UNDERGRADUATE RESEARCH OPPORTUNITIES IN CANADIAN
HIGHER EDUCATION: AN INITIAL STUDY

by

SANDRA WAN

B.Sc. The University of British Columbia, 2015

A GRADUATING PAPER SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF EDUCATION

in

THE FACULTY OF GRADUATE STUDIES

(Adult Learning and Education)

THE UNIVERSITY OF BRITISH COLUMBIA
August, 2020

Contents

INTRODUCTION

Lisa, a third-year Chemical Engineering student at the University of Toronto, spent an entire summer term participating in a research opportunity within the Faculty[1]. Her research was on air quality, with a specific focus on aerosols (tiny particles in the air)[2]. One of Lisa's responsibilities was to ensure the instruments (an aerodynamic particle size and a dust rag) used to capture the aerosols were working properly so these particles could be studied in further detail[3]. The research is important due to the aerosol's impact on the environment and individual health[4]. From the research experience, Lisa was able to receive more hands-on knowledge, apply what was learned in school, and develop new skills that could only be acquired outside of the classroom setting[5]. This summer opportunity would not have been possible without university support of such undergraduate research experiences.

UNDERGRADUATE RESEARCH IN PREPARING THE FUTURE WORKFORCE

On a global scale, studies show low productivity and a shortage of skilled workers (Haan, 2012). For Canada, the economy and labour market are in flux due to global factors such as internationalization and restructuring of traditional sectors, underperforming in comparison to other nations (Goldenberg & desLisbris, 2006; Haan, 2012). A significant investment is required to build Canada's workforce, with increasing emphasis on developing workers to shape the economy (Goldenberg & desLisbris, 2006).

Global economic changes and the labour market have resulted in the increasing engagement of higher education with workforce development (Harvey, 2000; Lester & Costley, 2010). The responsibility to develop skilled workers has now shifted towards postsecondary institutions (Harvey, 2000; Lester & Costley, 2010), with the goal to "transform students by

enhancing their knowledge, skills, attitudes, and abilities" (Harvey, 2000, p. 3). Employers expect graduates to perform immediately with relevant competencies in a professional work setting (Billett, 2009). At the same time, students and graduates see the value of work experience and internships for employability purposes (Kinash, Crane, Judd, & Knight, 2016). The perceived need for graduates to have competencies and be prepared for the world of work means that higher education institutions need to build relevant opportunities into the student experience. One method to address these concerns is for postsecondary institutions to strategically leverage undergraduate research (UR) to address stakeholder and economic needs. In facilitating UR, a variety of undergraduate research opportunities (UROs) are offered to students – whether they are embedded within degree requirements or provided as a co-curricular activity.

RESEARCH PURPOSE

Currently, there is a lack of knowledge about the types of UROs offered in Canadian postsecondary institutions, with much of the literature on UR in higher education originating from the United States, Australia, and the United Kingdom. Considering the decentralized higher education system in Canada, it is unclear if Canadian universities are utilizing similar approaches to providing students with UR experiences. Studying universities' approaches to facilitating UROs can help practitioners, university administrators, and faculty strengthen undergraduate student research experiences across the nation. The study may also identify potential areas in UR that require additional support, collaboration, resources, and areas for future research.

The intent of this paper is to better understand Canada's landscape in facilitating UROs within higher education and identify opportunities to enhance UR. This is achieved by collecting publicly available information on existing UROs across selected Canadian university institutions and analyzing these opportunities.

Research questions are as follows:

- What are the rationales for promoting UROs in Canadian postsecondary institutions?

- What type of UROs are available in selected Canadian postsecondary institutions?

- What differences are evident in UROs across selected Canadian postsecondary institutions based on publicly available sources?

In a professional capacity, I work as a Program Coordinator, Workplace Learning, facilitating a few UROs within a research-intensive Canadian university (University of British Columbia). Concurrently, I am also a Master of Education graduate student, learning and working at the same institution. Reflecting on my values as a graduate student and professional, my researcher paradigm falls under pragmatism. For me, I value workable solutions and action (praxis). One of the primary reasons I decided to pursue my graduate degree was to integrate my professional and student identities through application of theory and knowledge acquired from school to my work. Ultimately, through evidence-based practices, I hope to contribute to positive and meaningful change. My intention in writing this paper is to gain more context in UR and higher education. I want to learn about the types of opportunities available to undergraduates at the University of British Columbia as well as at other Canadian institutions. It builds on my professional capacity and knowledge in this area. Considering the breadth of Canadian higher education and my professional experience, the focus of this study, including the literature review, will be primarily on universities, as it is most relevant for my work.

The paper includes an initial literature review on UR in higher education, including a description of the different types of UROs as well as the benefits of and challenges to UR at universities. The research methodology is then outlined. This is followed by a presentation of the

findings, along with a summary of UROs for each selected Canadian postsecondary institution as part of the study. Lastly, a detailed discussion and recommendations conclude the paper.

LITERATURE REVIEW

WHAT IS UNDERGRADUATE RESEARCH?

In the ever-changing world of the twenty-first century, professionals are expected to think critically, problem-solve, and make informed decisions (Brew & Mantai, 2017). The need for these skills in the workforce has led higher education institutions to utilize research and inquiry as a method to develop students with these proficiencies (Brew & Mantai, 2017). UR in higher education is one prominent strategy that addresses the demands and expectations of the global and shifting work environment (Brew, 2013; Dvorak & Hernandez-Ruiz, 2019; Murray, 2017) and prepares the "workforce to deal with novel, complex, and unstructured problems" (Zimbardi & Myatt, 2014, p. 233). UR is student-focused and integrates teaching and research (Brew, 2013; Brew & Mantai, 2017; Jones & Lerner, 2019; Wallin & Adawi, 2018). These high-impact experiences (Kuh, 2003) are offered in a range of disciplines (Brew, 2013) and allow students to work on a project(s) connected to research conducted at the institution (Brew, 2003; Wallin & Adawi, 2018). As a process-oriented way of learning (Murray, 2017), UR leverages the mentor's (often a faculty member) expertise, resources, and experience but the student has the responsibility for and can make informed decisions on the research project (Hunter, Laursen, & Seymour, 2007). Existing literature considers UR to be a form of student engagement (Murray, 2017) – it is a powerful learning tool that complements traditional classroom learning (Falconer & Holcomb, 2008). Students involved in UR report greater satisfaction with their overall undergraduate experience compared to those who are not (Bauer & Bennett, 2003).

One challenge faced by practitioners, academics, and faculty is finding a common understanding and definition of UR (Murray, 2017). This is not surprising, considering the terminology needs to relate to multiple disciplines and contexts (Murray, 2017). For some, UR can be everything that students do during their time at college or university; for others, UR is a specific set of activities available only to a small group of students (Brew & Mantai, 2017). Some argue that UR should be closely structured and guided while others consider UR as students doing independent work (Brew & Mantai, 2017). It has been suggested that for an activity to be considered UR, students should be involved in the *whole* research process; others believe students can participate in one or several stages and it would be counted as an UR experience (Brew & Mantai, 2017). The diverse perspectives and opinions of what constitutes UR have led to different forms, activities, and varieties in UROs (Brew & Mantai, 2017; Murray, 2017). The Council of Undergraduate Research (CUR) defines UR as "an inquiry or investigation, conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline". However, many have argued for a broader definition to include the diverse types and range of UROs that would allow for *all* students to engage in this type of research and inquiry (Healey & Jenkins, 2018; Judge, Pollock, Wiles, & Wilson, 2012; Parker, 2018). Currently, there is a call, from researchers and practitioners, for a universal definition to include a spectrum of UR activities - on one end, the findings and experience of the research process are *new* to students (but the research is not novel); on the other end, students are contributing to new knowledge and the findings are original (Healey & Jenkins, 2018). Similar to other scholars, I disagree with CUR's narrow definition of UR and call for a broader description since it is uncommon for undergraduates to make an original contribution during the course of their degree. Personally, I think UR should encompass a spectrum of opportunities across

disciplines, where an undergraduate student participates in a form of inquiry to acquire new knowledge (whether novel or not). This form of inquiry can be inside and/or outside of the formal classroom setting. Further, it can involve components of or the entire research process.

Although there is no consensus on a singular definition, there is agreement on the overall goals of UR. First, there is emphasis on development of new knowledge – whether for the student and/or the academic community (e.g. Brew, 2013; Jones & Lerner, 2019; Wallin & Adawi, 2018). Second, promotion of student learning is key, requiring a delicate balance between research and learning (Kardash, 2000; Murray, 2017; Wallin & Adawi, 2018) and involves skill development (Brew, 2013; Jones & Lerner, 2019). Third, UR should provide students with value via an authentic research experience (Murray, 2017; Wallin & Adawi, 2018), helping them transition from an identity as student to researcher (Wallin & Adawi, 2018).

Role of Higher Education in Undergraduate Research

UR is believed to play a significant role in advancing the goals of higher education institutions (Murray, 2017). In 1998, the Boyer Commission Report (in the United States) encouraged colleges and universities to incorporate research-based learning into programs and curricula (Bauer & Bennett, 2003; Hunter *et al*., 2007; Zydney, Bennett, Shahid, & Bauer, 2002). Further, engagement in research through UROs has been emphasized in institutional missions, policies, and strategic planning (Brew & Mantai, 2017; Murray, 2017). UROs offered by educational institutions are important not only for economic and political reasons, but also for recruiting exceptional talent (Reisberg, 1998). With the increasing responsibility for higher education to prepare students for the professional workforce (Brew, 2013; Murray, 2017), UR is seen as a way to address this challenge (Brew, 2013).

In the last twenty years since the Boyer Commission Report, there has been growing interest in UR and significant increases in the number of UROs at colleges and universities (Brew & Mantai, 2017; Murray, 2017). This has resulted in an international movement ranging across different departments and disciplines (Healey & Jenkins, 2018; Murray, 2017). Higher education institutions have also made efforts to promote UR (Fechheimer, Webber, & Kleiber, 2011), working towards building a supportive institutional culture (Murray, 2017). This has been accomplished through cultivating knowledge-building communities between faculty and students (Brew, 2013; Murray, 2017), socializing students into academia, and deepening the integration of learning opportunities outside the classroom, with the hope that all students can experience UR at some point during their degree (Murray, 2017).

It is important to recognize the diversity of higher education, including the academic literature on URs in this field. This literature review primarily relates to universities and their participation in UR and its associated opportunities. As such, it may not be applicable to other types of higher education institutions that focus on advanced arts and design, professional accreditations, and technical and vocational training. These institutions may have different views on UR, and in fact, may not offer it since their perspectives were not found in the literature.

Higher education has placed an increasing emphasis on UR (Dvorak & Hernandez-Ruiz, 2019). There is a wide range of UROs and diverse perspectives on what they involve. The positive impact of UR on student engagement, retention, and academic success is evident in literature (Murray, 2017), with the potential to enhance students' experiences and higher education altogether (Brew, 2013). The rationale for promoting UR and its benefits will be discussed in subsequent sections.

