

FOR RECOMMENDATION

PUBLIC

OPEN SESSION

TO: UTSC Academic Affairs Committee

SPONSOR: Prof. Karin Ruhlandt, Vice-Principal Academic & Dean
CONTACT INFO: vpdean.utsc@utoronto.ca

PRESENTER: Prof. Thy Phu, Acting Vice-Dean, Graduate & Postdoctoral Studies
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DATE: March 3, 2026 for March 10, 2026

AGENDA ITEM: 3

ITEM IDENTIFICATION:

New Program: PhD in Interdisciplinary and Applied Biology, UTSC

JURISDICTIONAL INFORMATION:

The UTSC Academic Affairs Committee (AAC) “is concerned with matters affecting the teaching, learning, and research functions of the Campus” (*AAC Terms of Reference*, Section 4). Under Section 5.4 of the *AAC Terms of Reference*, the Committee recommends for approval, “new undergraduate degrees, graduate programs and degrees and joint degrees and programs with external institutions as defined in the *University of Toronto Quality Assurance Process*, and the closure of such programs.” The Committee on Academic Policy and Programs recommends to the Academic Board approval of proposals for new graduate programs and degrees (*AP&P Terms of Reference*, Section 4.4.a.ii.).

GOVERNANCE PATH:

1. **UTSC Academic Affairs Committee [For Recommendation]: March 10, 2026**
2. Committee on Academic Policy and Programs [For Recommendation]: March 31, 2026
3. Academic Board [For Approval]: April 16, 2026
4. Executive Committee [For Confirmation]: May 4, 2026

PREVIOUS ACTION TAKEN:

No previous action in governance has been taken on this item.

HIGHLIGHTS:

The University of Toronto Scarborough (UTSC) is proposing a new research thesis-based program designed to equip graduates with expertise in interdisciplinary approaches, knowledge sharing, and

emerging tools in the biological sciences. The proposed PhD program in Interdisciplinary and Applied Biology (IAB) will include four main training elements:

1. A research-based thesis using interdisciplinary approaches to address practical and applied issues in biology.
2. Flexible coursework that trains students in interdisciplinary methods and relevant biological fields.
3. A practicum with a partner organization or research team to emphasize the applied and real-world application of thesis research.
4. Presentation of research and practicum reflections at an interdisciplinary colloquium.

This program is designed to meet the evolving needs of graduate students while expanding access to advanced education for a wider diversity of learners. By emphasizing applied research and varied career outcomes, the program will appeal to students who may not initially consider a purely academic pathway but are capable of excelling in an advanced degree. Students will complete coursework, practical placements, and thesis research in person. The program length will be four years for students entering with a Master's degree and five years for students entering with a Bachelor's degree (BA or BSc) as Direct-Entry students. Required components include a continuous seminar series throughout the PhD program, a core course on interdisciplinary and applied research foundations, a full-time four-month practicum with a strategic partner organization, and a colloquium that provides a formal forum for presenting thesis and practicum research.

An external appraisal of the proposed PhD program was conducted on May 21 and 22, 2025, by Dr. Silvia Cardona (University of Manitoba) and Dr. Laura Galloway (University of Virginia). The reviewers expressed strong support for the proposal, highlighting its originality and “inherently modern” focus on interdisciplinary and applied research. They noted that the program's integration of scholarly activities with internship placements, preferentially outside the academic environment, will position graduates for success in both the workforce and academic careers. The reviewers affirmed the academic rationale and objectives, confirmed that the need for this program is clear, and acknowledged that the existing core faculty can staff the program given their research interests and expertise. They also confirmed that the program can launch successfully using existing equipment, core facilities, and other campus resources. Their recommendations focused on: (1) establishing a mechanism for admitting candidates with diverse educational backgrounds and relevant research experience, and (2) ensuring appropriate resource allocation for a Graduate Administrator, Graduate Chair support, student recruitment activities, and event coordination to sustain the program over the long term.

In response to these recommendations, the minimum admission requirements for both the regular and direct-entry pathways have been revised to allow applicants from outside biology and related disciplines, provided they have relevant research experience. The program has also clarified the type of degree normally required and the minimum grade-average equivalents for each pathway to improve transparency for prospective applicants. Finally, the Office of the Vice-Principal Academic and Dean has confirmed its commitment to ensuring the resources needed to support the program are effectively deployed.

Extensive consultation informed the development of this proposal. The Department of Biological Sciences consulted with stakeholders within their department, as well as the Graduate Chairs of the Department of

Ecology and Evolutionary Biology and the Department of Cell and Systems Biology at the St. George campus. Consultations also took place with decanal leadership from the Faculty of Arts & Science, the Temerty Faculty of Medicine, the University of Toronto Mississauga, and the School of Graduate Studies. The proposal has also been reviewed by the Provost's Advisory Group and the Office of the Vice-Provost, Academic Programs.

FINANCIAL IMPLICATIONS:

There are no net implications to the campus operating budget.

RECOMMENDATION:

Be It Recommended:

THAT the new PhD in Interdisciplinary and Applied Biology, in the Department of Biological Sciences, UTSC as described in the attached proposal, be approved effective September 1, 2027.

DOCUMENTATION PROVIDED:

New Graduate Program Proposal Package, PhD in Interdisciplinary and Applied Biology, which contains:

- a. New Program Review Report (with the site visit schedule appended), dated July 3, 2025
- b. Program's (Professor Mauricio Terebiznik) Response, dated February 26, 2026
- c. Dean's (Professor Karin Ruhlandt) Response, dated February 27, 2026
- d. Vice-Provost, Academic Programs' (Professor Nicholas Rule) Response, dated March 2, 2026
- e. New Graduate Program Proposal, PhD in Interdisciplinary and Applied Biology, dated February 27, 2026

External Reviewers' Report (July 3, 2025)

UTQAP Template

New Program Review Report

Framework for UTQAP Reviews

University of Toronto Quality Assurance (UTQAP) processes support a structured approach for creating, reflecting on, assessing and developing plans to change and improve academic programs and units in the context of institutional and divisional commitments and priorities.

The University of Toronto (U of T), in its [Statement of Institutional Purpose](#) (1992), articulates its mission as a commitment "to being an internationally significant research university, with undergraduate, graduate, and professional programs of excellent quality." Thus "quality assurance through assessment of new program proposals and review of academic programs and units in which they reside is a priority for the University...:

The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching are the foundations of academic excellence. More generally, all of the factors that contribute to collegial and scholarly life —academic and administrative complement, research and scholarly activity, infrastructure, governance, etc.—bear on the quality of academic programs and the broad educational experience of students. (*Policy for Approval and Review of Academic Programs and Units* (2010))

The University's approach to quality assurance is built on two primary indicators of academic excellence: the quality of the scholarship and research of faculty; and the success with which that scholarship and research is brought to bear on the achievement of Degree Level Expectations.

These indicators are assessed by determining how our scholarship, research and programs compare to those of our international peer institutions and how well our programs meet their Degree Level Expectations.

Program(s) under review:	PhD in Interdisciplinary and Applied Biology (IAB)
Commissioning officer:	Professor Karin Ruhlandt Vice-Principal Academic & Dean
Date of scheduled review:	May 21-22, 2025
Reviewers' names and affiliations:	1. <u>Silvia Cardona</u>, Professor, Associate Head Graduate, Microbiology, Faculty of Science, University of Manitoba 2. <u>Laura Galloway</u>, Commonwealth Professor, Department of Biology, Associate Dean for Research, University of Virginia

New Program Review Report

Please provide a joint Report evaluating the standards and quality of the proposed program.

- Respect the confidentiality required for all aspects of the review process.
- Append the site visit schedule to the report.

Note: Issues that are addressed through existing, specific University procedures are considered **out of scope** for UTQAP reviews (e.g., individual Human Resources issues, specific health and safety concerns). **Any such issues raised at any point during a review process** (site visit, review report) **must immediately be brought to the attention of the commissioning officer and routed through appropriate University channels for resolution.**

A. Summary

Reviewers are asked to:

- Address the substance of the New Program Proposal.
 - Comment on the adequacy of existing physical, human and financial resources, based in part on the external reviewers' assessment of the faculty members' education, background, competence and expertise as evidenced in their CVs.
 - Acknowledge any clearly innovative aspects of the proposed program together with recommendations on any essential or otherwise desirable modifications to it.
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The Department of Biological Sciences is proposing to become a graduate unit by developing a new graduate program, the Interdisciplinary and Applied Biology (IAB) PhD program. The main characteristics of this program, as the title suggests, are its 1) interdisciplinary nature and 2) applied components. The program will be interdisciplinary because of the diversity of biology subdisciplines the faculty members' research represents, and how their research connects with

their interdisciplinary networks. The program also aims to provide an applied component by allowing the students experiential learning and research opportunities beyond academia. A PhD program with such an applied component fits very well with UTSC's well-known reputation for providing students with work experience opportunities through their co-op and internship programs.

The department is equipped with open-concept renovated laboratories, a core facility that includes state-of-the-art microscopes, cell culture, and molecular biology equipment, as well as animal facilities and a greenhouse and plant growth chambers. Technical personnel are allocated to run the facilities and a fee for service is implemented to cover contract services for the most sophisticated equipment.

The department is composed of 40 faculty members, of which 9 teaching faculty are engaged in pedagogy research. The department has been highly successful, currently holding approximately 100 graduate students registered in tri-campus programs. The expertise and record of scholarship of faculty members is impressive.

The proposed program is quite novel. Its novelty is in its applied nature, including proposed integration of scholarly activities with internship placements outside the department and preferentially outside the academic environment. In addition, the program will be unique in that the curriculum supports interdisciplinary and applied research.

The reviewers feel very strongly that this graduate program will be very successful in terms of benefiting student careers and faculty research, and the UTSC overall. Furthermore, we believe that its well-thought out and unique curriculum will be appealing to current prospective students, many of whom are looking for stronger links between graduate programs and their careers. Indeed, the program feels inherently modern, with its focus on interdisciplinarity and applied biology. The inclusion of these elements in a program with an otherwise fairly classic structure will provide robust training that creates graduates ready to succeed in the workforce or academic careers. Therefore, we recommend instituting the program as it has been developed. Our recommendations should be taken as suggestions to increase the impact and the success of the program in the long term rather than implying criticism.

B. Recommendations

Please endeavour to distinguish between observations or suggestions (which can be included in "Findings") and formal recommendations (which should be included here). **The Dean and unit/program will be required to provide a public response to every recommendation listed in this section.**

We strongly recommend the program to proceed for approval. We found the Department of Biological Sciences fully qualified to become a graduate department with a PhD program in Interdisciplinary and Applied Biology (IAB). Our evaluation is based not only on the program design, but also on the research excellence of the faculty and the department, the human resources available and the excellent facilities shown during our visit. Successfully implementing this novel, well thought-out program will require a new graduate administrator with a primary focus the IAB program. Furthermore, as this is a new program, the allocation of 25 additional graduate slots will be needed. However, this number can be achieved incrementally, with the addition of five students per year for the first five years of the program.

The creation of the IAB program will fulfill the high interest students have voiced in studies that integrate academic activities with real-world experiences, preparing them well for diverse career opportunities. The program will allow peer-to-peer learning and cohort building contributing to a sense of community already felt at the departmental level. Finally, the program will enhance the reputation of the University of Toronto and the already strong research and training reputations of the UTSC Department of Biological Sciences.

C. Program Evaluation Criteria

Please provide commentary on the following evaluation criteria. In some cases, it may be preferable to address multiple criteria holistically. In such cases, please clarify which criteria are relevant to the comments.

1 Academic rationale and program objectives

- a) Clarity of the program's [objectives](#).
- b) Appropriateness of degree or diploma nomenclature given the program's objectives.
- c) Consistency of the program's objectives with the institution's mission and the University of Toronto's/the division's/unit's academic plans, priorities and commitments, including consistency with any implementation plans developed following a previous review.
- d) Evidence that the following have been substantially considered in the development of the program and its associated resources:
 1. Universal design principles and/or the potential need to provide mental or physical disability-related accommodations, reflecting the University's [Statement of Commitment Regarding Persons with Disabilities](#)
 2. Support for student well-being and sense of community in the learning and teaching environment, reflecting the work of the [Expert Panel on Undergraduate Student Educational Experience](#) and the commitment to establishing a Culture of

Caring and Excellence as recommended by the [Presidential and Provostial Task Force on Student Mental Health](#)

3. Opportunities for removing barriers to access and increasing retention rates for Indigenous students; for integrating Indigenous content into the curriculum in consultation with Indigenous curriculum developers; and for addressing any discipline-specific calls to action, reflecting the commitments made in [Answering the Call: Wecheehetowin: Final Report of the Steering Committee for the University of Toronto Response to the Truth and Reconciliation Commission of Canada](#) (PDF)
 4. Opportunities for removing barriers to access and increasing retention rates for Black students; for promoting intersectional Black flourishing, fostering inclusive excellence and enabling mutuality in teaching and learning, reflecting the commitments made in the [Scarborough Charter](#) and consistent with the recommendations of the [Anti-Black Racism Task Force Final Report](#)
 5. Opportunities for fostering an equitable, diverse and inclusive teaching and learning environment, reflecting the values articulated in existing institutional documents such as the [Statement on Equity, Diversity, and Excellence](#), the [Antisemitism Working Group Final Report](#), the aforementioned reports, and future institutional reports related to equity, diversity and inclusion.
- e) Unique curriculum or program innovations, creative components, significant high-impact practices, where appropriate.
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- a) The program's objectives have been clearly developed and what we'd expect in a top PhD program. They outline the academic rationale of the proposed program, aiming to i) develop a deep understanding of biology, its methods and applications (objectives 1 and 2); ii) achieve scientific literacy and research methodologies across multiple disciplines of biology (objectives 3 and 4); iii) conduct and manage original research at the intersection of multiple fields in biology (objectives 5 and 6); and iv) acquire effective communication skills to a vast range of audiences (objective 7). Objective 8, which relates to awareness of the validity and applicability of the aforementioned scientific methods, embraces the philosophy of the program by enhancing the student's ability to critically evaluate the strengths and limitations of methods and approaches in science.
- b) These objectives are appropriate for a program that aims to train students in applied biological research, and to interact with individuals and organizations beyond the classical laboratory and academic environment. Therefore, the nomenclature of the program represents well the objectives of the program.

- c) The University of Toronto Scarborough's mission is to foster an academic community where learning and scholarship of every member is enhanced within the context of human rights protection and under the principles of equal opportunity, equity and justice. The institution is committed to strengthen graduate education through the enrichment of graduate student experience and a focus on intellectual and intercultural competencies to succeed in a global world. This commitment was made clear through interactions with the Dean, the Decanal Team of the institution, and the Dean and members of the School of Graduate Studies. The proposed program will prepare students for leadership positions, applying biological knowledge and the scientific process to address global challenges. Therefore the program is consistent with the mission of the institution. The program design and objective are consistent with the University of Toronto Scarborough's focus on experiential learning. Finally, this program is consistent with the self-defined mission of the Department, which focuses on emphasizing interdisciplinary collaboration to address complex biological questions. In total, the program has been thoughtfully developed to build on the strengths of the department, the campus, and the overall institution.
- d) The new program complies with the expected considerations regarding i) mental or physical accessibility, ii) well-being during the educational experience, iii) removing barriers for Indigenous students, iv) fostering Black student success through inclusive excellence efforts, and v) embracing values of equity, diversity and excellence. Specifically, the proposed program has developed paragraphs that describe universal design principles (learning outcomes, page 126), and propose to leverage departmental initiatives to remove barriers to Indigenous and Black students (program development and resources, page 14).
- e) The uniqueness and innovative aspect of the program is its emphasis on the application of diverse fields of biology to real-world problem solutions. The program is truly novel. To our knowledge, there is no similar graduate program in the University of Toronto, or in other universities in Canada or internationally. Important aspects are the integration of multiple subdisciplines of biology with a mandatory 4- month practicum with an academic, industry, NGO or government partnership, allowing the students to gain hands-on experience in their preparation for diverse career paths and specific needs. At some other academic institutions graduate students can elect to do an internship. However, these experiences are extracurricular add-ons. In the IAB, the interdisciplinarity and applied elements of the program are integrated into the core of its design, providing a novel structure and greater impact on student learning.

2 Program Requirements

- f) Appropriateness of the program's structure and the requirements to meet its objectives and program-level learning outcomes, including the structure and requirements of any identified streams (undergraduate), fields or concentrations (graduate).
 - g) Appropriateness of the program's structure, requirements and program-level learning outcomes in meeting the institution's applicable undergraduate or graduate Degree Level Expectations.
 - h) Appropriateness of the proposed mode(s) of delivery (i.e., means or medium used in delivering a program; e.g., lecture format, distance, online, synchronous/asynchronous, problem-based, compressed part-time, flexible-time, multi-campus, inter-institutional collaboration or other non-standard forms of delivery) to facilitate students' successful completion of the program-level learning outcomes.
 - i) Ways in which the curriculum addresses the current state of the discipline or area of study and is appropriate for the level of the program.
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- f) The structure of the program comprises coursework; the PhD qualifying exam, where the students present their PhD thesis proposal; a 4-month practicum placement; and the submission of the PhD thesis, followed by an oral examination. The practicum and coursework that emphasize interdisciplinarity and communication about research and applied experiences are elements that are specific to the objectives of this program. Fulfilment of these requirements will allow the students to meet the objectives of the program and achieve the required learning outcomes.
- g) The program meets the University of Toronto degree level expectations (DLEs) for graduate programs, which are 1) depth and breadth of knowledge, 2) the ability to conduct research and scholarly activities, 3) application of knowledge, 4) professional capacities, 5) communication skills, and 6) awareness of the limitations of knowledge. Students who meet the objectives of the program will achieve the level of expectation for earning a PhD from the University of Toronto.
- h) The program contains a mix of delivery forms, comprising of in-person coursework, practicum and research activities under the guidance of faculty supervisors and supervisory committees, and plenty of opportunities to exercise communication skills, through an annual colloquium. These delivery forms are appropriate to the activities being conducted and will help develop a range of skills in the students.
- i) Graduate education in Biology is typically siloed within disciplines, e.g. ecology and

evolution, or cell and molecular biology. However, the field is increasingly interdisciplinary requiring integration across subdisciplines, such as cell biology, molecular biology, physiology, neuroscience, ecology and evolutionary biology. These subdisciplines require advanced methodologies such as imaging, data analysis and visualization, bioinformatics and methods in molecular biology. This diverse expertise is represented in the research performed by faculty members of the Department of Biological Sciences. The proposed program leverages the expertise of faculty members, and their work together permits addressing the current state of biology during course delivery and when supervising their students.

3 Program Requirements for Graduate Programs Only

- j) Clear rationale for program length that ensures that students can complete the program-level learning outcomes and requirements within the proposed time.
 - k) Evidence that each graduate student in the program is required to take all of the course requirements from among graduate-level courses.
 - l) For research-focused graduate programs, clear indication of the nature and suitability of the major research requirements for degree completion.
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- j) The IAB program length is normal for the PhD level (4 years full-time for students starting with a Master's degree and 5 years full-time for direct entry with a bachelor's degree). While these timelines ensure that most students will have adequate time to complete coursework, research, practicum and thesis requirements, the maximum time limits (6 years and 7 years, respectively) are in place for students in case of additional circumstances such as unexpected delays in their experimental approaches.
- k) The program requires students to complete 2 full course equivalents (FCEs) for regular PhD students and 2.5 FCEs for direct-entry PhD students. This need is fulfilled by specific graduate-level courses such as IAB1100H (Foundations of Interdisciplinary and Applied Research, 0.5 FCE), IAB3300H (Interdisciplinary and Applied Biology Practicum), and IAB3310H (Interdisciplinary and Applied Research Colloquium). The additional 0.5 FCE is provided by additional coursework chosen from other graduate departments. There does not seem to be a minimum number of FCEs required at the School of Graduate Studies, but each program must ensure the students comply with coursework at the graduate level.
- l) The program has a strong research orientation. The students are required to conduct original research culminating in a thesis. The thesis must represent a

distinct contribution to the field, combine subdisciplines and address an applied component. During the PhD qualifying exam, the students will write a research proposal, which will be followed by a public presentation and a questioning period by the examining committee. The requirement of original research is common to PhD programs. The IAB program has an additional research component that is fulfilled by the practicum placement. This experience is designed as a component of the thesis work, and provides students the opportunity to learn about the value of applied research with its application to address real-world problems and unknowns.

4 Admission Requirements

- m) Appropriateness of the program's admission requirements given the program's objectives and program-level learning outcomes.
 - n) Sufficient explanation of alternative requirements, if applicable, for admission into a graduate, second-entry or undergraduate program, e.g., minimum grade point average, additional languages or portfolios and how the program recognizes prior work or learning experience.
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- m) The program admission requirements are typical of a PhD program. For the regular admission to the program, students must hold a master's degree in a relevant discipline with an average grade equivalent to a University of Toronto A-. In addition, the students must show evidence of research potential, evidenced by application materials, such as letters of recommendation, statement of interest, and research experience. For direct entry to the PhD program, students must be academically exceptional (a minimum average grade or other academic achievements are mentioned to define exceptional), hold a bachelor's degree in biology or a relevant discipline and demonstrate evidence of research potential through the application materials. In both cases admission is only possible when a faculty member agrees to supervise the student's research and guarantees a full stipend.
- n) While the requirements are appropriate to ensure a high chance of success for the students admitted to the program, alternative requirements which will allow candidates who do not meet the stated requirements but have a unique combination of education and expertise appropriate to the program, should be considered for this PhD program with an applied focus.

5 Assessment of Teaching and Learning

- o) Appropriateness of the methods for assessing student achievement of the program-level learning outcomes and degree level expectations.
 - p) Appropriateness of the plans to monitor and assess:
 - 1. The overall quality of the program
 - 2. Whether the program is achieving in practice its proposed objectives
 - 3. Whether its students are achieving the program-level learning outcomes
 - 4. How the resulting information will be documented and subsequently used to inform continuous program improvement.
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- o) Student achievement will be assessed through relevant coursework, supervisor mentorship/annual committee meetings, the knowledge demonstrated in the qualifying exam, and the student's ability to defend their dissertation. These are typical assessment mechanisms for doctoral-level programs and appropriate for the proposed program. In addition, students will be assessed on their ability to communicate their knowledge orally and in writing via written assignments and presentations to professional audiences. These are typical assessment mechanisms for doctoral-level programs and appropriate for the proposed program.
- p) Overall, the methods proposed for assessing the quality of the program, whether it is achieving its objectives, and whether student outcomes reflect program goals are well-thought out and will be routinely implemented.
- p1) The overall quality of the program will be evaluated by reviewing various program-level metrics, e.g. enrollment data, qualifying exam success rates, and time to completion. The evaluation will be done in accordance with the criteria and timelines of the UTQAP process, which provides a comprehensive system for reviewing academic programs to ensure that they meet with the standards and expectations of the University of Toronto. Plans to assess the program following the UTQAP process will ensure the quality of the program.
- p2) The achievement of the proposed objectives by the program will be determined by an annual review of the components of the program (i.e. courses, qualifying exams, committee meetings, dissertation defenses). The review will ensure that the program, as it is being carried out, aligns with its learning outcomes. Further, student feedback (e.g. student evaluation of teaching) will be used to ensure that the student experience also aligns with the proposed outcomes.
- p3) The achievement of program-level learning outcomes by students will be determined by ensuring that course syllabi match program learning goals, and monitoring student achievement through success in courses, in qualifying exams, in annual committee meetings and in the dissertation defense. Through these activities

students will be assessed as to whether they are meeting the learning objectives of the program.

- p4) Every year the Graduate Program Chair will convene a committee to review program components in relation to program objectives and student-learning outcomes (see 2,3 above). This committee will provide recommendations for program improvement and alignment with program goals to the Graduate Program Chair, thus providing a framework for continuous program improvement.

6 Resources

Given the program's planned/anticipated class sizes and cohorts as well as its program-level learning outcomes:

- q) Participation of a sufficient number and quality of core faculty who are competent to teach and/or supervise in and achieve the goals of the program and foster the appropriate academic environment.
 - r) If applicable, discussion/explanation of the role and approximate percentage of adjunct and sessional faculty/limited term appointments used in the delivery of the program and the associated plans to ensure the sustainability of the program and quality of the student experience (see [QAF Guidance](#)).
 - s) If required, provision of supervision of experiential learning opportunities
 - t) Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, including implications for the impact on other existing programs at the University.
 - u) Evidence that there are adequate resources to sustain the quality of scholarship and research activities produced by students, including library support, information technology support and laboratory access.
 - v) If necessary, additional institutional or divisional resource commitments to support the program in step with its ongoing implementation.
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- q) A total of 31 of the 40 faculty in Biological Sciences will participate in the IAB graduate program, including 29 tenure-stream faculty and two teaching-stream faculty. Most faculty have primary graduate appointments in either Ecology & Evolutionary Biology (EEB) or Cell and Systems Biology (CSB), but their contributions to graduate teaching have been less than colleagues in the St. George Campus due to the logistical complexity of course offerings not being based at their home campus. As such, there is an ample number of faculty members who can staff the proposed courses (7 new, 2 ongoing). These faculty will also serve as mentors for

the ~25 students expected once the program has a steady-state enrollment (an increase in 5 students/year). As indicated in Section 8 below, these faculty have strong research programs and are well-recognized in their fields, indicating that they will introduce graduate students to quality research. The faculty in the Biological Sciences department cover a broad spectrum of research interests. Interactions between faculty, as well as between faculty and applied collaborators, give rise to the department's strength in interdisciplinary and applied research. Their current graduate courses, e.g. Advanced Microscopy and Imaging, have strong enrollment by graduate students from across the tri-campus system indicating the quality of the classroom training that is provided.

- r) Not applicable.
- s) Graduate students will undertake experiential learning opportunities, i.e. practicums, typically with non-academic partner institutions. The host of the practicum will serve on the student's graduate committee and hence will be integrated into student's mentoring team. Because the practicum will be a component of the dissertation, the student's advisor will also interact with the student during the practicum. Hence, while the host will also assist with the supervision during the practicum the dissertation advisor will be fully engaged, yielding continuity in the student's supervision.
- t) The Department of Biological Sciences will take advantage of existing infrastructure to support the planned IAB program. This includes office and lab space for trainees from within the advisor's space, space for TA responsibilities and classroom space from that available at UTSC. Research/office space will not impact existing programs as it occurs within space assigned to the advisor. Space for TA responsibilities is a requirement of the TA positions and hence is not space that is dedicated to this program as much as to the courses that the TA supports.
- u) The Department of Biological Sciences has a liaison within the library who provides assistance with accessing research and TA resources. In addition, the Centre for Teaching and Learning (CTL) provides support for Teaching Assistants. The department has ample common equipment, core facilities and support staff to provide state-of-the-art tools for students to use in their research. Indeed, the culture of community access for common equipment is seen as a real asset of graduate training in the department. Finally, all graduate students will have access to their supervisor's lab that will serve as "home" for their research.
- v) A new graduate administrator will be required to support starting the IAB program. This position has been requested by the Biological Sciences Department and subsequently approved by the UTSC Dean's Office. The resources are in place

for this hire, including office space. Additional resources will be required for a stipend and teaching release for the Graduate Chair of the program, recruiting and event costs. Finally, not surprisingly, the development of a new graduate program will require the allocation of graduate slots. As designed, 25 slots will be needed once the program reaches steady state. However, this number will be achieved incrementally, with the addition of five students per year for five years.

7 Resources for Graduate Programs Only

Given the program's planned/anticipated class sizes and cohorts as well as its program-level learning outcomes:

- w) Evidence that faculty have the recent research or professional/clinical expertise needed to sustain the program, promote innovation and foster an appropriate intellectual climate.
 - x) Where appropriate to the program, evidence that financial assistance for students will be sufficient to ensure adequate quality and numbers of students.
 - y) Evidence of how supervisory loads will be distributed, in light of qualifications and appointment status of the faculty.
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- w) Faculty at UTSC Biological Sciences are active in research and intellectually engaged with their fields. This is addressed in depth in Section 8. In brief, research funding levels are consistent over years and tri-council grant participation rate since 2013 for UTSC Biological Sciences research faculty is over 85%. Career-stage adjusted expectation for scholarly metrics based on citations, such as the H-index, for Biological Sciences faculty are at or above levels considered to be “good”, a metric commonly used in evaluations for promotion, although not without its limitations. Together this indicates a faculty with robust research expertise that will provide students with a cutting-edge, engaging intellectual climate.
- x) The current base funding package for graduate students at the University of Toronto is \$40,000 per year (including tuition) for four years, with five years of support to those coming through the “direct entry” option. This is comprised of TAs, RAships and scholarships to varying extents among students. Individual packages will vary depending on specific components, but many are expected to be higher than the base. This is a new base funding package, larger than previous years, and is anticipated to be very competitive for recruiting students, leading to many, quality applications.

There are resources to support the additional students in the IAB program. With the addition of the new Scarborough Academy of Medicine and Integrated Health

(SAMIH), UTSC is growing in undergraduate enrollment including an additional 1,728 students expected to add to the over 3,714 presently in the Biological Sciences programs. These new undergraduate students will bring increasing demand for course offerings and enrollments to Biological Sciences, driving a need for additional TA support. Furthermore, in our campus visit, we learned that faculty currently have an excess of grant support earmarked for graduate students relative to the number of graduate students currently in labs, indicating capacity to increase student numbers without additional grant support.

- y) Supervisory loads will be distributed according to the capacity and resources of individual PIs. This plan is the same as the current model of recruitment of graduate students through tri-campus programs. At present, student capacity and resources for students are influenced by the grant support available and the number of students currently being mentored. These practices will also be used to place students for the IAB program. Placement in labs for the IAB program may also be influenced by a PI's partnerships with opportunities for practicum placements. In total, the distribution of supervisory loads has been carefully considered and will lead to student success.

8 Quality and Other Indicators

- z) Evidence of the quality of the faculty (e.g., qualifications, funding, honours, awards, research, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the program and commitment to student mentoring)
 - 1. The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching.
- aa) Any other evidence that the program and faculty will ensure the intellectual quality of the student experience.
- bb) Any additional indicators of quality identified by the division or academic unit.
- cc) How the proposed program compares to the best in its field among international peer institutions.

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- z) UTSC Biological Sciences has a very strong, well-funded, faculty that are active in research and graduate training.

