching & Assessment – The University's IQAP Office should implement a standardized student survey for all program reviews. The survey results could be used to compare programs across the institution and be an effective tool to assess an individual program's successive improvements from each review. The survey could be sent to all students in the program to gauge their satisfaction on specific aspects of the university and the program, teaching and learning

experiences, areas they deem are strengths and weaknesses, and recommendations for improvement.
Department's Response and Actions to be Taken: The Department of Biology would be keen to work with the IQAP Office in developing a standardized student survey for program reviews if there was an appetite for standardization in this way.
Dean's Response: The Faculty of Science recognizes that the diversity in curriculum and programming across the University's various Faculties may make it difficult to create one standardized student survey, but we appreciate the recommendation that has been provided by the reviewers. Together with our Academic Review Administrator and our University IQAP office, we will explore the possibility of creating standardized surveys that can be reused by our Departments/Schools for each program review.

Recommendation #5: Resources to Meet Program Requirements – The Biology programs are operating efficiently; however, the **Department's human resources (faculty and staff) are stretched**. There will be research stream faculty retirements over the next few years. **The Department of Biology urgently needs new complement hires (teaching and research) to maintain the excellent programs and experiential learning opportunities**. Additionally, the **Department and Faculty will have to pay close attention to its aging infrastructure to ensure resources are available for ongoing facility and equipment renewal.**
Department's Response and Actions to be Taken: The Department of Biology will endeavour to continue to deliver excellence in teaching and learning in the face of a shrinking faculty complement. As the financial position of the Faculty is addressed and starts to permit new hirings, a major priority for us to address will be to hire a teaching stream faculty member; we note that our teaching-track to research-track faculty ratio is the lowest in the Faculty of Science. We communicated this need to the Faculty through an application for a teaching-stream position in the most recent Faculty Appointments Advisory Committee (FAAC) call. We stated in our application that the preferred candidate would possess expertise to help lead pedagogical initiatives for our large enrollment courses, with a particular need within our most sought-after Molecular Biology & Genetics program stream. At the June 27, 2024, Faculty Council meeting, our request for a teaching track position in the area of Genetics and Microbiology officially became one of three positions approved by the Provost, for a tentative 2025 July start date. We are incredibly grateful for the ongoing support of the Faculty of Science, particularly the Dean, Associate Dean, and (Acting) Assistant Dean, in ensuring that the Department of Biology has the resources needed to continue providing teaching excellence within our programs, in the face of significant retirements. Hirings of research stream faculty members also are a critical need, given the many recent and up-coming retirements (with eight retirements anticipated over the next three years). While these research-track faculty members would not teach as many courses as a teaching-track faculty member, research-track faculty members bring important research perspectives to our courses, supervise graduate students – who serve an essential role within our courses as Teaching Assistants, and provide project and thesis opportunities for our undergraduate students, which enrich their program experiences and foster deep experiential learning.
Dean's Response: Recognizing that there are evolving faculty renewal needs that take place each year, the Faculty encourages all Departments and Schools to submit faculty requests as part of the formalized appointments process, through the Faculty Appointments Advisory Committee (FAAC).

The Faculty continues to be proactive with the teaching and learning needs of our Departments/Schools and this past year, the FAAC focused solely on teaching track hiring requests. While hiring is currently on hold given the current fiscal challenges, we advocated for and received approval for critical CLA renewals, and teaching stream hires from the Office of the Provost. We look forward to supporting Biology as it looks to hire their new teaching-stream faculty member in the area of Genetics and Microbiology.

The Faculty of Science regularly supports Departments and Schools with funding that is needed for mission critical teaching and learning operations through the annual budget submission and consultation process. This includes funding to support materials and equipment that are needed for labs in the Department of Biology and involves a multi-year capital asset replacement plan in each academic unit. We encourage the Department to continue submitting these requests through the annual budget submission process, and to continue exploring other potential funding opportunities that may arise through other partnerships.

McMaster University

Implementation Plan

Summary of the Reviewers' Recommendations with the Department's and Dean's Responses

In the chart below, please outline the recommendations made by reviewers, briefly outline the actions you plan to take, who will be responsible for leading the action, and a timeline for completion.