TYPES OF UNDERGRADUATE RESEARCH OPPORTUNITIES

UR typically includes students and faculty members, although the extent of their involvement and the relationship between the two can vary greatly (Murray, 2017). Across institutions, the type of offerings may differ (Brew, 2013; Murray, 2017) with no universal UR institutional model (Murray, 2017). In this section, the common types of UROs found in literature are discussed, which include apprenticeships, research-related course and program offerings, and opportunities to disseminate research.

Apprenticeship Opportunities

The apprenticeship model is the "catch-all" term for the most common and traditional type of URO. It involves a one-to-one, student-to-faculty relationship where the student works on a research project supported by the faculty member (e.g., Hunter *et al.*, 2007; Kardash, 2000; Seymour, Hunter, Laursen, & DeAntoni, 2003). The apprenticeship model has a variety of naming conventions – fellowships, internships, research scholarships, and grants to name a few (Murray, 2017). Of the studies reviewed for this paper, most focused on this type of URO. These apprenticeships can be paid or volunteer positions (Fechheimer *et al*., 2011), however, the finance piece has been known to influence students' participation in UR since they receive compensation for their work (Murray, 2017). Furthermore, apprenticeships are meant to be intensive, full-time work with projects being open-ended but defined in a way that results can be determined within a specific time frame (Hunter *et al*., 2007). The type of work may include working with others, reading and understanding literature, and inquiry and analysis (Alderton & Manzi, 2017). Initially, training is provided and as the term progresses, the student becomes increasingly self-directed and independent (Falconer & Holcomb, 2008; Hunter *et al*., 2007; Murray, 2017). Through the apprenticeship, students observe and model research skills from

faculty members and have the opportunity to enhance their research practice in an academic setting (Kardash, 2000). Most UR apprenticeships take place in the summer (Alderton & Manzi, 2017; Murray, 2017) which allows students to fully commit to the research project without having to also attend to school work (Murray, 2017). Within the apprenticeship model, there are three types of research projects – student-directed, faculty-directed, and collaborative (Murray, 2017). Student-directed research is when the undergraduate student identifies and investigates a research problem, acting as the "principal investigator" for the project. The student is responsible for all aspects of the research with the faculty mentor acting as more of a consultant. Faculty-directed research is the most conventional type of the three where the faculty member is the principal investigator. Students work to support existing projects determined by the faculty. Collaborative research projects allow for both the student and faculty to contribute as partners. The apprenticeship model is a powerful complement to classroom learning, promoting relationship development, comprehension and application of academic scholarship, immersion into an unpredictable environment, and dissemination of research (Falconer & Holcomb, 2008).

Course and Program-Based Opportunities

Unlike apprenticeship opportunities, course and program-based UROs are usually for academic credit and/or are part of undergraduate degree requirements. Course-based approaches allow academics to reach a larger number of students and usually provide an entry to research (Brew & Mantai, 2017; Moore, Hvenegaard, & Wesselius, 2018; Russell, Weaver, & Wink, 2008). Course-based UROs are limited in the type of research that can be done but are effective in introducing students to introductory research processes and academic writing (Murray, 2017). Research methods courses are examples of such course-based approaches. They can range from

conducting experiments to term projects that students can do individually or in groups (Murray, 2017). Another example of a course-based approach (a relatively recent innovation) is course-based undergraduate research experiences (CUREs). CUREs involve the class in investigating a research question or problem where the results are unknown to students and/or the instructor (Dvorak & Hernandez-Ruiz, 2019). CUREs have been increasingly popular, particularly in the sciences, as they allow a large number of students to engage in authentic research and be mentored (Dvorak & Hernandez-Ruiz, 2019; Jones & Lerner, 2019; Wallin & Adawi, 2018). Use of CUREs in humanities and social sciences classes for this review were not identified. Program-based approaches are similar to the apprenticeship model in that they involve frequent one-to-one interactions with the faculty member (Moore *et al.*, 2018). Where they differ from the apprenticeship model is that students receive academic credit for their work (Moore *et al.*, 2018). Theses, capstones, and directed studies are the most common program-based UROs. Both theses and capstones are often done in the last year of the students' degree (e.g., Fechheimer *et al.*, 2011; Hosein & Rao, 2017; Zydney *et al.*, 2002). Theses are usually academically oriented where the research topic is approved by a faculty advisor and the product is a lengthy paper (Murray, 2017). Capstones, on the other hand, can be major projects, papers, or presentations that allow students to apply their knowledge from previous courses to a real problem or issue (Murray, 2017). Directed studies are often student-directed research where a faculty member oversees the project (Murray, 2017). The independent nature of the project allows the student to pursue a topic of interest and implement the entire research process with minimal direction (Murray, 2017).

Opportunities to Disseminate Research

Disseminating research can be done through a wide range of platforms – undergraduate research conferences, symposia, publications, and discipline-specific academic journals (Murray, 2017). Undergraduate conferences and symposia hosted by colleges and universities allow undergraduate students to present their research findings (Healey & Jenkins, 2018; Judge *et al*., 2012; Kardash, 2000) through poster or oral presentations (Murray, 2017). Students situate their work in a wider context and receive recognition (Walkington, Walkington, Hill, & Kneale, 2017). Conferences can be discipline-specific (Hunter *et al*., 2007; Kardash, 2000; Murray, 2017) or multidisciplinary (Walkington *et al*., 2017). Recently, the number of undergraduate research conferences and student participation across disciplines have increased at institutional, national, and international levels (Walkington *et al*., 2017). Opportunities to disseminate research is important as it completes the research experience and enhances student learning (Walkington *et al*., 2017). Additionally, they provide a means to welcome undergraduates to the research community as knowledge producers, with their work made public (Murray, 2017).

The three common forms of UROs found in literature have been outlined in this section. The apprenticeship model is the most popular type of URO that students engage in. Course and program-based approaches (theses, capstones, and directed studies) are offered as mandatory or optional components to students' undergraduate degree requirements. Opportunities, such as conferences, symposia, and journals, facilitate the dissemination of research.

RATIONALE FOR UNDERGRADUATE RESEARCH: WHY IT HAS BECOME A POPULAR INITIATIVE IN HIGHER EDUCATION

Much of the existing literature provides evidence on why UR should be promoted in higher education institutions (especially in universities) as a result of its wide range of benefits.

Faculty and practitioners leverage the approach as a formal pedagogy to teaching and learning with mentorship playing a significant role in the process. Further, students, faculties, and institutions benefit from UR in various ways. In subsequent sections, challenges, barriers, and concerns regarding UR and UROs are also addressed.

Undergraduate Research as a Pedagogy

According to the Council of Undergraduate Research, UR is the pedagogy of the twenty-first century (Walkington *et al.*, 2017). UR is a student-centred pedagogical approach (Hosein & Rao, 2017; Zimbardi & Myatt, 2014) that aims to promote problem-solving, deep learning, and interactive teaching (Hosein & Rao, 2017). UR focuses on student learning in both the content (i.e., knowledge production) and the research process (Hosein & Rao, 2017; Murray, 2017). Furthermore, the foundation of UR is constructivism, where the learner's prior knowledge is constantly constructed and re-constructed with new knowledge by the individual (Hunter *et al.*, 2017; Kardash, 2000; Murray, 2017). Learning arises through discovery and transformation of information by the learner (Hunter *et al.*, 2017; Kardash, 2000; Murray, 2017). As a result, the student works towards becoming a researcher in the process (Hosein & Rao, 2017). Within constructivism, UR is a specific form of active learning, encouraged in higher education curricula due to its dynamic, complex, and collaborative nature (Murray, 2017). It allows learners to gain knowledge and skills while adapting to changing environments (Murray, 2017). Different types of active learning manifest in UR and its opportunities: experiential learning, discovery learning (i.e. problem-based and inquiry-based learning), service learning, and collaborative learning (small groups) (Murray, 2017).

Attempts have been made to develop pedagogical models that enhance UR and support practitioners and educators in facilitating these experiences. Considering the most popular type

of URO, the cognitive apprenticeship model describes learning as best promoted when novices

(students) work closely together with experts (faculty mentors) on relevant tasks (Kardash,

2000). This allows the novice to acquire a similar thought process as the experts when engaging

in the work (Kardash, 2000). Healey and Jenkins (as cited in Brew, 2013) created a framework

with UR and inquiry along two dimensions (**Figure 1**). The space within the two dimensions

determine the type of engagement: research-tutored, research-based, research-led, and research-
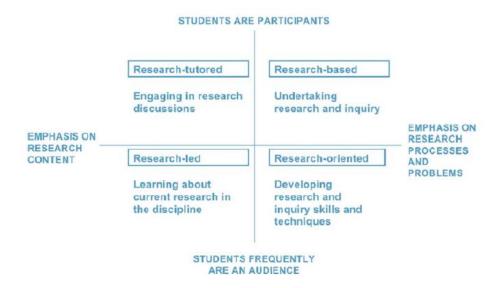
oriented (Healey & Jenkins as cited in Brew, 2013).

Figure. 1 Framework for UR and inquiry (Healey & Jenkins as cited in Brew, 2013, p. 607)

Other models include:

- Levey and Petrulis' s framework (as cited in Brew, 2013) maps out student activity

  according to *who* frames the inquiry in research;

- the Research Skills Development (RSD) outlines students' development of research skills

  across a course or program through increasing autonomy (Willison & O'Regan as cited in

  Brew, 2013);

- Brew's model (2013) assists educators and faculty with designing a research-based
  course or program which includes considerations related to context, learning outcomes,
  and level of student autonomy.

With the diverse types of UROs across disciplines, it is not surprising the existence of different approaches and pedagogical models for UR.

Mentorship in Undergraduate Research

Many attribute the success of UR to the student-faculty mentor relationship (Murray, 2017) and argue that it is a fundamental element in UR experiences (e.g., Johnson, Behling, Miller, & Vandermaas-Peeler, 2015; Lopatto, 2010; Wallin & Adawi, 2018). The mentoring experience is when "… an experienced professional trains the newcomer about profession or discipline specific practices, expectations, and norms" (Alderton & Manzi, 2017, p. 26). Mentorship plays an important role in addressing the social and emotional needs of the student (Lopatto, 2010) that combines personal and professional interactions (Judge *et al*., 2012). The mentor fosters student success through informal engagements; offers guidance on academic and career-related matters; provides emotional support; promotes exploration in student identity; and prepares students for their careers (Johnson *et al.*, 2015; Judge *et al*., 2012; Murray, 2017). While it is customary for faculty to act as mentors, it has become increasingly common for graduate students and postdoctoral researchers to take on this traditional role (Wallin & Adawi, 2018). Findings from some empirical studies report students benefiting from an extended professional network due to the mentorship provided (Alderton & Manzi, 2017; Eagan, Hurtado, Chang, Garcia, Herrera, & Garibay, 2013). They also gain confidence and self-authorship (Alderton and Manzi, 2017).