The Department of Biological Sciences has 40 faculty members, of which 30 are tenure stream with active research programs. These include many high-profile researchers that have been recognized with Canada Research Chairs (CRC), the Royal Society of Canada and the American Academy of Arts & Science. For instance,

Bebhinn Treanor who chairs the IAB proposal writing team has a CRC Tier II Chair; and was just awarded a Phase I grant for a University of Toronto Institutional Strategic Initiative (ISI) on “One Health”; a major premise of the interdisciplinary PhD proposal. Other faculty include former CRC Tier I Chair holder Maydianne Andrade who is an international expert in black widow spider mating and co-founder of TIDE and the Canadian Black Scientists Network; CRC Tier II Chair holder Christina Guzzo, a leader in HIV flow virometry techniques and part of the EPIC pandemic-focused consortium at U of T; Peter Molnar who models climate change impact on polar bears with a high profile that includes a recent paper accepted in Science; and Ken Welch who has shown a unique metabolism in vampire bats that was recently covered by international media outlets. Additionally, key proponents of the proposal have held senior leadership positions in the VP Dean and VP Research offices (Andrade, Cadotte, Welch & Harrison).

Since 2011, Biological Sciences faculty have attracted more than \$2-3M annually in research funding, and these funding rates have remained consistent over the past several years. Biological Sciences faculty participate in federal tri-council (Natural Sciences & Engineering Research Council, NSERC, Canadian Institutes of Health Research, CIHR, or Social Sciences & Humanities Research Council, SSHRC). In addition, private, government and not-for-profit sectors (e.g. MITACS) provide significant and continuous support to their research programs. The tri-council grant participation rate since 2013 for the department is over 85%. This is significantly higher than the comparator (Division IV Life Sciences at U of T) over the same period.

Biological Sciences faculty have research programs that make an impact on their fields in part by authoring high-quality, high-impact papers. This can be determined through citation rates of their scholarly publications. The h-index for Biological Sciences faculty, a broadly used scholarly metric based on citations, is at or above the “typical” levels for each academic rank for all faculty, with at least half of the faculty at each rank having very strong h-indices. This indicates a faculty that is active and making important contributions to their fields.

The commitment to student mentoring is clear from the number of students presently being supported and mentored in the department. Approximately 111 graduate students, 68 PhD and 43 MSc, from 4 graduate units, including the tri-campus programs in Cell and Systems Biology, Ecology and Evolutionary Biology, Physical and Environmental Sciences, as well as Immunology. We spoke with current graduate students about their training and mentoring experiences and the intellectual community in the Biological Sciences department at UTSC. Graduate

students were uniformly positive about the UTSC community and their training environment, indicating the commitment to graduate education of the faculty and success of their graduate mentoring.

Finally, the faculty in Biological Sciences are a great fit for the proposed IAB program. The faculty already engage in an interdisciplinary way around graduate teaching (see also answer to the next question). Graduate courses are typically team taught with team members coming from different areas within the broad discipline of biology, creating an interdisciplinary flavor to classroom education. A number of faculty members have research in which they engage with non-academic partners, be they federal, foundation or industry. The IAB program will capitalize on these relationships and build them out.

z1) UTSC Biological Sciences faculty are known for the degree to which they bring scholarship into their teaching. For example, the faculty offer an Advanced Microscopy and Imaging course (CSB1018H) that is enrolled by graduate students from across the tri-campus system. The planned “Foundations of Interdisciplinary and Applied Research” (IAB1100H) as well as “Visualization and Presentation of Research Findings” (IAB2200H) courses build on faculty scholarly expertise and are likely to make an impact beyond the UTSC campus.

aa) The IAB program includes a seminar series. This departmental seminar series already exists and provides an alternative to cognate graduate unit course requirements (e.g., CSB1011Y/Y - PhD Seminar series) for UTSC-based graduate students. This seminar series will introduce graduate students to the research of a broad range of scientists outside of their program. It also serves as a key component of the intellectual community of the department. The IAB Research Colloquium will provide similar opportunities, but through exposure to research that is ongoing within the department and as part of practicums. Again, it is expected to enhance the intellectual community of the department, as well as provide an appreciation of the applied potential of Biological Sciences research and a preview of practicum experiences to junior students in the program.

bb) N.A.

cc) The proposed program is novel; there is no match, even at an international level! Two international programs provide doctorate level training in “Applied Biology”: University of Massachusetts – Lowell and the Royal Melbourne Institute of Technology. Neither of these programs integrate a practicum into their requirements. Therefore, while the topics of the research may be applied, the

delivery of the training experience is not. There is no question that the proposed program is filling a unique niche! At the same time, the IAB program addresses well-recognized needs for interdisciplinarity in graduate education in biology – a field where training is typically much more siloed than how research is conducted – as well as the desires of students who are increasingly interested in non-academic career options.

9 Commissioning Officer Acceptance

After receiving the report from the reviewers, the commissioning officer formally accepts the final report and fills in the table below.

As Commissioning Officer, I confirm that: ✓ The New Program Proposal and all relevant faculty CVs were provided to the reviewers to support their assessment of the new program. ✓ The Report addresses the program evaluation criteria, as required by the UTQAP. ✓ I have brought to the attention of the reviewers any clear factual errors in the report and the reviewers have corrected these. ✓ I have brought to the attention of the reviewers any omitted UTQAP requirements. ✓ I have attached the site visit schedule to the report.	
Commissioning Officer: Professor Karin Ruhlandt, Vice-Principal Academic & Dean 	Report Accepted as Final on July 3, 2025

PROGRAM APPRAISAL SITE-VISIT SCHEDULE
PhD Program in Interdisciplinary and Applied Biology (IAB)
Department of Biological Sciences

Review Team:

- [Silvia Cardona](#), Professor, Associate Head Graduate, Microbiology, Faculty of Science, University of Manitoba
- [Laura Galloway](#), Commonwealth Professor, Department of Biology, Associate Dean for the Sciences and Research, University of Virginia

In-Person Site-Visit Dates:

- Wednesday, May 21, 2025: 8:30 am – 5:00pm ET
- Thursday, May 22, 2025: 9:00 am – 5:00pm ET

Zoom Details:

- Meeting URL: <https://utoronto.zoom.us/j/87461147908>
- Meeting ID: 874 6114 7908
- Passcode: 657328

***Please note:** You will be placed in the waiting room upon joining and admitted once the host is ready.

Day 1: Wednesday, May 21, 2025		
TIME (ET)	DETAILS	LOCATION
8:30 am to 9:00 am	Set-up Meeting and Review Team Introductions • Professor Silvia Cardona (Reviewer) • Professor Laura Galloway (Reviewer) • Rene Harrison, Vice-Dean Graduate & Postdoctoral Studies • Kevin Mak, Academic Programs Officer • Lee Bazely, Programs and Curriculum Specialist • Sarah Chaudhury, Programs and Curriculum Specialist	SRB Building SY141A
9:10 am to 9:50 am	Briefing Meeting with Dean and Decanal Team • Karin Ruhlandt, Vice-Principal Academic and Dean • Rene Harrison, Vice-Dean Graduate & Postdoctoral Studies • Katie Larson, Vice-Dean Teaching, Learning & Undergraduate Programs • David Zweig, Vice-Dean Recruitment, Enrolment & Student Success • Jessica Fields, Vice-Dean of Faculty Affairs, Equity & Success • Suzanne Sicchia, Associate Dean Undergraduate Programs & Curriculum • Lynn Tucker, Associate Dean, Experiential and Global Learning • Zahra Bhanji, Assistant Dean • Kevin Mak, Academic Programs Officer	SRB Building SY141A
10:00 am to 10:50 am	Meeting with Department of Biological Sciences Chair and Senior Leadership	Biology Chair Office - SW421H

	• Mauricio Terebiznik, Associate Professor & Chair • Bebhinn Treanor, Professor & Associate Chair Research & Graduate Studies • Shelley Brunt, Associate Professor, Teaching Stream & Associate Chair Teaching & Undergraduate Affairs • Karolyn Keir, Manager of Operations and Finance	
10:50 am to 11:05 am	BREAK	
11:05 am to 12:00 pm	Meeting with the Biological Sciences Core IAB Faculty (Group A) • Bebhinn Treanor, Professor • Ken Welch, Associate Professor • Andrew Mason, Professor • Aarthi Ashok, Professor, Teaching Stream • Rachel Sturge, Associate Professor, Teaching Stream • Maydianne Andrade, Professor	SRB Building SY141A and Zoom
12:00 pm to 1:00 pm	LUNCH	SRB Building SY141A
1:00 pm to 1:30 pm	Meeting with Vice-Principal Research and Innovation • Alison Mountz, Interim, Vice Principal Research and Innovation	SRB Building SY141A
1:40 pm – 2:10 pm	Meeting with UTSC Graduate Administrators • Shelley Eisner, Campus Graduate & Postdoctoral Administrator • Gisela Bento, Campus Graduate & Postdoctoral Coordinator	SRB Building SY141A
2:20 pm to 3:00 pm	Meeting with the Vice-Dean, School of Graduate Studies, St. George Campus and Former Graduate Chair of Clinical Psychology PhD Program at UTSC • Vina Goghari, Professor	Zoom
3:00 pm to 3:15 pm	BREAK	
3:15 pm to 4:00 pm	Tour of Biological Sciences Infrastructure - Plant Growth Facilities Labs and Centre for the Neurobiology of Stress (CNS) • Adam Mott, Assistant Professor and Director of the Plant Growth Facilities • Christina Guzzo, Associate Professor and Director of the Centre for the Neurobiology of Stress	In person
4:10 pm to 4:50 pm	Meeting with Department and Graduate Chair of Physical and Environmental Sciences • George Arhonditsis, Professor	SRB Building SY141A
5:00 pm	Departure from UTSC to Yorkville Hotel Sonesta • Professor Silvia Cardona (Reviewer) • Professor Laura Galloway (Reviewer) • Lee Bazely, Programs and Curriculum Specialist • Sarah Chaudhury, Programs and Curriculum Specialist	

Day 2: Thursday, May 22, 2025		
TIME (ET)	DETAILS	LOCATION
9:00 am to 9:30 am	Initial Set-up Meeting with Reviewers - Professor Silvia Cardona (Reviewer) - Professor Laura Galloway (Reviewer) - Rene Harrison, Vice-Dean Graduate & Postdoctoral Studies - Kevin Mak, Academic Programs Officer - Lee Bazely, Programs and Curriculum Specialist - Sarah Chaudhury, Programs and Curriculum Specialist	SRB Building SY141A
9:30 am to 10:00 am	Meeting with Biology Department Chairs at St. George Campus - Nicholas Provart, Department Chair, Cell & Systems Biology (CSB) - Joel Levine, Department Chair, Ecology & Evolutionary Biology (EEB)	Zoom
10:10 am to 10:45 am	Meeting with UofT Mississauga Department of Biology Chair Steven Short, Associate Professor & Department Chair of Biology, UofT Mississauga	Zoom
10:45 am to 11:00 am	BREAK	
11:00 am to 12:00 pm	Meeting with the Biological Sciences Core IAB Faculty (Group B) - Nick Mandrak, Professor - Péter Molnár, Associate Professor - Scott MacIvor, Associate Professor - Marc Cadotte, Professor - Cosima Porteus, Assistant Professor - Adam Mott, Assistant Professor - Christina Guzzo, Associate Professor - Eliana Gonzales-Vigil, Assistant Professor - Rongmin Zhao, Associate Professor - Ina Anreiter, Assistant Professor - Xue Pan, Assistant Professor - Eyal Gruntman, Assistant Professor	SRB Building SY141A and Zoom
12:10 pm to 1:00 pm	Graduate Student Lunch with Reviewers - Professor Silvia Cardona (Reviewer) - Professor Laura Galloway (Reviewer) - Arvin Persaud, PhD Student in Cell and Systems Biology - Serene Moussaoui, PhD Student in Cell and Systems Biology - Jerrica Jamison, PhD Student in Cell and Systems Biology - Laini Taylor, PhD Student in Ecology and Evolutionary Biology - Hena Sheth, PhD Student in Cell and Systems Biology - Andreea Bosorogan, PhD Student in Cell and Systems Biology - Garland Xie, PhD Student in Ecology and Evolutionary Biology - Joe Kawalec, PhD Student in Environmental Science - Becky Heineman, PhD Student in Cell and Systems Biology	Grad Lounge SW524A (In-Person Only)
1:10 pm to 1:50 pm	Aquatics/Vivarium Tour - Kimberly Hannon-Kovacs, Vivarium Director - Rene Harrison, Vice-Dean Graduate & Postdoctoral Studies	Aquatics/Vivarium SW121

2:00 pm to 2:30 pm	Meeting with the Biological Sciences Administrative Staff • Karolyn Keir, Manager of Operations and Finance • Jennifer Campbell, Administrative Coordinator • Vanessa Melo, Assistant to the Chair • Vania Branker, Program Coordinator	SRB Building SY141A
2:40 pm – 3:00 pm	Reviewer Consultation • Professor Silvia Cardona (Reviewer) • Professor Laura Galloway (Reviewer)	SRB Building SY141A
3:00 pm to 3:15 pm	BREAK	
3:15 pm to 4:00 pm	Reviewer Consultation and Meeting with the Vice-Dean Graduate & Postdoctoral Studies • Rene Harrison, Vice-Dean Graduate & Postdoctoral Studies	SRB Building SY141A
4:10 pm to 5:00 pm	Debriefing Meeting with Dean and Decanal Team • Karin Ruhlandt, Vice-Principal Academic and Dean • Rene Harrison, Vice-Dean Graduate & Postdoctoral Studies • Katie Larson, Vice-Dean Teaching, Learning & Undergraduate Programs • David Zweig, Vice-Dean Recruitment, Enrolment & Student Success • Jessica Fields, Vice-Dean of Faculty Affairs, Equity & Success • Suzanne Sicchia, Associate Dean Undergraduate Programs & Curriculum • Lynn Tucker, Associate Dean, Experiential and Global Learning • Zahra Bhanji, Assistant Dean • Kevin Mak, Academic Programs Officer	SRB Building SY141A
5:00 pm	Departure from UTSC to Yorkville Hotel Sonesta • Professor Silvia Cardona (Reviewer) • Professor Laura Galloway (Reviewer) • Lee Bazely, Programs and Curriculum Specialist • Sarah Chaudhury, Programs and Curriculum Specialist	

Program's Response (February 26, 2026)

February 26, 2026

Professor Karin Ruhlandt
Vice-Principal Academic & Dean
Office of the Vice-Principal Academic & Dean
University of Toronto Scarborough

Chair's Administrative Response: New Program Review for the PhD in Interdisciplinary and Applied Biology

Dear Dean Ruhlandt,

I am pleased to provide the departmental administrative response to the external review of our proposed new PhD program in Interdisciplinary and Applied Biology.

On behalf of the Department of Biological Sciences, I would like to thank the reviewers: Dr. Silvia Cardona, Professor and Associate Head (Graduate), Microbiology, Faculty of Science, University of Manitoba; and Dr. Laura Galloway, Commonwealth Professor, Department of Biology and Associate Dean for the Sciences and Research, University of Virginia, who were commissioned to conduct an external review of the program. A site visit was held on May 21 and 22, 2025, during which the reviewers met with academic leadership, faculty and staff affiliated with the proposed program at the University of Toronto Scarborough, current academic leadership and PhD students from the University of Toronto's tri-campus cognate units, as well as the Vice-Dean, Research and Program Innovation at the School of Graduate Studies. The reviewers submitted their final report on July 3, 2025.

The reviewers expressed strong support for the proposed PhD program, highlighting its originality, its "inherently modern" interdisciplinary and applied focus, and its effective integration of scholarly training with non-academic internship placements. They concluded that the program's distinctive curriculum, robust departmental support, and the Faculty's "impressive" expertise and research record will position graduates for success in both academic and non-academic careers. I am pleased that the reviewers recommended approval of the program "as developed," and I welcome their suggestions for strengthening long-term student experience, particularly in community building, career development, and research training. In preparing this response, I consulted with faculty colleagues and the graduate program committee led by the Associate Chair for Research and Graduate Studies, through our regular monthly meetings and additional one-on-one discussions throughout the year.

Resources

The reviewers confirmed that the program can be staffed by existing core faculty given their research interests and areas of expertise. They also acknowledged our ability to launch the program using current equipment, core facilities, and other campus resources. However, they identified several areas requiring further consideration to support the program's long-term success. These include resources related to the Graduate Chair role, the hiring of a new Graduate Administrator to support the program, student recruitment, event coordination, and the allocation of graduate slots, while also being mindful of maintaining adequate TA support for our undergraduate student population.

We agree with the reviewers that adequate resources would ensure the program's long-term success. The Department is working with the Dean's Office to ensure that the administrative framework needed for launch is in place, including reallocating existing departmental and campus resources to support graduate administration, student recruitment, event coordination, and the Graduate Chair role. Through these consultations, we have determined that our current administrative capacity allows for the launch of the program. For this reason, we will not be taking up the recommendation to hire a graduate administrator at this time. Meanwhile, we will undertake a detailed review to identify the personnel required to ensure our department is well-supported for the program's development and sustainability. This is particularly critical given the significant growth experienced by our Department, resulting from SAMIH-related enrolment. Accordingly, the two sentences on page 71 that reference the intention to hire a graduate administrator have been removed.

We also appreciate the reviewers' recommendations about the required allocation of graduate slots and believe that the yearly intake will be dictated by the demand, resources, and supervisor and internship spots available. In the first few years of the program, we anticipate an annual intake of approximately five students, reaching a cohort at year five of 25 students.

Program Requirements and Admission Requirements

We note that the reviewers assumed the program's structure required Direct-Entry students to complete 2.5 FCEs, and we appreciate the opportunity to provide additional context regarding the requirements. Although the program was initially designed with optional additional credits for Direct-Entry students, our revision takes inspiration from the reviewers' feedback, and we have clarified that the requirement will be 2.5 FCEs for the Direct-Entry stream and 2.0 FCEs for students in the regular-entry stream. This additional 0.5 FCE coursework for Direct-Entry students will address potential knowledge gaps in the first year of the program, to be drawn from a diverse array of graduate courses available at UTSC and U of T in general. This additional requirement will increase the breadth of student training and reinforce the interdisciplinary nature of their experience. We have also revised the timelines for both the regular entry and Direct-Entry streams to better distinguish the two pathways and to indicate that coursework and the Qualifying Examination must be completed within 16–20 months for regular entry students and 16–22 months for Direct-Entry students (see pages 19, 23, 25, 26 and 42 of the proposal).

The reviewers also raise an excellent point regarding entry requirements, and we appreciate their suggestion to provide alternative entry requirements for "candidates who do not meet the stated requirements but have a unique combination of education and expertise appropriate to the program." We recognize that the interdisciplinary and applied nature of the program will attract diverse candidates, such as those with professional qualifications or experience (e.g., Professional Master's programs, or industry work). Thus, as

suggested, we will consider alternative entry requirements for these candidates on a case-by-case basis, considering their educational background and experience as well as supervisors' support for admission. As such the minimum admission requirements for both the regular-entry and Direct-Entry pathways have been modified to include the statement that "applicants with degrees in other fields and relevant research experience may also be considered." In addition, the type of degree normally required and the minimum average grade equivalents have been specified for both pathways to improve transparency for prospective applicants. Furthermore, the minimum admission requirements have been updated so that all applicants, regardless of their pathway, must submit two academic letters of reference and a one-page statement of research interests (see pages 17–19 of the proposal).

On behalf of the Department, I thank the reviewers for their thoughtful recommendations and guidance as this program moves forward. We will continue to monitor the curriculum and work with the Dean's Office to ensure students are well-supported and prepared to progress through the program.

Sincerely,



Mauricio Terebiznik
Associate Professor and Chair
Department of Biological Sciences
University of Toronto Scarborough

Dean's Response (February 27, 2026)



UNIVERSITY OF
TORONTO
SCARBOROUGH

Office of the Vice-Principal Academic & Dean

February 27, 2026

Professor Nicholas Rule
Vice-Provost, Academic Programs
Office of the Vice-Provost, Academic Programs
Division of the Vice-President & Provost
University of Toronto

Dean's Administrative Response: New Program Review for the PhD in Interdisciplinary and Applied Biology

Dear Professor Rule,

I am pleased to provide the decanal administrative response to the external review of our proposed PhD in Interdisciplinary and Applied Biology.

I extend my sincere thanks, on behalf of the University of Toronto Scarborough (UTSC) and the Department of Biological Sciences, to the reviewers: Dr. Silvia Cardona, Professor and Associate Head (Graduate), Microbiology, Faculty of Science, University of Manitoba; and Dr. Laura Galloway, Commonwealth Professor, Department of Biology and Associate Dean for the Sciences and Research, University of Virginia, for their thorough evaluation of the PhD in Interdisciplinary and Applied Biology. The site visit, held on May 21 and 22, 2025, provided an opportunity for the reviewers to engage with academic leadership, faculty, and staff affiliated with the program at the University of Toronto Scarborough, as well as current academic leadership and PhD students from the University of Toronto's tri-campus cognate units and the Vice-Dean, Research and Program Innovation at the School of Graduate Studies.

In their July 3, 2025 report, the reviewers reaffirmed the merit of the proposed PhD program, emphasizing its contemporary approach to interdisciplinary and applied research training. They observed that the program's blend of academic scholarship with experiential learning opportunities beyond the university positions its graduates to thrive across a wide range of professional pathways.

I appreciate the reviewers' affirmative assessment and the forward-looking guidance they have provided to help strengthen the program's development. In preparing this administrative response, my office drew on the insights and analysis shared by Professor Mauricio Terebiznik in his letter of February 26, 2026, which has informed the considerations outlined below.

Resources

The reviewers noted that the program is well-supported by current faculty expertise and campus infrastructure, and that it is positioned to begin operations without the need for additional space or equipment. They also highlighted several considerations that will shape the program's growth over time, including:

1. providing the resources needed for the new Graduate Chair role,
2. allocation of graduate slots, while remaining mindful of maintaining adequate TA support for the Department of Biological Sciences' current undergraduate population, and
3. the hiring of a new Graduate Administrator to support the program, student recruitment, event coordination.

I, along with the Department, am grateful to the reviewers for their assessment. In response to considerations 1 and 2, we confirm support for the Graduate Chair role and for the recommended allocation of graduate slots, along with safeguards to maintain sufficient TA support. For the 25 additional graduate slots that will be required, I concur with the Department Chair's observation that yearly intake will depend on demand, available resources, and the capacity of supervisors and internship placements. However, with respect to consideration 3, the recommendation to hire a new Graduate Administrator, we have determined a different course of action. Following further evaluation of existing resources, we are confident that these can be effectively deployed to support graduate administration, student recruitment, and event coordination without the initial need for an additional hire. Our resourcing plan reflects the fact that the Department now has eight administrative staff whose responsibilities span course and program administration, departmental and administrative coordination, and financial administration and oversight, which provides a strong foundation for the proposed program. Moving forward, we will undertake a detailed staffing review with the opportunity of the addition of staff to assure that the program is well supported.

Accordingly, the two sentences on page 71 that reference the intention to hire a graduate administrator have been removed.

Program Requirements and Admission Requirements

In response to the reviewers' feedback on coursework, the Department Chair has clarified that:

- Direct-Entry (five-year) students will complete 2.5 FCEs, while those entering through the regular-entry (four-year) stream will complete 2.0 FCEs. The additional 0.5 FCE for Direct-Entry students broadens their foundational training and supports the program's interdisciplinary aims.
- The timelines for both pathways have also been adjusted to distinguish them more clearly: the Qualifying Examination will be completed within 16–20 months for regular-entry students and 16–22 months for Direct-Entry students. These revisions are reflected on pages 19, 25, 26, and 42 of the proposal.
- In response to the reviewers' recommendation to accommodate applicants with diverse academic and professional backgrounds, the minimum admission requirements for both pathways now specify that applicants with degrees in other fields and relevant research experience may be considered. To improve transparency, the proposal now outlines the typical degree expectations and minimum grade requirements for each pathway.
- All applicants must submit two academic reference letters and a one-page statement of research interests, regardless of entry stream. These updates appear on pages 17–19 of the proposal.

Changes to the Proposal Not Related to the Recommendations of the External Reviewers

In collaboration with the Department, we have updated the program proposal to incorporate routine finalization edits, including the revised program start date, corresponding enrolment projections, recent faculty information, and several minor editorial improvements. These changes were made as part of standard proposal refinement and are not related to the external reviewers' recommendations.

Section 2 (page 7) now reflects a new anticipated start date of September 2027 and updates the timing of the first program review to 2033–34. Table 1 in Section 8 (page 55) has been revised accordingly, shifting initial enrolment to 2027–28 and steady-state enrolment to 2031–32. Additional minor adjustments on pages 10 and 11 include earlier

introduction of the IAB acronym and correction of a missing word. Pages 77–82 now contain expanded descriptions of faculty research strengths across the biological sciences. Non-academic implementation text has been removed from page 58, and further stylistic and typographical edits have been made on pages 10, 11, 17, 26, 55, and 103. Information on IAB3310H Interdisciplinary and Applied Biology Colloquium, along with revised sequencing for both entry pathways, has also been updated for clarity; these changes are reflected on pages 24, 41, and 42. In addition, references to Professor Fillion have been removed from pages 68 and 69 to reflect his recent departure. References to Professor Andrade have also been removed from pages 59, 68, and 143, as she will no longer be with the Department of Biological Sciences when the program launches.

I am encouraged by the overall positive review of the proposed PhD in Interdisciplinary and Applied Biology. Once again, I thank the reviewers for their recommendations and helpful guidance. My office remains committed to working closely with the Department to ensure the curriculum meets the needs of students and that the program is appropriately resourced for long-term success.

Sincerely,

A handwritten signature in dark ink, reading "Karin Ruhlandt". The signature is fluid and cursive, with the first name "Karin" and last name "Ruhlandt" clearly distinguishable.

Professor Karin Ruhlandt
Vice-Principal Academic & Dean

Vice-Provost, Academic Programs' Response (Mar. 2, 2026)



March 2, 2026

Professor Karin Ruhlandt
Vice-Principal Academic & Dean
Office of the Vice-Principal Academic & Dean
University of Toronto Scarborough

Re: Review Report, Proposed New PhD in Interdisciplinary and Applied Biology

Dear Dean Ruhlandt,

Thank you for sharing the review of the proposed PhD in Interdisciplinary and Applied Biology. The reviewers strongly supported approval of the program, highlighting its originality, interdisciplinarity, and practical relevance.

As nicely summarized in your administrative response to the review, the reviewers identified several resource-related areas to support the program's long-term success, including:

1. Providing the resources needed for the new Graduate Chair role
2. Allocating graduate enrolment slots per the program's incremental intake plan
3. Hiring a new Graduate Administrator to support recruitment and event coordination

Your response confirms your office's commitment to ensuring provision of the necessary resources and notes that existing resources can be effectively deployed to support items 1 and 2, above. Hence, no changes to the proposal have been made in response to these recommendations. On recommendation 3, you and the Department Chair indicate the administrative responses that upon further evaluation, existing resources are available to support graduate administration, student recruitment, and event coordination without the initial need for an additional hire. The proposal has been updated to remove the reference to the intention to hire a graduate administrator.

You note that based on reviewers' feedback, the following changes have been made to the admission and program requirements and these are now reflected in the proposal:

- Direct-Entry (i.e., five-year) students will complete 2.5 Full Course Equivalents (FCEs) whereas students in the Regular-Entry (i.e., four-year) PhD option will complete 2.0 FCEs.
- Direct-Entry students will complete the Qualifying Examination within 16–22 months whereas Regular-Entry students will complete it within 16–20 months.
- To accommodate applicants with diverse backgrounds the minimum admission requirements for both pathways now specify that applicants with degrees in other fields and relevant research experience may be considered
- All applicants must submit two academic reference letters and a one-page statement of research interests, regardless of entry stream.

Finally, you advise that the department has made minor updates to the proposal by revising the start date, enrolment projections, faculty roster, and making editorial improvements.

Consequent to the reviewers' overwhelmingly positive input and your subsequent improvements to the planned program, I will be pleased to recommend this new PhD degree program for institutional approval following divisional approval.

Sincerely,



Nicholas Rule
Professor
Vice-Provost, Academic Programs

cc: Rhonda Martin, Executive Assistant to the Dean, University of Toronto
Scarborough
Thy Phu, Acting Vice-Dean Graduate & Postdoctoral Studies, University of
Toronto Scarborough
Kevin Mak, Manager Academic Program Reviews & Quality Assurance,
University of Toronto Scarborough
Joshua Barker, Dean of Graduate Studies and Vice-Provost Graduate and
Research Education, School of Graduate Studies
Sarah Sharma, Acting Vice Dean, Programs and Innovation, School of Graduate
Studies
Brian Desrosiers-Tam, Director, Office of the Vice-Provost, Graduate Research
and Education, School of Graduate Studies

Lachmi Singh, Director, Academic Programs, Planning and Quality Assurance,
Office of the Vice-Provost, Academic Programs

Jennifer Francisco, Academic Change Specialist, Office of the Vice-Provost,
Academic Programs

Annette Knott, Academic Change Specialist, Office of the Vice-Provost,
Academic Programs

New Graduate Program Proposal

University of Toronto Proposal: New Undergraduate and Graduate Program

Full name of proposed program: (i.e., Specialist in Historical Studies; Master of Arts in History)	PhD in Interdisciplinary and Applied Biology (IAB)
Degree name and short form: i.e., Honours Bachelor of Science, HBA; Master of Arts, MA;	Doctor of Philosophy (PhD)
Program name: i.e., History; Sustainability Management	Interdisciplinary and Applied Biology
Professional program (yes or no):	No
Unit (if applicable) offering the program: i.e., site of academic authority. Where a program is housed elsewhere (in physical terms), this should also be indicated. For graduate, if a new graduate unit is contemplated, please indicate here.	Department of Biological Sciences, UTSC The Department of Biological Sciences will become a new graduate unit.
Faculty/division:	University of Toronto Scarborough
Dean's office contact:	Thy Phu, Acting Vice-Dean, Graduate and Postdoctoral Studies Kevin Mak, Manager, Academic Program Reviews & Quality Assurance
Proponent:	Andrew Mason; Bebhinn Treanor; Kenneth Welch; Mauricio Terebiznik; Aarthi Ashok; Marc Cadotte; Rachel Sturge; Nate Lovejoy
Version date (please change as you edit this proposal):	February 27, 2026

Framework for UTQAP New Programs

The [University of Toronto Quality Assurance Process](#) (UTQAP) supports a structured approach for creating, reflecting on, assessing and developing plans to change and improve academic programs and units in the context of institutional and divisional commitments and priorities.