Recommendation	Action(s) to be Taken	Responsibility for Leading Action	Timeline for Completing Action
Recommendation #1: Program Recommendations – None	The Department of Biology will continue to monitor its programs, including course complement, course, and program enrollment to uphold excellence in teaching and ensure that student needs are met.	Associate Chair (Undergraduate)	Ongoing
Recommendation #2: Admission Requirements – The department should continue to ensure that admission requirements align with degree level expectations and program learning outcomes (PLOs) for the programs and the PLOs continue to be fulfilled as the courses offered in Biology continue to evolve.	The department will continue to monitor admission requirements to ensure alignment with degree level expectations and PLOs and will start to implement a regular review over PLOs and their 'mapped' distribution among courses.	Associate Chair (Undergraduate) with input from the BUGS Committee and Instructional Assistants	Ongoing
Recommendation #3: Curriculum – The department should continue to engage with students to ensure that program	The department will collaborate with the BioSoc to consider ways to engage and provide	Associate Chair (Undergraduate) and Undergraduate Academic Program Assistant in	September 2024 for establishing the undergraduate-focused communication site, with ongoing development

goals are being realized (especially for recently introduced programs) and to actively inform students about its programs and experiential opportunities through the many student-focused events; the department also should consider methods to enhance its messaging to students (e.g., utilizing Avenue to Learn to create an undergraduate-focused communications site)	information to undergraduate students. The Associate Chair (Undergraduate) has requested a 'course shell' on the Avenue to Learn system, to function as an undergraduate-focused communications site; this will include minimally sections for 'Information,' Events,' and 'Resources' (e.g., scientific writing, how to write a scientific paper)	consultation with the BioSoc and input from the BUGS Committee	Ongoing for other activities
Recommendation #4: Teaching & Assessment – The IQAP Office should implement a standardized student survey for all program reviews. The survey could be sent to all students in the program to gauge their satisfaction on specific aspects of the university and the program, teaching and learning experiences, areas they deem are strengths and weaknesses, and recommendations for improvement. Survey results could be used to compare programs across the institution and be an effective tool to assess individual program successive improvements from each review.	The department would be keen to consult with the IQAP office, to provide input from experience gained with the recent review.	Associate Chair (Undergraduate) is willing to represent the department in the described capacity	TBD by the IQAP office together with Faculty of Science Academic Review Administrator and the ADUG

Recommendation #5: Resources to Meet Program Requirements – Human resources (faculty and staff) currently are stretched; the strain will increase into the future, as several research stream faculty will retire over the next few years. The Department of Biology urgently needs new complement hires (teaching and research) to maintain the excellent programs and experiential learning opportunities. The department will have to pay close attention to its aging infrastructure to ensure resources are available for ongoing facility and equipment renewal.	The department submitted an application for a teaching-stream position in response to the most recent Faculty Appointments Advisory Committee (FAAC) call; the preferred candidate would possess expertise to help lead pedagogical initiatives for our large enrollment courses, with a particular need within our most in-demand Molecular Biology & Genetics program streams. As of July 2024, we received word that the Provost has given permission to proceed with hiring into this position. Hiring research stream faculty members also is critical, given the many recent retirements (eight anticipated over the next three years); hiring new research stream faculty members would bring important perspectives as well as graduate students – as Teaching Assistants – to our courses; retaining our current research faculty complement would enable the department to continue to provide project and thesis opportunities for our undergraduate students, which enrich their program	Teaching-track faculty hiring – Chair and departmental Appointments Committee, with input from all departmental members. Research Faculty Hiring – In the next FAAC competition permitting submission of a research-track position, Chair & Departmental Executive will draft the application, after having received departmental approval for the research area).	Teaching-track position – August 2024: seek Faculty approval for position posting September/October 2024: post position and ensure it is advertised broadly November 2024: evaluate applications to arrive at a long list of candidates December 2024: virtual interview with long-listed candidates January/February 2025: interview short-listed candidates July 2025: anticipated start date for successful candidate.

	experiences and foster deep experiential learning.		

Quality Assurance Committee Recommendation

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation at the November 28, 2024, meeting. The committee recommends that the **Biology** undergraduate program should follow the regular course of action with an 18-month progress report and subsequent full external cyclical review to be conducted no later than eight years after the start of the last review.