Student Benefits

The rationale for promoting UR in higher education is evident in the extensive literature on student benefits following participation in these activities. Studies focus on undergraduate student outcomes and particular gains as a result of the research experience. In the sections below, I highlight the student benefits in relation to skill development, career insights and advantages, academic success, confidence development, and sense of community and belonging.

Skill Development

Through participation in UR experiences, students develop a wide array of skills. Research skills include understanding disciplinary-specific and conceptual knowledge, knowing how to conduct research, and acquiring technical skills (e.g. Hunter *et al*., 2007; Kardash, 2000; Seymour *et al.*, 2003). UR also helps students comprehend how researchers think (Bauer & Bennett, 2003; Petrella & Jung, 2008; Seymour *et al*., 2003; Zydney *et al*., 2002) and apply knowledge to the work (Lopatto, 2010; Murray, 2017). Furthermore, students gain skills in research design (Kardash, 2000; Murray, 2017) and develop attitudes and behaviours for doing research (Hunter *et al.*, 2007; Kardash, 2000; Murray, 2017). Consequently, some studies show that students develop non-technical skills as a result of their UR experience. From those studies, primary outcomes include critical thinking, problem solving, and refined communication skills (e.g., Bauer & Bennett, 2003; Hunter *et al*., 2007; Kardash, 2000; Seymour *et al*., 2003). Other non-technical skills include organization and time management, collaborating with others, and working and thinking independently (e.g., Alderton & Manzi, 2017; Hunter *et al.,* 2007; Seymour *et al.,* 2003)

Career Insights and Advantages

A common student outcome from several studies is the clarification and refinement of career goals and discovery of career opportunities (e.g. Alderton & Manzi, 2017; Hunter *et al*.,

2007; Seymour *et al*., 2003). Often, UR allows students to experience what graduate school might be like, resulting in the likelihood of pursuing further studies (e.g. Alderton & Manzi, 2017; Hunter *et al*., 2007; Seymour *et al*., 2003). Students can also benefit in preparing for career and graduate school – seek career advice, obtain recommendation letters from faculty, acquire assistance with graduate school applications, and receive additional UROs (Hunter *et al*., 2007). In addition, students report increased networking opportunities and attainment of professional connections (Hunter *et al.*, 2007; Murray, 2017; Seymour *et al.*, 2003). UR has the ability to launch students into academic and other careers (Murray, 2017).

Academic Success

Many students report having an enriching academic experience and are more invested in their educational activities and discipline following an UR experience (Falconer & Holcomb, 2008; Kuh, 2003; Murray, 2017). They take ownership of their learning, shifting this responsibility from professor to student (Falconer & Holcomb, 2008; Hunter *et al.,* 2007; Petrella & Jung, 2008; Seymour *et al*., 2003). Results of enhanced academic engagement due to participation of UROs include increased retention rates in undergraduate programs (e.g. Brew & Mantai, 2017; Jones & Lerner, 2019; Russel *et al*., 2008) and higher grade point averages (GPAs) (Alderton & Manzi, 2017; Fechheimer *et al*., 2011).

Confidence Development

UR can develop students' overall confidence (Hunter *et al*., 2007; Lopatto, 2010; Petrella & Jung, 2008), including self-efficacy and feelings of competence (Alderton & Manzi, 2017; Hunter *et al*., 2007; Seymour *et al*., 2003). Often, students feel more confident performing and disseminating research (Seymour *et al*., 2003). They also report being proud of their work (Alderton & Manzi, 2017). Ultimately, increased confidence allows students to be more assured about their career plans and choices (Murray, 2017).

Sense of Community and Belonging

Through participating in UROs, students find community and belonging (Alderton & Manzi, 2017; Hunger *et al*., 2007) as well as a heightened sense of identity as a researcher (Eagan *et al.*, 2013; Hunter *et al.*, 2007; Seymour *et al.,* 2003). A few studies suggest they have the potential to build close relationships with peers, colleagues, and faculty members (Alderton & Manzi, 2017; Falconer & Holcomb, 2008). Students report appreciating the interactions with others during their UR experience – socialization allows undergraduates to gain access to information, professional networks, and resources (Eagan *et al*., 2013; Murray, 2017; Seymour *et al.*, 2003). In relation to feeling a sense of belonging within the academic community, the transition from identity as a student to researcher is a significant outcome and benefit (Eagan *et al*., 2013; Hunter *et al*., 2007; Seymour *et al*., 2003). Students see themselves as researchers who have the ability to contribute to original academic scholarship (Murray, 2017).

Faculty Benefits

Although much of the literature focuses on student benefits, other stakeholders see the value of UR. In particular, faculty frequently report undergraduate students helping advance their research (e.g. Hunter *et al.,* 2007; Johnson *et al.,* 2015; Petrella & Jung, 2008). By having students participate, faculty have a larger support system for existing and future research projects (Murray, 2017). Subsequently, undergraduate student involvement enhances productivity, creating synergies that serve the research group (Johnson *et al*., 2015). Faculty members also enjoy working with undergraduates (Johnson *et al*., 2015; Kardash, 2000) as it provides them with a renewed sense of enthusiasm for the work (Brew & Mantai, 2017). Faculty especially appreciate retaining students following UROs for additional projects – the sustained engagement is a win-win situation for all involved (Fechheimer *et al*., 2011).

Institutional and Economic Benefits

From an institutional and economic standpoint, UR can help higher education institutions gain prestige and new financial grants (Reisberg, 1998). Publications, abstracts, and research presentations by undergraduate students can enhance the institutions' visibility in the academic community (Petrella & Jung, 2008). Furthermore, institutions acquire a competitive advantage in student recruitment by having robust UROs (Johnson *et al.,* 2015). Through UR, institutions are preparing the future workforce for an increasingly competitive job market (Russel *et al.*, 2008). Some employers from diverse industries see the value of research and the positive contributions that it can bring to organizations; candidates who have research experience are also more competitive (Murray, 2017). Moreover, the line between academia and the corporate sector is blurring as graduates with doctorates are working outside of academic institutions (Murray, 2017). UR in higher education is critical now more than ever, especially with the growing demand for research skills in non-academic sectors (Murray, 2017).

CHALLENGES, BARRIERS, AND CONCERNS

It is evident that UR contributes positively to students, faculty members, postsecondary institutions, and the economy. UR as a pedagogy is a powerful tool that complements classroom learning, especially when coupled with faculty mentorship. Despite such advantages, UR has yet to address certain challenges: scalability and access of UROs, differences in UR offerings between disciplines, concerns faced by certain student identity populations – women, racial minorities, and students with disabilities – and barriers preventing UR support by faculty.

Scalability and Access of UROs

One of the underlying goals of UR is to make it available for all students (Healey & Jenkins, 2018). Scalability of these UROs has been a growing concern and many question the feasibility of universal participation in UR by all undergraduates (Murray, 2017). Challenges remain around the wide-scale implementation and adoption of UR practices across institutions (Brew & Mantai, 2017). As the number of opportunities increase, another matter for consideration is the potential to impact quality student learning and the substantial use of institutional resources (Jones & Lerner, 2019). Further, most URO offerings pertain to the apprenticeship model between a student and faculty mentor (Jones & Lerner, 2019; Russell *et al.,* 2008). This one-to-one approach does not address the increasing student demand with institutional and/or department capacities constrained (Jones & Lerner, 2019). Further, Hu, Kuh, and Gayles (2007) state that larger research universities have student-to-faculty ratios that limit the number of students who can realistically work with faculty, making equitable access to UROs an area of significant consideration (Moore *et al*., 2018). Due to the limited number of opportunities available within institutions, naturally, this makes UR programs extremely competitive, with only the top students doing research (Hu *et al*., 2007; Jones & Lerner, 2019; Russell, Hancock, & McCullough, 2007). Recently, there have been calls to broaden accessibility of research experiences to more students but barriers remain (Zimbardi & Myatt, 2014). Present UR programs tend to have GPA cutoffs which only serve high academic achieving students (Brew & Mantai, 2007; Eagan *et al*., 2013; Jones & Lerner, 2019; Russell *et al.,* 2008). Additionally, limited conceptualizations of UR by administrators, educators, and faculty are hindering what increased access might look like for higher education institutions (Zimbardi & Myatt, 2014).

Few attempts have been made to address the challenges of scalability and access of UROs. Jones and Lerner (2019) recommend incorporating an introductory research seminar or a research experiential course as part of program requirements. Course-based undergraduate research experiences (CUREs) have the potential to involve many undergraduate students in inquiry-based research within a classroom setting (Jones & Learner, 2019) and are also less resource intensive (Murray, 2017). CUREs can support students in strengthening their research proficiency over time, through multiple course offerings within a program (Murray, 2017). More attention is needed to ensure UR is accessible to every undergraduate student.

Differences in Undergraduate Research Offerings Across Disciplines

Another topic of consideration that has emerged is having equitable access to UROs across *all disciplines* (Murray, 2017). Currently, participation in these UROs is primarily for undergraduates in the natural sciences and engineering, with fewer opportunities in the arts and humanities (e.g., Fechheimer *et al*., 2011; Murray, 2017; Russell *et al.,* 2007). While there are increases in the number of UR activities across science and engineering disciplines, the same cannot be said for the arts and humanities (Hu *et al*., 2007). One reason for this disparity between disciplines is the general preference for funding towards the natural sciences and engineering (Murray, 2017). The gap in the number of opportunities available and participation rate by discipline is further enlarged due to the characteristics of the disciplines themselves (Murray, 2017). For instance, the natural sciences have traditionally involved undergraduates in research, usually through mentorship (Murray, 2017). These students benefit from interactions with the whole research community, where they work with fellow peers, graduate students, postdoctoral fellows, and faculty members (Murray, 2017). However, this is not the case in the humanities where students work more independently and do not have the same extensive mentoring

community compared to the natural sciences, impacting participation rates (Murray, 2017). Barriers to UR in the arts and humanities have also been identified. There is a decline in arts and humanities enrollment due to the perceived stature of these programs within their own institutions (Murray, 2017). This has led to a reduction and lack of appropriate models for UR in the arts and humanities (Murray, 2017). Undergraduates see research in the humanities as inaccessible (Murray, 2017). Some faculties believe that integrating research projects into arts courses is inappropriate (Reisberg, 1998). Further work is needed to remove barriers and/or re-think what UR could like due to inequitable access for certain disciplines, especially in the arts and humanities.

Student Challenges

Institutional challenges including attempts to scale up UR and current programs that privilege high achieving academic students impact access to opportunities. This is amplified by differences in UR offerings across disciplines. In particular, certain student identity groups are more impacted by access to UR and research in general – women, racialized groups, and students with disabilities. The literature for this review on challenges and barriers faced by these groups primarily relate to those in the natural sciences and engineering only. Similar studies in the humanities and arts have not been found.