The University of Toronto (U of T), in its [Statement of Institutional Purpose](#) (1992), articulates its mission as a commitment "to being an internationally significant research university, with undergraduate, graduate, and professional programs of excellent quality." Thus "quality assurance through assessment of new program proposals and review of academic programs and units in which they reside is a priority for the University....:

The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching are the foundations of academic excellence. More generally, all of the factors that contribute to collegial and scholarly life — academic and administrative complement, research and scholarly activity, infrastructure, governance, etc. — bear on the quality of academic programs and the broad educational experience of students. ([Policy for Approval and Review of Academic Programs and Units](#) (2010))

The University's approach to quality assurance is built on two primary indicators of academic excellence: the quality of the scholarship and research of faculty; and the success with which that scholarship and research is brought to bear on the achievement of Degree Level Expectations. These indicators are assessed by determining how our scholarship, research and programs compare to those of our international peer institutions and how well our programs meet their Degree Level Expectations.

The University of Toronto embraces academic change as a critical part of maintaining and enhancing programs of outstanding quality through a process of continuous improvement.

New Program Proposal

The New Program Approval Protocol applies to new undergraduate or graduate degrees, undergraduate specialists and majors within approved degrees, and to graduate degree programs, offered in full or in part by the University of Toronto or by the University of Toronto jointly or conjointly with institutions federated or affiliated with the University. New for-credit graduate diplomas and new standalone degree programs arising from a long-standing field in a master's or doctoral program go through the Expedited Approval Protocol (see [UTQAP section 2.8](#)). All proposed new programs except graduate diplomas are subject to external appraisal.

This template aligns with UTQAP requirements and will help to ensure that all evaluation criteria established by the Quality Council are addressed in bringing forward a proposal. Divisions may have additional requirements that should be integrated into the proposal.

Development and Approval Steps	Date (e.g., of external appraisal site visit, final signoff, governance meeting, Quality Council submission, Ministry submission)
New program consultation meeting	February 21, 2023
Consultation Proponents/Dean's Office/Provost's Office	
Provost's Advisory Group	December 18, 2024
External Review	May 21-22, 2025
Decanal Signoff <i>In signing off I confirm that I have ensured appropriate:</i> ✓ compliance with the evaluation criteria listed in UTQAP section 2.3 ✓ consultation with the Office of the Vice-Provost, Academic Programs early in the process of proposal development ✓ consultation with faculty and students, other University divisions and external institutions	Karin Ruhlandt, Dean, University of Toronto Scarborough April 15, 2025
Provostial signoff <i>In signing off I confirm that the new program proposal:</i> ✓ is complete ✓ includes information on all the evaluation criteria listed in UTQAP section 2.3	Nicholas Rule, Vice-Provost, Academic Programs February 6, 2025
Unit-level approval (if required)	[date]
Faculty/divisional governance	[date]
Submission to Provost's Office	
AP&P	[date]
Academic Board	[date]
Executive Committee of Governing Council	[date]
The program may begin advertising as long as any material includes the clear statement that, "No offer of admissions will be made to the program pending final approval by the Quality Council and the Ministry of Colleges and Universities (where the latter is required)."	
Ontario Quality Council	[date]
Submitted to the Ministry (in case of new graduate degrees and programs, new diplomas)	[date]

New Program Proposal

PhD in Interdisciplinary and Applied Biology
Department of Biological Sciences
University of Toronto Scarborough

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1 Executive Summary

Please provide a brief overview of the proposed program summarizing the key points from each section of the proposal.

Training in biology is traditionally organised around a variety of subdisciplines addressing questions about biological systems at different levels of analysis ranging from molecular, through cellular/organismal to populations and ecosystems. Most postgraduate biology programs reflect this approach, with specific areas of focus (such as cell biology or evolutionary biology). While these programs do provide opportunities for interdisciplinary training and preparation for non-academic career paths, few are specifically designed around these goals. It is widely recognized that innovative approaches to PhD training are needed to meet current societal needs¹. Global crises including climate change, declining biodiversity, anthropogenic impacts on natural communities and ecosystems, emerging pathogens and pandemics, human health in rapidly changing environments, and food and agriculture safety and security require the training of solution-oriented scientists who command interdisciplinary knowledge and tools. Such interdisciplinary approaches are critical to addressing the UN Sustainable Development Goals (SDGs; <https://sdgs.un.org/goals>). The proposed PhD program in Interdisciplinary and Applied Biology (IAB) aims to produce scientists capable of tackling these challenges. Here, 'applied' indicates the program's emphasis on solution-orientated scientific investigation of globally relevant issues, prioritizing collaboration and knowledge mobilization with non-academic partners. The program will equip graduates with expertise in interdisciplinary approaches, knowledge sharing, and facility with emerging tools and approaches in the biological sciences. The scientists emerging from our program will be ideally positioned to solve problems and contribute to sectors of vital importance to Canada and around the world.

IAB will include four main training elements to achieve the goals described above: 1) production of a research-based thesis that uses interdisciplinary approaches to address a practical issue/applied issue in biology; 2) flexible course work that trains students in interdisciplinary approaches and provides skills in relevant biological fields and disciplines; 3) a practicum with a partner organization and/or research team to develop and emphasize the applied and real-world application of the thesis research project; and 4) presenting research and practicum reflections at an interdisciplinary colloquium.

There's a clear need for this program with no comparable program nationally, and evidence of significant interest from student surveys. This program will provide a solid base of biological knowledge, extending from the molecular to the ecosystem levels and emphasizing connections across these levels of understanding. Graduates will have developed the skills, knowledge, and experience to understand complex biology-based issues and problems, ask appropriate questions and design relevant research programs, and solve difficult biological problems. Graduates will be prepared for a broad range of careers in education, government, science, non-governmental organizations (NGOs), and industry. By focusing first on interdisciplinary and applied work, students will be prepared for the widest possible range of career paths.

¹ PhD training is no longer fit for purpose — it needs reform now. Editorial. Nature 613, 414 (2023). DOI: <https://doi.org/10.1038/d41586-023-00084-3>

2 Effective Date and Date of First Review

Anticipated date students will start the program: September 2027

First date degree program will undergo a UTQAP review and with which unit¹:

Department of Biological Sciences, 2033-34, concurrent with UTQAP review of undergraduate department.

3 Academic Rationale and Program Objectives

Program Objectives

List the program's objectives.

¹ Programs that are inter- and multidisciplinary must identify a permanent lead administrative division and identify a commissioning officer for future cyclical program reviews.

Program Objective 1: proficiency in current understanding of biology and their potential application in interdisciplinary and applied research.

Program Objective 2: thorough understanding of how current knowledge and techniques in biological research can inform practical issues and technological, policy, and management applications.

Program Objective 3: scientific literacy representing expertise in the current state of knowledge in more than one discipline within biology.

Program Objective 4: comprehension of how research methodologies are used to create and interpret knowledge in the disciplines of biology.

Program Objective 5: conduct original research at the intersection of multiple fields of biology.

Program Objective 6: effectively and independently manage a program of original interdisciplinary and applied research.

Program Objective 7: communicate, for appropriate areas of expertise and for a range of audiences, the current level of scientific understanding, outstanding questions, and relevant methodologies.

Program Objective 8: be aware of the validity and applicability of scientific methods in different contexts and applications.

Academic Rationale

Provide the academic rationale for the proposed program considering the prompts below.

- a) Discuss the appropriateness of degree or diploma nomenclature given the program's objectives.
- b) Discuss the consistency of the program's objectives with the institution's [mission](#) and U of T's/the division's/unit's [academic plans](#), [priorities](#) and commitments, including consistency with any implementation plans developed following a previous review.

- c) Evidence that the following have been substantially considered in the context of developing the changes to the program and its associated resources:
- a. [Universal design principles](#) and/or the potential need to provide mental or physical disability-related accommodations, reflecting the University's [Statement of Commitment Regarding Persons with Disabilities](#)
 - b. Support for student well-being and sense of community in the learning and teaching environment, reflecting the work of the [Expert Panel on Undergraduate Student Educational Experience](#) and the commitment to establishing a Culture of Caring and Excellence as recommended by the Presidential and [Provostial Task Force on Student Mental Health](#)
 - c. Opportunities for removing barriers to access and increasing retention rates for Indigenous students; for integrating Indigenous content into the curriculum in consultation with Indigenous curriculum developers; and for addressing any discipline-specific calls to action, reflecting the commitments made in [Answering the Call: Wecheehetowin: Final Report of the Steering Committee for the University of Toronto Response to the Truth and Reconciliation Commission of Canada](#)
 - d. Opportunities for removing barriers to access and increasing retention rates for Black students; for promoting intersectional Black flourishing, fostering inclusive excellence and enabling mutuality in teaching and learning, reflecting the commitments made in the [Scarborough Charter](#) and consistent with the recommendations of the [Anti-Black Racism Task Force Final Report](#)
 - e. Opportunities for fostering an equitable, diverse, and inclusive teaching and learning environment, reflecting the values articulated in existing institutional documents such as the [Statement on Equity, Diversity, and Excellence](#), the [Antisemitism Working Group Final Report](#), the aforementioned reports, and future institutional reports related to equity, diversity and inclusion.
- d) Unique curriculum or program innovations, creative components, significant high impact practices, where appropriate

Context and Academic Rationale

Training in biology is traditionally organised around a variety of subdisciplines addressing questions about biological systems at different levels of analysis ranging from molecular, through cellular/organismal to populations and ecosystems. Most postgraduate biology programs reflect this approach, with specific areas of focus (such as cell biology or evolutionary biology). Traditional graduate programs in biology do provide opportunities for interdisciplinary training and preparation for non-academic career paths – the advanced research, analysis and critical thinking skills arising from a PhD are inherently widely applicable in diverse career contexts. Few programs, however, are specifically designed around these goals. The proposed PhD program in Interdisciplinary and Applied Biology (IAB) program will invert the usual bias, by focusing first on interdisciplinary and applied work aimed at preparing students for the widest possible range of career paths (including, but not privileging, academic career paths). In addition, the parallel focus on interdisciplinary approaches – combining techniques and theory from distinct areas of biology (or other disciplines) acknowledges the contemporary emphasis on interdisciplinary strategies but makes this a required component of the program.

The IAB program will appeal to students with an interest in advanced postgraduate training with clear connections to flexible career paths. In addition to meeting the evolving needs of current graduate students, an important goal of this program is to expand access to post-graduate education by a wider diversity of students. By emphasizing a variety of applications and career outcomes, the program will appeal to a range of undergraduates who might not initially consider a purely academic pathway but are nevertheless capable of excelling in an advanced degree.

Technological developments, rapid scientific progress, and knowledge revolutions have led to increased disciplinary specialization in the life sciences. Many university biology departments and graduate programs are defined by methodology, level of focus, or even by the taxonomic group studied. In contrast, the most significant challenges confronting humanity can best be mitigated using interdisciplinary methodologies. For example, [UN Sustainability Goals \(SDGs\)](#) emphasise the need for broad-based collaborative approaches to address global challenges of ensuring and elevating equity in human health, promoting human wellbeing in growing cities, and all while facing the constraints of a changing climate, diminishing water resources, and a biodiversity crisis (i.e., SDGs 2, 3, 6, 11, 13, 14, & 15). The IAB program will produce scientists capable of leading interdisciplinary efforts to address important current and future challenges. The

program will equip graduates with expertise in interdisciplinary approaches, knowledge sharing, and facility with emerging tools and methodologies in the biological sciences. Scientists that emerge from our program will be ideally positioned to solve problems, advance knowledge, and contribute to sectors of vital importance in Canada and the world.

Appropriateness of Degree and Program Name relative to Program Objectives

The program will be designed as a research (thesis) based PhD program similar to other biology University of Toronto PhD programs (e.g. PhD in Ecology and Evolutionary Biology (EEB), PhD in Cell and Systems Biology (CSB)). Students will complete a program of course work, skills training, professional development (writing and presentation), but the majority of the program consists of pursuing an original body of research culminating in a thesis (and subsequent publications in the primary scientific literature). Thesis research will be carried out under the guidance of a primary faculty supervisor and supervisory committee. Thus, the program is structured as a standard research-based PhD. The program nomenclature reflects the unique focus on applied and interdisciplinary training, with significant portions of the skills development and research technical training incorporating partnerships with other organizations or academic units and ongoing reflection on interdisciplinary approaches and applied studies in biology.

The name of the Interdisciplinary and Applied Biology program reflects the dual commitment to training scientists that combine multiple approaches to address real-world problems. In this context, 'interdisciplinary' refers to employing concepts, frameworks, and methods from distinct biological subdisciplines. 'Applied' indicates the program's emphasis on solution-orientated scientific investigation of globally relevant issues, prioritizing collaboration and knowledge mobilization with non-academic partners. The PhD is the appropriate level for this program since students will be expected to develop detailed and multifaceted research projects that will require interdisciplinary mastery and to complete placements that complement and advance their thesis research.

The focus of the proposed IAB program on applied biological sciences, and the combination of its training elements will differentiate it from other graduate programs at both the University of Toronto and other institutions in Canada. It is recognized (at U of T and more widely) that graduate students increasingly require preparation for a diverse

range of career outcomes. Most existing biology PhD programs emphasize training for careers in academia. The program proposed here is designed to place the scientific content of students' thesis work in an interdisciplinary and applied context through collaboration with private sector, government agencies, and non-governmental organizations.

Additionally, in more traditional biology PhD programs, composition of the supervisory and examination committees is generally constrained to include only academic biologists. In contrast, supervisory committees in IAB will be intentionally constructed to include expertise from other disciplines and from non-academic institutions (such as collaborators from NGOs, government ministries, local institutions such as the Zoo who have adjunct status with the Department of Biological Sciences and who will seek Associate Graduate affiliation with IAB), so that IAB theses can be more effectively and holistically evaluated for the quality and originality of the contribution.

Distinctiveness

The prescribed applied placements (practica) will develop student networks that build pathways to employment with partner organizations. In addition to meeting the evolving needs of current graduate students, an important goal of this program is to expand access to post-graduate education for more diverse student recruitment. By emphasizing a variety of research applications and career outcomes, the program will appeal to a range of undergraduates who might not initially consider a purely academic pathway but are nevertheless capable of excelling in an advanced degree enroute to applied careers in science (see 5. Need and Demand section, below). The proposed PhD program will use four main training elements to achieve the goals described above: production of a research-based thesis that uses interdisciplinary approaches in biology; flexible course work that trains students in interdisciplinary approaches and provides skills in relevant biological fields and disciplines; a training placement with an academic or external partner organization to reinforce the development of interdisciplinary and/or applied aspects of the proposed thesis research; and a program colloquium series to develop scientific communication skills in academic and non-academic contexts.

Consistency with Institutional Mission and Priorities

This program aligns with the University of Toronto's mission to be an internationally significant research university, with graduate programs of excellent quality. Central to this mission is the recognition that new opportunities for graduate student training be offered at all three campuses, to "provide an environment that is conducive to research,

and make its campuses attractive settings for scholarly activity”. The practicum component of the proposed program also embraces two of the University’s key priorities: 1. Leveraging our urban location more fully for the mutual benefit of University and City; and 2. Strengthening and deepening international partnerships. As outlined in [UTSC’s 2020-2025 Strategic Plan, *Inspiring Inclusive Excellence*](#), UTSC has been leader in innovative approaches to higher education since its inception. One of the most attractive features of UTSC for undergraduate students has long been its undergraduate co-op programs in a broad range of disciplines. The proposed practicum component of the IAB PhD program expands this opportunity for experiential learning to the graduate level. *Inspiring Inclusive Excellence* means “embracing and promoting the enriching contributions that come from diverse backgrounds, ways of knowing, ideas, perspectives, and experiences”; key features of the IAB program, with its focus on interdisciplinarity and applied experience. This program builds on interdisciplinary expertise in the Department of Biological Sciences at UTSC and established and emerging partnerships with external academic and non-academic partners, and our campus is ideally situated to host the program. UTSC is home to several existing and planned units and facilities that will intersect with the proposed program, including the Centre for Environmental Research in the Anthropocene, the upcoming Scarborough Academy of Medicine and Integrated Health, the upcoming UTSC-Toronto Zoo Conservation Campus, the Toronto Pan Am Sports Centre, the Centre for Teaching and Learning, and the Centre for the Neurobiology of Stress. Our faculty (see below) already engage with extra-institutional partners who will host traineeships, both local (e.g., Toronto Zoo; Rouge National Park; hospitals of the Scarborough Health Network; Toronto and Region Conservation Authority, community gardens, Environmental Defense) and regional (e.g., Fisheries and Oceans Canada; Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry; and the Royal Ontario Museum). UTSC is situated at the urban/rural interface where many of the issues described above can be studied locally. These factors make the Department of Biological Sciences and UTSC an ideal home for the proposed program.

Program Development and Resources

The IAB program has been specifically developed to support student well-being and to build a sense of community among students, faculty, and partners. IAB1100H, Foundations of Interdisciplinary and Applied Research is a required first year cohort-building core experience for students at the start of their degree. To this end, projects will involve collaborative work and peer-to-peer mentoring, with the goal of fostering teamwork and building connections among students that will support them as they

progress through their degree. In addition, IAB3310H, Interdisciplinary and Applied Biology Colloquium is a continuous course for all graduate students in the program, which is tied to their practicum placements. This annual colloquium will serve to highlight the program-specific experiential learning achievements of senior students, to inspire and educate junior students, and to explicitly foster peer-to-peer learning and cohort building.

The IAB program will also leverage departmental initiatives to remove barriers to access and increase retention rates for Black and Indigenous students. In 2023, the Department of Biological Sciences launched the *Inclusive Excellence Award in Biological Sciences*. This faculty-funded award for Black and Indigenous students entering the second year of undergraduate studies provides not only a monetary award to help overcome financial barriers to higher education, but also provides the awardee with a faculty mentor and diverse research opportunities through work-study placements within faculty labs, which will well position these students for graduate studies in the IAB program. In addition, the graduate course, EEB1456H, Bias in Stem: History, Data, & Progress was developed by a faculty member in the Department of Biological Sciences and addresses the historical legacy of bias and exclusion in science, recent data that quantifies the scale of the problems and/or the science behind them, and provides evidence-based strategies to overcome these issues. IAB students will be encouraged to take this course as one of their elective courses to help foster an equitable, diverse, and inclusive teaching and learning environment both during their graduate studies and in their future endeavours. The Department of Biological Sciences also has a standing EDI Committee with graduate student representation, providing IAB students with the opportunity to participate in the planning and execution of departmental initiatives to advance EDI principles.

4 Calendar Copy

Insert calendar copy, including the program description.

Biological Sciences

Interdisciplinary and Applied Biology (IAB): Introduction

Faculty Affiliation

University of Toronto Scarborough

Degree Programs

Interdisciplinary and Applied Biology

PhD

Overview

The Department of Biological Sciences is an interdisciplinary hub for the study of life sciences, offering a robust foundation in biological principles while fostering specialization in emerging fields. The department integrates teaching, research, and outreach to address complex biological questions and global challenges, preparing students for careers in academia, industry, healthcare, and environmental science. The department is committed to a strategy of balanced faculty recruitment in order to maintain a breadth of research expertise, while maintaining sufficient depth to establish collaborative nodes of strength in faculty scholarship and supporting program delivery.

The Interdisciplinary and Applied Biology (IAB) program is a research thesis-based program that will provide PhD-level training in the biological sciences, with an emphasis on interdisciplinary training, hands-on experience, and the applicability of basic science to real-world problems. The program will place fundamental research in an interdisciplinary and applied context that will intentionally incorporate training for a diversity of possible pathways after graduation. The program will equip graduates with expertise in interdisciplinary approaches, knowledge sharing, and usage of emerging tools and techniques in the biological sciences. Students will work in person to complete a combination of coursework and practical placements, as well as their PhD thesis research, focused on applied issues in biological sciences using interdisciplinary approaches. The department defines itself as a biological sciences unit in the broadest sense, rather than focusing on specific subdisciplines within biology. This is reflected in the diversity of faculty research, as well as the range of undergraduate programs

delivered by the department. There is a significant culture of interdisciplinary collaboration both within the department as well as with external research partnerships.

Contact and Address

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Interdisciplinary and Applied Biology

The Interdisciplinary and Applied Biology (IAB) program is a research thesis-based program that will provide PhD-level training in the biological sciences, with an emphasis on interdisciplinary training, hands-on experience, and the applicability of basic science to real-world problems. The program will place fundamental research in an interdisciplinary and applied context that will intentionally incorporate training for a diversity of possible pathways after graduation. The program will equip graduates with expertise in interdisciplinary approaches, knowledge sharing, and usage of emerging tools and techniques in the biological sciences. The scientists emerging from our program will be ideally positioned to solve problems, advance knowledge, and contribute to sectors of vital importance to Canada and the world.

Applicants may enter the PhD program via one of two routes: 1) following completion of an MSc degree; or 2) direct entry following completion of an honours bachelor's degree.

PhD Program

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies. Applicants must also satisfy the Department of Biological Sciences' additional admission requirements stated below.
- Applicants must normally hold a Master's degree in biology or a related discipline from a recognized university with a minimum course grade average of A-; however, applicants with degrees in other fields and relevant research experience may also be considered.
- Admission to the program is finalized when a graduate faculty member agrees to supervise the student's research and guarantees a full stipend for the student.
- In addition to the SGS online application form, the following materials will be required:
- Two academic letters of reference from instructors or research supervisors will be required.
- A one-page statement of research interests and experience, including reasons for applying to the IAB graduate program.

Completion Requirements

- Students must be in good academic standing at the end of Year 1.
- **Coursework.** Students must successfully complete a total of 2.0 full-course equivalents (FCEs) as follows:
 - IAB1100H Foundations of Interdisciplinary and Applied Research (0.5 FCE)
 - IAB3300H Interdisciplinary and Applied Biology Research Practicum (0.5 FCE)
 - IAB3310H Interdisciplinary and Applied Research Colloquium (0.5 FCE)
 - 0.5 FCE of approved graduate coursework
- IAB1010Y IAB Seminar Series (0.0 FCE)
- **A PhD Qualifying Exam**, normally scheduled between 16-20 months after the start date of enrolment in the graduate program, which involves three components:
 - A written research proposal
 - A 20-minute presentation to the department and questioning by the public
 - In-camera questioning by a PhD proposal examination committee immediately following the public presentation.
- Students must submit a **Thesis** and defend it at a **Doctoral Final Oral Examination** conducted by the School of Graduate Studies.

Mode of Delivery: In person

Program Length

4 years full-time (typical registration sequence: Continuous)

Time Limit

6 years full-time

PhD Program (Direct-Entry)

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies. Applicants must also satisfy the Department of Biological Sciences' additional admission requirements stated below.
- Applicants must normally hold a bachelor's degree in biology or a related discipline from a recognized university with an average minimum grade equivalent to the University of Toronto A- in the final two years of the bachelor's coursework; however, applicants with degrees in other fields and relevant research experience may also be considered.
- Admission to the program is finalized when a graduate faculty member agrees to supervise the student's research and guarantees a full stipend for the student.
- In addition to the SGS online application form, the following materials will be required:
- Two academic letters of reference from instructors or research supervisors will be required.
- A one-page statement of research interests and experience, including reasons for applying to the IAB graduate program.

Completion Requirements

- Students must be in good academic standing at the end of Year 1.
- **Coursework.** Students must successfully complete a total of 2.5 full-course equivalents (FCEs) as follows:

- IAB1100H Foundations of Interdisciplinary and Applied Research (0.5 FCE)
 - IAB3300H Interdisciplinary and Applied Biology Research Practicum (0.5 FCE)
 - IAB3310H Interdisciplinary and Applied Research Colloquium (0.5 FCE)
 - 1.0 FCE of approved graduate coursework
- IAB1010Y IAB Seminar Series (0.0 FCE)
- **A PhD Qualifying Exam**, normally scheduled between 16-22 months after the start date of enrolment in the graduate program, which involves three components:
 - A written research proposal
 - A 20-minute presentation to the department and questioning by the public
 - In-camera questioning by a PhD proposal examination committee immediately following the public presentation.
- A minimum of two supervisory committee meetings during the first year of direct-entry PhD
- Students must submit a **Thesis** and defend it at a **Doctoral Final Oral Examination** conducted by the School of Graduate Studies.

Mode of Delivery: In person

Program Length

5 years full-time (typical registration sequence: Continuous)

Time Limit

7 years

Interdisciplinary and Applied Biology PhD Courses

Consult the graduate unit regarding course availability.

Course Code	Course Title
IAB1010Y	IAB Seminar Series
IAB1100H	Foundations of Interdisciplinary and Applied Research
IAB2200H	Visualization and Presentation of Research Findings

IAB2210H	Interdisciplinary One Health for Biological Sciences
IAB2250H	Discipline-Based Education Research in Biology
IAB3300H	Interdisciplinary and Applied Biology Research Practicum
IAB3310H	Interdisciplinary and Applied Research Colloquium

5 Rationale for Program as Designed

Rationale for Admission Requirements

- a) Discuss the appropriateness of the program's admission requirements as they are articulated in the calendar entry above, given the program's objectives and program-level learning outcomes.
- b) Provide a sufficient explanation of alternative requirements, if applicable, for admission into a graduate, second-entry or undergraduate program, e.g., minimum grade point average, additional languages or portfolios, and how the program recognizes prior work or learning experience.

Students admitted to the PhD program, following successful completion of a Master's degree, are required to have an average grade equivalent to at least a University of Toronto A– during their Master's degree. This requirement will help ensure these students are adequately prepared academically to meet the demands of a PhD program. Having completed a Master's thesis, students are expected to have developed some theoretical, technical, methodological, and critical thinking skills that will well-position them for success in a PhD program. Students entering the program directly from an undergraduate degree (Direct-Entry stream) are required to have a Bachelor's degree in biology or relevant discipline from a recognized university with a minimum grade equivalent to the University of Toronto A– in the final two years of the bachelor's coursework and evidence of research potential, assessed through evaluation of application materials such as letters of recommendation, transcripts and statement of research interests and/or experience. This average grade equivalent is higher than some U of T cognate programs require for entry into a Master's degree (e.g. CSB MSc admissions require a minimum B+ average in their final year and a mid-B average in the previous year) in order to ensure students have a strong grasp of the requisite theoretical knowledge to ensure they can meet the demands of a PhD program. Evidence of research potential (assessed through evaluation of application materials

such as letters of recommendation, transcripts and statement of research interests and/or experience) is also a requirement in order to ensure that these students have acquired at least some of the technical, methodological, and critical thinking skills required to succeed in the PhD program. Students entering via either stream are required to have a Master's degree (regular stream) or undergraduate degree (Direct-Entry stream) in biology or a relevant discipline. Given the interdisciplinary focus of the IAB program, students with degrees in other life science disciplines, or the physical sciences will also be considered.

Applicants will be instructed to contact and secure the support of an IAB Graduate Faculty Member. This informal interview process should include virtual and/or in person meetings between the prospective student, the faculty, and other members of their lab or the IAB department as relevant. If possible, discussion of a potential partner placement opportunity should also be considered at this time. Pending a successful informal interview process, graduate faculty members wishing to accept students into the IAB program must forward the name of the student to the Graduate Chair or their designate. With support from the Graduate Administrator, the Graduate Chair (or designate) will review applications for completeness. Applicants with complete applications and the support of a graduate faculty member will be considered for admission (referred to as “fully reviewed applicants”). The Graduate Chair will convene an IAB Graduate Admissions Committee to consider and rank prospective students within each admissions category (i.e., PhD and PhD Direct-Entry) based on demonstrated academic and research excellence and potential. Top-ranked candidates will be forwarded for relevant admissions/funding award consideration. Pending such funding support, the remaining applicants will be offered admission based on their meeting minimum SGS admissions requirements and based on ranking.

Rationale for Program Structure

All New Programs

In a **single** response, please discuss the new program requirements, by considering the program relative to the following criteria:

- a) Discuss the appropriateness of the program's structure and requirements as stated in the calendar to meet its objectives and [program-level learning outcomes](#), including the structure and requirements of any identified streams

(undergraduate), fields or concentrations (graduate). Please include a discussion of the program's planned/anticipated class sizes.

- b) Appropriateness of the program's structure, requirements and program-level learning outcomes in meeting the institution's applicable [undergraduate or graduate Degree Level Expectations](#)
- c) State the proposed mode(s) of delivery of the program. Discuss the appropriateness of the mode(s) of delivery (i.e., means or medium used in delivering a program; e.g., lecture format, distance, online, synchronous/asynchronous, problem-based, compressed part-time, flex-time, multi-campus, inter-institutional collaboration or other non-standard forms of delivery) to facilitate students' successful completion of the program-level learning outcomes.
- d) Discuss the ways in which the curriculum addresses the current state of the discipline or area of study and is appropriate for the level of the program.
- e) Please provide details on any experiential learning that is part of the program, including confirmed and interested partners, duration of experiential learning component in a program, and anticipated number of placements.

The proposed IAB program is an in person, research thesis-based Ph.D. program. The program length will be four years for students entering with a Master's degree, and five years for students entering with a Bachelor's degree (BSc or BA) as Direct-Entry students. Students will be funded by fellowships, RAships (funded by the primary supervisor), and TAs during this guaranteed funding period. The purpose of this program is to provide PhD-level training in the biological sciences, with an emphasis on cross-disciplinary training, hands-on experience, and the application of basic science to real-world problems.

Students will complete a 4-month research project with an academic, industry, NGO, or government agency partner during a practicum placement (IAB3300H) and a thesis project that focuses on an **applied or interdisciplinary issue in biological sciences**. Thesis work can be supervised by a single advisor, but due to the interdisciplinary focus of the program, co-supervision will be encouraged (as indicated in examples below), allowing students to combine research elements from different fields of biology, or across other disciplines (e.g. Chemistry, Physics, Computer Science). Students will be guided by a supervisory committee with expertise in the relevant areas.

This program will provide a unique combination of interdisciplinary training and practical application leading to a diversity of possible career pathways. Distinguishing features of the program include:

- training in interdisciplinary approaches that cross traditional academic boundaries
- emphasis on application of biological knowledge to real-world issues
- a graduate training environment that emphasizes preparation for non-academic careers
- explicit incorporation of training via partnerships with off-campus organizations and other labs
- partnerships with other Departments at UTSC as well as the other campuses
- programmatic elements relating to UTSC's position at the rural-urban interface

Program Requirements:

- Courses
- Supervisory Committee Meetings
- PhD Proposal and Qualifying Exam
- Practicum
- Program Colloquia
- Thesis and Final Oral Exam (FOE)

Courses

Graduate coursework will provide training in interdisciplinary approaches and applied biology. In alignment with similar tri-campus PhD graduate program requirements in the natural sciences, students in IAB will complete 2.0 FCEs in total for regular entry and 2.5 FCEs for direct entry, consisting of:

- **IAB1010Y IAB Seminar Series** (0 FCE): This is a required “continuous” seminar series that lasts for the duration of the PhD program. This course is for CR/NCR only and does not contribute to the required FCE. Students must, except during their practicum placement or any required remote work towards their thesis, attend at least 10 out of 12 weekly seminars during each fall and winter term. It is expected that attendance at the IAB weekly seminars will be how most students comply with this requirement. With the approval of the supervisor(s), students may attend comparable weekly seminars (e.g., held by cognate departments or on other campuses) instead. The course is completed when the student

successfully defends their PhD thesis.