Women

The ongoing underrepresentation of women in the scientific and technological fields (Kardash, 2000; Murray, 2017) is due to the attrition rates of females studying science and engineering at each transition point within the educational system (Murray, 2017). With employers desiring to recruit exceptional talent in these fields, underrepresentation of women in science and engineering hinders this goal (Murray, 2017). Many have argued that these fields

would benefit from having diverse perspectives to advance academic knowledge production –

equal representation of genders has the potential to eliminate "androcentric bias" (Murray, 2017).

Furthermore, low numbers of female students and faculty to support and advocate for each other

(Murray, 2017) and a "chilly" climate (Kardash, 2000) also contribute to the attrition of women

in research fields. Additional causes include a dominant Western practice that does not consider

women's ways of knowing and learning (Kardash, 2000); lack of opportunities in managerial

experiences (Murray, 2017); and substantial differences in salaries between men and women

(Murray, 2017). Some studies report women finding these workplaces to be non-inclusive.

Negative judgements of their skill and qualifications by male colleagues persist (Kardash, 2000)

and women are often faced with discrimination and harassment (Murray, 2017). Within

academic institutions, women faculty report challenges with managing their work and personal

lives and that their research productivity is negatively impacted due to additional responsibilities

that require a "woman's perspective" (Murray, 2017). Another interesting note is that female

students generally underestimate their own abilities and lack self-confidence in doing research

compared to their male counterparts (Kardash, 2000). However, Kardash (2000) found that there

was no difference in skill level between genders. Moreover, feedback from faculty in affirming

their abilities has been helpful in building female students' self-confidence (Kardash, 2000).

With the barriers facing women in research, UR is one way to ensure they remain engaged for

the long-term. Fechheimer *et al.* (2011) found that participation in UR increased women's

retention rates in the sciences with the likelihood of them pursuing graduate school.

Racialized Groups

Racialized groups – in particular, African, Hispanic, Latino/Latina, and Indigenous

students – have also been underrepresented in science and engineering (Estrada, Hernandez, &

Schultz, 2018; Murray, 2017). Bachelor degree completion rates of these individuals are lower

than their White and Asian counterparts, and even a lower number of them pursue graduate

school (Eagan *et al.*, 2013). During their undergraduate degree, research suggests many

racialized students may not be aware of the UROs available, do not see the value in participating

in research, and lack interactions with faculty (Jones & Lerner, 2019). Additionally, financial

and cultural barriers (Jones & Lerner, 2019) come into play with students feeling they do not

belong in the academic community (Eagan *et al.*, 2013; Murray, 2017). Racialized students

report feeling less prepared for their coursework, resulting in lower GPAs, which can impact

their chances of obtaining UROs as many of these are competitive and require high grades

(Murray, 2017). Similar to women, participation in UR can contribute positively to increasing

their retention and level of interest as well as the prospect of attending graduate school. This has

been demonstrated by several studies (*e.g.* Estrada *et al.*, 2018; Fechheimer *et al.*, 2011; Jones,

Barlow, & Villarejo, 2010; Parker, 2018). Participation in UR by racialized students has been

shown to enhance their identities (Eagan *et al.*, 2013) and empower these individuals to see

themselves as researchers (Murray, 2017). Nonetheless, more work needs to be done to raise

awareness of UROs and develop programs targeted to these students.

Students with Disabilities

Challenges have been raised when it comes to supporting students with disabilities in UR

experiences. These are associated with mobility limitations, hearing and vision impairments, and

learning disabilities (Murray, 2017). Currently, institutions do not have sufficient resources and

adequate infrastructure to offer additional support (i.e., transcription and interpretation services,

alternative communication technologies) and provide these students with quality research

experiences (Murray, 2017). There is also a lack of accommodations with regards to physical

space and facilities (Murray, 2017). Again, such issues have yet to be addressed, considering the interest of achieving equitable access to UROs for all.

Faculty Challenges

Faculty play a significant role in facilitating UR experiences, notably when it comes to the mentorship component in research. Faculty see the benefits of supporting this initiative but are met with challenges. Lack of recognition by the institution, high investment from the faculty, and faculty perceptions are described in detail to highlight the barriers to promoting UR.

Lack of Recognition by the Institution

Higher education institutions rarely provide adequate incentives for faculty to engage in UROs, resulting in limited growth of such opportunities and capacity of these individuals (Fechheimer *et al*., 2011). Institutions do not recognize the mentoring of undergraduates through research in tenure and promotion practices or in determining workload and compensation (Brew & Mantai, 2017; Evans, 2010; Johnson *et al*., 2015; Moore *et al*., 2018). Another factor is that teaching and research are seen by many as separate entities (Healey & Jenkins, 2018). Formal policies claim that research and teaching are connected yet faculty are pressured to focus on research production, which conflicts with the institutional call to promote UR (Brew & Mantai, 2017; Evans, 2010). This is further exacerbated when faculty have to manage their teaching, curricular activities, administration, and service demands (Brew & Mantai, 2017; Evans, 2010). Moreover, undergraduates are typically limited to working with tenure-stream faculty (who are few in contrast to the increasing number of non-tenure-stream appointments), since adjunct and part-time faculty are not as accessible outside of the classroom setting (Johnson *et al*., 2015). They are less engaged with the university and typically lack the time to mentor students (Johnson

et al., 2015). The absence of incentives for faculty to engage in UR and conflicting demands

contribute to the limited number of UROs available to students.

High Investment by the Faculty

Facilitating UR is an investment in resources from the faculty (Zydney *at al.*, 2002), in

terms of their time and monetary funding to support undergraduate students (Johnson *et al.*,

2015; Moore *et al*., 2018; Murray, 2017; Zydney *et al.*, 2002). Often, there is no financial

compensation for faculty to hire undergraduates which creates another barrier (e.g. Brew &

Mantai, 2017; Johnson *et al*., 2015; Petrella & Jung, 2008). Brew and Mantai (2017) describe

UR as a labour intensive endeavour, requiring faculty to dedicate a significant amount of time to

mentoring and working with the student(s) (Evans, 2010; Johnson *et al*., 2015; Zydney *et al*.,

2002). Sometimes, this may lead to burnout, relationship-induced stress, and decreased

productivity (Johnson *et al*., 2015). Considering the time and resources that faculty invest in UR,

institutions should provide recognition and adequate financial support to eliminate this barrier.

Faculty Perceptions

Certain faculty have limited perceptions of what constitutes UR and how undergraduates

should develop research capacity, which further reduces the number of opportunities that

students can learn through research (Brew, 2013; Brew & Mantai, 2017; Johnson *et al*., 2017).

Some do not have the knowledge or skills to implement research-based learning (Brew &

Mantai, 2017; Johnson *et al*., 2017). For others, there is a general disinterest in engaging in UR

(Murray, 2017). They do not see the financial value in UR, where the money can be directed

towards higher degree research (Brew & Mantai, 2017; Johnson *et al.*, 2015) or view

undergraduates as merely students rather than knowledge producers (Brew & Mantai, 2017).

From a health and safety perspective, some faculty argue that undergraduates do not have

adequate knowledge and skill levels and/or lack the right attitude for conducting research (Brew & Mantai, 2017). Even then, certain Faculty and departments lack an overall UR culture of promoting and engaging students in research during their degree (Brew & Mantai, 2017).

LITERATURE REIVEW: SUMMARY

Now more than ever, UR is a priority for universities (Brew, 2013), playing a significant role in advancing strategic goals (Murray, 2017). This has resulted in the growth of UROs at higher education institutions in the last twenty years (Healey & Jenkins, 2018). URO types vary and are diverse across a range of disciplines, from apprenticeships, course and program-based approaches (i.e., CUREs, theses, capstones, directed studies), to dissemination opportunities (i.e., conferences, symposia, research journals). UR is seen as an important pedagogy (Walkington *et al*., 2017) that promotes deep learning and allows students to become researchers in the process (Hosein & Rao, 2017). Furthermore, the student-faculty mentorship has been argued as the most fundamental aspect of a successful UR experience. UR contributes positively to students' skill development, career insights, academic success, confidence development, and provides a sense of belonging and researcher identity. UR also benefits faculty, institutions, and the economy. Though UR is considered an asset, certain challenges remain. These include the feasibility of scaling up of and equitable access to UROs. Barriers to UR for certain student identity groups and faculty have yet to be addressed. More concrete and affirmative action is needed to better support women, racialized groups, and students with disabilities to participate in UR. Lacking in the current literature are studies around UR in the arts and humanities, as there is much emphasis on UR experiences in the natural sciences and engineering. This is especially evident in research studies that focus on challenges and barriers of marginalized and underrepresented student groups. As mentioned earlier, there is also inadequate attention to the UR Canadian context, with

much of the literature primarily coming from countries such as the United States, Australia, and the United Kingdom. With little attention to UR in Canadian higher education, this research paper aims to shed some light on UROs in this context.

METHODOLOGY

BASIC CONTENT ANALYSIS

Basic content analysis is a methodology "for making replicable and valid inferences from texts to the contexts of their use" (Krippendorff, 2004, p. 18, as cited in White & Marsh, 2006). Empirically, it identifies and describes themes of communication content through the presence of certain words, concepts, phrases, or characters (Weber as cited in Drisko & Machi, 2015). Basic content analysis enables large volumes of existing documents to be analyzed systematically and in a qualitative or quantitative manner, requiring little to no interpretation from the coder (Drisko & Machi, 2015). It is also normally descriptive in its purpose and can be used to compare and contrast between groups (Drisko & Machi, 2015). One of the key characteristics of basic content analysis is the *presence* (or lack of) and *frequency* of low-inference or literal text (Drisko & Machi, 2015). The analysis focuses mainly on frequency counts, with the goal of producing tallies of key categories, themes, or ideas to describe the data under study (Drisko & Machi, 2015). As such, coding is involved in this particular type of methodology (Drisko & Machi, 2015). Proportions or percentages of text are organized into specific topics or themes, allowing the researcher to highlight key findings into a report or table (Drisko & Machi, 2015). Researchers can define the focus of the study in basic content analysis, determine what material to include, and when to stop (Drisko & Machi, 2015). In analyzing the data in relation to the research questions, the texts and the context are "logically independent", requiring the researcher

to form conclusions from one independent domain (text) to the other (context) (White & Marsh, 2006). Often, researchers use basic content analysis to document a social problem and provide evidence to advocate for change (Drisko & Machi, 2015).

Basic content analysis puts emphasis on reliability and correspondence validity, where similar code results are produced by different coders and where materials have the same meanings, respectively (Drisko & Machi, 2015). Data is considered stable and unchanging, usually involving publicly available documents for purposes other than research (Drisko & Machi, 2015). All in all, the intent of basic content analysis is be systematic and replicable (Drisko & Machi, 2015). As such, the researcher's personal and cultural background, social context, and research purposes do not influence the data analysis in significant ways, which reduce threats to internal validity (Drisko & Machi, 2015). With any methodology, challenges and limitations need to be considered. One challenge faced by researchers using basic content analysis is determining the appropriate code, even with predetermined categories (Drisko & Machi, 2015). To address this issue, having clear coding choices and descriptions are helpful for the coder in the analysis (Drisko & Machi, 2015). Limitations to basic content analysis include lack of meaningful inferences for the research study, reduction or simplification during analysis, and the context in which the text is produced is sometimes disregarded (Drisko & Machi, 2015).

RESEARCH METHODOLOGY

For this research study, basic content analysis is used as outlined by White and Marsh (2006). This includes identifying the appropriate data, determining the sampling unit, establishing the data collection unit and coding scheme, coding the data (adjusting the process as needed), and analyzing the coded data (White & Marsh, 2006). Four Canadian institutions from the U15 Group of Canadian Research Universities[6] have been chosen. Selected institutions are

also determined by region within Canada (Atlantic, Prairies, Central Canada, and West Coast). Institutions from the U15 are used since these universities make up 80 percent of all competitive university research within the nation[7]. Considering the U15 and where universities are located geographically, the following institutions have been selected: Dalhousie University (Atlantic), the University of Alberta (Prairies), the University of Toronto (Central Canada), and the University of British Columbia (West Coast). For the purposes of this research paper, UROs are defined as **optional** research-based activities outside of formal classroom settings and not for academic credit in which the undergraduate student participates. Based on this definition, data on apprenticeships, conferences, and research journals were analyzed. Other UROs that did not fit into such categories were also considered provided they were not for academic credit.

In terms of the data source and collection process, written text from public websites were gathered for analysis. Applicable Faculties, Schools, and departmental websites were reviewed to find URO-related information, specifically looking for webpages titled "Student Research Opportunities" or "Undergraduate Research Opportunities". Research office websites were also reviewed. Ensuring the number of UROs missed were limited, a general search for "undergraduate research opportunities" plus the name of the institution using Google's search engine was performed. Moreover, professional and graduate degree programs and Faculties were omitted in the sample since they are irrelevant to undergraduate research. UROs dated 2019 and onwards (including deadlines from the 2019 – 2020 academic year) were only considered since these are current offerings available to students. The full list of Faculties and Schools used to find URO data for each institution can be found in **Appendix A** to **D**. As per White and Marsh (2006), an iterative deductive coding process was used for the study. Coding schemes for apprenticeship, conferences, and research journals are included in **Appendix E** to **G**. Coding

categories were developed based on the factors identified for analysis as well as URO characteristics from the literature review. Each URO was categorized to one of the following types: apprenticeships, conferences, and research journals. Once the typology of the URO was determined, it was then coded using the coding scheme specific to its type. After all UROs had been coded, the data analysis involved tallying the code names of each category for all four institutions. These frequency counts were then summarized into tables. To analyze the data among institutions, specific factors were used to determine patterns and differences: governance and administration of UROs; UROs by typology, discipline (in particular, the hard sciences and engineering with arts and humanities), student identity populations; and funding source.

SCOPE AND LIMITATIONS

The research study excludes UROs that are considered research-intensive courses and ones that are for academic credit. Excluding this type of URO may not provide a holistic view of URO offerings across Canadian postsecondary institutions. The study lacks generalizability since data from only four Canadian postsecondary institutions are collected. Though the sample is small, this can be the start to better understanding UR in the Canadian context. Additionally, with the data source originating only from publicly available websites, some UROs may be missed if universities omit this information online and/or if URO descriptions are not updated. There may also be potential error on the researcher not being able to find all relevant UROs. To minimize this issue, the general search for "undergraduate research opportunities" using Google's search engine has been included as part of the data collection process.

RESULTS

Table 1 summarizes the total number of UROs (by type) found in each institution for the study. For each university, an overview of the findings is described in detail. This includes information on apprenticeships, conferences, research journals, other non-credit based UROs as well as general observations from reviewing Faculty and departmental websites pertaining to UR. The complete list of individual UROs from each institution are listed in **Appendix H** to **K**.

Table. 1 Frequency Count of UROs by Type per Institution

INSTITUTION	URO TYPE	COUNT
Dalhousie University	Apprenticeships	11
	Conferences	10
	Research Journals	8
	Other	0
	TOTAL	**29**
University of Alberta	Apprenticeships	23
	Conferences	6
	Research Journals	7
	Other	9
	TOTAL	**45**
University of Toronto	Apprenticeships	35
	Conferences	9
	Research Journals	36
	Other	9
	TOTAL	**89**
University of British Columbia	Apprenticeships	59
	Conferences	16
	Research Journals	13
	Other	1
	TOTAL	**89**

DALHOUSIE UNIVERSITY

In total, Dalhousie University has the least number of UROs (twenty-nine) among the selected institutions in this study. **Table 2** provides a breakdown of apprenticeships for the university while **Table 3** offers additional insights between paid and unpaid apprenticeships.

Table. 2 Dalhousie University – Apprenticeships

Total number of apprenticeship-UROs: 11

APPRENTICESHIPS		
Code Category	**Coding Names**	**Count**
Employment Type	Paid	9
	Unpaid	2
Employment Type – Full-time/Part-time	Full-time	6
	Part-time	5
	FT or PT	-
When URO is offered	Summer	6
	Academic Year	1
	Year Round	4
Discipline	All Disciplines	1
	Discipline-Specific (ScienceEng)	8
	Discipline-Specific (Arts)	2
	Discipline-Specific (Other)	-
Who	All	8
	Canadian/PR	2
	International	1
Year Level	1	1
	2	2
	3	4
	4	5
	Year – N/A	6
Minimum Grade Requirement	A-	1
	B	4
	Grade - N/A	6
Location	Canada	11
	Research-Abroad	-
Funding – Source	Internal	6
	External	3
	N/A – Source	2

At Dalhousie University, six apprenticeships are paid, full-time positions which are offered in the summer term (May to August). The minimum duration of the appointments varies between ten to sixteen-weeks with the latter having the highest frequency count. Part-time paid positions constitute the remaining five apprenticeships and are offered during the academic year (September to April) or year-round (summer term and academic year) for a minimum of sixteen-weeks. Two apprenticeships are unpaid, part-time, and are offered year-round. Eight of the eleven apprenticeships provide opportunities for students in the sciences and engineering while two are specific to students in the arts and humanities. Furthermore, nine are open to all students

(i.e. Canadian, permanent residents, and international). A few apprenticeships from the university target certain student groups: The Summer Research Program for Non-Medical Students[8] supports African and Indigenous students; Imhotep's Legacy Academic Summer Student Research Scholarship[9] is for African undergraduates; the Michael J. Keen Award[10] offers a research opportunity for female students; and two are for honours students (Sarah Lawson Research Scholarship[11] and Sobey Agriculture Undergraduate Research Award[12]).

Table. 3 Dalhousie University – Paid and Unpaid Apprenticeships

PAID		9
Full-time		6
10 weeks	1	
12 weeks	2	
16 weeks	3	
Part-time		3
12 weeks	1	
16 weeks	2	
UNPAID		2
Full-time		-
-	-	
Part-time		2
16 weeks	1	
Duration Unknown	1	

Moreover, six apprenticeships do not specify a minimum year level or average grade requirement. However, the ones that do require students to be in year three or four (upper year) of their studies and/or obtain a "B" average in order to be eligible for the opportunity. The apprenticeships found at Dalhousie University are all conducted within Canada. In terms of the paid apprenticeships, full-time positions offer between $4,500 to $6,500 (with $4,500 as the mode) to the student; part-time positions vary between $900 to $1,400. Additionally, four of the nine paid apprenticeships (full-time only) require top-up from the faculty supervisor to the student. Top-up amounts range from $1,125 to $3,000 for full-time positions.

Table 4 and **Table 5** exhibit the number of opportunities at Dalhousie University for undergraduates to disseminate research through conferences and research journals. Eight conferences are hosted outside of the institution and predominantly cater to sciences students. Only one conference travel grant supporting science undergraduates has been identified. Internally, the university, through the Dalhousie Arts and Social Sciences Undergraduate Society, organizes an annual conference[13]. There are more undergraduate research journals (seven) under the arts and humanities compared with sciences and engineering (one).

Table. 4 Dalhousie University - Conferences

Total number of conferences-UROs: 10

CONFERENCES		
Code Category	**Coding Names**	**Count**
Conferences - Discipline	Multidisciplinary	-
	Discipline-Specific Con - (ScienceEng)	8
	Discipline-Specific (Arts)	1
	Discipline-Specific (Other)	-
Travel Grants	Travel - Multidisciplinary	-
	Travel - Discipline-Specific (ScienceEng)	1
	Travel - Discipline-Specific (Arts)	-
	Travel - Discipline-Specific (Other)	-

Table. 5 Dalhousie University – Research Journals

Total number of research journals-UROs: 8

RESEARCH JOURNALS		
Code Category	**Coding Names**	**Count**
Discipline	Multidisciplinary	-
	Discipline-Specific (ScienceEng)	1
	Discipline-Specific (Arts)	7
	Discipline-Specific (Other)	-

No other UROs have been identified beyond apprenticeships, conferences, and research journals at Dalhousie University. There does not appear to be a central undergraduate research unit and information pertaining to UROs are housed differently depending on the Faculty and the department. In particular, most Faculties highlight UROs on the main Faculty page. There are no

UROs found under the Faculty of Management. Only departments under the Faculty of Science have an "undergraduate research" section in their departmental pages.

UNIVERSITY OF ALBERTA

The University of Alberta has the second highest count of UROs (45). **Table 6** and **Table 7** provide a summary of apprenticeships and the breakdown between paid and unpaid positions respectively. Apprenticeships are primarily paid, full-time positions (sixteen) that occur in the summer term. A minimum of sixteen-weeks in duration appear to the most frequent length. In contrast, paid, part-time positions are fewer (five) and are offered in the academic year or year-round for at least sixteen-weeks. One research abroad opportunity offers students an unpaid, full-time apprenticeship for ten-weeks. Eight of the twenty-three apprenticeships are open to all disciplines, twelve cater to sciences and engineering, zero target arts and humanities undergraduates, and three are for students in the Faculty of Kinesiology, Sport, and Recreation. The majority (eighteen) of apprenticeships are available to both Canadian/permanent resident and international students with five additional ones only for Canadian/permanent resident students. The i-STEAM Pathways program[14] is the only apprenticeship that supports a racialized student group (Indigenous students). Moreover, ten apprenticeships do not indicate a minimum year level or grade requirement on their program pages. Similar to the results for Dalhousie University, the ones with specifications require students to be in year three or four and maintain a "B" average to be eligible for the opportunity. Of the twenty-three apprenticeships found, eighteen are located within Canada while five are research abroad. For paid apprenticeships, full-time position stipends vary between $1,500 to $6,000, with $5,000 and $6,000 as the most frequent monetary amounts. Students are paid between $500 to $3,200 for part-time positions, with $2,500 as the mode. Three paid apprenticeships require faculty supervisors to top-up.