- **IAB1100H Foundations of Interdisciplinary and Applied Research (0.5 FCE):** This is a required first-year cohort-building graduate core course in Interdisciplinary and Applied Biology. This course will involve multiple faculty members from diverse fields of study and provide training in using multiple technical approaches and perspectives to analyze biological problems.
- **IAB3300H Interdisciplinary and Applied Biology Practicum (0.5 FCE):** The program will have a prescribed training component involving a strategic partner organization, such as the Toronto Zoo, Toronto and Region Conservation Authority, Rouge National Park, Fisheries and Oceans Canada, Ontario Ministry of Natural Resources, Centenary Hospital, Scarborough and Rouge Hospital, SciNet, and biotechnology and pharmaceutical companies, or other university labs. This training component would typically involve a full-time 4-month (one academic term) practicum with the partner organization. The student will produce a written report and reflection on their placement research and experience.
- **IAB3310H Interdisciplinary and Applied Biology Colloquium (0.5 FCE):** This course provides a forum in which students present the results of their thesis-based and placement-based (IAB3300H) research in a formal seminar. The colloquium will take place once a year, each fall. Students are encouraged to attend each year for the duration of their program. Each student will present at the colloquium once during their program tenure (typically in year 3 or 4). Colloquium attendance is mandatory until candidacy is achieved (except during their placement period [IAB3300H], or if approved, thesis-related work/travel prevents this). Student attendance and participation, along with written reflections or reports, are assessed for a letter grade by the graduate advisory committee, with unapproved absences negatively impacting their course grade.
- **0.5 (regular entry) or 1.0 (direct entry) FCE of additional coursework** to deepen the expertise needed for their research. This can be fulfilled either by enrolling in 0.5-FCE graduate courses or combining 0.25-FCE module courses from graduate courses offered by the Biological Sciences graduate program (e.g., IAB2200H, IAB2210H) or other graduate departments in consultation with the supervisory committee and upon approval of the Graduate Program Director.

- **Supervisory Committee Meetings**

Student progress in the program is monitored through annual supervisory committee meetings throughout the degree. Students must prepare and submit to committee members in advance of the meeting a maximum 10-page written report outlining the background to the project, aims and hypotheses, and summarizing progress to date and outlining future experimental plans. At the committee meeting, students will give an ~20 minute oral presentation outlining these details, followed by questioning from supervisory committee members. Students entering via the Direct-Entry stream are required to hold at least one additional supervisory committee meeting during their first year (i.e. conduct at least 2). This requirement is meant to ensure that these students are making good progress in both their coursework and developing the necessary theoretical and technical skills required for their PhD research, and to provide the opportunity for early identification of knowledge gaps.

PhD Proposal and Qualifying Exam

IAB regular-entry students will be required to submit a written PhD proposal and undertake a Qualifying Exam within 16-20 months after the start date of enrollment in the program; IAB Direct-Entry students have 16–22 months to do so. This Qualifying Exam involves three components:

- Preparation of an ~10-15 page written research proposal containing the following elements:
 - Title, name, abstract, list of abbreviations
 - Abstract summarizing all aspects of the proposal (~200 words)
 - Introduction and Literature Review
 - Overall goals and objectives
 - Hypothesis or hypotheses
 - Significance/Impact
 - Progress to date – methods and preliminary results presented in text and figures/tables
 - Proposed Research – specific aims and methodologies, potential pitfalls and alternative approaches
- 20-25 minute oral presentation of the proposal to the department and questioning by the public
- ***In-camera*** questioning by a PhD proposal examination committee, consisting of the primary supervisor and co-supervisor (as relevant), two members of the supervisory committee, and one (or two) faculty member(s) from IAB or another

graduate department at the University of Toronto who is not a member of the supervisory committee (external examiner), immediately following the public presentation.

The focus of the Qualifying Exam is on the background theory and proposed research, rather than on progress to date. The outcome for a PhD proposal exam will be:

- Pass and proceed in the PhD program
- Incomplete: the student has demonstrated some of the required skills and knowledge but has not satisfied the committee. The student will be asked to repeat the proposal process within 4 months, at which time the student will either pass or fail. A fail is defined as follows: the student has shown considerable lack of background knowledge and poor development of research skill and will be asked to leave the program

Practicum

Students will complete a research project with an academic, industry, NGO, or government agency partner during a practicum placement (IAB3300H) that focuses on an **applied or interdisciplinary issues in biological sciences** that is complementary to their thesis project. The expectation is that placements would be paid internships from the host organization or supported through fellowships (e.g. Mitacs) and students will be employees of the partner.

These research projects will prioritize interdisciplinary approaches and includes external partners, and these will be assessed explicitly as a criterion in student committee meetings and proposal defense. Example projects based on current interests of participating faculty include:

1) The impact of anthropogenic stressors on lipid metabolism, plant health, food production, and resilience. Faculty supervisors Xue Pan (plant molecular biologist) and Marnie Isaac (environmental chemist, DPES) working with an internship partner such as Vineland Research and Innovation Center. This project would assess how lipid metabolism and signaling influence plant development and responses to the effect of climate change (e.g. increased temperature) and scale up these findings to project food production under scenarios of environmental change drivers. The student would learn molecular biology techniques, including advanced imaging and chromatographic techniques to assess lipid dynamics, advanced spatial statistics and climate modeling approaches, and how to integrate technical and policy improvements in the

agroecology to apply findings to designing food systems to ensure food security under future climates.

2) The impact of insect pathogens on ecosystem services in urban environments.

Faculty supervisors Ina Anreiter (invertebrate physiologist) and Scott MacIvor (pollination ecologist) working with an internship partner such as a community garden NGO. Here the student would examine how urban stressors affect wild bee physiology and how the resulting reduced activity and increased mortality impacts pollination rates in urban food production systems. The student would learn environmental monitoring and assessment protocols to detect pathogen presence and quantify exposure risk. They would also hone advanced molecular and genetic techniques to assess pathogen impact, and develop community outreach and coordination expertise, including in environmental and community advocacy and policy development.

3) The impact of persistent organic pollutants (POPs) on mammalian immune systems.

Faculty supervisors Bebhinn Treanor (immunology) and Satyaki Rajavasireddy (genomics and transcriptomics) working with internship partner the NGO Environmental Defense. Here, the student would assess the impact of POPs on immune function and the underlying molecular mechanisms using transcriptomic and proteomic approaches. The student would learn cellular and molecular biology techniques, advanced imaging modalities, and genomics and proteomics techniques. The placement with an NGO such as Environmental Defense would allow the student to learn how to translate scientific findings into regulatory policy.

4) Bio-inspiration in acoustic technology. Bio-inspired approaches to technology and materials science are increasingly important in a wide range of disciplines. Here, working with faculty supervisor Andrew Mason (bioacoustics and sensory biology), the student will conduct research on microscale animal acoustic systems, with the specific aim of identifying and developing novel sensory technologies. Potential partnerships with industry (or FASE) would create novel research opportunities in applied biology. See, for example:

<https://www.strath.ac.uk/research/subjects/electroniclectricalengineering/instituteforsensors/signalscommunications/centreforultrasonicengineering/>

5) Host-pathogen interactions and disease spread. Faculty co-supervisors Christina Guzzo (virology) and Peter Molnar (ecological modeling) working with Health Canada. Here, the student would combine examining host-pathogen interactions from a molecular and cellular perspective with ecological modeling of disease spread. The

student would learn molecular and cellular biology techniques including proteomic approaches and advanced imaging, as well as develop mathematical and statistical models and analysis of existing datasets of the spread of disease in human populations.

6) Cellular mechanisms mediating the function of adjuvants and carrier nanoparticles in vaccine formulation. Faculty supervisor Mauricio Terebiznik (cell biology) working with Dr Roger Brookes (immunology, Principal Scientist at Sanofi Canada) and Dr Rajarshi Royshoundhury (Head of Formulation and Stability Division at Sanofi Canada). Here, the student would investigate the cellular pathways that lead to the uptake and intracellular fate of particulate components in vaccine formulations to better understand the delivery and processing of antigenic materials in cells. The student would learn to formulate, prepare and characterize the physiochemical properties of vaccine nanoparticles with Sanofi scientists and determine how these properties impact their interaction with cellular process at Prof Terebiznik's lab. Students would investigate how fabrication and environmental variables could affect vaccine nanoparticles–cell interactions, to predict optimal distribution and storage conditions for vaccine formulations.

7) Coordinated development of a research thesis project and the related pedagogical toolkit for student-centered learning. Co-supervised by Ken Welch (vertebrate physiology) and academic partner, Aarthi Ashok (cell biology and pedagogy of biology), the student will study how dietary specialization shaped the evolution of glucose homeostasis in bats, while simultaneously developing education research themes and materials to immediately empower educators to teach these concepts, and their relationship to the broader subjects of dietary, physiology, and evolution in undergraduate curricula. The student will develop expertise in vertebrate physiology and ecology, learn advanced statistical skills for analyzing data in phylogenetically informed ways, while simultaneously developing teaching skills, teaching materials, and the scaffolding to evaluate learning outcomes effectively.

8) Connecting biostatistical analyses experience with a project in the Scholarship of Teaching and Learning (SoTL). Students completing research projects in biological science fields that include developing expertise in analyses of large datasets could partner with teaching stream faculty in the department to conduct research in teaching-as-learning (TAR) projects. These projects may include analysing student performance on pre- and post-tests to evaluate student learning gains, meta-analyses of student performance in multiple courses to assess effectiveness of pedagogical techniques, and using mixed method models to understand the impact of teaching strategies on specific

student demographic groups. The student will develop expertise in statistical analyses and learn about pedagogical techniques and SoTL while developing their own teaching portfolios. The student will learn transferability of their data analyses skills from their research project to a discipline-based education research project that aligns with their interests in biology education.

Program Colloquia

As outlined above under Courses, IAB students will participate in the annual colloquium, which provides a scaffolded and capstone experience for students preparing to, and returning from, their practicum placements (IAB3300H). In the first two or three years, IAB students will attend the annual colloquium, in which senior IAB students will present their practicum work and experience, together with keynote presentations by select academic and placement partners speakers, and will engage in broad, interdisciplinary discussions of presented work. Upon completion of their IAB3300H practicum placement, each IAB student will prepare and present (at the next colloquium) an oral talk summarizing their practicum work and experience.

The annual colloquium will serve to highlight the program-specific experiential learning achievements of senior students, to inspire and educate more junior students, to explicitly foster peer-to-peer learning and cohort building. Presenting students will be challenged to effectively convey their work and its importance to a broad audience.

Thesis and Final Oral Exam (FOE)

Students will complete a thesis adhering to UofT School of Graduate Studies (SGS) guidelines: [Doctoral Thesis Guidelines – School of Graduate Studies](#). PhD candidates will present their thesis for evaluation to a Thesis Approval Committee before proceeding to the School of Graduate Studies (SGS) PhD Final Oral Examination. The Thesis Approval Meeting must be held six to eight weeks prior to the SGS PhD FOE. The PhD FOE committee will consist of the supervisor (and Co-supervisor if applicable), two members of the thesis advisory committee, one or two IAB faculty members, or faculty with an SGS appointment from another cognate department who are not directly involved with the thesis research, and an examiner external to University of Toronto. A quorum of 4 voting members is required.

Table 1: Degree Level Expectations, Program Learning Outcomes and Requirements

Guidance: If the proposal is undergraduate, please replace this table with a similar undergraduate table, or an alternative in order to demonstrate alignment of DLEs to PLO. All divisions' [DLE descriptions are on the VPAP website](#).

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAVP])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
Expectations: This PhD in Interdisciplinary and Applied Biology is awarded to students who have demonstrated the following:		
1. Depth and Breadth of Knowledge A thorough understanding of a substantial body of knowledge that is at the forefront of their academic discipline or area of professional practice.	Depth and Breadth of Knowledge is defined in Interdisciplinary and Applied Biology as: Program Objective 1: proficiency in current understanding of biology and their potential application in interdisciplinary or applied research Program Objective 2: thorough understanding of how current knowledge and techniques in biological research can inform	The program design and requirements that ensure these student outcomes for depth and breadth of knowledge are: - Qualifying Exam: LO 1-LO 3. - IAB 1100H (Foundations of Interdisciplinary and Applied Research): LO 1-LO 3 - IAB 1010Y (Seminar Series): LO 2.

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
	practical issues and technological, policy, and management applications This is reflected in students who are able to: Learning Outcome (LO)1: generate new questions in the context of existing scientific knowledge in primary field of study and identify relevant approaches and techniques to answer these questions and advance scientific understanding and application LO 2: integrate the knowledge from a secondary field of study that complements their primary field of study LO 3: demonstrate both breadth and depth of knowledge in the core areas	- IAB 3300H (Interdisciplinary and Applied Biology Practicum): LO 1-LO 3. - IAB 3310H (Interdisciplinary and Applied Research Colloquium): LO 2, LO 3. - Additional Coursework (various, see Appendix A): LO 2, LO 3. - Thesis and Oral Exam: LO 1-LO 3.

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
	of biology as determined by the written PhD proposal and qualifying exam	
2. Research and Scholarship The ability to conceptualize, design, and implement research for the generation of new knowledge, applications, or understanding at the forefront of the discipline, and to adjust the research design or methodology in the light of unforeseen problems. The ability to make informed judgments on complex issues in specialist fields, sometimes requiring new methods; and The ability to produce original research, or other advanced scholarship, of a quality to satisfy peer review, and to merit publication.	Research and Scholarship is defined in Interdisciplinary and Applied Biology as... Program Objective 3: scientific literacy representing expertise in the current state of knowledge in more than one discipline within biology Program Objective 4: comprehension of how research methodologies are used to create and interpret knowledge in the disciplines of biology This is reflected in students who are able to: LO 4: identify knowledge gaps in the primary field of study and design and	The program design and requirements that ensure these student outcomes for research and scholarship are: - Advisory Committee Meetings: LO 4-LO 8. - Qualifying Exam: LO 4-LO 8. - IAB 1100H (Foundations of Interdisciplinary and Applied Research): training. LO 5 - IAB 3300H (Interdisciplinary and Applied Biology Practicum): Practicum experiences and written report LO 4-LO 8. - IAB 3310H (Interdisciplinary and Applied Research Colloquium): Attending

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
	implement innovative research initiatives aimed at addressing them. Integrate knowledge from the secondary field of study as appropriate to support research LO 5: review and evaluate the current scientific literature in both primary and secondary fields of study, and make informed judgements regarding the research approaches taken. LO 6: design experiments that exhibit rigorous scientific methodologies, articulate findings and produce research papers that would meet peer review requirements, if published LO 7: assemble and interpret information and supporting data that represent the current state of	colloquia and presenting research LO 6, LO 8. - Additional Coursework (various, see Appendix A): Coursework and class assignments LO 4, LO 5, LO 7. - Thesis and Oral Exam: LO 4-LO 8.

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
	knowledge on a contemporary scientific issue or question LO 8: demonstrate originality in the application of knowledge and development of written arguments	
3. Application of Knowledge The capacity to undertake pure and/or applied research at an advanced level; and contribute to the development of academic or professional skills, techniques, tools, practices, ideas, theories, approaches, and/or materials.	Application of Knowledge is defined in Interdisciplinary and Applied Biology as... Program Objective 5: Conduct original research at the intersection of multiple fields of biology This is reflected in students who are able to: LO 9: demonstrate proficiency in experimental design, data collection, and analysis	The program design and requirements that ensure these student outcomes for application of knowledge are: - Advisory Committee Meetings: LO 9, LO 10 - IAB 3310H (Interdisciplinary and Applied Research Colloquium): presenting at colloquium LO 9, LO 10. - IAB 3300H (Interdisciplinary and Applied Biology Practicum): Practicum report LO 9, LO 10. - Qualifying Exam: LO 9.

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
	LO 10: conduct original research that advances understanding within primary field of study, supported by work within secondary field, and exhibit adaptive problem-solving as appropriate.	- Thesis and Oral Exam: LO 9, LO 10.
4. Professional Capacity/ Autonomy The qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and largely autonomous initiative in complex situations; The intellectual independence to be academically and professionally engaged and current; The ethical behavior consistent with academic integrity and the use of appropriate guidelines and procedures for responsible conduct of research;	Professional Capacity/Autonomy is defined in Interdisciplinary and Applied Biology as... Program Objective 6: effectively and independently manage a program of original interdisciplinary or applied research This is reflected in students who are able to: LO 11: prepare a formal proposal for a program of research suitable for competitive funding applications	The program design and requirements that ensure these student outcomes for professional capacity/autonomy are: - Advisory Committee Meetings: LO 11-LO 13. - IAB 1100H (Foundations of Interdisciplinary and Applied Research): Training in LO 12-LO 14. - IAB 3300H (Interdisciplinary and Applied Biology Practicum): Practicum

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
The ability to evaluate the broader implications of applying knowledge to particular contexts.	LO 12: work independently to meet milestones as appropriate, including the creation of deliverables, and the dissemination and publication of results that would meet peer-review standards. LO 13: formulate different hypothesis and justify the approaches used to test the hypotheses based on self-directed learning from the existing knowledge base (including alternative approaches) LO 14: apply ethical considerations in research and adhere to guidelines and procedures for the responsible conduct of research, consistent with academic integrity	experience and written report LO 11-LO 14. - Additional Coursework (various, see Appendix A): some class topics include discussions of ethics LO 14. - Thesis and Oral Exam: LO 11-LO 14.

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
5. Communications Skills The ability to communicate complex and/or ambiguous ideas, issues and conclusions clearly and effectively.	Communications Skills is defined in Interdisciplinary and Applied Biology as... Program Objective 7: communicate, for appropriate areas of expertise and for a range of audiences, the current level of scientific understanding, outstanding questions, and relevant methodologies This is reflected in students who are able to: LO 15: effectively communicate complex scientific concepts in written and oral form to a professional audience LO 16: disseminate scientific research to broad audiences	The program design and requirements that ensure these student outcomes for communication skills are: - Advisory Committee Meetings: LO 15, LO16. - IAB 1010Y (Seminar Series): Attendance at and presenting LO 15, LO 16. - IAB 3300H (Interdisciplinary and Applied Biology Practicum): Practicum experience and written report LO 15, LO16. - IAB 3310H (Interdisciplinary and Applied Research Colloquium): presenting at colloquium LO 15, LO16. - Additional Coursework (various, see Appendix A):

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
		Class assignments in various electives LO 15-LO 16. - Qualifying Exam: LO 15 - Thesis and Oral Exam: LO15, LO16.
6. Awareness of Limits of Knowledge An appreciation of the limitations of one's own work and discipline, of the complexity of knowledge, and of the potential contributions of other interpretations, methods, and disciplines.	Awareness of Limits of Knowledge is defined in Interdisciplinary and Applied Biology as... Program Objective 8: Be aware of the validity and applicability of scientific methods in different contexts and applications This is reflected in students who are able to:	The program design and requirements that ensure these student outcomes for communication skills are: - Advisory Committee Meetings: LO 17-LO19. - IAB 3300H (Interdisciplinary and Applied Biology Practicum): Practicum experience and written report LO 17-LO19. - IAB 3310H (Interdisciplinary and Applied Research Colloquium): presenting at colloquium LO 17-LO 19.

<u>Doctoral DLEs (Based on the Ontario Council of Academic Vice-Presidents [OCAV])</u>	<u>Doctoral Program Learning Outcomes</u>	How the Program Design/Structure of the Required Courses and Other Learning Activities Supports the Achievement of Program Learning Outcomes
	LO 17: identify the relevance of knowledge from other disciplines and approaches LO 18: critically evaluate experimental design approaches and research and identify its limitations LO 19: contextualize their scientific research within the broader field(s)	- Qualifying Exam: LO 17, LO 18. - Thesis and Oral Exam: LO 17-LO 19.

For Graduate Programs Only

- f) Clear rationale for program length that ensures that students can complete the program-level learning outcomes and requirements within the proposed time.
 1. Evidence that each graduate student in the program is required to take all of the course requirements from among graduate-level courses (see language included in response below).
 - a. For research-focused graduate programs, clear indication of the nature and suitability of the major research requirements for degree completion.

Sequencing (including Continuous enrolment in IAB1010Y and IAB3310H)

Regular PhD Option:

Year	Requirements
1	IAB1010Y Seminar Series; IAB1100H Foundational Course; IAB3310H Colloquium
2	0.5 FCE elective; IAB1010Y Seminar Series; IAB3310H Colloquium; Qualifying Exam within 16-20 months
3	IAB1010Y Seminar Series; IAB3300H Practicum; IAB3310H – Presentation. Candidacy Achieved by end of year three
4	IAB1010Y Seminar Series; Final Oral Exam

- Year 1 – IAB1100H: Foundations of Interdisciplinary and Applied Research. Conduct a minimum of one supervisory committee meeting.
- Year 2 – Written PhD Proposal and Qualifying Exam (within 16 – 20 months); Take 0.5 FCE in elective modular grad courses (see Appendix A)
- Year 3 - Practicum (IAB3300H); Complete remaining modular coursework (if any); Present at IAB Colloquium (IAB3310H)
- Year 4 – Thesis and SGS PhD Final Oral Examination

The program length for all students entering the PhD with an appropriate Master's degree is four years and the time limit is six years. Students will receive funding for 4 years and we anticipate most students will complete in under six years.

Direct-entry Option:

Year	Requirements
1	IAB1010Y Seminar Series; IAB1100H Foundational Course; IAB3310H Colloquium; 0.5 FCE elective
2	IAB1010Y Seminar Series; IAB3310H Colloquium; 0.5 FCE elective; Qualifying Exam within 16-22 months
3	IAB1010Y Seminar Series; IAB3310H Colloquium; IAB3300H Practicum
4	IAB1010Y Seminar Series; IAB3310H Colloquium - Presentation (if not completed in year 3); Candidacy Achieved by end of year four
5	IAB1010Y Seminar Series; Final Oral Exam

- Year 1 – IAB1100H: Foundations of Interdisciplinary and Applied Research; Complete additional 0.5 FCE in supportive grad courses as recommended/required by supervisory committee. Conduct a minimum of two supervisory committee meetings.
- Year 2 – Written PhD Proposal and Qualifying Exam (within 16 – 22 months); Take 0.5 FCE in elective modular grad courses (see Appendix A);
- Year 3 – If required by committee, complete additional 0.5 FCE in supportive grad courses.
- Year 4 - Practicum (IAB3300H); Complete remaining modular coursework (if any); Present at IAB Colloquium (IAB3310H)
- Year 5 – Thesis and defense

The program length for all students entering the PhD with an undergraduate degree (Direct-Entry) is five years and the time limit is seven years. Students will receive funding packages for 5 years and we anticipate most students will complete in under seven years.

Whereas the Province's Quality Assurance Framework requires that students complete a minimum of two-thirds of courses at the graduate level, the University of Toronto requires graduate students to complete all their course requirements from among graduate-level courses. This proposed program complies with the University of Toronto's requirements

6 Assessment

- a) Discuss the appropriateness of the methods for assessing student achievement of the program-level learning outcomes and degree level expectations.
- b) Discuss the appropriateness of the plans to monitor and assess the following:
 - 1. The overall quality of the offering's structure
 - b. Whether the program and/or the offering within the program is achieving in practice its proposed objectives
 - c. Whether its students are achieving the program-level learning outcomes
 - d. How the resulting information will be documented and subsequently used to inform continuous program improvement.

Learning Outcomes & Assessment

LO1: generate new questions in the context of existing scientific knowledge in primary field of study and identify relevant approaches and techniques to answer these questions and advance scientific understanding and application

Assessed through assignments via coursework in IAB 1100H (Foundations of Interdisciplinary and Applied Research) and IAB 2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will also be assessed through supervisor mentorship and annual committee meeting written reports and questioning by committee members, and ultimately through the successful defence of the thesis. The veracity of data collection or production is a key component of the successful defense of the thesis. Another important criterion for the successful defence of the thesis is the analysis and interpretation of data according to methods that are accepted within the discipline. As part of a thesis discussion, new findings must be contextualized in relation to major concepts and/or methods within biological sciences. The discussion must include a connection between research findings and other advanced knowledge in biological sciences. It is also expected that there will be a critical evaluation of the robustness of key results and a critical presentation of the strengths and weaknesses of a research project. The thesis should also include future research directions that build upon the major findings of the completed project.

LO 2: integrate the knowledge from a secondary field of study that complements their primary field of study

Assessed through annual written committee reports and questioning by committee members, as well as the completion of a thesis literature review, and coursework and assignments in IAB 1100H (Foundations of Interdisciplinary and Applied Research), IAB 2250H (Discipline-Based Education Research in Biology), and IAB 3310H (Interdisciplinary and Applied Research Colloquium).

LO 3: demonstrate both breadth and depth of knowledge in the core areas of biology as determined by the written PhD proposal and qualifying exam

Assessed through the literature review component of the PhD proposal and the candidate's ability to respond to questions from the examining committee. Research requires a sound understanding of the foundation of our current understanding such that new ideas may be generated. By writing a literature review, students will engage deeply with the current literature in biological sciences and learn to both critically evaluate previous research and synthesize research in order to evaluate past research, critically identify compelling scientific questions, and design research projects within the context of established and/or emerging paradigms. The supervising professor will oversee the completion of the thesis literature review and provide critical feedback as needed. Depth and breadth of knowledge will also be assessed through questions from qualifying exam members. The underlying outcome here is to increase content knowledge, to improve critical evaluation and synthesis skills and to improve written and oral communication abilities.

LO 4: identify knowledge gaps in the primary field of study and design and implement innovative research initiatives aimed at addressing them. Integrate knowledge from the secondary field of study as appropriate to support research

Assessed through assignments via coursework in IAB 1100H (Foundations of Interdisciplinary and Applied Research) and IAB 2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will also be assessed through supervisor mentorship, annual written committee reports and questions by supervisory committee members, and ultimately through the successful defence of the thesis. The written PhD proposal will document knowledge gaps and design research methodologies to address them, and the candidate's understanding of how to implement research methodologies to address their questions will be assessed through questioning by the examining committee. The thesis and FOE will serve to assess the successful implementation of the research initiatives and the integration of knowledge from a secondary field of study through the literature review

component, the veracity of data collection, the analysis and interpretation of data, and as part of the thesis discussion, where new findings must be contextualized in relation to major concepts and/or methods within biological sciences.

LO 5: review and evaluate the current scientific literature in both primary and secondary fields of study, and make informed judgements regarding the research approaches taken.

Assessed through assignments via coursework in IAB 1100H (Foundations of Interdisciplinary and Applied Research) and IAB 2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will also be assessed through supervisor mentorship, annual written committee reports and questions by supervisory committee members, and ultimately through the successful defence of the thesis. Committee reports and the thesis will include a literature review and discussion that will critically evaluate the research approaches and validity of published research findings

LO 6: design experiments that exhibit rigorous scientific methodologies, articulate findings and produce research papers that would meet peer review requirements, if published

Assessed through annual supervisory committee meeting reports and questions by supervisory committee members, and the successful FOE of a research thesis overseen by a committee of four professors, including the supervising professor or co-supervising professors. Students will be mentored by supervisors to produce research at a standard suitable for peer-reviewed publication.

LO 7: assemble and interpret information and supporting data that represent the current state of knowledge on a contemporary scientific issue or question

Introduced in IAB1100H (Foundations of Interdisciplinary and Applied Research), and further developed in IAB2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will ultimately be assessed through both supervisor mentorship, annual supervisory committee meeting reports and questioning by committee members, and the successful defense of the thesis. Assessment of this LO will emphasize the literature review component of committee reports and the thesis. Research requires a sound understanding of the foundation of our current understanding such that new ideas may be generated. By writing a literature review, students will engage deeply with the current literature in the biological sciences and learn to both critically evaluate previous research and synthesize research in order to evaluate past research, critically identify compelling

scientific questions, and design research projects within the context of established and/or emerging paradigms. The supervising professor will oversee the completion of the thesis literature review and provide critical feedback as needed. The underlying outcome here is to increase content knowledge, to improve critical evaluation and synthesis skills and to improve written communication abilities.

LO 8: demonstrate originality in the application of knowledge and development of written arguments

Assessed through coursework assignments, annual written committee reports and through the successful FOE of the thesis. The clarity and appropriate conciseness of the writing is inherent within the criteria of the thesis having merit to be or contribute to a peer-reviewed publication.

LO 9: demonstrate proficiency in experimental design, data collection, and analysis

Introduced in IAB 1100H (Foundations of Interdisciplinary and Applied Research), further developed IAB 2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will be assessed through both supervisor mentorship, annual written committee reports, and the successful FOE of the thesis. The veracity of experimental design and data collection is a key component of the successful defense of the thesis. Another important criterion for the successful defence of the thesis is the analysis and interpretation of data according to methods that are accepted within the discipline. As part of a thesis discussion, new findings must be contextualized in relation to major concepts and/or methods within biological sciences. The discussion must include a connection between research findings and other advanced knowledge in biological sciences. It is also expected that there will be a critical evaluation of the robustness of key results and a critical presentation of the strengths and weaknesses of a research project.

LO 10: conduct original research that advances understanding within primary field of study, supported by work within secondary field, and exhibit adaptive problem-solving as appropriate

Assessed through annual committee meeting reports and questioning by supervisory committee members, and the successful defense of a research thesis overseen by a committee of four professors, including the supervising professor or co-supervising professors. Students will be mentored by supervisors to produce research at a standard suitable for peer-reviewed publication.

LO 11: prepare a formal proposal for a program of research suitable for competitive funding applications

The relevant skills will be introduced in all coursework in the program, and progress will be assessed in course assignments. The primary assessment for this LO is through both supervisor mentorship and the successful completion of the qualifying exam, which will incorporate a presentation and oral defense of a written research proposal that will form the basis of the thesis. The clarity and appropriate conciseness of the writing, and the ability to contextualize the research to support competitive funding applications is inherent within the criteria of the thesis having merit to be or contribute to a peer-reviewed publication.

LO 12: work independently to meet milestones as appropriate, including the creation of deliverables, and the dissemination and publication of results that would meet peer-review standards.