Table. 6 University of Alberta –Apprenticeships

Total number of apprenticeship-UROs: 23

APPRENTICESHIPS		
Code Category	**Coding Names**	**Count**
Employment Type	Paid	22
	Unpaid	1
Employment Type – Full-time/Part-time	Full-time	17
	Part-time	5
	FT or PT	1
When URO is offered	Summer	16
	Academic Year	2
	Year Round	5
Discipline	All Disciplines	8
	Discipline-Specific (ScienceEng)	12
	Discipline-Specific (Arts)	-
	Discipline-Specific (Other)	3
Who	All	18
	Canadian/PR	5
	International	-
Year Level	1	3
	2	10
	3	13
	4	13
	Year – N/A	10
Minimum Grade Requirement	B+	3
	B	8
	B-	1
	C+	1
	GPA - N/A	10
Location	Canada	18
	Research-Abroad	5
Funding – Source	Internal	12
	External	10
	N/A – Source	1

Table.7 University of Alberta - Paid and Unpaid Apprenticeships

PAID			22
Full-time			16
	4 weeks	1	
	8 weeks	3	
	10 weeks	3	
	12 weeks	3	
	14 weeks	1	
	15 weeks	1	
	16 weeks	4	
Part-time			5
	16 weeks	5	
Full-time or Part-time			1
	16 weeks	1	
UNPAID			1
Full-time			1
	10 weeks	1	
Part-time			-
	-	-	

Frequency counts for conferences and research journals (all are administered by the institution) at the University of Alberta are outlined in **Table 8** and **Table 9** respectively. Two conferences are multidisciplinary while the remaining three are specific to arts and humanities (two) and kinesiology and exercise sciences (one). There is one conference travel grant that provides financial support to arts and humanities students. For research journals, two are multidisciplinary, four are in the arts and humanities, and one is in the sciences and engineering.

Table. 8 University of Alberta – Conferences

Total number of conferences/symposia-UROs: 6

CONFERENCES		
Code Category	**Coding Names**	**Count**
Conferences - Discipline	Multidisciplinary	2
	Discipline-Specific Con - (ScienceEng)	-
	Discipline-Specific (Arts)	2
	Discipline-Specific (Other)	1
Travel Grants	Travel - Multidisciplinary	-
	Travel - Discipline-Specific (ScienceEng)	-
	Travel - Discipline-Specific (Arts)	1
	Travel - Discipline-Specific (Other)	-

Table. 9 University of Alberta – Research Journals

Total number of research journals-UROs: 7

RESEARCH JOURNALS		
Code Category	**Coding Names**	**Count**
Discipline	Multidisciplinary	2
	Discipline-Specific (ScienceEng)	1
	Discipline-Specific (Arts)	4
	Discipline (Other)	-

The University of Alberta offers a few additional UROs outside of apprenticeships, conferences, and research journals. One unique URO offering that is not found in other institutions part of the study is the research certificate. Undergraduates can pursue this opportunity by completing a combination of selected research-based courses, conducting their own research project, and presenting at a conference. This is an optional, not for credit activity for students who want additional accreditation to showcase their research experience. Research certificates are specific to the following disciplines: psychology (science[15] and arts[16]), biological science[17], applied social science research[18], and biomedical research[19]. In addition to research certificates, two research grants are found to support field research costs (not the student's salary) related to northern (i.e., Boreal, Circumpolar, and Artic) projects and are available to all upper year undergraduates. Financial grants (two) from the university support UR engagement and are more open-ended in eligibility and scope compared to traditional UROs. They are available to all students and disciplines and faculty may not necessarily be involved.

Another feature unique to the University of Alberta is a central unit known as the Undergraduate Research Initiative[20] (URI). URI supports and encourages research activities of undergraduate students at the university. It provides research opportunities and information sessions to students of all disciplines. URI also offers advising appointments, hosts events and workshops (i.e., performing statistical data analysis, design and present a research poster, research paper writing, etc.), and shares resources to help students get involved with research.

URI administers a few funding opportunities: the Alberta Innovates Summer Research Studentship, URI Undergraduate Research Stipend, i-STEAM Pathways program, and the URI Undergraduate Research Support Fund. URI also organizes the annual Festival of Undergraduate Research and Creative Activities (FURCA) conference and advertises publication opportunities.

From the Faculty and departmental pages for the University of Alberta, "undergraduate research" or "student research opportunities" pages are usually highlighted on the main Faculty webpages instead of through departmental pages. This pertains to the following Faculties: Agriculture Life and Environmental Sciences, Arts, Augustana Campus, Engineering, and Kinesiology. Exceptions to this rule include the Alberta School of Business and the Faculty of Science. The Alberta School of Business does not contain information on UROs. The Faculty of Science generally highlights UROs in their departmental pages and on their main webpage.

UNIVERSITY OF TORONTO

The University of Toronto is tied for the highest number of UROs (89) among the selected institutions in this study. **Table 10** provides detailed information on apprenticeships for this institution while **Table 11** offers supplementary data for paid and unpaid opportunities. Apprenticeships at the University of Toronto are predominantly paid, full-time positions (twenty-six) that are offered in the summer term. The minimum duration varies between eight and seventeen-weeks with twelve and sixteen-weeks being the most common lengths. Only two paid, part-time positions (academic year or year-round) for a minimum of sixteen weeks have been identified. Furthermore, unpaid, full-time apprenticeships are all summer research abroad opportunities. One unpaid, part-time apprenticeship (year-round) is found. While sixteen of the apprenticeships at the university are open to all disciplines, nineteen cater only to students in the sciences and engineering and zero target arts and humanities undergraduates. Both

Canadian/permanent residents and international students can apply to most apprenticeships at the university (all except for one). There are none that specifically support certain student identity groups. Fifteen do not indicate a minimum year level requirement; the ones that do require undergraduates to be in their third or fourth year of studies. As for the average grade requirement, a "B+" average is mandatory for those that include a minimum criterion. However, twenty apprenticeships do not indicate a grade prerequisite.

Table. 10 University of Toronto - Apprenticeships

Total number of apprenticeship-UROs: 35

APPRENTICESHIPS		
Code Category	**Coding Names**	**Count**
Employment Type	Paid	30
	Unpaid	5
Employment Type – Full-time/Part-time	Full-time	30
	Part-time	3
	FT or PT	2
When URO is offered	Summer	29
	Academic Year	1
	Year Round	5
Discipline	All Disciplines	16
	Discipline-Specific (ScienceEng)	19
	Discipline-Specific (Arts)	-
	Discipline-Specific (Other)	-
Who	All	34
	Canadian/PR	1
	International	-
Year Level	1	11
	2	14
	3	18
	4	12
	Year – N/A	15
Minimum Grade Requirement	A	1
	B+	9
	B	3
	C+	1
	C	1
	GPA - N/A	20
Location	Canada	29
	Research-Abroad	6
Funding – Source	Internal	25
	External	4
	N/A – Source	6

Table. 11 University of Toronto – Paid and Unpaid Apprenticeships

PAID		30
Full-time		26
8 weeks	2	
12 weeks	10	
14 weeks	1	
15 weeks	1	
16 weeks	9	
17 weeks	1	
Duration Unknown	2	
Part-time		2
16 weeks	2	
Full-time or Part-time		2
Duration Unknown	2	
UNPAID		5
Full-time		4
16 weeks	4	
Part-time		1
Duration Unknown	1	

Furthermore, twenty-nine apprenticeships are located within Canada while the remaining six are research abroad opportunities. Of the thirty paid apprenticeships available, full-time position stipends vary between $2,000 to $4,800 (mode of $3,000); for part-time positions, the known amount is $1,000. Nine of the thirty paid apprenticeships require top-up from the faculty supervisor. Top-up values for full-time positions range from $1,125 to $3,000; top-up values for part-time positions are not specified on the websites.

Two apprenticeships at the university are worth highlighting. First, the University of Toronto Excellence (UTEA) Summer Research Awards[21] provides research opportunities to undergraduate students from all disciplines. A $6,000 stipend is awarded to the student. What is notable is that the top-up amount requirement from faculty supervisors depends on the specific discipline. For UTEAs in the social sciences and humanities, a $6,000 stipend is awarded to the student without faculty needing to top-up. On the other hand, UTEAs in the natural sciences and engineering only provide $4,875 to the student, with a mandatory minimum top-up ($1,125) from the faculty. Second, the First Year Summer Research Fellowship[22] offers first year students

within the Faculty of Applied Science and Engineering to pursue research during the summer term, which is different than many apprenticeships that cater only to upper year students.

With regards to disseminating research, **Table 12** and **Table 13** highlight the conferences and research journals at the university. These conferences and conference travel grants are administered by the institution. Three of the conferences are multidisciplinary, two are arts and humanities specific, and one is geared towards the sciences and engineering.

Table. 12 University of Toronto - Conferences

Total number of conferences-UROs: 9

CONFERENCES		
Code Category	**Coding Names**	**Count**
Conferences - Discipline	Multidisciplinary	3
	Discipline-Specific Con - (ScienceEng)	1
	Discipline-Specific (Arts)	2
	Discipline-Specific (Other)	-
Travel Grants	Travel - Multidisciplinary	-
	Travel - Discipline-Specific (ScienceEng)	1
	Travel - Discipline-Specific (Arts)	2
	Travel - Discipline-Specific (Other)	-

Conference travel grants are discipline-specific as noted in **Table 12**. Furthermore, the University of Toronto has the highest number of research journals among the selected institutions, with the majority (twenty-three) of undergraduate research journals in the arts and humanities. Eight journals are in sciences and engineering while four are multidisciplinary.

Table. 13 University of Toronto – Research Journals

Total number of research journals-UROs: 36

RESEARCH JOURNALS		
Code Category	**Coding Names**	**Count**
Discipline	Multidisciplinary	4
	Discipline-Specific (ScienceEng)	8
	Discipline-Specific (Arts)	23
	Discipline (Other)	1

Alternative UROs include research grants (five) intended to help undergraduates gain research experience and to offset research-related equipment costs. These grants are generally

awarded to conduct research on a particular topic. In some cases, students need to demonstrate a financial need in order to be eligible. Concurrently, there are travel funds (two) to help students pursue research-related activities (not for presenting at conferences) and are open to all undergraduates. Two student groups have also been identified, offering peer support in UR – one promotes academic journal discussions among students while the other brings together a community of individuals interested in UR.