Assessed coursework and assignments in IAB 1100H (Foundations of Interdisciplinary and Applied Research), IAB3300H (Interdisciplinary and Applied Biology Practicum), IAB3310Y (Interdisciplinary and Applied Biology Colloquium), and other relevant courses that are offered in the IAB program. Also assessed through annual committee meeting reports and questioning by supervisory committee members, and the successful defense of a research thesis overseen by a committee of four professors, including the supervising professor or co-supervising professors. Students will be mentored by supervisors to produce research at a standard suitable for peer-reviewed publication.

LO 13: formulate different hypotheses and justify the approaches used to test the hypotheses based on self-directed learning from the existing knowledge base (including alternative approaches).

Assessed through assignments via coursework in IAB 1100H (Foundations of Interdisciplinary and Applied Research) and IAB 2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will also be assessed through supervisor mentorship, annual committee meeting reports and questioning by the supervisory committee, and ultimately through the successful defence of the thesis. The veracity of experimental approaches a key component of the successful defense of the thesis. Another important criterion for the successful defence of the thesis is the analysis and interpretation of data according to methods that are accepted within the discipline. As part of a thesis discussion, new findings must be contextualized in relation to major concepts and/or methods within biological sciences.

LO 14: apply ethical considerations in research and adhere to guidelines and procedures for the responsible conduct of research, consistent with academic integrity.

This outcome is largely concerned with the student's performance in a real research group setting, and will be assessed through 1) the supervisor-student relationship during the student's work in gathering or producing data for production of the thesis. And 2) The student's performance in IAB 3300H (Interdisciplinary and Applied Biology Research Practicum). Ethics and appropriate conduct of research will also be assessed in required research methods courses, IAB 1100H (Foundations of Interdisciplinary and Applied Research) and UofT training courses required for working with humans and other vertebrates (i.e. Animal Ethics course and Animal Handling and Procedures courses).

LO 15: effectively communicate complex scientific concepts in written and oral form to a professional audience.

Written communication abilities are assessed through coursework assignments, annual committee meeting reports, and through the successful defense of the thesis. The clarity and appropriate conciseness of the writing is inherent within the criteria of the thesis having merit to be or contribute to a peer-reviewed publication. Oral communication abilities are assessed through student participation in IAB 1010H (IAB Seminar Series) and IAB 3310H (Interdisciplinary and Applied Research Colloquium), through course assignments, annual committee meeting presentations, public presentation of the PhD proposal, and as part of the successful oral defense of the thesis.

LO 16: disseminate scientific research to broad audiences.

Assessed through student participation in IAB 1010H (IAB Seminar Series) and IAB 3310H (Interdisciplinary and Applied Research Colloquium), through course assignments, annual committee meeting reports and presentations, the written PhD proposal and public presentation, and through the successful defense of the thesis. In each of these contexts, students will need to effectively communicate with audiences ranging from the public, students in other disciplines, peers, and faculty who are experts in certain subject matters. The clarity and appropriate conciseness of the writing is inherent within the criteria of the thesis having merit to be or contribute to a peer-reviewed publication.

LO 17: identify the relevance of knowledge from other disciplines and approaches.

Assessed as part of two courses: IAB 1100H (Foundations of Interdisciplinary and Applied Research) and IAB 2250H (Discipline-Based Education Research in Biology), and other IAB courses. The critical evaluation of published research will be reviewed as part of these courses. This LO is also assessed through annual committee meeting reports and questioning by the supervisory committee, and through the research process leading to the successful defense of a thesis. A key criterion for successful defense of the PhD thesis will be the student's ability to apply diverse scientific knowledge and methods to their thesis research.

LO 18: critically evaluate experimental design approaches and research and identify its limitations.

Assessed through assignments in IAB 1100H (Foundations of Interdisciplinary and Applied Research), IAB 2250H (Discipline-Based Education Research in Biology) and other relevant courses that are offered in the IAB program. This will also be assessed through supervisor mentorship, annual committee meeting reports and questioning by the supervisory committee, and ultimately through the successful defence of the thesis.

LO 19: contextualize their scientific research within the broader field(s).

Assessed using written assignments and oral presentations as part of IAB 1100H (Foundations of Interdisciplinary and Applied Research), IAB 3300H (Interdisciplinary and Applied Biology Research Practicum), and IAB 3310H (Interdisciplinary and Applied Research Colloquium). The critical evaluation of published interdisciplinary and applied research will be reviewed as part of IAB 1100H and other courses offered in the IAB program. Students will acquire practical training during the placement in IAB 3300H, and contextualize this experience by participating in a research colloquium in IAB 3310H, comprising all students who have completed their practicum that year. This LO is also assessed through annual committee meeting reports and oral presentations to the supervisory committee, the written PhD proposal and public presentation, and through the research process leading to the successful defense of a thesis. A key criterion for successful defense of the PhD thesis will be inherent in the student's ability to situate their work within the current state of knowledge in relevant disciplines and in the context of outstanding scientific questions and societal needs.

Plans to Monitor and Assess the Quality of the Offering's Structure

We anticipate reviewing metrics relevant to the program such as enrolment data, success rates of qualifying exams and time to completion in accordance with the criteria and timelines of the UTQUAP process. Annually, the Graduate Program Chair will strike a committee to review all course outlines to ensure consistent alignment with program learning outcomes. This committee will also monitor student achievement and student feedback (e.g. course evaluation data) to engage in ongoing program improvement.

7 Need and Demand

- a) Provide a brief description of the need and demand for the proposed program, including information on student demand and internal cognate and external comparator programs. Please fill out and refer to the table in Appendix E listing the comparator programs.

The biomedical, biotechnological, and green technology sectors have seen tremendous growth and are important economic drivers in Canada^{1,2,3,4}, accounting for billions of dollars in economic activity⁵. For example, the green tech economy has grown more than 20% in the past decade³. Training highly skilled and innovative contributors to these sectors requires rigorous research-based skills development, along with an integrative knowledge base and an ability to apply scientific understanding to technology development and practical solutions to global problems. The IAB PhD program will provide a training environment that prioritizes not only integrative scientific rigour but also knowledge translation, as well as giving students practical experience in non-academic settings.

Students who aspire to find positions in non-academic sectors recognize that graduate-level training is an important route for developing practical skills and experience necessary for realizing career prospects and professional success. Insufficient practical skills training is seen by students and funders as a key training gap in Canada and elsewhere^{8,9,10}. The distinguishing aspects of the proposed program (interdisciplinary training, placements with diverse organizations, and focus on translation or applied research) will appeal to both students who intend to pursue careers in non-academic sectors, and ones interested in academic careers who recognize the advantages of interdisciplinary training^{5,6,7}, or who want to develop their own research program that prioritizes societal impact and codesign with communities, industry, and non-academic

organizations¹¹. Given the explicit necessity to produce trainees with practical and transferrable skills, there is clear need for an applied, skills-oriented biology program.

We expect this program will attract a diverse group of high-calibre domestic and international students who have completed undergraduate and MSc degrees in a variety of scientific and technological life-sciences disciplines. Many of our faculty members regularly engage in conversations with prospective students who express a desire to obtain applied and transferrable skills, and the IAB program will be a highly desirable program at one of Canada's premier universities.

To evaluate potential demand for the IAB program, we conducted a survey of undergraduate and graduate students in the Department of Biological Sciences to assess interest in this proposed IAB program offered by the Department of Biological Sciences at UTSC (Appendix F). A total of 321 students completed the survey, of which 90% were currently undergraduate students, and therefore prospective IAB applicants. The vast majority (86%) of respondents indicated that they were interested in a graduate program following their current degree. Notably, when asked how important they consider the experiential learning component (practicum) of the IAB program, 93% indicated high or very high. Similarly, 93% indicated high or very high when asked how important they consider the IAB program's emphasis on real-world applicability of biological knowledge. Respondents were highly enthusiastic about the program, with 84% of respondents indicating a high or very high level of interest in the program, and 68% of indicating that if the program were available they would apply. Further, albeit not a PhD program, the success of the professional Master of Environmental Science program at UTSC provides compelling evidence that applied and external-focussed training, research, and partnerships are in high demand.

The proposed IAB program is distinct from other programs at U of T and elsewhere. Appendix H contains a comparison of U of T PhD programs that outlines the differences between them, including the different backgrounds of applicants and career trajectories. The Department of Biology at UTM has two MSc programs that align with our PhD program, one in biotechnology and one in biomedical communication. These are specialized programs but would serve as ideal sources of applicants for the IAB PhD program. Importantly, while the professional Master of Environmental Science at UTSC, and the School of the Environment MSc in Environmental Studies Collaborative Specialization also provide students with practicum placements, neither provides the integrative biology foundations nor the independent research opportunities available in

IAB. However, graduates from these MSc programs would be ideally positioned to be accepted into and succeed in the IAB PhD program.

Nationally, we identified three applied biology PhD programs (Appendix E), but none are specifically integrated across all disciplines of biology, nor did they systematically provide practicum opportunities for students. Additionally, the two international programs we identified (Appendix E) were not as integrative as this proposed program and also did not include a practicum component. IAB will be a nationally and internationally distinct program in its biological interdisciplinarity and in providing a practicum. Given this clear empty niche on the training landscape, with sufficient marketing, we believe that there will be very high demand and that we will reach enrolment targets quickly.

¹. Biotech sector is having a generational moment in Canada. The Hill Times. Sep. 11, 2023. <https://www.hilltimes.com/story/2023/09/11/canadian-biotech-sector-is-having-a-generational-moment-in-canada/396411/>

². Accelerated growth in Canada's life sciences industry. Tory's Quarterly: Canadian Sector Report. Fall 2021. <https://www.torlys.com/en/our-latest-thinking/publications/2021/11/accelerated-growth-in-canadas-life-sciences-industry>

³. Canada's Environmental and Clean Technology Sector (2021). Office of the Chief Economist of Canada. July 2023. <https://www.international.gc.ca/trade-commerce/assets/pdfs/economist-economiste/analysis-analyse/ect-etp-2021-en.pdf>

⁴. Canada's green tech industry hiring boom could provide significant employment opportunities for immigrants. CIC News. Nov. 13, 2023. <https://www.cicnews.com/2023/11/canadas-green-tech-industry-hiring-boom-could-provide-significant-employment-opportunities-for-immigrants-1138878.html#gs.7xieya>

⁵. Canadian biotech investments: 2019-2023. BIOTECCanada. <https://www.biotech.ca/policy-matters/industry-data/>

⁶. Spanjaard, Daniela & Hall, Tim & Stegemann, Nicole, 2018. Experiential learning: Helping Students become 'career-ready'. Australian marketing journal, Elsevier, vol. 26(2): 163-171. DOI:[10.1016/j.ausmj.2018.04.003](https://doi.org/10.1016/j.ausmj.2018.04.003).

7. Agarwal, A., Why is experiential learning the real learning for employees. Entrepreneur India. Jan. 22, 2018. <https://www.entrepreneur.com/en-in/growth-strategies/experiential-learning-for-employees-is-a-must/307820>
8. Rose, M. 2012. Graduate student professional development: A survey with recommendations. The Social Sciences and Humanities Research Council of Canada.
9. Study on experiential learning and pathways to employment for Canadian youth. Supporting university students to succeed. Universities Canada. Mar., 2018. <https://www.univcan.ca/wp-content/uploads/2018/03/study-on-experiential-learning-and-pathways-to-employment-for-canadian-youth-submission-march-2018accessible.pdf>
10. Kovačević, M., Bitušíková, A., & Dagen, T. 2022. Emergence of current European thinking and policies on doctoral education. European Journal of Education, 57(3), 381-394.
11. Kurle, C. M., Cadotte, M. W., Jones, H. P., Seminoff, J. A., Newton, E. L., & Seo, M. 2022. Co-designed ecological research for more effective management and conservation. *Ecological Solutions and Evidence*, 3(1).

- b) In 500 words or less, discuss the labour market demand for the program, including three occupations that graduates from the proposed program may be employed in, the demonstrated demand for employment the professions and employment prospects.

This program will provide broad cross-disciplinary training in the biological sciences, extending from molecular to ecosystem levels and emphasizing connections across these levels of understanding. Graduates will have developed the skills, knowledge, and experience needed to understand complex issues in biology, formulate research questions and hypotheses, and design relevant research programs that address some of the most pressing global challenges. Graduates will be prepared for a broad range of careers in education, government, science, NGOs, and industry. According to Government of Canada Job Bank, Biologists (<https://www.jobbank.gc.ca/marketreport/summary-occupation/2621/ON>) are employed in both laboratory and field settings by governments, environmental consulting companies, resource and utilities companies, chemical, pharmaceutical, biotechnical companies, hospitals and health, research and educational institutions. Job prospects

for Biologists in Ontario in the coming years are good, with employment growth expected due to 1. Investments in life sciences and research, including strengthening of the biomanufacturing sector; 2. Funding commitments to expand local vaccine manufacturing capabilities post pandemic; and 3. Initiatives related to advancement in agriculture to address the impact of climate change, wildlife management and to support the aquatic ecosystem. The job prospects in Ontario for Agricultural Chemists (<https://www.jobbank.gc.ca/marketreport/outlook-occupation/20043/ON>), who conduct research and analysis in support of industrial operations, product and process development, and environmental control is very good. Employment growth for this position is due to 1. Investments in biomanufacturing and life sciences sector; and 2. Need for chemical products and processes to support environmental planning, food sciences, and agricultural production. The job prospects for a Bioinformatician (<https://www.jobbank.gc.ca/marketreport/outlook-occupation/24504/ON>), who are employed in public administration, pharmaceutical and medical manufacturing, and health care, is also good. Employment growth in this position is due to 1. Funding commitments to expand local vaccine manufacturing capabilities; 2. Initiatives to address the impact of climate change, wildlife management, and support the aquatic ecosystem; and 3. High levels of infrastructure projects planned to be undertaken across the province that will require support for impact assessments. These three examples clearly demonstrate demand for graduates from the proposed program, which is anticipated to come from public and private organizations in sectors ranging from health care to agriculture and conservation, to policy and governance, and to science education and communication (see Appendix I for letters of support from prospective employers).

8 Enrolment

- a) Please provide details regarding the anticipated in-take by year, reflecting the expected increases to reach steady state. Include approximate domestic/international mix. This table should reflect normal estimated program length. (Please adjust the table as necessary.)
- b) Please provide an explanation of the numbers shown and their relation to the Faculty/division's enrolment plan. Please be specific where this may differ from approved enrolment plans

Table 1: Enrolment Projections*

Year of Study	2027-28	2028-29	2029-30	2030-31	2031-32 *	2032-33	2033-34
Year 1	5	5	5	5	5	5	5
Year 2		5	5	5	5	5	5
Year 3			5	5	5	5	5
Year 4				5	5	5	5
Year 5					2	2	2
Total	5	10	15	20	22	22	22

*steady state.

We anticipate only 1 or 2 of the projected 5 new IAB PhD students admitted per year will arrive via direct entry. While the normal duration of the program is 4 and 5 years for regular and direct-entry students, respectively, there will likely be some students that may require an additional 1 or even 2 years. In these cases, the management of the additional program time will be handled in an individualized manner in direct consultation between the student, supervisor, and the IAB Chair or their designate, and in additional consultation with SGS, where appropriate. These are expected to be largely, if not exclusively, domestic students. If spots and funds are available for an exceptional international student, then an international student may be admitted on occasion. The table indicates domestic students only.

9 Consultation

Describe consultation with internal (faculty, students, cognate units, etc., as appropriate) and external stakeholders (alumni, community or professional organizations, etc., as appropriate).

Impact on other programs delivered by the unit: We anticipate a positive impact on our current undergraduate programs, as described in Section 13 below. There is no graduate program currently delivered by our unit.

Impact on other units: There is minimal overlap with existing biology graduate programs at UofT; EEB, CSB, and Forestry have strongly defined disciplinary foci. We are not aware of another PhD program in the life sciences (excluding biomedical programs) at the University of Toronto that explicitly incorporates a practicum as proposed here. The School of the Environment offers an internship in relation to the Environmental Studies Collaborative Specialization for students who do not have an internship component built in their home degree; and these graduates may, in some cases, become excellent IAB PhD students. Our proposal for a graduate program built on the model of a comprehensive biology department is unique in the UofT context. Our program will positively impact other graduate units, including EEB and CSB, by increasing graduate course offerings, which could be cross-listed in these programs, with five new courses: IAB1010Y Seminar Series; IAB1100H Foundations of Interdisciplinary and Applied Research; IAB2200H Visualization and Presentation of Research Findings; IAB2210H Interdisciplinary One Health for Biological Sciences; and IAB2250H Discipline-based Education Research in Biology.

We anticipate that this program will attract a cohort of students distinct from existing biology graduate programs.

Consultations:

- UTSC Biological Sciences Faculty
 - Departmental retreat, December 15, 2022
 - Faculty meeting, September 19, 2024
 - Faculty meeting, October 17, 2024
 - Departmental retreat, December 4, 2024
- Graduate Chair of Ecology & Evolutionary Biology, Dr. Marla Sokolowski [October 12, 2022; email]
- Graduate Chair of Cell & Systems Biology, Dr. Nick Provart [October 13, 2022; email]
- UTSC Dean's office meeting to finalize program proposal development, including the Vice-Dean Graduate and Post-doctoral Studies and Academic Programs Officer [April 18, 2023]
- 3CD Tri-campus Deans meeting [June 20, 2024]*
- UTSC Chairs and Directors meeting [June 21, 2024]*

*Vice-Dean Harrison presented the IAB PhD program at these meetings for broad awareness and consultation. Encouragement was received as well as recommendations for relevant graduate units for consultation.

- Atiya Hamid, Experiential Learning Academic Liaison & Support Coordinator, UTSC. June 24, 2024. Provided additional experiential learning resources available at UTSC for this graduate program.
- UTSC Vice-Dean Graduate & Postdoctoral Studies, Dr. Rene Harrison, met with UTM Vice-Dean Graduate Studies & Postdoctoral Affairs, Dr. Ajay Rao and UTM Vice-Dean, Academic Programs, Dr. Bryan Stewart [July 22, 2024]

Based on Consultations: Full Proposals & Tri-campus MOA emailed on Monday, June 24, 2024 to:

- Graduate Chair of Cell & Systems Biology, Dr. Nick Provart
- Graduate Chair of Ecology & Evolutionary Biology, Dr. Joel Levine
- Graduate Chair of Environmental Sciences PhD, Dr. George Arhonditsis
- Chair of Biology UTM, Dr. Steven Short
- FAS Acting Vice-Dean Graduate, Dr. Mike Brudno
- EEB and CSB chairs as well as Geography and Planning and School of the Environment and Vice-Deans Gillian Hamilton and Michael Brudno [August 7, 2024]

The feedback from these broad consultations is summarized as follows:

- Overall, the IAB program is positioned to be unique within the graduate programs offered through U of T, and the proposal was viewed favourably
- The structure of the program with a 'co-op' like internship placement is truly unique and would bring great value to the students in the program
- Interdisciplinary aspect could be better articulated
- Reconcile class sizes of 10 with an intake of 5 students/year
- More details on the internship/ practicum or examples of partners would be helpful to get a sense of how it would actually work
- Some tangible agreements or at least indications that partnering organizations are open to hosting students in these placements
- Workload considerations for graduate teaching across the three campuses should be addressed before the program proposal proceeds to governance.

- Geographers are interested in being involved in the PhD program and consider their programs complementary. They have environmental, health geography and methods courses that could be relevant to the program.

Appendix I includes letters of support from potential placement partners. While this program is currently a UTSC-based graduate program, in the event that the graduate program develops into a Tri-campus graduate unit, we have drafted a Tri-campus Graduate MOA that addresses workload considerations.

The proposal was also shared with Dr. Lisa Robinson, Dean of the Temerty Faculty of Medicine (TFoM), and Dr. Justin Nodwell, Vice Dean, Research & Health Science Education of TFoM in late November 2024. Some recommendations were incorporated and a suggestion on lab rotations was considered but deemed difficult due the small cohort size. This may be considered as the program develops.

10 Resources

Faculty

Please fill out the table below. In a separate appendix provide all CVs of all faculty in the table.

Table 3: Faculty Complement (please list alphabetically by category)

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status and graduate unit. (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
Tenure Stream: Full					
Cadotte, Marc	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology; Full, Department of Physical and	EEB MSc; EEB PhD, EnvSci	TS, CI IAB1100H IAB2210H

			Environmental Sciences		
Gazzarrini, Sonia	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB1100H
Harrison, Rene E.	Biological Sciences - 100	NA	Full, Cell & Systems Biology; Full, Department of Laboratory Medicine and Pathobiology	CSB, LMP	TS, CI CSB1018H
Lovejoy, Nathan	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology; Full, Department of Cell & Systems Biology	EEB, CSB	TS, CI IAB1100H, IAB2200H
Mandrak, Nicholas	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology	EEB, EnvSci	TS, CI IAB1100H
Mason, Andrew	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology; Full,	EEB	TS, CI IAB1100H

New Program Proposal for PhD in Interdisciplinary and Applied Biology

			Department of Cell & Systems Biology		
McGowan, Patrick	Biological Sciences - 100	NA	Full, Department of Cell and Systems Biology; Full, Department of Physiology	Psychology	TS, CI IAB1100H
Treanor, Bebhinn	Biological Sciences - 100	NA	Full, Department of Cell and Systems Biology; Full, Department of Immunology	CSB, Immunology	TS, CI IAB1100H IAB2210H,
Weir, Jason	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology	EEB	TS, CI
Tenure Stream: Associate					
Guzzo, Christina	Biological Sciences - 100	NA	Department of Cell and Systems Biology; Department of Immunology	CSB	TS, CI IAB2210H

MacIvor, Scott	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology; Full, Department of Physical and Environmental Sciences	EEB, EnvSci	TS, CI IAB2210H
Molnar, Péter	Biological Sciences - 100	NA	Full, Department of Ecology & Evolutionary Biology	EEB	TS, CI IAB2200H
Nash, Joanne	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB3310H (Colloquium Coordinator)
Reid, Stephen G.	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI
Welch, Kenneth	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology; Full, Department of Ecology & Evolutionary Biology	CSB, EEB	TS, CI IAB1100H

New Program Proposal for PhD in Interdisciplinary and Applied Biology

Terebiznik, Mauricio	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI
Zhao, Rongmin	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB1100H
Tenure Stream: Assistant					
Anreiter, Ina	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology; Full, Department of Ecology & Evolutionary Biology	EEB	TS, CI IAB1010Y (Seminar coordinator)
Gan, Kathlyn	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB2200H
Gonzales-Vigil, Eliana	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB3310H (Colloquium Coordinator)
Gruntmann, Eyal	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB1010Y (Seminar coordinator)
Koyama, Minoru	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB2200H

New Program Proposal for PhD in Interdisciplinary and Applied Biology

Mott, Adam	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB1100H
Pan, Xue	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB	TS, CI IAB1100H
Porteus, Cosima	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology	CSB, EEB	TS, CI IAB3310H (Colloquium Coordinator)
Rajavasireddy, Satyaki	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology; Full, Department of Ecology & Evolutionary Biology	CSB	TS, CI IAB1010Y (Seminar coordinator)
Wang, Yan	Biological Sciences - 100	NA	Full, Department of Cell & Systems Biology; Full, Department of Ecology & Evolutionary Biology	CSB	TS, CI IAB3310H (Colloquium Coordinator)
Teaching Stream: Full Professor					

New Program Proposal for PhD in Interdisciplinary and Applied Biology

Ashok, Aarthi	Biological Sciences - 100	NA	Associate; Department of Cell & Systems Biology	CSB	CI IAB2250H
Teaching Stream: Assistant Professor					
Fitzpatrick, Mark J.	Biological Sciences - 100	NA	Associate; Department of Ecology & Evolutionary Biology	EEB	CI IAB2250H

All New Programs

Given the program's planned/anticipated class sizes and cohorts (enrolment section) as well as its program level learning outcomes please discuss:

- a) Participation of a sufficient number and quality of core (i.e., appointed) faculty who are competent to teach and/or supervise in and achieve the goals of the program and foster the appropriate academic environment.

The Department of Biological Sciences comprises 28 tenure and 7 teaching stream faculty, currently supervising ~100 graduate students through their existing graduate affiliations. 27 tenure and 2 teaching stream faculty will participate in this program with 30 faculty eligible to serve as supervisors or on the supervisory committee. Importantly, participating faculty represent the full range of sub-disciplinary expertise within the department. Because the Department of Biological Sciences does not currently administer a graduate program, graduate student recruitment to the department is via graduate appointments in existing tri-campus units. Most faculty hold a primary graduate appointment in either Ecology & Evolutionary Biology (EEB) or Cell and Systems Biology (CSB). Many faculty also hold a cross-appointment to a second graduate unit and recruit students via the most suitable program based on the specific research interests of the student. Graduate supervisory capacity is determined by the research funding held by individual faculty, because (as is typical for graduate programs in the natural sciences) the RA portion of graduate stipends is paid from supervisors' grant funds. Graduate admissions are competitive in the existing programs and many faculty have the capacity to take on additional graduate students.

Faculty in the Department currently offer graduate courses in existing graduate units (EEB, CSB), but UTSC contribution to teaching has been lower than for faculty with St. George affiliations, suggesting that UTSC faculty have capacity for additional graduate teaching. Most graduate courses in CSB and EEB are offered on the St. George campus, requiring faculty and students to travel for graduate courses. The IAB program would therefore not only provide unique content, with courses available to students in the current as well as the proposed programs, but also better accommodate the needs of UTSC faculty and students. The graduate teaching load required to support the proposed program would be accommodated within current capacity and anticipated growth in graduate teaching, in accordance with the [Workload Policy and Procedures for Faculty and Librarians \(e.g. WLPP section 4.2\)](#). Class sizes likely to be ~10 students for graduate courses (based on current offerings).

The department has broad expertise in disciplines in biological sciences as evidenced by the complement of faculty research clusters with complementary interests and expertise. These are summarized below. The research clusters are self-organized based on shared research interests. Several faculty members are active within multiple groups. Other indications of faculty success are provided in Appendix E.

Tenure-stream faculty have a broad scope of collaborations with academic (145 partnerships), government (20), NGO (15), and industry (10) partners (Appendix G). These partnerships include academic collaborations with other departments across the University's three campuses, and other academic institutions in Canada and internationally. Our faculty also have partnerships with provincial, national, and international government partners (e.g., Fisheries and Oceans Canada, U.S. National Oceanic & Atmospheric Administration (NOAA), Ontario Ministry of Natural Resources, Toronto and Region Conservation Authority) and NGOs (e.g., David Suzuki Foundation, Ontario Nature, Polar Bears International, Toronto Zoo, Wildlife Preservation Canada). These existing partnerships will be leveraged for graduate practicum placements (Please see Appendix I for Letters of Support). This partnership model will place the scientific content of students' thesis work in a multidisciplinary and applied context that will intentionally incorporate training for a diversity of possible pathways after graduation. This is a unique feature of the program that will be attractive for both faculty participation and student recruitment.

Research Clusters

Conservation & Biodiversity (CB)

Faculty: Marc Cadotte; Nate Lovejoy; Scott MacIvor; Nick Mandrak; Péter Molnár; Jason Weir; Yan Wang.

Understanding the processes that generate biodiversity patterns is critical to developing sound strategies to conserve biological resources in a changing world. The Conservation & Biodiversity group consists of global experts in biodiversity science that emphasize a larger scale, and longer time frame approach to understanding the causes and consequences of biodiversity. This research group stands unique within U of T by integrating scale and time to a truly 'big picture' view of biodiversity. This large-scale approach provides profound insights on diversity and the ecological processes that form the basis of many conservation efforts.

Cells & Infection (CI)

Faculty: Christina Guzzo; Rene Harrison; Péter Molnár; Mauricio Terebiznik; Bebhinn Treanor; Yan Wang.

Research within the Cells & Infection cluster covers a broad array of methodological approaches and model organisms to investigate the genetic, molecular, and cellular aspects of the immune response to infection and host-pathogen interactions, and disease ecology. Several of these faculty work at the interface of basic and applied research, collaborating with biopharmaceutical and biotechnology companies to translate their research findings to advance human health.

Centre for the Neurobiology of Stress (CNS)

Faculty: Ina Anreiter; Kathlyn Gan; Eyal Gruntman; Minoru Koyama; Patrick McGowan; Joanne Nash; Stephen Reid; Ken Welch.

Stress is broadly defined as an intense event which triggers a counteracting response from the organism. Understanding how stress affects function and adaptation from the molecular to the organismal level is critical in order to i.) develop strategies to promote the ability of the nervous system to withstand stressors; ii.) develop strategies to combat neurological disease following stress and iii.) understand how conservation strategies can lessen the impact of stress on natural populations. Research within the CNS group is multidisciplinary, spanning molecular biology, proteomics, cell biology and imaging, physiology and behavioural and field studies. This combined expertise facilitates an integrated approach to the study of the neural stress response and allows investigation of the effects of stress from the level of gene expression to the modulation of synaptic and cellular function to the effects in the whole animal.

Comparative Physiology (CP)

Faculty: Stephen Reid; Ken Welch; Andrew Mason, Joanne Nash; Cosima Porteus.

Research in the Comparative Physiology group addresses three broad questions. i.) What are the mechanisms by which a particular function/process is accomplished? Inherent in the study of physiological mechanism is the direct link to how physiological processes are altered in the diseased state; ii.) What are the evolutionary origins of a particular mechanism and can a particular mechanism be described or identified as an adaptation to a particular problem or situation; iii.) How do various mechanisms and adaptations allow animals within their natural habitats to cope with environmental

challenges, and what happens when environmental change occurs so as to render these adaptations insufficient? Inherent in almost all studies of comparative physiology is the question of how animals adapt to their environment. With the global climate changing at a rapidly accelerating pace, the study of how animals adapt to environmental change is taking on an ever-increasing importance.

Integrative Behaviour & Neuroscience (IBN)

Faculty: Ina Anreiter; Andrew Mason; Stephen Reid.

The IBN is focused on functional and evolutionary aspects of animal behaviour. The goal of the group is to provide intellectual and physical support for integrative approaches to research that may span levels of expertise not usually within the purview of a single lab group. In so doing, the IBN creates the seed for a research focus that is unique on the tri-campus landscape and is found in only a few other institutions in North America. It is widely recognized that the genome sequencing efforts of the past decade or so have not produced the types of insights into phenotypic variation that were expected. Research of the type undertaken in the IBN group seeks to bridge the gap between gene and phenotype, using behaviour as a model. By explicitly including effects of natural variation in the environment on complex phenotypes, IBN research takes us one step closer to practical application of genomic data to our understanding of variation among individuals and species.

Plant Cellular & Molecular Processes (PCMP)

Faculty: Sonia Gazzarrini; Eliana Gonzales-Vigil, Adam Mott; Xue Pan; Satyaki Rajavasireddy; Rongmin Zhao.

Research Focus: Mechanisms of Growth and Development in Model Plant Species
The PCMP group has significant expertise in biochemistry, molecular genetics, molecular biology, physiology and advanced microscopy. The group uses a combination of these techniques to address fundamental questions about plant growth and development, metabolism, reproduction, and response to environmental cues and stressors. Collectively, the group works on a range of monocot and dicot species, but with an expressed focus on model species such as Arabidopsis, barley, and tobacco.

Environmental Epigenetics & Development (EED)

Faculty: Ina Anreiter; Minoru Koyama; Patrick McGowan.

The EED group studies epigenetic changes in organisms across the spectrum of

biological diversity. Epigenetics is the study of heritable changes in gene function that are not caused by changes in the DNA sequence. These changes in gene regulation can have an environmental origin and can affect offspring development. This research cluster is based on an interconnected set of labs that share research infrastructure and expertise.

Biological Sciences faculty attract more than \$2-3M annually in research funding. Funding rates in the department have largely remained stable over the past several years. Biological Sciences faculty participate in federal tri-council (Natural Sciences & Engineering Research Council, NSERC, Canadian Institutes of Health Research, CIHR, or Social Sciences & Humanities Research Council, SSHRC). In addition, private and not-for-profit sectors (e.g., MITACS) provide significant and continuous support to our research programs. Our well-funded research programs are instrumental for the recruitment of graduate students as well as postdoctoral fellows (PDFs) and research associates.

Faculty in the department are highly supportive of the proposed effort. With 28 research stream faculty and 7 teaching stream faculty, the UTSC Department of Biological Sciences is similar in size to biology departments at other universities and U of T (EEB has 27 research stream faculty, excluding ROM staff; CSB has 31), and has the critical mass to develop, support, and maintain the proposed program.

- b) If applicable, discussion/explanation of the role and approximate percentage of adjunct and sessional faculty/limited term appointments used in the delivery of the program and the associated plans to ensure the sustainability of the program and quality of the student experience.

Not applicable.

- c) If required, provision of supervision of experiential learning opportunities.

Supervisors will maintain regular connections and oversight of PhD students engaged in their applied practicums.

- d) Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, including implications for the impact on other existing programs at the University.

Through this proposal the UTSC Department of Biological Sciences will become a graduate unit in order that it may offer the PhD program. The Graduate Chair will be appointed as per SGS policy. The Graduate Chair will appoint an Associate Graduate Chair to run the day-to-day operations of the PhD program. Faculty engaged in the PhD hold graduate faculty memberships in the new graduate unit.

Based on other locally-administered PhD programs at UTSC (Clinical Psychology and Environmental Science) we anticipate this IAB graduate unit will need \$150,000 to cover the costs which include hiring a Graduate Coordinator, Graduate Chair stipend and partial teaching release, recruiting and event costs (e.g., Colloquium costs and other cohort building social events). The department is working with the Dean's Office to ensure that the administrative framework needed for the launch of the program is in place, including reallocating existing departmental and campus resources to support graduate administration, student recruitment, event coordination, and the Graduate Chair role.

Graduate students can be accommodated in existing faculty lab and graduate student spaces. Reliable access to seminar rooms, classrooms, and teaching labs will be required.

Each campus independently administers all student and trainee space. Generally, the primary supervisor of IAB trainees is responsible for ensuring space for the trainee. When that trainee is co-supervised by faculty at different campuses, the trainee will be assigned space in at least one supervisor's area, with space made available (e.g. shared, or bookable spaces) at the alternative site by the co-supervisor. These details will be agreed upon when the student is offered admission. The specifics of this process for each campus are outlined below.

Coursework and TA responsibilities space: Generally speaking, IAB students attending courses at a campus other than their home campus are free to make use of available public student study areas across campus. Those IAB grad students serving as TAs for a course taking place at a campus other than their home campus, the hosting department or EDU is responsible for providing sufficient shared, bookable space for TAs to complete their duties (e.g. grading, meeting with students, etc.). For those TAs working at their home campus, they are free to utilize the space allocated to them by their supervisor (see below) or to book available, shared TA spaces.

UTSC: All PhD students supervised by UTSC-based IAB faculty are allotted office space allocated to their supervisor or co-supervisors. For PIs residing in the Science Wing (SW), this generally takes the form of desk space within the “outer office” attached to faculty offices. For PIs residing in the Science Research (SY) building, trainee desk space is generally allocated from the pool of desks within the open concept lab/office spaces shared by those labs. When space is newly made available to existing or newly hired faculty, and especially when renovations to such spaces are required, the Departmental Chair, the PIs involved, and the CAOs office will consult on space design, keeping in mind the need for associated trainee and TA space.

- e) Evidence that there are adequate resources to sustain the quality of scholarship and research activities produced by students, including library support, information technology support, and laboratory access.

There is a well-developed culture of interdisciplinary and applied learning at UTSC. UTSC has a long history of providing excellent co-op experiences. There is extensive campus level expertise for experiential learning (including Work-Integrated Learning Experience Coordinators and External Relations Teams in the Arts and Science co-op Office): <https://www.utsc.utoronto.ca/artscicoop/staff>

There is a need for academic advising tailored to IAB graduate students and we envision this work to be part of a new Graduate Coordinator role in our department. The coordinator would also serve as an important resource to address student needs related to academic, career, personal and mental health supports.

The Department of Biological Sciences has a liaison within the library. This liaison acts as a source of information for our department in many ways, including matching departmental needs with available resources, teaching assistant training, assignment design consultations, and information technology needs.

The Centre for Teaching and Learning (CTL) will be a potential practicum partner for IAB students interested in an education-related research thesis. Its resources and offerings will also be invaluable for training our teaching assistants.

The Department is well equipped with core facilities, equipment and spaces to support student learning and research as part of the IAB program. Housed in the historic

Andrews Building in the heart of UTSC's verdant south campus, the Department of Biological Sciences has an impressive track record of cutting-edge academics.

Administrative EL staff across campus are available to support faculty and staff with various EL projects and initiatives. For full list of UTSC Experiential and Global Learning team members: <https://utoronto.sharepoint.com/sites/utsc-ExperientialLearning/SitePages/Services-for-Faculty-&-Staff.aspx>

Support may include guidance on partnership development (both locally and globally), assessment and reflection.

Please see the following appendices:

- Appendix C: Library statement confirming the adequacy of library holdings and support for student learning.
 - Appendix D: Standard statement concerning student support services.
- f) If necessary, additional institutional or divisional resource commitments to support the program in step with its ongoing implementation.

There are no interdivisional teaching implications.

The program will not affect any existing agreements with other institutions.

This is not a joint program.

Resources for Graduate Programs Only

Given the program's planned/anticipated class sizes and cohorts as well as its program level learning outcomes:

- a) Evidence that faculty have the recent research or professional/clinical expertise needed to sustain the program, promote innovation and foster an appropriate intellectual climate.
- b) Where appropriate to the program, evidence that financial assistance for students will be sufficient to ensure adequate quality and numbers of students.
- c) Evidence of how supervisory loads will be distributed, in light of qualifications and appointment status of the faculty.

Faculty in Biological Sciences currently supervise ~100 graduate students (approximately, 70 PhD students) through existing tri-campus graduate programs (mainly EEB, CSB, and DPES). Research and professional expertise and an appropriate intellectual climate are well established. The department maintains all functions of an academic department that trains graduate students other than the administration of a graduate program.

Supervisory loads will be distributed (as they are currently) according to capacity and resources of individual PIs, who will be responsible for recruiting students to their labs. The Department delivers 19 undergraduate programs (eight Specialist programs, which include four co-op programs; ten Major programs, which include five co-op programs; and a Minor program). These cover the full spectrum of disciplines within biological sciences. We anticipate that once the program is established, it will attract participation from faculty in other (tri-campus) budgetary units.

As of 2025-26, the University of Toronto's funding for all PhD students, including PhD students in this program, will be guaranteed an annual base funding package of at least \$40,000 including tuition. The base funding package typically is composed of TAs, RA contributions from the supervisor, and funds from UTSC. These contributions may shift in amounts if graduate students receive scholarships. Students in the regular PhD will receive four years of funding and students in the direct-entry option will receive five years of funding. The tables below outline the breakdown of the student funding packages by source, depending on whether a student has a Tri-Council award or not.

Table 1. Funding commitment breakdown for students **with** major external scholarship support (e.g. NSERC PGS-D) – Amounts may vary from student to student (e.g. in RAship support), depending on the amount of external funding awarded. Two relatively common examples are given.

	Support Source	Yearly Amount (\$, approximate values)	Yearly Amount (\$, approximate values)
Income		NSERC Doctoral Funded (3 years of support)	OGS funded (funded for 3 sessions at \$5,000 per session)
	External Fellowship (value in this row will	\$40,000.00	\$15,000.00

	differ depending on fellowship)		
	RAship support (provided by supervisor/co-supervisors)	\$4,000.00	\$10,000.00
	TAsip support (normally 125hours/year)	\$6,900.00	\$6,900.00
	UTSC Fellowship (UTF) base support	\$0	\$10,000.00
	UTF Top-Up	\$2,000.00	\$4,000.00
Expenses			
	Tuition	\$6,210.00	\$6,210.00
	Student Fees (at UTSC; Amounts differ at UTM, UTSG)	\$2,362.23	\$2,362.23
	UHIP (Visa students only)	\$0	\$0
Total per year (net student stipend; not including UHIP cost)		\$52,900 (\$49,052.23)	\$45,900 (\$39,690)

Table 2. Funding commitment breakdown for Students **without** major external scholarship support (including students with expired external scholarships).

	Support Source	Yearly Amount (\$, approximate values)
Income		
	RAship support (provided by supervisor/co-supervisors)	\$12,000.00

	TAs support (normally 125 hours/year)	\$6,900.00
	UTSC Fellowship (UTF) support	\$12,527.77
Expenses		
	Tuition	\$6,210.00
	Student Fees (at UTSC; Amounts differ at UTM, UTSG)	\$2,362.23
	UHIP (Visa students only)	\$0
Total per year (net student stipend; not including UHIP cost)		\$40,000 (\$31,427.77)

Funding for IAB Graduate Students beyond funded cohort

Students will typically TA between 70-210 hours per year beyond the funding cohort, though available TA slots are prioritized first for IAB students within their funded cohort duration. Continuing RA support from the supervisor/co-supervisors is encouraged (and has regularly occurred) but is not promised nor mandatory. Students that have not completed their program within the funding window may apply for a tuition waiver and/or Doctoral Completion Award, based on the restrictions outlined by the SGS.

Support during “partner placement”

During the term when IAB graduate students take part in their placement with a partner group, they will be generally unable to undertake TA assignments. There are two envisioned ways that student support from TAs may continue, relatively uninterrupted during these placements:

1. Graduate students and supervisors can agree to have the student complete the 70 hours of TA work (that which would have occurred during the placement) to a TA assignment in another term that funding year. For example, the student may elect to complete all 140 hours during either the fall or winter terms, or to complete 70

hours of work in the summer term rather than in the fall as may typically be the case.

2. Graduate students and supervisors can agree to “buy out” 70 hours of TAs support during the placement term. Funds to support this “buy out” will come from the supervisor, or from other funding sources (e.g. MITACS fellowship). Flexibility in this funding model is key given that supervisor funding, partnership ability to support student stipends, and external (e.g. MITACS) funding are not guaranteed.

11 Quality and Other Indicators

- a) Evidence of the quality of the faculty (e.g., qualifications, funding, honours, awards, research, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the program and commitment to student mentoring)
 - a. The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching.
- b) Any other evidence that the program and faculty will ensure the intellectual quality of the student experience.
- c) Any additional indicators of quality identified by the division or academic unit.
- d) How the proposed program compares to the best in its field among international peer institutions.

Collective expertise

The department defines itself as a biological sciences unit in the broadest sense, rather than focusing on specific subdisciplines within biology. This is reflected in the diversity of faculty research, as well as the range of undergraduate programs delivered by the department. There is a significant culture of interdisciplinary collaboration both within the department as well as with external research partnerships. Many faculty already have established collaborations with local organizations and researchers, many of whom would be ideal practicum partners for the proposed program. Hence the department is ideally suited to design and implement this innovative and unique graduate program. The quality of our department’s faculty, research, teaching and scholarly output is summarized by metrics presented in Appendix E.

Diversity

An important goal of this program is to expand access to post-graduate education for a wider diversity of students. Our current innovative undergraduate programs prepare students for post-graduate study, including the proposed IAB program. This proposed program may be better suited to the needs of our diverse student body, many of whom may be interested and capable of excelling in an advanced degree but may be constrained to the local area by family or financial constraints. In addition, a postgraduate program that explicitly links to a broad range of career pathways would hold significant appeal. The IAB program differs from existing postgraduate programs, which emphasize an academic career focus, despite recent efforts to offer co-curricular training in career orientation and training, by integrating interdisciplinary and practicum-based learning as central tenets, which would better prepare students for both academic and non-academic careers.

The department already has a track record of establishing pathways for students to transition from undergraduate degrees into post-graduate programs such as through the current links between the Conservation & Biodiversity Program and Integrative Biology to the professional Master of Environmental Science. In addition, we offer co-op opportunities for students in all our undergraduate programs and promote combined programs of study (e.g., our biology undergraduate programs can be combined with coursework through the Ontario Institute for Studies in Education (OISE) to extend towards a master's degree and professional teacher education). Our diverse student body are hence ideal target groups for a new program that engages their need for broad career prospects.

Initiatives Involving Collaborative and Interdisciplinary Research and Collaborative Teaching in the Department of Biological Sciences

Faculty in our Department are leaders and members of **UTSC Clusters of Scholarly Prominence Program (CSPP) initiatives**. The CSPP Program was created to promote the formation of *self-sustaining, interdisciplinary and interdepartmental collaborative clusters of scholarship in areas of established and emerging strength at UTSC that have a demonstrable capacity to augment the University of Toronto's global standing through prominence in scholarship, creative activity, and exceptional learning*.

Biological Sciences professors Bebhinn Treanor, an immunologist, and Satyaki Rajavasireddy, a plant scientist, lead the cluster Exposomics of Persistent Organic Synthetic Envirottoxins (ExPOSE). ExPOSE is formed by an interdisciplinary team of faculty from the UTSC Departments of Biological Sciences (Professors Ina Anreiter and Adam Mott), Health and Society, Physical & Environmental Sciences and Chemistry. The ExPOSE cluster leverages opportunities for its academic team to interact and work with both civil society and government stakeholder organizations, focused on pollutants and its effects in the environment and health.

Biological Sciences professor Cosima Porteus, a physiologist, co-leads the Water Pathways cluster, with Professor Mathew Wells, a geophysicist in the Department of Physical & Environmental Sciences. This multidisciplinary cluster of researchers brings together their expertise in biological, physical and social sciences to work with community groups and conservation agencies to identify pollution problems and to determine effective social and scientific strategies to restore water quality. The team is formed by faculty from multiple U of T Departments, including Biological Sciences (Professor Nicholas Mandrak), Physical & Environmental Sciences, Geomatics and Environment, Ecology and Evolution, UTM Biology and Anthropology.

Biological Sciences professor Marc Cadotte, an ecologist, co-leads with Professor Myrna Simpson, a soil chemist from the Department of Physical & Environmental Sciences, the cluster Centre for Environmental Research in the Anthropocene (CERA). The CERA team also includes Biological Sciences' professors Ken Welch Jr., Nick Mandrak and Scott MacIvor. The team is completed by faculty from the UTSC Departments of Sociology and Physical & Environmental Sciences. CERA's goal is to create a cutting-edge collaborative research program and training opportunities to address key questions about how anthropogenic stressors influence ecosystems.

Biological Science professors Eliana Gonzales-Vigil and Adam Mott are members of the Sustainable Food and Farming Futures Cluster (SF3). This interdisciplinary cluster is led by Professors Jayeeta Sharma and Marney Isaac from the Department of Physical & Environmental Sciences and includes co-colleagues from multiple Departments across U of T including Global Development Studies, Political Science, Sociology, Culinary, Management, Health & Society, Human Geography, Anthropology and Historical & Cultural Studies. The objective of this cluster is *to identify how the*

environmental impacts of agriculture can be reduced, while simultaneously promoting food security, equitable food systems, and the availability of culturally relevant foods.

Biological Sciences professor Christina Guzzo is a team member of **Prepare, REact, Collect, Innovate, Share and Engage (PRECISE) Pandemic Platform**. PRECISE congregates more than 50 principal investigators, from across U of T and Hospitals together, with colleagues from public health and both private and non-profit stakeholders, to constitute a network capable of responding to both current and emerging infectious threats affecting Canadians. The PRECISE team is highly interdisciplinary, as it gathers research teams with expertise in infectious diseases, immunology, microbiology, molecular diagnostics and social sciences. PRECISE is part of the **Canadian Hub for Health Intelligence and Innovation in Infectious Diseases**, a consortium of over 90 universities, hospitals, industries, government and community partners. Its mission is to bolster Canada's capacity to ensure a fast and coordinated response to future pandemics and infectious health threats.

Biological Sciences professor Bebhinn Treanor leads the **One Health Consortium**, which is rooted in the UofT **Institutional Strategic Initiative (ISI)** program that *supports cross-divisional, interdisciplinary research networks focused on addressing grand challenges, and associated research questions that lead to transformational societal impact*. Professor Bebhinn Treanor leads a team of interdisciplinary co-principal investigators with expertise spanning from human to wildlife and ecosystem health. This collaborative network explores interconnections across the scales of life from molecules to populations, and aquatic and terrestrial ecosystems. The objective of the One Health Consortium is to fill knowledge gaps in neglected areas of study of the natural world as it relates to the health of all species to work towards mitigation of key challenges including biodiversity loss, pathogen spillover and loss of ecosystem services.

Faculty in our Department are principal investigators (PIs) and co-PIs of NSERC **Collaborative Research and Training Experience (CREATE) programs**. **CREATE** *supports the training and mentoring of teams of highly qualified trainees through the development of innovative training programs that encourage collaborative and integrative approaches and facilitates the transition of new researchers from trainees to productive employees in the Canadian workforce*

Biological Sciences professor, Scott MacIvor is a principal investigator in the CREATE program “Design of Living Infrastructure for Ecosystem Services (DesignLIFES)

Network". This is an interdisciplinary program that includes multiple PIs across U of T divisions. DesignLIFES is meant to *train the next generation of engineers, landscape architects and scientists in the interdisciplinary professional and technical skills they will need to design, create and manage living and green infrastructure for Canadian cities.*

Biological Sciences professor Marc Cadotte is the leading PI for the CREATE program "Training the future leaders in urban forestry (UFOR)". UFOR's goal is to develop a *permanent, innovative, interdisciplinary and inter-university graduate training program in urban-forest management across Canada.* The program links scientists in multiple Canadian universities with a collaborative network that includes government, NGOs, and industrial partners, providing skills development, mentoring, and hands-on experience to trainees.

Biological Sciences professor Peter Molnar is a co-applicant PI on the NSERC CREATE proposal: Community-Oriented Artificial Intelligence and Mathematical Modelling of Infectious Disease. This program is focused on the use of mathematical, computational, and machine-learning methods to model infectious disease. The applicant team is an interdisciplinary group that includes ecologists, epidemiologists and computational biologists from the University of Toronto.

NSERC-SSHRC Sustainable agriculture research initiative

The mission of this program is to prime the development of solutions for a sustainable, resilient and profitable agriculture sector in a net-zero economy, by supporting multidisciplinary, collaborative networks of researchers in the social and natural sciences, engineering and in areas that broaden the traditional network of agriculture research partners.

Biological Sciences professors Eliana Gonzales Vigil (plant biochemistry) and Adam Mott (plant immunity) are members of the NSERC-SSHRC Sustainable agriculture research initiative "Toward sustainable urban and peri-urban agriculture for net-zero food systems," which is co-led by researchers at the University of Toronto Scarborough, and involves experts from multiple Canadian universities and partners communities.

Undergraduate curricula development and inclusive pedagogies

Biological Sciences teaching and tenure stream faculty, together with teaching managers and technicians, co-lead and participate on collaborative joint initiatives to develop and delivery curricula and to create Community of Practice spaces to share

knowledge and develop innovative teaching practices. Examples of this include the following:

Professors Emily Bell and Aarthi Ashok (teaching stream faculty) secured an UTSC Experimental Learning Fund award for the project: **“Developing a “CURE Lab” in Biological Sciences for Expanding Access to Discovery-based Research Opportunities for Undergraduates.”** As a result of this they developed the course **BIOB97H3: Course-based Undergraduate Research Experience in Biological Sciences, Bio-CURE**. This course has been co-taught by Professor Bell and Professor Andrew Mason (tenure stream), with the collaboration of other tenure stream professors in the Department. **BIOB97H3** aims to introduce students to the process of scientific inquiry as they engage in a hypothesis-driven research project fueled by their own research question and challenged by their own experimental work.

Professors Ivana Stehlik (teaching stream), Aarthi Ashok (teaching stream) and Ina Anreiter (tenure stream), together with Carolyn Keir (Departmental Manager and sessional Instructor) and Luciana Baruffaldi-Yanez (Laboratory Coordinator), created the project **EDI-BioSci Outreach and Inreach**, which was awarded an UTSC Departmental Pedagogies of Inclusive Excellence (PIE) grant for its implementation. EDI-BioSci Outreach and Inreach is a collaboration between the Department of Biological Sciences; Community Partnerships & Engagement; UTSC Biology Students' Association (BioSA); Racialized Student Collective (RSC); Scarborough Campus Students' Union (SCSU); and West Hill Collegiate, Toronto District School Board.

Professor Shelley Brunt (teaching stream) and Dr. Sajeni Mahalingam (Laboratory Manager) have developed the program **Biological Sciences Undergraduate Summer Research Experience**, focused on increasing access to research opportunities for first- and second-year students, with a focus on EDI; providing work-integrated learning opportunities for biology students, and developing professional skills and student autonomy. The program was awarded an Experiential Learning Fund grant for the implementation of its experiential learning components.

Professors Joanne Nash (tenure stream) and Mark Fitzpatrick (teaching stream) have developed a workshop to foster the inclusion of neurodiversity at UTSC by educating participants about neurodiversity, enhancing faculty-student engagement, and promoting inclusive practices for curriculum development and beyond, ensuring all

neurodiverse individuals thrive academically and professionally within our department and across campus.

Appendix A: Courses

Title	Course Code	Course Description
IAB Seminar Series *New Course	IAB1010Y	This is a required “continuous” seminar series that lasts for the duration of the PhD program. This course is for CR/NCR only and does not contribute to the required FCE. Students must, except during their practicum placement or any required remote work towards their thesis, attend at least 10/12 weekly seminars during each fall and winter term. It is expected that attendance at the IAB weekly seminars will be how most students comply with this requirement. With the approval of the supervisor(s), students may attend comparable weekly seminars (e.g. held by cognate departments or on other campuses) instead. The course is completed when the student successfully defends their PhD thesis.
Foundations of Interdisciplinary and Applied Research *New Course	IAB1100H (0.5 FCE)	This is a required first year cohort-building core course. It is a lecture / seminar course that will provide students with training in research methodologies and perspectives and how these are defined in different disciplines. Students will learn how to design experiments, manage their research projects, and develop critical thinking, analytical, and communication skills while working collaboratively and independently to address interdisciplinary research questions.
Visualization and Presentation of Research Findings *New Course	IAB2200H (0.25 FCE)	Students will be introduced to strategies and tools for data visualization and presentation. The course will employ the R programming language to graph standard datasets across the different disciplines in biology, including hierarchical, multivariate, phylogenetic, spatial, and network data. The course

Elective		will culminate with application of visualization tools to produce graphical data summaries suitable for publication or public communication.
Interdisciplinary One Health for Biological Sciences *New Course Elective	IAB2210H (0.25 FCE)	Global initiatives like the United Nations Sustainable Development Goals and the Global Biodiversity Framework explicitly recognize that human wellbeing is intricately linked to the health of the natural world. One Health is the integrated concept linking ecological degradation and animal welfare to human health. This seminar course will provide an overview of One Health concepts and research, as well as the policy implications of improving human health through ecosystem management. Students will read articles and discuss current issues on the conceptual basis and policy implications of connecting human health to ecological disruption.
Discipline-Based Education Research in Biology *New Course Elective	IAB2250H (0.5 FCE)	This course will help students build a foundation of a reflective and scholarly teaching practice in higher education. Students will be introduced to current theoretical frameworks, Scholarship of Teaching and Learning (SoTL) inquiry including pedagogical research study design, human subjects research ethics considerations, and qualitative and quantitative analyses. Students will learn how to propose new research questions and apply evidence-based approaches to curriculum design and teaching innovation. Students will deepen their understanding of SoTL literature and contribute to current pedagogical research inquiry in the department. This will prepare students to become the next generation of excellent biology educators and SoTL scholars.
Interdisciplinary and Applied Biology Practicum *New Course	IAB3300H (0.5 FCE)	Students in this course will complete placements with an academic or non-academic partner where they will receive training and/or conduct research in an area of study that complements their thesis research. Students will explore interdisciplinary methods and approaches aimed at broadening the

		application of their research to real world challenges. At the end of the placement, students will prepare a written report and oral presentation summarizing the work done at their chosen placement.
Interdisciplinary and Applied Biology Research Colloquium *New Course	IAB3310H (0.5 FCE)	This course provides a forum in which students present the results of their thesis-based and placement-based (IAB3300H) research in a formal seminar. The colloquium will take place once a year, each fall. Students are expected to attend each year. Students will each present at the colloquium once during their program tenure (typically in year 3 or 4). Colloquium attendance is mandatory (except during their placement period (IAB3300H), or if approved, thesis-related work/travel prevents this). Student attendance and participation, along with written reflections or reports, are assessed for a letter grade by the graduate advisory committee, with unapproved absences negatively impacting their course grade.
Integrative Biology of Behaviour *Existing Course	EEB1360H (0.5 FCE)	This graduate course introduces students to four approaches to studying questions in ecology and evolutionary biology, using the study of animal behaviour as a unifying theme. Students will gain an appreciation for the diversity of questions and methodologies addressed by current research with a focus on four different research approaches at two levels of analysis: proximate (Neuroethology, Physiology) and ultimate (Behavioural Ecology, Molecular phylogeny). The goal is to provide students with tools for taking integrative approaches to hypothesis testing in each field.
Advanced Microscopy and Imaging *Existing Course Elective	CSB1018H (0.25 FCE)	This graduate course will cover theory and practical demonstrations of current light, fluorescent and electron microscopy. The first four weeks of classes will have lectures and demonstrations on brightfield, epifluorescent, confocal and scanning and transmission microscopy. As well, consideration will be given to

		specimen preparation. Student presentations will occur in the remaining three weeks of formal classes.
Bias in Stem: History, Data, & Progress *Existing Course Elective	EEB1456H (0.25 FCE)	In this course we will discuss the historical legacy of bias and exclusion in science, recent data that quantifies the scale of the problems and/or the science behind them, and finally evidence-based strategies to overcome these issues. This course is inspired by, and modified from, a course designed by Prof. Corrie Moreau at Cornell.

Appendix B: Library Statement

University of Toronto Libraries Report for Interdisciplinary and Applied Biology (IAB) PhD Program, Department of Biological Sciences, UTSC, September, 2024

Context: The University of Toronto Library (UTL) system is the largest academic library in Canada and is currently ranked third among academic research libraries in North America.² The UTL has an annual acquisition budget of \$42.4 million. Its research and special collections comprise over 12.8 million print volumes, 5.6 million microforms, and rich collections of manuscripts, films, and cartographic materials. The system provides access to more than 3.5 million electronic books, 200,000+ journals, and a rich array of online primary source materials.³ Numerous, wide-ranging collections, facilities and staff expertise reflect the breadth of research and instructional programs at the University and attract unique donations of books and manuscripts from around the world, which in turn draw scholars for research and graduate work.

Major North American Research Libraries					
	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
ARL RANK	UNIVERSITY	UNIVERSITY	UNIVERSITY	UNIVERSITY	UNIVERSITY
1	Harvard	Harvard	Harvard	Harvard	Harvard
2	Yale	Yale	Yale	Yale	Yale
3	Columbia	Toronto (3rd)	Toronto (3rd)	Toronto (3rd)	Toronto (3rd)
4	Toronto (4th)	Columbia	Michigan	Michigan	Michigan
5	Michigan	Michigan	Columbia	Columbia	New York

Top 5 Canadian Universities in the ARL Ranking of Major North American Research Libraries				
2018- 2019	2019-2020	2020-2021	2021-2022	2022-2023
RANK/UNIVERSITY	RANK/UNIVERSITY	RANK/UNIVERSITY	RANK/UNIVERSITY	RANK/UNIVERSITY
4/Toronto	3/Toronto	3/Toronto	3/Toronto	3/Toronto
30/Alberta	39/Alberta	29/British Columbia	24/British Columbia	35/British Columbia
40/British Columbia	40/British Columbia	39/Alberta	39/McGill	41/McGill

² As per Association of Research Libraries Statistics.

³ Figures as of January 2023

47/McGill	51/McGill	42/McGill	42/Alberta	49/Alberta
62/Ottawa	75/Calgary	70/Calgary	58/Ottawa	71/York

Space and Access Services: The UTL's 40 libraries are divided into four administrative groups: Central, Departmental/local, Campus (UTM & UTSC) and Federated and Affiliated College Libraries. The UTL provides a variety of individual and group study spaces for students. Study space and computer facilities are normally available twenty-four hours, five days per week at one location, Robarts Library, with additional extended hours during study and exam periods at both UTSC and UTM. Web-based services and electronic materials are accessible at all times from campus or remote locations.

Equity, Diversity and Inclusion (EDI): EDI is a high priority at UTL. UTL has developed an [EDI Statement](#), an [Anti-Racism Statement](#) and a [Collections Diversity Plan](#). These statements are supported by a concrete [action plan](#), which UTL is committed to achieving. UTL is prioritizing staff diversity, staff cultural competencies and awareness of systemic biases, building and improving relationships with Indigenous and other underrepresented communities, incorporating the principles of the Accessibility for Ontarians with Disabilities Act in its services, and working with the University's Equity Offices to remove barriers in support of our community members who seek to fulfill their academic, research, and employment goals.