The Faculties of Science and Applied Science and their departmental pages promote UROs, often through an "undergraduate student research" or "student research" page but the types of UROs that are listed vary greatly. Most arts and humanities webpages do not have a page to highlight UROs. Additionally, there are no UROs found in the Faculty of Management and Music webpages. The Faculty of Kinesiology and Physical Education includes research opportunities, a mix of research-based courses, conferences, and research abroad offerings.

UNIVERSITY OF BRITISH COLUMBIA

The University of British Columbia (UBC) is tied for the highest number of UROs (89) with the University of Toronto. **Table 14** provides an overview of apprenticeships available at the institution, which then are split between paid and unpaid positions (**Table 15**). Due to the large number of research abroad opportunities at UBC, paid and unpaid apprenticeships are further organized into two additional tables for better characterization - UROs within Canada (**Table 16**) and those that are research abroad (**Table 17**). Apprenticeships within Canada are primarily paid, full-time positions (eighteen of twenty-two) that are offered in the summer term with sixteen-weeks as the most common minimum duration. Paid, part-time positions are fewer in comparison (four), taking place during the academic year or year-round.

Table. 14 University of British Columbia – Apprenticeships

Total number of apprenticeship-UROs: 59

APPRENTICESHIPS		
Code Category	**Coding Names**	**Count**
Employment Type	Paid	23
	Unpaid	36
Employment Type – Full-time/Part-time	Full-time	40
	Part-time	19
	FT or PT	-
When URO is offered	Summer	39
	Academic Year	5
	Year Round	15
Discipline	All Disciplines	21
	Discipline-Specific (ScienceEng)	28
	Discipline-Specific (Arts)	9
	Discipline (Other)	1
Who	All	52
	Canadian/PR	5
	International	2
Year Level	1	8
	2	11
	3	33
	4	32
	Year – N/A	23
Minimum Grade Requirement	A-	4
	B+	10
	B	5
	B-	11
	GPA - N/A	29
Location	Canada	38
	Research-Abroad	21
Funding – Source	Internal	40
	External	3
	N/A – Source	16

Unpaid, part-time positions (fifteen) are advertised as volunteer opportunities occurring year-round. Of the institutions in this study, UBC has the highest count of volunteer positions promoted on webpages (minimum duration unknown). This does not necessarily mean that other universities in this study do not offer volunteer positions, but rather, they may not track and advertise such opportunities as UBC does. However, including volunteer information online may be beneficial (and more accessible) for students who do not know where to find research opportunities and are looking for such experiences. For research abroad apprenticeships, almost

all (nineteen of twenty) are unpaid, full-time positions that occur in the summer term. In contrast to paid, full-time apprenticeships located within Canada, research abroad positions have a shorter minimum duration, varying between four to twelve weeks, with eight-weeks being the most frequent length. Only one paid, full-time summer research abroad opportunity is found. There are no part-time (paid and unpaid) research abroad apprenticeships available. To summarize, almost all full-time (paid and unpaid) apprenticeships occur in the summer term. Most unpaid positions include research abroad and volunteering opportunities which are also the highest in frequency counts compared to other institutions.

Table. 15 University of British Columbia – Paid and Unpaid Apprenticeships
(Canada and Research Aboard)

PAID		23
Full-time		19
8 weeks	4	
10 weeks	1	
12 weeks	2	
14 weeks	1	
16 weeks	8	
17 weeks	1	
Duration Unknown	2	
Part-time		4
16 weeks	2	
21 weeks	1	
32 weeks	1	
UNPAID		**36**
Full-time		21
4 weeks	1	
5 weeks	1	
6 weeks	3	
8 weeks	9	
9 weeks	1	
10 weeks	4	
12 weeks	2	
Part-time		15
4 weeks	1	
24 weeks	1	
32 weeks	1	
Duration Unknown	12	

Eighteen of the thirty-eight apprenticeships within Canada are only available to undergraduates in the sciences and engineering, compared to nine opportunities supporting arts and humanities students. Ten apprenticeships located within Canada are available to all disciplines. In contrast, eleven of twenty-one research abroad apprenticeships are open to students in any discipline. The remaining positions are only available to students in sciences and engineering with no research abroad opportunities specifically for arts and humanities students.

Table. 16 University of British Columbia – Paid and Unpaid Apprenticeships
(Within Canada Only)

PAID			22
Full-time			18
	8 weeks	3	
	10 weeks	1	
	12 weeks	2	
	14 weeks	1	
	16 weeks	8	
	17 weeks	1	
	Duration Unknown	2	
Part-time			4
	16 weeks	2	
	21 weeks	1	
	32 weeks	1	
UNPAID			16
Full-time			1
	9 weeks	1	
Part-time			15
	4 weeks	1	
	24 weeks	1	
	32 weeks	1	
	Duration Unknown	12	

Table. 17 University of British Columbia – Paid and Unpaid Apprenticeships
(Research Abroad Only)

PAID			1
Full-time			1
	8 weeks	1	
Part-time			-
	-	-	
UNPAID			**20**
Full-time			20
	4 weeks	1	
	5 weeks	1	
	6 weeks	3	
	8 weeks	9	
	10 weeks	4	
	12 weeks	2	
Part-time			-
	-	-	

Of the apprenticeships offered at UBC, the majority (52) are open to all students with two that are only targeted towards international students. Additionally, two apprenticeships support specific student groups. The Aboriginal Undergraduate Research Mentorship Program[23] caters to Indigenous students in STEM (science, technology, engineering, and mathematics) fields. Similarly, the Quantum Pathways[24] program not only supports Indigenous students in quantum material, physical sciences, and engineering, it is also open to female and racialized students. Considering requirements to participate in apprenticeships, twenty-nine do not indicate a minimum average grade. Some UROs require a "B+" (ten) or "B-" (eleven) average in order to be eligible for the opportunity. Further, twenty-three apprenticeships do not specify a year-level requirement but the ones that do require students be in year three or four. Paid, full-time apprenticeships vary between $2,300 to $9,000 ($4,500 is the mode). Funding for paid, part-time apprenticeships range from $2,400 to $4,964. Seven of the twenty-three paid apprenticeships require additional top-up from the faculty supervisor. These top-up values vary between $1,125 to $5,740 for full-time positions and $600 to $3,633 for part-time positions.

For the study, it is worth mentioning that UBC is the only institution that offers **paid** apprenticeships supporting arts and humanities students. The Quinn Research Assistantship Awards[25] provide undergraduate students in psychology to gain research experience. The second apprenticeship is the Faculty of Creative and Critical Studies Undergraduate Student Research Awards[26], which allows students within the Faculty to conduct research and creation activities during the summer term.

Table 18 and **Table 19** highlight conferences and research journals respectively, and these are organized by the institution. Four conferences are multidisciplinary, two are in the arts and humanities, and five are in the sciences and engineering. For conference travel grants, they range from supporting students in specific disciplines to ones that are available to all undergraduates as outlined in **Table 18**. Research journals in the arts and humanities have a higher frequency count (seven) compared to journals in the sciences and engineering (two).

Table. 18 University of British Columbia – Conferences

Total number of conferences/symposia-UROs: 16

CONFERENCES		
Code Category	**Coding Names**	**Count**
Conferences - Discipline	Multidisciplinary	4
	Discipline-Specific - (ScienceEng)	5
	Discipline-Specific (Arts)	2
	Discipline-Specific (Other)	-
Travel Grants	Travel - Multidisciplinary	2
	Travel - Discipline-Specific (ScienceEng)	1
	Travel - Discipline-Specific (Arts)	2
	Travel - Discipline-Specific (Other)	-

Table. 19 University of British Columbia – Research Journals

Total number of conferences/symposia-UROs: 13

RESEARCH JOURNALS		
Code Category	**Coding Names**	**Count**
Discipline	Multidisciplinary	4
	Discipline-Specific (ScienceEng)	2
	Discipline-Specific (Arts)	7
	Discipline (Other)	-

UBC offers one other URO that is different from apprenticeships, conferences, and research journals. The Undergraduate Research Opportunities[27] is a student-run initiative that helps undergraduates from all disciplines obtain research opportunities. The club organizes mentorship programs, networking events, and other research-related services to support students in acquiring research experience[28]. No travel or research grants have been identified like the ones found at the University of Alberta and University of Toronto.

UR and UROs are highlighted differently depending on the Faculty/School/department. Certain Faculties and departmental pages have a 'student research/undergraduate research" page (i.e., Kinesiology, Land and Food Systems, Science, Irving K. Barber Faculty of Arts and Social Science, Irving K. Barber, Faculty of Science), while others lack one altogether (i.e. Forestry, Applied Science, Arts, School of Engineering, Sauder School of Business). Despite some Faculties omitting UROs on their pages, there are a few exceptions made by their departments. For example, Mechanical Engineering and Biomedical Engineering under the Faculty of Applied Science include UROs. Anthropology, psychology, and sociology under the Faculty of Arts advertise course offerings, volunteer opportunities and studentships related to research.

DISCUSSION

Several factors are used to gain deeper insights into the current Canadian higher education URO landscape. Governance and administration of UROs allow for understanding of how postsecondary institutions are facilitating these opportunities and whether they use similar or different approaches. UROs are further analyzed to determine patterns based on typology, offerings by discipline (especially between the hard sciences and arts and humanities), and whether certain opportunities are targeted to specific student populations. Funding of these

UROs is also examined to identify its source and determine who takes on the financial cost to support UR. In considering these factors, recommendations are provided to address and enhance UR at Canadian research-intensive universities.

GOVERNANCE AND ADMINISTRATION OF UROs

Strategic Plans

In addressing the first research question, the rationale for promoting UROs can be found in institutional strategic plans. Among the universities included in this study, they see benefits in engaging undergraduates in research. For faculty, UR allows them to identify and mentor potential research members and graduate students[29]. For students, this inquiry-based method is seen as a lifelong benefit[30]. Student learning experiences and their success are maximized due to exposure to research and how it is carried out in the academic community[31]. Through research, students develop problem solving, creativity, communication, and teamwork skills[32]. Further, it provides them with the opportunity to apply their learning, utilize research skills, and contribute to new knowledge[33]. These experiences provide the necessary "foundation in skills and expertise for future careers, whether in academia or beyond" (p. 49)[34]. Moreover, it is worth noting that some Faculty and departmental webpages include brief descriptions of the benefits of participating in UR, echoing similar rationales as the ones identified in the strategic plans and the literature review. As a way to enhance UR, universities highlight one particular approach in their strategic documents – to increase the number of UROs available. Specifically, UBC and the University of Toronto aim to leverage their existing UR programs and to scale them up. No other strategies have been mentioned.