Teaching, Learning & Research Support: Libraries play an important role in the linking of teaching and research in the University. To this end, information literacy instruction is offered to assist in meeting the IAB PhD Program degree level expectations in the ability to gather, evaluate and interpret information, as well as manage citations and data, and understanding author rights and publishing open access. Librarians collaborate with instructors or teacher assistants (TAs) on assignment design, provide student research consultations, and offer just-in-time student research help in person, by phone, or through online chat. Librarians are also available to support knowledge synthesis projects on a case-by-case basis. Special initiatives, such as the Library's Makerspace to access 3D printers, circuits, and other technologies for creating and innovation, and TA teaching and learning support, extend information literacy beyond the classroom. These services align with the Association of College and Research Libraries (ACRL) *Framework for Information Literacy for Higher Education*.⁴

Program Specific Instructional Support: Instruction can occur at various levels for IAB PhD students and would be provided by the faculty liaison librarian for Biological Sciences. The UTSC Library facilitates formal instruction integrated into the class schedule and hands-on tutorials related to course assignments, citation management, introduction to ArcGIS Online, data management and literacy, search strategies for finding relevant scholarly articles, and more. For example, graduate students are

⁴ Association of College & Research Libraries. Framework for Information Literacy for Higher Education. ACRL, 2016. http://www.ala.org/acrl/sites/ala.org/acrl/files/content/issues/infolit/Framework_ILHE.pdf

already supported in labs such as Porteus Lab for citation management and searching scholarly literature, integrated instruction in the graduate professional development program, and asynchronous modules on data literacy. The Library, through its liaison librarians, customizes library guides which appear prominently in Quercus course pages. For example, the Libraries provides a [Library Guide](#) and training workshops on submitting and publishing your thesis to support graduate students needs.

Collections: Many college and campus libraries collect materials that will support IAB PhD program; the largest collection of materials is centrally located in the Gerstein Science and Information Centre. Collections are purchased in all formats to meet the variety of preferences and styles of our current students and faculty. The University of Toronto Library is committed to collecting both print and electronic materials in support of IAB PhD program at the University of Toronto.

Journals: The Library subscribes to 25 of the top 25 journals listed in Journal Citation Reports (JCR)⁵ in subject area Biology. Of these titles, 25 are available electronically to staff and students of the University. We prioritize acquisition of online journals where possible. Additionally, UTL has electronic subscriptions to 25 of the top 25 journals listed in JCR's Biotechnology and Applied Microbiology category.

Monographs: The UTL maintains comprehensive book approval plans with 43 book vendors worldwide. These plans ensure that the Library receives academic monographs from publishers all over the world in an efficient manner. In support of IAB PhD program, monographs are purchased in electronic form where possible, and the Library currently receives all current e-books directly from the following publishers: Springer, Elsevier, Oxford University Press, Cambridge University Press, major US university presses and Canadian university presses. Individual librarian selectors also select unique and interesting scholarly material overlooked by approval plans. These selections include contributions to the collections of the Thomas Fisher Rare Book Library, special requests from faculty, and individual e-books.

Knowledge Synthesis: Libraries are key partners in research through their collaborations with faculty in completing knowledge syntheses projects, [Systematic and Scoping Review Collaboration](#) (SSRC), and providing consultations to faculty and students on comprehensive searching for method driven reviews.

Preservation, Digitization, and Open Access: The UTL supports open access to scholarly communication and research information through its institutional research repository (known as T-Space), its Downstream print repository, its open journal services, subscriptions to open access publications, article processing charges (APCs) discounts, and support for preservation of research materials in all formats,

⁵2020 Journal Citation Reports® (Thomson Reuters, 2020)

including theses projects. In addition to acquiring materials in support of IAB PhD program, the Library has digitized its monograph holdings published before 1923. These books are available without charge to any Internet user.

Key Databases: UTL has subscriptions to all key databases in the subject area of Interdisciplinary and Applied Biology that would support IAB PhD students. These include BIOSIS Previews, Scopus, CAB Abstracts, MEDLINE, EMBASE, PubMed, and major interdisciplinary databases Web of Science, GEOBASE, and JSTOR.

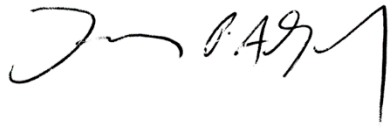
Special Collection Highlight: The UTSC Library collaborates with a faculty representative from the Biological Sciences department to serve on the Executive Committee of UTSC's Journal of Natural Sciences, along with several other science departments. Currently, the Chemistry Librarian is in this role. Key activities of this committee involve the hiring of undergraduate and graduate editorial members of the journal, as well as providing guidance on the manuscript submission, peer review, and publishing process.

Current Gaps: It is encouraged to include the Biological Sciences librarian in any department's graduate professional and skills development programming, including orientation, to further integrate teaching and learning supports for industry research, citation management, data literacy and data management, and knowledge synthesis and knowledge translation for graduate students. It would be important to understand the scope of this program and if it needs knowledge synthesis and knowledge translation support. Depending on the need, the library may need to grow its capacity with our knowledge translation and knowledge synthesis service. Also, it is suggested to expand library space and study carrels for graduate students only alongside a growing graduate population that will require advanced research skills, data skill development, and publishing services help.

Other Library-departmental engagement: The library maintains regular communication with faculty and students through email regarding key workshops, service, collections, course needs, and outreach opportunities. The Librarian in Biological Sciences is available to meet with graduate students for research consultations. The Librarian is also engaged in providing support to graduate students who are TAs, such as Introduction to OER for TAs workshop through the Centre of Teaching and Innovation Support (CTSI) and the Teaching Assistants' Training Program (TATP) program. Graduate students are encouraged to engage in the TATP program and Graduate Professional Development (GPD). In addition, the Biological Sciences Librarian collaborates with Biology faculty and the Digital Scholarship Unit to showcase, archive, and preserve student research via TSpace or through special digital collections.

Prepared by: Sarah Shujah, Liaison Librarian, UTSC Library, June 7, 2023, Updated September 5, 2024

Submitted by: Larry Alford, Chief Librarian, University of Toronto Libraries, December 10, 2024

A handwritten signature in black ink, appearing to read "J. P. 49" followed by a stylized flourish.

Appendix C: Student Support Services

All University of Toronto undergraduate and graduate students have access to student services on all three campuses, Mississauga, St. George (downtown Toronto), and Scarborough, regardless of their 'home campus'. The services and co-curricular educational opportunities provide a complement to the formal curriculum by engaging and challenging students to reach their full potential as learners, leaders, and citizens. At the University of Toronto Scarborough (UTSC) these services are organized by the Office of Student Affairs and the Office of the Vice-Principal Academic and Dean, and support the success of our students from the time they are admitted through degree completion and beyond.

Academic Advising & Career Centre (AA&CC)

Integrates developmental advising, learning skills, and career development on further education and employment through individual appointments, workshops, experiential programming, events, peer support, and a range of online resources. The AA&CC is a team of professionals who advise, counsel, and coach students with their learning and career development. They invite incoming students to attend the Get Started academic orientation program for support on academic and career planning in the summer, prior to starting first year. Students are eligible for services throughout their studies. Alumni are eligible for career development and employment coaching services for an additional 2 years following graduation.

Academic Travel Fund

Provides research and related scholarly funding for undergraduate students to underwrite the costs of valuable non-course based academic activities such as attending and presenting at conferences.

Access*Ability* Services

Provides services and academic accommodations to students with a learning, physical, sensory, mental health disability or medical condition. Services include, but are not limited to, disability consulting and referrals for students, as well as workshops, online resources, assistive technology support, and note taking and test/exam accommodations. Access*Ability* Services ensures that policies, practices, procedures, and programs at UTSC are inclusive and provide equal access for students with

disabilities. AccessAbility Services also serves a growing campus as a key resource for consulting on accessible design, both physically and pedagogically.

Athletics & Recreation

Provides a respectful and inclusive environment for students to engage in physical activity, promotes overall well-being, and encourages a sense of community. Students have access to the Toronto Pan Am Sports Centre (TPASC), which features a range of accessible amenities including Olympic-sized pools, a climbing wall, multiple gyms and studios, a fitness centre, and an indoor track. The department also has multi-sport fields, an 8-court tennis facility, and a varsity level baseball diamond housed in the valley. As a hub for health living on campus, Athletics & Recreation offers a variety of fitness and instructional programming, organized sports and leagues, as well as aquatics for all levels of physical activity. Highlights include drop-in sports, learn to play programs, women's programming, and the popular outdoor recreation program.

Department of Student Life

Offers a range of programming for first-year students, first generation students, mentorship and leadership development, community outreach, as well as Indigenous, intercultural, and multi-faith programming using an anti-oppressive framework. The Department manages the recognition of approximately 282 campus groups including the facilitation of 17 departmental student associations as well as liaising with all student societies to ensure compliance with University policy.

Responsibilities include: managing the committee process for allocating funds to student groups involved in various campus life programs and initiatives, ensuring adherence to the risk assessment process for all campus student events, supporting space allocation for clubs and events, representing the University as a partner in the annual Fall Orientation, and support of the Co-Curricular Record.

Health & Wellness Centre

Provides health promotion, mental health support, counselling, and medical services to all UTSC students with a current student card and valid health card. Physicians and Registered Nurses provide first aid, treatment of minor illnesses, annual check-ups, immunizations, selected over-the-counter medications, referrals to specialists, and more. Wellness counsellors are equipped to support students with a number of issues including, but not limited to: stress management, anxiety, depression, crisis counselling,

family issues, mental health, relationships, sexuality, bereavement, and eating disorders. In addition, group therapy and specialized workshops are offered throughout the year. The Health & Wellness Centre also has five Wellness Peer Programs that provide education and raise awareness about healthy lifestyle choices in areas including: nutritional health, sexual health, safe substance use, and mental wellness. These programs are supported by student-volunteers who build connections with their student-peers across campus.

International Student Centre

Provides support to international students studying at UTSC and to students interested in studying abroad to enhance their educational experience. Support for international students includes pre- arrival, transition, and immigration advising as well as mentorship, intercultural workshops, and University Health Insurance Plan (UHIP) support. The International Student Centre also provides guidance and resources for student mobility opportunities including inbound and outbound exchanges, and research and study abroad programs.

International Student Orientation and Transition (programming provided by the International Student Centre)

This is a two to three week set of activities from August to September. These activities include pre- arrival support, settling in city excursions, and socials. Also, online mentorship through our pre-arrival platform pairs international students with a peer educator to learn more about the campus and Canadian academic environment.

Student Housing & Residence Life

Responsible for the development of residence facilities and policies. The residence experience is a safe, fun and inclusive community offering a range of social and extracurricular activities that support the academic achievements and personal development of students. Student Housing & Residence Life also provides off-campus housing services and resources for students living independently.

Workshops and advising is available to guide students through the process of searching for listings, tenant rights and responsibilities, lease agreements, and more.

Centre for Teaching and Learning

Undergraduate Student Support (that is not nested within specific courses)

1. **English Language Development Support (ELDS):** ELDS supports all students who experience difficulties in using English in their coursework. Programming includes individual tutoring appointments, online resources and tools, language proficiency testing, and workshops. Students can enhance their skills in academic communication, cultural proficiency, reading, writing, listening and speaking comprehension, and vocabulary development.
2. **Mathematics and Statistics Learning Support (MSLS):** MSLS offers regular workshops to students on typical challenging math/stats topics. Also offered are drop-in group and individual tutoring for students with quantitative reasoning questions in courses requiring these skills. Students can also access virtual tutoring sessions and online modules and materials.
3. **Writing Support (WS):** In addition to offering in-class tailored workshops on particular aspects of writing, WS offers student appointments to discuss their assignment drafts with a writing expert. All students are eligible and can register for 50-minute appointments or use the 20-minute drop-in service. Students can also access online modules and resources.

Undergraduate Student Support (that is nested within specific courses)

1. **English Language Development Support (ELDS):** To support academic challenges for English Language Learners, ELDS has integrated programming, including a Reading and Writing Excellence program, that helps students develop their skills as they complete course assignments.
2. **Facilitated Study Group (FSG) program:** Working with course instructors, CTL trains successful students to serve as facilitators to organize study groups for

historically difficult courses. The facilitators help participating students enhance their skills to identify major course concepts, and learn study strategies and fresh approaches for assignments and exams. Regular FSGs are offered as well as ones in partnership with English Language Development Support for students with English language challenges.

3. **Mathematics and Statistics Learning Support (MSLS):** MSLS collaborates with introductory calculus courses to deliver a pre-course diagnostic test to identify students who lack certain critical numeracy skills. Students receive their diagnosis and are informed of specific seminars and workshops that can help them develop the skills they lack. MSLS also runs review sessions before major calculus and statistics exams. As well, MSLS faculty consult with non-mathematics course instructors around quantitative reasoning skills required in their courses, and are willing to provide relevant course instruction either in class or as online modules.
4. **Experiential Learning (EL):** Faculty supports include curriculum and pedagogical course design, with specific focus on learning objectives, assessment and reflection. Reflective inquiry is key to experiential learning, and CTL's Educational Developer - Experiential Learning, is available for 1:1 consultation.
5. **Writing Support (WS):** Faculty and TAs can meet with writing coordinators to advise on teaching writing assignments, and the design and implementation of writing and research paper assignments. After such consultations, the writing instructors are willing to deliver specific writing, editing, or research skill instruction within the course, either in class or by creating tailored class and online resources. WS also delivers a limited number of course-specific writing clinics to which students bring their drafts to receive tutor and peer feedback.
6. **Video-capture of Lectures:** Upon faculty request, course lectures can be video-recorded and made available for review to students in those courses.

Supporting Faculty in Development of Teaching Expertise

Individual consultations and workshops are available for a range of topics including course and syllabus design, developing and achieving learning outcomes, effective assessment, presentation skills, active learning techniques, inclusive teaching, classroom management, classroom visits and debrief, preventing plagiarism, as well as development of a reflective teaching practice and teaching portfolio construction. There are:

- Teaching orientation events that introduce instructors to key policies and best practices of teaching at UTSC;
- Workshops throughout the year on a range of teaching topics;
- An annual teaching symposium;
- Individual consultations for syllabus, assignment or course design and other classroom issues; and
- Classroom visits for formative feedback.

Quercus and educational technology support including:

- Quercus, UTSC's learning management system;
- Instructional design for online assignments, courses and resources;
- Classroom response devices (eg. clickers);
- Multiple choice test scanning and question quality assessment;
- Mid-course assessments; and
- Administrative support for course evaluations.

Teaching Grants to enhance the content, delivery, assessment or infrastructure of courses; grant categories include equipment, software, enhancements/ innovations, assessment, and professional development.

Assistance with Teaching Portfolios and Teaching Award nomination packages.

Teaching Assistant Training and Graduate Student Professional Skills Development

General first-time TA Training workshops for new Teaching Assistants.

Workshops on advanced topics for TAs based on TA interest (examples: 'Effective and Efficient Grading', 'Responding to Students in Crisis').

Graduate Student Professional Development Day.

Graduate Student Professional Skills Programming.

Graduate Thesis Writing Support Group.

Writing Support and English Language Development, one-to-one appointments for writing/language skills.

Co-op Offices (Arts & Science and Management)

Serve more than 3400 students registered in over 40 Co-operative education programs spanning the Arts, Science, and Business/Management disciplines. The Arts & Science and Management Co-op Offices formally integrate a student's academic studies with work experience by facilitating four-, eight-, twelve-, or sixteen-month full-time, paid experiential learning opportunities. Students in Co-op receive developmental support in goal setting, job search, resume writing, on-line presence, and interviewing. For each four-month experience, students are evaluated on the basis of mid-term and final performance reviews as well as a final project that is graded by a faculty member within the discipline.

Departmental Student Associations (DSAs)

DSAs establish a bridge between students and their academic departments. They are governed by annually elected student executive bodies and composed entirely of student members. These student groups liaise with faculty, the Department of Student Life, and the Scarborough Campus Students' Union to develop joint programming that enhances the discipline-specific learning and career development goals of students in each department.

Financial Aid and Awards

Provides resources and consultation services to assist students with financing their education, including processing of OSAP and other funding sources.

Lesbian, Gay, Bisexual, Transgendered and Questioning

Students are served by a campus-supported Positive Space Committee comprised of allies drawn from all segments of UTSC, as well as a student LGBTQ club funded and facilitated independently through the Council on Student Services.

Orientation and Transition Programs

Provide new and first-year students with support and resources required for successful transition into university life. A list of programs includes:

- Get Started academic orientation, offered by the Academic Advising & Career Centre, runs throughout June and July, and currently hosts over 2,600 new incoming students along with their parents and guests. The interactive program provides an introduction to information and tools to allow for a successful start including first-year course selection, student card registration, and exploring the campus.
- Fall Orientation is a multi-day series of events hosted by the Scarborough Campus Students' Union (SCSU) and the Department of Student Life, in collaboration with various other campus partners. Two key events include UTSC Welcome Day and the Faculty Mix & Mingles (Arts & Science, Computer Science and Management) led by the Department of Student Life. SCSU coordinates student participation in the tri-campus parade and other on-campus activities. These activities provide a welcoming and inclusive environment for new and first-year students.

Further emphasis on first year student support is continued in the First Year Experience Program and First-Generation Program led by the Department of Student Life.

- International Student Orientation and Transition programming provided by the International Student Centre is a two to three week set of activities from August to September. These activities include pre-arrival support, settling in city excursions, and socials. Also, a mentorship service, known as the Buddy Program, pairs international students with a peer educator to learn more about the campus and Canadian academic environment.

Registrar's Office

Provides a range of services to the academic departments, including: student course and program registration; scheduling classes, term tests and final exams; recruiting candidates for admission; facilitating admission of incoming first year and upper-level students to limited enrolment programs, and removing those who fail to maintain program GPA requirements; maintaining student registration records; providing data support and summaries of enrolment; and resource-use for planning purposes.

Student Centre

Offers bookable activity spaces for students as well as a food court, a full-service restaurant, and a variety store. It also houses the Office of Student Affairs, the Department of Student Life, the Health & Wellness Centre, The Underground, UTSC Women's & Trans Centre, Fusion Radio, and the Scarborough Campus Students' Union.

Additional Resources for Graduate Students

Vice-Dean Graduate at UTSC

Provides resources and support to graduate students and postdoctoral fellows. Services for graduate students include management of Graduate Education website, administration of the affiliated graduate students listserv, maintenance of the Graduate Student Lounge, assisting with room bookings for PhD Final Oral Exams (FOEs) and Supervisory Committee Meetings held at UTSC, providing information and support for Visiting Graduate Students and their host supervisors at UTSC, administering the funding packages for UTSC based graduate programs, providing assistance with documentation for OSAP and other provincial student loans, and administering UTSC graduate awards, including the UTSC Graduate Student Summer Gym Rebate Program for the Toronto Pan Am Sports Centre (TPASC).

Writing Centre (TWC)

Individual help with writing is available for UTSC graduate students and postdoctoral fellows in person or through online interfaces to address any type of graduate student writing—from course papers and application materials to research proposals, thesis chapters, and papers for publication. The Writing Centre also offers "Just Write" sessions to provide an opportunity for graduate students and postdoctoral fellows to

work on their current writing project in a distraction-free environment, with the built-in accountability and social support of writing with others.

Graduate Professional Skills Program (GPS)

A non-academic program presented by SGS which consists of a variety of offerings providing doctoral stream students a range of opportunities for professional skills development. The program focuses on skills beyond those conventionally learned within a disciplinary program — skills that may be critical to success in the wide range of careers that graduates enter, both within and outside academe. GPS aims to help students communicate effectively, plan and manage their time, be entrepreneurial, understand and apply ethical practices, and work effectively in teams and as leaders. GPS offerings are also available locally at UTSC. While the number of GPS offerings continues to grow, there are currently approximately twenty options available as part of the Graduate Professional Skills Workshop Series at UTSC.

The School of Graduate Studies on the St. George Campus

Provides registrarial services to all graduate students at the University of Toronto including, but not limited to, recruitment, admission, orientation, registration, confirmation letters, program progress, PhD final oral exams, and graduation.

Graduate Awards Office (GAO) at the School of Graduate Studies

Provides administrative support for a wide range of scholarship and financial aid programs.

Graduate Professional Development (GPD)

Helps students succeed in graduate school and prepares them for a wide range of employment opportunities. SGS Graduate Professional Development initiatives include the Graduate Professional Skills (GPS) Program, the Three Minute Thesis (3MT®) Competition, the SGS Summer Institute, the SGS Innovation in Graduate Professional Development Fund, and the Graduate Speaker Series.

Grad Room on the St. George Campus

Is a hub for graduate students to get involved in graduate life, build a community of graduate scholars, and learn and practice new skills in Graduate Professional Development (GPD).

SGS International Graduate Student Portal

Brings together all of the resources available to international students on all three University of Toronto campuses.

Graduate Wellness Counselling

Graduate students can access counselling services at the School of Graduate Studies, 63 St. George Street. Two full-time Wellness Counsellors from the [Health and Wellness Centre](#) on St. George Campus offer brief counselling services tailored to the challenges presented by graduate-level university life. The focus of counselling is on identifying strengths, acquiring resiliency, and building coping skills.

Graduate Centre for Academic Communication (GCAC)

Provides graduate students with advanced training in academic writing and speaking. The Centre offers five types of support designed to target the needs of both native and non-native speakers of English: non-credit courses, single-session workshops, individual writing consultations, writing intensives, and a list of additional resources for academic writing and speaking. While the [workshops](#) function on a drop-in basis, [writing centre consultations](#) require an appointment, and [courses](#) and [writing intensives](#) require registration.

Conflict Resolution Centre (CRC) for Graduate Students

Current graduate students or postdoctoral fellows at UTM, UTSC, or UTSG are welcome to connect confidentially with one of the trained grad-to-grad (G2G) Peer Advisors to talk about options and strategies for addressing concerns and accessing university supports and resources. G2G Peer Advisors do not intervene or advocate – they listen and can help grad students and postdocs to navigate their own way forward. Faculty or staff members can refer students to the G2G Peer Advisors and/or contact the CRC directly to discuss early and effective conflict resolution strategies and opportunities for skills development and training for their department. G2G Peer Advisors are available to meet with graduate students on all three University of Toronto campuses.

Appendix D: Comparator Programs

Please list U of T and external comparators and provide a short summary of the programs and highlight any differences between the degree programs and what is proposed. Please remove the examples from the table below.

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
University of Toronto, Department of Ecology and Evolutionary Biology (EEB)	PhD in Ecology and Evolutionary Biology	\$6,210.00 for 2024-25	The EEB program offers students the opportunity to carry out research in core areas of ecology and evolution as well as related sub-disciplines including conservation, genomics, and molecular biology. The main goal of the graduate program is the development of scientists who perform innovative, publication-quality research; think critically; master skills specific to their fields; and excel at conveying their ideas and results in both written and spoken formats	This program is focused on the core areas of ecology and evolutionary biology rather than the diverse focus of the IAB program, which spans cell and molecular biology, physiology, neuroscience, as well as ecology and evolutionary biology. The EEB PhD program does not explicitly incorporate interdisciplinarity in their training and research and does not include a mandatory practicum with a partner organization or academic.
University of Toronto, Department of Cell and Systems Biology (CSB)	PhD in Cell and Systems Biology	\$6,210.00 for 2024-25	The CSB PhD program aims to produce scientists who will form part of the next generation of independent researchers in cell, molecular and systems biology, and become future high-level teachers, frontier-expanders, and decision-makers in these fields of inquiry.	While the disciplinary focus of the CSB program is quite diverse, and more similar to the IAB program than EEB, this program also does not explicitly incorporate interdisciplinary training and research, nor does it include a mandatory practicum with a partner

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			In keeping with this, PhD graduates are expected to emerge from the program as independent and autonomous scientists, producing a written thesis that describes original research that stands as a testimony to their ability to generate publishable, stand-alone contributions to the peer-reviewed scientific literature. As part of their training, PhD students will acquire skills in the communication of scientific research (including teaching skills), and acquire broad-based knowledge of the theory and practice underpinning their chosen field.	organization or academic as part of graduate training.
University of Toronto, Department of Physical & Environmental Sciences	PhD in Environmental Science	\$6,210.00 for 2024-25	The PhD program in Environmental Science is designed to provide a broad knowledge of current environmental issues, and specific training in the most appropriate research methodologies to address questions that lie at the interface between traditional science disciplines. PhDs are concentrated on the following areas: Climate Change and the Environment; Contaminant Flux; Environmental Science in Transitional	While the PhD program in Environmental Science aims to attract students whose interests and backgrounds do not fit into traditional disciplinary boundaries, and allows for students to tackle research projects that need to make use of research concepts, approaches, and tools from more than one of these fields, similar to the aim of the IAB program, the research projects are largely focused on environmental issues (see

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			Economies; Great Lakes Ecosystems; Remediation and Restoration of Degraded Environmental Systems; and Urban Geoscience.	concentrations in preceding column), compared to the broad diversity of research foci in the IAB program (Cell and Molecular Biology, Microbiology, Immunology, Virology, Physiology, Neuroscience, Plant Biology, Ecology, and Evolutionary Biology). In addition, the PhD in Environmental Science does not include a mandatory practicum with a partner organization or academic as part of graduate training.
Ontario Comparators				
Integrative Biology (PhD), University of Guelph	https://www.uoguelph.ca/programs/phd-integrative-biology/		“The Department of Integrative Biology is comprised of faculty members in three overlapping fields of emphasis: Ecology, Evolutionary Biology and Comparative Physiology. Research is focused on a wide variety of organisms (from microbes to plants to animals) at multiple levels of organization (from molecules and cells through to entire ecosystems). Basic research is being used as a foundation to address some of the most important regional and global issues.	Focused on Evolution, Ecology, and Comparative Physiology, and therefore narrower in scope than the proposed PhD. Further, this program does not include a practicum.

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			We offer a research-based Master's and Doctoral program. Master's students take 1.5 credits in course work, and prepare and defend a research-based thesis for their MSc (approximately six semesters). The PhD program requires the successful completion of a qualifying exam and the completion and defense of a research-based thesis. All graduate students are guaranteed financial support through Research and/ or Teaching Assistantships and internal/ external scholarships."	
PhD Applied Bioscience, University of Ontario Institute of Technology	https://ontariotechu.ca/programs/graduate/science/phd-applied-bioscience/		"The primary objective of the Doctor of Philosophy (PhD) program in Applied Bioscience is to train students to become high-quality researchers at the interface between chemistry and biology. The Faculty of Science, with no traditional departments, exposes students to interdisciplinary research, allowing them to gain experience working successfully within collaborative networks. The graduate programs equip	Focused on the interface of Chemistry and Biology and consists of 4 research fields: Biomolecular Sciences, Ecosystem Health, Forensic Bioscience and Human Health Biology. This program is of narrower breadth than the proposed PhD and does not include experiential practicums.

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			students with a wide array of both practical and conceptual scientific skills that prepare them for leadership roles in the life sciences. These goals are achieved through independent research and rigorous course work. The programs bring together students and faculty from a variety of scientific backgrounds, which further enriches the student learning experience. In addition, in keeping with the university's strategic plan, research is aimed at creating innovations that will improve the lives of Canadians.”	
Applied Animal Biology, Faculty of Land and Food Systems, UBC	https://www.landfood.ubc.ca/graduate/applied-animal-biology-msc-phd/		“The UBC Animal Welfare Program is one of the largest and most respected programs in the world in the field of animal welfare science. Since its inception in 1997, the program’s research has led to improvements in the lives of animals in British Columbia and around the world. The mission of the program is to improve the welfare and humane care of animals in agriculture, research, companionship and other areas through active efforts in research, education and	Focused on agriculture, including animal physiology, behaviour, welfare, and management of livestock, aquaculture, and wildlife species. This program is more focused and less interdisciplinary than our proposed program. Further, this program does not include a practicum.

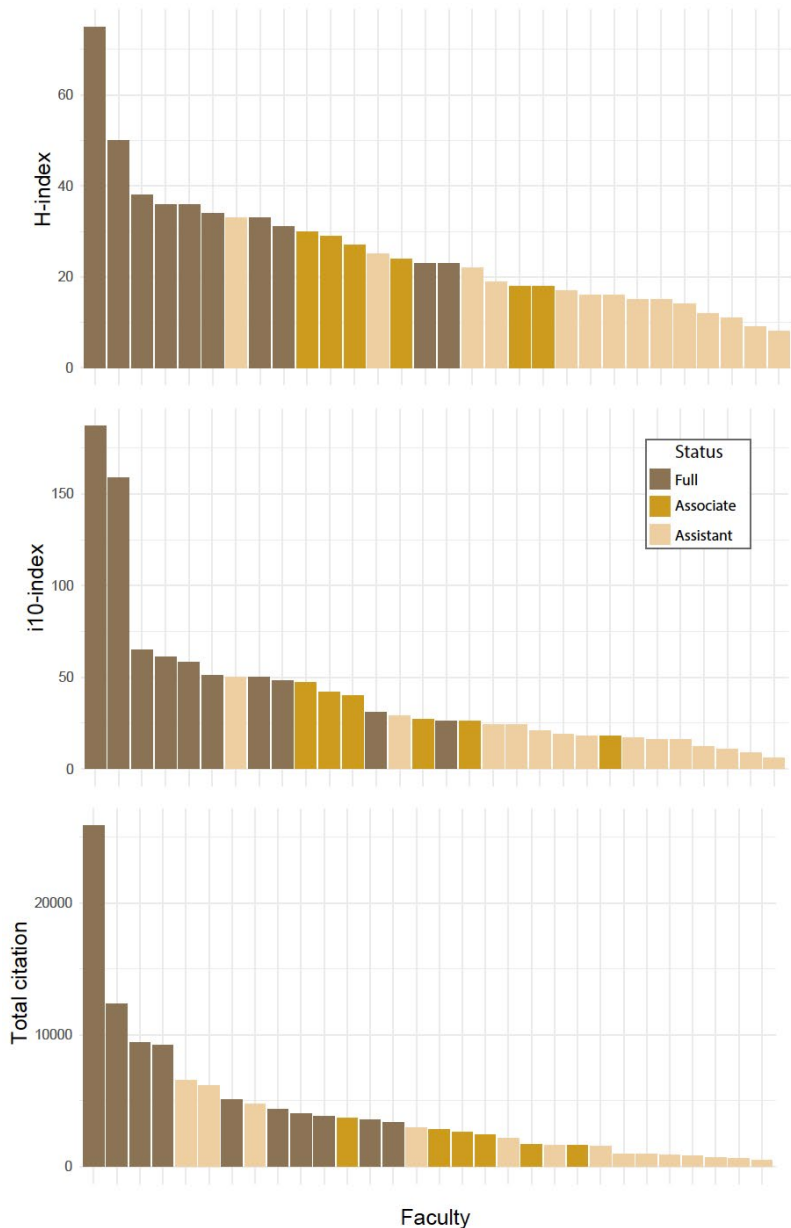
Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			public outreach. For additional information view the UBC Animal Welfare website. Graduate training in applied animal biology normally involves a combination of courses in both basic and applied sciences, with research leading to a thesis or dissertation. Students are expected to publish their research results in relevant leading international refereed journals. Coursework selected in consultation with the student's supervisory committee includes graduate courses in areas relevant to each student's research."	
International Comparators				
PhD Applied Biology, University of Massachusetts - Lowell	https://www.uml.edu/sciences/biology/programs-of-study/phd-applied-biology.aspx		"UMass Lowell's Ph.D. in Applied Biology program integrates foundational areas of biology (e.g., Biochemistry, Cell & Molecular Biology, Genetics, Developmental Biology, Evolutionary Biology) with focused interdisciplinary biological research and preparation for career advancement.	Similar in scope, integrative biology, but excludes ecology and environmental biology, and includes professional skills development. However, does not explicitly include practicum.

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			The program combines fundamental and rigorous training in the pursuit of new knowledge regarding the mechanisms of biological processes coupled with the skills needed to apply this knowledge in the workforce. In addition to traditional academic careers in research and education at colleges and universities and academic research hospitals and institutes, our graduates are also prepared for non-academic careers.”	
PhD Applied Biology and Biotechnology, Royal Melbourne Institute of Technology	https://www.rmit.edu.au/study-with-us/levels-of-study/research-programs/phd/phd-applied-biology--biotechnology-dr231		“Our innovative programs and projects address real-world issues essential to Australia’s innovation agenda. Research within this discipline uses molecular approaches to diagnose and synthesize solutions for disease and environmental problems. Under expert supervision, you will develop your skills and join researchers already active in: aquatic and marine biology	This program works across several subdisciplines in biology with a focus on biotechnology. It does not include a practicum.

Institution and Unit	Degree and Program (including URL)	Tuition	Program Description and Curriculum	Differences Between This Program and What is Proposed
			ecotoxicology (biomarkers for environmental pollutants) bioremediation of contaminated environments environmental and molecular approaches to diagnose and develop solutions for disease, agricultural and environmental problems genomics and sequencing techniques applied to various organisms microbiology (food, medical, environmental and nano biotechnology, vaccine development, fundamentals of host/pathogen interactions) plant biology (plant biotechnology and genomics, molecular plant breeding, ecotoxicogenomics, fire and environmental ecology). RMIT has purpose-built biotechnology labs and advanced microscopy, spectroscopy, tissue culture, microbiology, nanobiotechnology and analytical biochemistry, and experimental animal house facilities located at our Bundoora and City campuses.”	

Appendix E: Faculty Scholarship Metrics

This figure shows three commonly referenced scholarly metrics based on citations include the H-index (number of publications (N) above N citations), i10-index (number of publications above 10 citations), and the total number of citations, all coded by the professorial status of the faculty. H-indices above 20 for Associate Professors and 30 for Full Professors are considered strong indicators of research success



(<https://academiainsider.com/what-is-a-good-h-index-for-each-academic-position/>). Our faculty compares very well against these global averages.

Appendix F: Survey of Interest in the IAB Program

Survey to assess interest in a new Biology graduate program at UTSC

We surveyed current students in the Department of Biological Sciences to assess their interest in the proposed graduate program. We received 321 responses.

Preamble and questions:

'We would like to assess your interest in a possible graduate-level program in "Interdisciplinary and Applied Biology" (IAB), to be offered by the Department of Biological Sciences at UTSC. Many biological challenges confronted by humanity require an interdisciplinary approach where biological knowledge is a fundamental component.

Responding to this reality, the IAB program will provide MSc and PhD-level training in biological sciences, with an emphasis on cross-disciplinary training and projects, hands-on experience, and the applicability of basic science to real-world problems. Graduates will be capable of leading and engaging in multidisciplinary efforts to tackle pressing issues in a variety of subjects, such as climate change, rural and urban ecosystem services, disease and emerging pathogens, green technology, food safety and security, and health technologies. A key aspect of the IAB program will be to offer a significant experiential learning component, involving students working with off-campus partner organizations.

To gauge interest in the proposed program, we would appreciate your responses to the following questions:'

1. Are you interested in a graduate program after your current degree?
2. Have you actively searched for graduate programs in Biology?
3. How important would you consider the experiential learning component of the IAB (involving students working with off-campus partner organizations)?
4. How important would you consider the IAB program's emphasis on real-world applicability of biological knowledge?
5. Rate your level of interest in a UTSC-based graduate program in Interdisciplinary and Applied Biology (IAB) at UTSC.
6. If it were available, would you apply to a UTSC-based graduate program in Interdisciplinary and Applied Biology (IAB)?
7. Please indicate the degree you are currently pursuing

Survey Results:

321

Responses

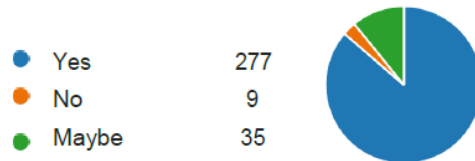
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Average time to complete

Closed

Status

1. Are you interested in a graduate program after your current degree?



2. Have you actively searched for graduate programs in Biology?



3. How important would you consider the experiential learning component of the IAB (involving students working with off-campus partner organizations)?

Very High	199
High	100
Low	4
Very Low	10
Not Interested	8



4. How important would you consider the IAB program's emphasis on real-world applicability of biological knowledge?

Very High	215
High	83
Low	6
Very Low	9
Not Interested	7



5. Rate your level of interest in a UTSC-based graduate program in Interdisciplinary and Applied Biology (IAB) at UTSC.

Very High	138
High	132
Low	30
Very Low	9
Not Interested	12



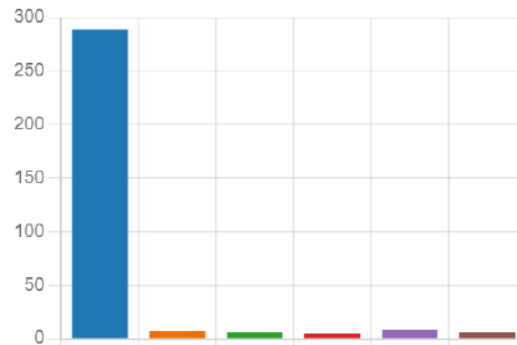
6. If it were available, would you apply to a UTSC-based graduate program in Interdisciplinary and Applied Biology (IAB)?

Yes	219
No	26
Maybe	76



7. Please indicate the degree you are currently pursuing

Undergraduate Student	289
MSc Candidate (EEB)	7
MSc Candidate (CSB)	6
PhD Candidate (EEB)	5
PhD Candidate (CSB)	8
MSc or PhD (DPES, Immunology)	6



Appendix G: Partnerships

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Ashok, Aarthi	TDSB	Government	Outreach
Cadotte, Marc	TDSB	Government	Outreach
Cadotte, Marc	Ontario Nature	NGO	Research
Cadotte, Marc	TRCA	NGO	Research
Cadotte, Marc	Pela	Industry	Research
Cadotte, Marc	KiDrone	Industry	Research
Cadotte, Marc	Metonics	Industry	Research
Cadotte, Marc	Nature Conservancy	NGO	Research
Cadotte, Marc	Parks Canada	Governmental	Research/outreach
Cadotte, Marc	Toronto Zoo	Not-for-profit	Research/outreach
Cadotte, Marc	Yokohama University	Academic	Research
Cadotte, Marc	Fudan University	Academic	Research
Cadotte, Marc	China East Normal University	Academic	Research
Cadotte, Marc	South China Normal University	Academic	Research
Cadotte, Marc	Kunming Institute of Botany	Academic	Research
Cadotte, Marc	Chinese Academy of Sciences	Academic	Research
Cadotte, Marc	Stellenbosch University	Academic	Research
Cadotte, Marc	University of Grenoble	Academic	Research
Cadotte, Marc	Munich Institute of Technology	Academic	Research
Cadotte, Marc	German integrative biodiversity centre	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Cadotte, Marc	Czech Academy of Sciences	Academic	Research
Cadotte, Marc	University of Hong Kong	Academic	Research
Cadotte, Marc	Ural Federal University	Academic	Research
Cadotte, Marc	University of Florida	Academic	Research
Cadotte, Marc	Comahue, Argentina	Government	Research
Cadotte, Marc	Queensland University of Technology	Academic	Research
Cadotte, Marc	São Paulo State University	Academic	Research
Cadotte, Marc	Universidade Federal de Lavras	Academic	Research
Cadotte, Marc	University Concepción	Academic	Research
Cadotte, Marc	Masaryk University	Academic	Research
Cadotte, Marc	Hochschule für Wirtschaft und Umwelt	Academic	Research
Cadotte, Marc	Martin-Luther University Halle-Wittenberg	Academic	Research
Cadotte, Marc	Universidad Autónoma del Estado de Morelos	Academic	Research
Cadotte, Marc	Landcare Institute, New Zealand	Government	Research
Cadotte, Marc	Rutgers University	Academic	Research
Cadotte, Marc	City of Durban	Government	Research
Cadotte, Marc	University of Delhi	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Cadotte, Marc	University of North Carolina	Academic	Research
Gazzarrini, Sonia	Department of Biosciences, University of Milan	Academic	Research
Gazzarrini, Sonia	Bioproduction Research Institute, Sapporo, Japan	Academic	Research
Gazzarrini, Sonia	China Agricultural University, Beijing	Academic	Research
Gonzales-Vigil, Eliana	Agriculture and Agri-food Canada in Saskatchewan	Government	Research
Guzzo, Christina	U Ottawa - Flow Cytometry Core Facility	Academic	Research
Guzzo, Christina	SickKids Research Institute	Academic	Research
Guzzo, Christina	NIAID, NIH	Government	Research
Guzzo, Christina	EcoSpark	Not-for-profit	Outreach
Harrison, Rene E.	Albany Medical College, Albany	Research	Academic
Harrison, Rene E.	University of Alberta	Research	Academic
Harrison, Rene E.	University of Western Ontario	Research	Academic
Harrison, Rene E.	University of Queensland	Research	Academic
Harrison, Rene E.	St. Michael's Hospital, Toronto	Research	Academic
Lovejoy, Nathan	University of Sao Paolo	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Lovejoy, Nathan	University of Central Florida	Academic	Research
Lovejoy, Nathan	Academy of Natural Sciences Philadelphia	Academic	Research
Lovejoy, Nathan	University of Costa Rica	Academic	Research
Lovejoy, Nathan	Cano Palma Biological Station, Costa Rica	Academic	Research/Teaching/ Outreach
Lovejoy, Nathan	Fisheries and Oceans Canada	Government	Research
Lovejoy, Nathan	Royal Ontario Museum	Government	Research
Lovejoy, Nathan	Western Michigan University	Academic	Research
Lovejoy, Nathan	University of Michigan	Academic	Research
Lovejoy, Nathan	National Ocean and Atmospheric Administration	Government	Research
MacIvor, Scott	Centre for Biogenomic Research (U of Guelph)	Academic	Research
MacIvor, Scott	David Suzuki Foundation	NGO	Research/Outreach
MacIvor, Scott	Ontario Nature	NGO	Research
MacIvor, Scott	Wildlife Preservation Canada	NGO	Research
MacIvor, Scott	Green Roof Innovation	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
	Technology (GRIT) lab, UT St George		
MacIvor, Scott	Chiba University (Japan)	Academic	Research
MacIvor, Scott	Hong Kong University	Academic	Research
MacIvor, Scott	Engineering (U of T St George)	Academic	Research
MacIvor, Scott	UrBioNet	Academic	Research
MacIvor, Scott	MITACS	Funder	Research
MacIvor, Scott	Centre for Urban Environments (CUE) (UTM)	Academic	Research
Mandrak, Nicholas	UTSC-DPES	Academic	Research/Teaching
Mandrak, Nicholas	Toronto Zoo	Government	Research
Mandrak, Nicholas	DFO	Government	Research
Mandrak, Nicholas	ROM	Academic	Research
Mandrak, Nicholas	Parks Canada	Government	Research
Mandrak, Nicholas	Nawash	Indigenous	Research
Mandrak, Nicholas	McGill	Academic	Research
Mandrak, Nicholas	UWindsor	Academic	Research
Mandrak, Nicholas	UT-EEB	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Mandrak, Nicholas	South African Institute for Aquatic Biology	Academic	Research
Mandrak, Nicholas	Laurentian University	Academic	Research
Mandrak, Nicholas	OMNRF	Government	Research
Mandrak, Nicholas	MITACS	Funder	Research
Mandrak, Nicholas	Ontario Power Generation	Industry	Research
Mandrak, Nicholas	Centre for Urban Environments (UTM)	Academic	Research
Mandrak, Nicholas	Stellenbosch University	Academic	Research
Mason, Andrew	University of Strathclyde	Academic	Research
Mason, Andrew	St Olaf's College,	Academic	Research
Mason, Andrew	UC Berkeley	Academic	Research
Mason, Andrew	University of Lincoln, UK	Academic	Research
McGowan, Patrick	Centers for Disease Control (CDC)	Government (US)	Research
McGowan, Patrick	McMaster University	Academic	Research
McGowan, Patrick	Lunenfeld-Tanenbaum Research Institute (Toronto)	Academic	Research
McGowan, Patrick	Cell and Systems Biology (St-George)	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
McGowan, Patrick	Université de Montreal	Academic	Research
McGowan, Patrick	Physiology (St-George)	Academic	Research
Molnar, Péter	UC Denver Colorado	Academic	Research
Molnar, Péter	UC Denver Boulder	Academic	Research
Molnar, Péter	University of Alberta	Academic	Research
Molnar, Péter	University of Calgary	Academic	Research
Molnar, Péter	University of Glasgow	Academic	Research
Molnar, Péter	Memorial University Newfoundland	Academic	Research
Molnar, Péter	Toronto Zoo	NGO	Research, Outreach
Molnar, Péter	Ruder Boskovic Institute, Zagreb	Academic	Research
Molnar, Péter	York University	Academic	Research
Molnar, Péter	Polar Bears International	NGO	Research, Outreach
Molnar, Péter	Oakland University	Academic	Research
Molnar, Péter	Imperial College	Academic	Research
Molnar, Péter	Oxford University	Academic	Research
Molnar, Péter	Trinity College	Academic	Research
Molnar, Péter	Osa Conservation	NGO	Research, Outreach
Molnar, Péter	Animal Health Unit, Dept. of Environment, YK Government	Academic, Government, Outreach	Research, Outreach
Molnar, Péter	Duke University	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Mott, Adam	Vineland Research and Innovation Centre	Not for profit	Research
Mott, Adam	Gregor Mendel Institute - Vienna	Government/ Academic	Research
Mott, Adam	Michigan State University	Academic	Research
Mott, Adam	BASF (crop sciences)	Industry	Research
Mott, Adam	Ontario Greenhouse Vegetable Growers	Industry	Research
Mott, Adam	Wageningen University and Research	Academic	Research
Nash, Joanne	Krembil Research Institute	Academic	Research
Nash, Joanne	Centre for Neurodegenerative Disease (CRND) St George	Academic	Research
Nash, Joanne	University of Montreal	Academic	Research
Sturge, Rachel	Toronto Zoo	Government	Teaching
Sturge, Rachel	ROM	Academic	Teaching
Sturge, Rachel	TRCA - Tommy Thompson Park	Government	Teaching/Research
Terebiznik, Mauricio	Pasteur- Sanofi	Industry	Research
Terebiznik, Mauricio	Elanco	Industry	Research
Terebiznik, Mauricio	Ryerson University	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Terebiznik, Mauricio	Abcelex tech	Industry	Research
Terebiznik, Mauricio	Fio Cruz Salvador, Brazil	Academic	Research
Terebiznik, Mauricio	University of Cuyo, Argentina	Academic	Research
Terebiznik, Mauricio	SOSCIP ONTARIO	Government	Research
Terebiznik, Mauricio	Hospital for Sick Children	Hospital	Research
Terebiznik, Mauricio	Ontario Public Health Agency	Government	Research
Terebiznik, Mauricio	Sanofi Pateur Limited	Industry	Research
Treanor, Bebhinn	The Hospital for Sick Children	Academic	Research
Treanor, Bebhinn	Kings College London	Academic	Research
Treanor, Bebhinn	Institute of Biomaterials and Biomedical Engineering, UofT	Academic	Research
Treanor, Bebhinn	National Jewish Health/University of Colorado Denver	Academic	Research
Weir, Jason	Royal Ontario Museum	Academic	Research
Weir, Jason	University of British Columbia	Academic	Research
Weir, Jason	University of Chicago	Academic	Research
Weir, Jason	University of Helsinki	Academic	Research

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Weir, Jason	Museu Paraense Emílio Goeldi	Academic	Research
Weir, Jason	University of Oklahoma	Academic	Research
Weir, Jason	New York State Museum	Academic	Research
Weir, Jason	University of Ghent	Academic	Research
Weir, Jason	Department of Conservation, New Zealand	Gov	Research
Weir, Jason	University of Western Australia	Academic	Research
Weir, Jason	University of Oxford	Academic	Research
Weir, Jason	Imperial College London	Academic	Research
Weir, Jason	Augustana College	Academic	Research
Weir, Jason	Canterbury Museum, New Zealand	Academic	Research
Weir, Jason	Chinese Academy of Sciences	Academic	Research
Welch, Kenneth	Johns Hopkins University	Academic	Research
Welch, Kenneth	Centre for Urban Environments (UTM)	Academic	Research
Welch, Kenneth	Bat Conservation International	Academic	Research
Welch, Kenneth	Earth and Related Technologies Hub (UTSC)	Academic	Research/Teaching

Faculty Name	Collaborating Department/ Agency, etc.	Agency Type (Academic/ Professional/ Government, etc.)	Nature/Scope of Endeavor (Research/ Teaching/Outreach)
Welch, Kenneth	Advance Facility for Avian Research (Western U)	Academic	Research
Welch, Kenneth	Environment & Climate Change Canada	Government	Research
Welch, Kenneth	Universidad Nacional Autonoma de Mexico	Academic	Research
Zhao, Rongmin	Biochemistry, U Saskatchewan	Academic	Research
Zhao, Rongmin	Biochemistry, UTSG	Academic	Research

Appendix H: Comparison with Cognate Programs at the University of Toronto

Note: Direct-entry requirements that differ from that for students with MSc degrees are indicated with DE.

Program	Appeals to Students with	Program Structure	Key Themes	Commonalities	Career Trajectories
IAB PhD	• Background in natural sciences; • Interest in carrying out and applying broad areas of biological research	• Four-year program (5 years DE) • Completion of 2.0 FCEs worth of courses (2.5 for DE) • Professional internship • Oral appraisal exam • Original publishable thesis	• Interdisciplinary skills • Combining and applying tools and understanding from across biology • Applying science to address important global and societal issues	• Focus on novel fundamental research. • Ability to communicate research in written and oral media.	• Academic/ Education • Biotechnology/ Pharmaceuticals • Health related (non-hospital) • Health (hospital-based) • Government • Industry, Research and Development • Environment, Agriculture • Media, Publishing
EEB PhD	• Background in organismal biology, ecology, and evolution;	• Four-year program (5 years DE)	• Disciplinary excellence • Generating knowledge		• Academic/ Education • Environment, Agriculture • Habitat management

	• Interest in carrying out fundamental ecology and evolution research	• Completion of 1.5 FCEs worth of courses (2.0 for DE) • Oral appraisal exam • Original publishable thesis	• Understanding the origins, structure and function of organisms, populations and communities		• Conservation
CSB PhD	• Background in molecular biology, physiology, and cell biology; • Interest in carrying out fundamental research on molecular and cellular processes	• Four-year program (5 years DE) • Completion of 1.0 FCEs worth of courses • Oral appraisal exam • Original publishable thesis	• Disciplinary excellence • Generating knowledge • Understanding the fundamental processes governing biological systems		• Academic • Biotechnology/ Pharmaceuticals • Health related (non-hospital) • Health (hospital-based) • Government • Industry, Research and Development
Env.Sci PhD	• Background in natural sciences, incl. biology,	• Four-year program (5 years DE)	• Understanding and applying fundamental concepts		• Academic/ Education • Health related (non-hospital) • Government • Environment, Agriculture

	chemistry, and geology; • Interest in the professional practice of environmental science and management	• Completion of 2.0 FCEs worth of courses (3.0 for DE) • Oral appraisal exam • Original publishable thesis	• Applying science to address questions about environmental impact and management		• Habitat management • Conservation • Industry, Research and Development
Immunology PhD	• Background in molecular biology, physiology, and cell biology; • Interest in carrying out fundamental immunology research and applying research to addressing medical issues	• Typically five-year program • Immunology focused courses (4.0 FCEs) • Qualifying exam • Original publishable thesis	• Disciplinary excellence • Generating knowledge • Applying science to address questions about immunology		• Academic/ Education • Biotechnology/ Pharmaceuticals • Health related (non-hospital) • Health (hospital-based) • Government • Industry, Research and Development

Appendix I: Letters of Support



April 30, 2024
Professor Marc Cadotte
Department of Biological Sciences
University of Toronto Scarborough

Re: Letter of support for new PhD in Interdisciplinary and Applied Biology (IAB)

Dear Prof. Cadotte,

Thank you for sharing the details of the proposed graduate program in Interdisciplinary and Applied Biology in the Department of Biological Sciences at University of Toronto Scarborough. As a partner working on the management of natural areas in Ontario, we are excited about the possibility of continuing our collaboration with formalized and sustained opportunities for the transfer of skilled trainees.

Ontario Nature is a registered charitable organization with a mission to protect wild species and wild spaces through conservation, education and public engagement. Since it was established as the Federation of Ontario Naturalists in 1931, Ontario Nature has been a champion for nature, representing more than 30,000 members and supporters and over 155 Nature Network member groups across Ontario. Our programs are diverse, focusing on youth leadership, community science, land use planning, protected areas, endangered species and wetland conservation. We also own and manage a system of 26 nature reserves, totaling 3,156 hectares, protecting examples of the some of the province's most rare and vulnerable habitats.

We value our partnership with you and Dr. Scott MacIvor to evaluate the impact of restoring alvar habitats using prescribed burns on plants and bees on Pelee Island. Results from this project, beginning in 2018, have impacted the management of our nature reserve. It has also led to the development of a best management practices guide that conservation practitioners across Ontario will reference.

This new PhD program will not only equip students with advanced training, but will also prioritize applied, real-world experience. By creating opportunities and incentives for partnerships, students will be able to apply their training to addressing practical problems, while learning embedded in a non-academic setting.

We are excited by the opportunity to potentially host PhD trainees for their applied internship. Furthermore, students receiving this type of integrated applied training, coupled with meaningful experience, would be employable within our sector, and we would look to these types of graduates to fill vacancies.

Sincerely,

Smera Sukumar
Conservation Science and Stewardship Director
Ontario Nature
smeras@ontarionature.org | 416-444-8419 ext. 229

720 Bathurst St, Toronto, ON M5S 2R4
T/ 416-444-8419 1-800-440-2366 F/ 416-444-9866
info@ontarionature.org ontarionature.org

CHARITABLE REGISTRATION #10737 8952 RR0001

April 29, 2024
Professor Nicholas E. Mandrak
Department of Biological Sciences
University of Toronto Scarborough

Re: Letter of support for new PhD in Interdisciplinary and Applied Biology (IAB)

Dear Prof. Mandrak,

Thank you for sharing the details of the proposed graduate program in Interdisciplinary and Applied Biology in the Department of Biological Sciences at University of Toronto Scarborough. As a partner working on fish ecology and aquatic conservation, I am excited about the possibility of continuing our collaboration with formalized and sustained opportunities for the transfer of skilled trainees.

Fisheries and Oceans Canada conducts research and management activities to ensure the sustainability of Canada's aquatic ecosystems. Much of our freshwater focus involves better understanding ecological patterns and processes, including the effect of human activities on aquatic ecosystems, and information needs for at-risk and invasive species.

This new PhD program will not only equip students with advanced training, but will also prioritize applied, real-world experience. Given that most research challenges are interdisciplinary in nature, the program's proposed focus will ensure that graduate students develop appropriate skills to address practical problems, while learning embedded in a non-academic setting.

I am excited by the opportunity to potentially host PhD trainees for their applied internship. Furthermore, students receiving this type of integrated applied training, coupled with meaningful experience, would be very employable within our sector, and I would look to these types of graduates to fill vacancies.

Sincerely,



Dr. D. Andrew R. Drake
Research Scientist
Great Lakes Laboratory for Fisheries and Aquatic Sciences
Fisheries and Oceans Canada
867 Lakeshore Rd.,
Burlington, Ontario, Canada
L7S 1A1

April 15, 2024
Professor Marc Cadotte
Department of Biological Sciences
University of Toronto Scarborough

Re: Letter of support for new PhD in Interdisciplinary and Applied Biology (IAB)

Dear Prof. Cadotte,

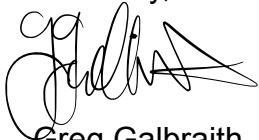
Thank you for sharing the details of the proposed graduate program in Interdisciplinary and Applied Biology in the Department of Biological Sciences at University of Toronto Scarborough. As a partner working on devising technological solutions to utilizing organic waste, we are excited about the possibility of continuing our collaboration with formalized and sustained opportunities for the transfer of skilled trainees.

Our company, Lomi, is on a mission to remove food scraps from the global waste stream, returning these valuable resources back to the earth to help regenerate the soil.

This new PhD program will not only equip students with advanced training, but will also prioritize applied, real-world experience. By creating opportunities and incentives for partnerships, students will be able to apply their training to addressing practical problems, while learning embedded in a non-academic setting.

We are excited by the opportunity to potentially host PhD trainees for their applied internship. Furthermore, students receiving this type of integrated applied training, coupled with meaningful experience, would be very employable within our sector, and we would look to these types of graduates to fill vacancies.

Sincerely,

A handwritten signature in black ink, appearing to read 'Greg Galbraith', with a stylized, flowing script.

Greg Galbraith
Product Development Manager
Lomi



Toronto and Region Conservation Authority

April 30, 2024
Professor Marc Cadotte
Department of Biological Sciences
University of Toronto Scarborough

Re: Letter of support for new PhD in Interdisciplinary and Applied Biology (IAB)

Dear Prof. Cadotte,

Thank you for sharing the details of the proposed graduate program in Interdisciplinary and Applied Biology in the Department of Biological Sciences at University of Toronto Scarborough. As a partner working on watershed and ecosystem science, restoration, and management in the Greater Toronto Area, we are excited about the proposed program. This program will help strengthen our collaboration with formalized and sustained opportunities for knowledge transfer and training of the skilled trainees.

Since 1957, Toronto and Region Conservation Authority (TRCA), as enabled through the provincial Conservation Authorities Act, has taken action to enhance our region's natural environment and protect our land, water, and communities from the impacts of flooding and increasingly extreme weather events. TRCA's jurisdiction includes nine watersheds and their Lake Ontario shorelines spanning 3,467 square kilometres. TRCA manages thousands of hectares of land and actively involved in protection and restoration of natural areas to provide benefits to people and biodiversity. TRCA mobilizes a collaborative and science-based approach to achieve collective impacts within our communities.

The proposed PhD program will not only equip students with advanced training, but will also prioritize applied, real-world experience. By creating opportunities and incentives for partnerships, students will be able to apply their training to addressing practical problems, while learning in a non-academic setting. The students receiving this type of integrated applied training, coupled with meaningful experience, would be very employable within ecosystem and conservation management sector.

I am confident that organizations like TRCA and other conservation authorities will benefit immensely from having access to opportunities for hosting PhD trainees from the proposed program for their applied internship. I would like to express my support for this program and wish you all the best for successful application.

Thank you,

Namrata Shrestha, Ph.D. (she / her)
Senior Manager, Watershed Planning and Reporting
Watershed Planning and Ecosystem Science | Development and Engineering Services

April 15, 2024
Professor Marc Cadotte
Department of Biological Sciences
University of Toronto Scarborough

Re: Letter of support for new PhD in Interdisciplinary and Applied Biology (IAB)

Dear Prof. Cadotte,

Thank you for sharing the details of the proposed graduate program in Interdisciplinary and Applied Biology in the Department of Biological Sciences at University of Toronto Scarborough. As a partner working on the development of biology-based technological solutions to energy production, we are excited about the possibility of continuing our collaboration with formalized and sustained opportunities for the transfer of skilled trainees.

Metonics is an engineering firm that specializes in developing and manufacturing mission critical instrumentation systems for the geophysics, environmental, energy, nuclear and aerospace industries.

This new PhD program will not only equip students with advanced training, but will also prioritize applied, real-world experience. By creating opportunities and incentives for partnerships, students will be able to apply their training to addressing practical problems, while learning embedded in a non-academic setting.

We are excited by the opportunity to potentially host PhD trainees for their applied internship. Furthermore, students receiving this type of integrated applied training, coupled with meaningful experience, would be very employable within our sector, and we would look to these types of graduates to fill vacancies.

Sincerely,

A handwritten signature in black ink, appearing to read 'Edwin Steele', with a stylized flourish at the end.

Edwin Steele
Metonics
1215 Queensway East Unit 59
Mississauga, ON

April 25, 2024
Professor Marc Cadotte
Department of Biological Sciences
University of Toronto Scarborough

Re: Letter of support for new PhD in Interdisciplinary and Applied Biology (IAB)

Dear Prof. Cadotte,

Thank you for sharing the details of the proposed graduate program in Interdisciplinary and Applied Biology in the Department of Biological Sciences at University of Toronto Scarborough. As a partner working with Biological Sciences on several training, teaching, and research initiatives, we are excited about the possibility of continuing our collaboration with formalized and sustained opportunities for the transfer of skilled trainees.

As a not-for-profit organization with a mission to *connect people, animals and conservation science to fight extinction*, your Toronto Zoo is pleased to support this proposal. This new PhD program will not only equip students with advanced training, but will also prioritize applied, real-world experience. By creating opportunities and incentives for partnerships, students will be able to apply their training to addressing practical problems, while learning embedded in a non-academic setting.

We are excited by the opportunity to potentially host PhD trainees for their applied internship. Furthermore, students receiving this type of integrated applied training, coupled with meaningful experience, would be very employable within our sector, and we would look to these types of graduates to fill vacancies.

Sincerely,



Dolf DeJong
CEO
416-392-5909
ddejong@torontozoo.ca