Administration of UROs

The University of Alberta is the only institution among those studied that has a central unit dedicated to supporting UR – Undergraduate Research Initiative (URI). Essentially, it is a one-stop shop of UROs and resources for students. This is in contrast to the other three institutions – Dalhousie University, University of Toronto, and UBC – in which a dedicated unit is absent and Faculties and departments are the ones offering and promoting UROs. Overall, this decentralized approach lacks consistency and structure. Within the same institution, faculties do not highlight UROs the same way; the same can even be said among departments within the same Faculty. Moreover, certain Faculties/departments include URO information, some have specific opportunities for their undergraduates within their discipline, while others lack any offerings. As for the Vice-President, Research and Innovation and institutional research webpages, often, there is no information pertaining to UROs. This is likely due to the intended audience of these pages, which are geared towards supporting *faculty members* in obtaining grants and other funding for their research. In addition, because such faculty research grants are significantly larger in monetary funding compared to UROs (which are usually only a few thousand dollars), UROs may be seen as less relevant to advertise. Considering the loosely coupled system of Canadian higher education (even within its own institution), the decentralized approach to administering UROs aligns with its organizational structure. In particular, Faculties and departments are able to manage autonomously without significant reliance on other units and can make their own decisions. Though the University of Alberta has URI, not all UROs found in this study are managed by the unit. The university appears to be utilizing a hybrid model, administering UROs under URI as well as through Faculties and departments. There are benefits to this approach. First, through URI, information and services related to undergraduate research

are housed in one place, which can make it easier for students to find what they need. This may be particularly important for undergraduates who are new to UR and may want to connect with an advisor who is knowledgeable in this area. Second, Faculties and departments also have autonomy in facilitating UROs, despite the existence of a central unit. This allows Faculties and departments the option of offering additional resources for students on their own accord.

The overarching strategy to enhance UR is by increasing the number of opportunities available. Universities rely on Faculties and departments to facilitate UROs but this approach lacks consistency of information on websites, even within the same institution. Faculties and departments have the autonomy to determine what and how to promote UROs, likely due to the loosely coupled nature among Faculties and departments within institutions.

TYPOLOGY

Comparing the three types of UROs in the study, apprenticeships (128) have the highest frequency, followed by research journals (64), and conferences (41). This is not surprising, considering that most studies from the literature review primarily focus on apprenticeships. In further analysis of apprenticeships across institutions, **Table 20** includes the total frequency count categorized by four position types. Evidently, full-time apprenticeships (93) are more common than part-time positions (32). These full-time apprenticeships are offered in the summer term only, whereas part-time positions usually occur during the academic year. Paid, full-time apprenticeships have the highest frequency count among the four types, with a minimum of sixteen-weeks as the most common duration for the summer term. This is likely due to the full-time nature of the role, where students can commit to the position during the summer period compared to the academic year when they also have to juggle with course work.

Table. 20 Total Frequency Count of Apprenticeship Types

POSITION TYPE	COUNT
Paid, Full-time	67
Paid, Part-time	14
Unpaid, Full-time	26
Unpaid, Part-time	18

Note: 3 paid positions can be full-time or part-time (not included in the tally)

In contrast, paid, part-time positions have the lowest frequency count of the four types. These paid, part-time positions typically occur in the academic year or are offered year-round for a minimum of sixteen weeks (equivalent to one term). The part-time nature can offer students the flexibility to pursue work concurrently with their studies. Based on the data, it is unclear why paid, part-time apprenticeships have the lowest frequency count. From the student perspective, the paid nature of the position and the flexibility it can provide while pursuing academic studies can be beneficial. However, for faculty supervisors, perhaps this type is less ideal for them in order to advance their research. Further studies between full-time and part-time research positions are required to better understanding current findings. Unpaid, full-time apprenticeships have the second highest frequency count of the four types. These positions are typically research abroad opportunities in the summer term for a short duration (eight weeks is the most common length). Unpaid, part-time positions are offered during the academic year (minimum duration unknown) and are generally volunteer roles. These unpaid apprenticeships exist perhaps as a result of the current systemic support (or lack of) for UR at universities. From the literature review, current challenges around recognition of and limited resources to support faculty in hiring undergraduates and/or their research may influence this decision. Additionally, some faculty perceive undergraduates as inexperience and may justify the time to offer training and mentorship as forms of compensation.

Regarding opportunities to disseminate research, presenting at conferences and publishing in undergraduate research journals are available to students in all of the institutions studied. Conference are held in the academic year – dates are usually sometime between January to April. Submission deadlines for undergraduate research journals are also during the academic year in the spring months. The timing of conferences and submissions to research journals taking place in the January to April period may be to allow time for students to conduct research in the fall (September to December) and then present their findings in the subsequent term.

Minimum requirements, by grade and year level, to participate in apprenticeships are also analyzed across institutions. Sixty-five of 128 apprenticeships found in this study do not indicate a minimum grade requirement. However, the ones that do require students to hold a minimum "B" average to be eligible for an URO. Fifty-four of 128 apprenticeships do not specify a year level requirement. Apprenticeships indicating a minimum year level require students to be in year three or four. Based on these findings, apprenticeships advantage moderately high-achieving students ("B" average) who are in their upper year of studies.

To summarize, apprenticeships tend to be paid, full-time, summer opportunities for a minimum of sixteen-weeks. Unpaid, full-time positions are usually summer research abroad opportunities and are shorter compared to the full-time apprenticeships within Canada. During the academic year, part-time apprenticeships (paid and unpaid) are more common with additional opportunities to disseminate research in the form of conferences and undergraduate research journals. Further, paid positions are more frequently advertised online compared to unpaid roles. Although a large portion of apprenticeships do not indicate requirements in grades and/or year level, UROs that set minimum standards require students to maintain a "B" average and/or are in their third or fourth year of their undergraduate degree.

DISCIPLINES

In addition to examining UROs based on their typologies, analyzing by discipline, between sciences and engineering ("ScienceEng") with arts and humanities ("Arts") can shed light on the number of opportunities available to students. **Table 21** summarizes the number of apprenticeships for each institution, organized by discipline.

Table. 21 Number of Apprenticeships in each Institution by Discipline

Institution	Count			
	All Disciplines	ScienceEng	Arts	Other
Dalhousie University	1	8	2	-
University of Alberta	8	12	-	3
University of Toronto	16	19	-	-
University of British Columbia	21	28	9	1
TOTAL	**46**	**67**	**11**	**4**

Although there are apprenticeships ("All Disciplines") that allow students from any discipline to apply, undergraduates in the sciences and engineering fields have increasingly more opportunities (67) in contrast to students in the arts and humanities (eleven). Across all institutions, there are higher counts of apprenticeships specifically for students in the sciences and engineering compared to those that are for all disciplines and are only for arts and humanities students. Further, only Dalhousie University and UBC offer apprenticeships for students in the arts and humanities. These findings are consistent with the lack of equitable access to UROs by discipline as outlined in the literature review. One reason for the higher number of apprenticeships in the sciences and engineering is due to inequities in funding between these disciplines. The results indicate significantly more paid apprenticeship offerings for sciences and engineering students compared to the two paid arts apprenticeships (at UBC) found in this study. From the literature review, the discrepancy in the number of UROs between the sciences and arts may also be due to the characteristics of the disciplines themselves. Across

the institutions studied, the promotion of UR and UROs online is apparent in the sciences and engineering webpages. However, the same cannot be said for websites in the arts and humanities.

Within the sciences and engineering, there are similar numbers of opportunities for disseminating research, whether it is through conferences (fourteen) or research journals (twelve). These findings differ in the arts and humanities, where there are significantly more opportunities to publish in research journals (41) than to present at a conference (seven). Overall, most conferences are geared towards the sciences and engineering as outlined in **Table 22**. However, there are slightly more conference travel grants for the arts and humanities (five) than the sciences and engineering (three) and ones that are available to all disciplines (two). Additional conference travel funding in the arts and humanities may be to offset the lack of conference offerings from institutions within the discipline.

Table. 22 Conferences in each Institution by Discipline

Institution	Count			
	Multidisciplinary	**ScienceEng**	**Arts**	**Other**
Dalhousie University	-	8	1	-
University of Alberta	2	-	2	1
University of Toronto	3	1	2	-
University of British Columbia	4	5	2	-
TOTAL	**9**	**14**	**7**	**1**

Across all four institutions, research journals in the arts and humanities are the most frequent (**Table 23**), and is the only URO type where there are more opportunities within the arts compared with sciences and engineering. The most common disciplines for research journals in the arts and humanities include political science, women and gender studies, sociology, history, psychology, philosophy, classics, and anthropology. From the results, publishing in research journals may be the primary method of engaging in undergraduate research in the arts and humanities, through papers, essays, and/or articles and then submitting them for publication.

Table. 23 Research Journals in each Institution by Discipline

Institution	Count			
	Multidisciplinary	**ScienceEng**	**Arts**	**Other**
Dalhousie University	-	1	7	-
University of Alberta	2	1	4	-
University of Toronto	4	8	23	1
University of British Columbia	4	2	7	-
TOTAL	**10**	**12**	**41**	**1**

What is available (or lack of) on Faculty and department webpages offers additional insights to undergraduate research in relation to certain disciplines. For this study, all Faculty of Science webpages comprise of an "undergraduate research" page along with most departmental websites highlighting similar and/or additional opportunities. In general, other Faculties include an "undergraduate research" page, with Management/Commerce being the only exception (absence of UROs). As for the arts and humanities, the existence of an "undergraduate research" page varies between institutions. Most departmental webpages within the arts and humanities lack this page, which may explain the low UROs numbers specific to the arts and humanities. On the other hand, many UROs from this study originate from Faculties and departmental webpages in the sciences and engineering.

STUDENT IDENTITY POPULATIONS

There is no information on the websites to determine if any conferences and research journals cater to specific student identity populations among undergraduates. Generally, opportunities to disseminate research are available to all students. A few conferences encourage upper year (year three and four) students to participate, but they do not exclude year one and two students from presenting. Similarly, it is assumed research journals are open to all since the websites do not specify who, among undergraduates, can submit.

In this section, the focus here is on apprenticeships in relation to specific student identity groups. **Table 24** includes the number of apprenticeships found in each institution along with the number of UROs that cater to certain student identities. In total, only eight of 128 apprenticeships support particular undergraduate populations.

Table. 24 Apprenticeships by Institution – Total vs. Specific Student Identity Populations

	Dalhousie University	**University of Alberta**	**University of Toronto**	**University of British Columbia**
Total	11	23	35	59
Specific Student Identity Populations	5	1	-	2

Dalhousie University has the highest number of apprenticeships in this regard – supporting honours (two), women (one), Indigenous (one), and African (two) students. For other institutions, these types of apprenticeships support women and racialized (primarily Indigenous) undergraduates. Moreover, they cater only to students in sciences and engineering, with zero apprenticeships supporting specific student groups in the arts and humanities. Such apprenticeships may be absent due to the lack of literature on women and racialized populations in UR within the arts and humanities. What is also missing from the study are UROs supporting undergraduates with disabilities. This is perhaps due to inadequate institutional resources as depicted in the literature review. Comparing between apprenticeships for Canadian/permanent resident and international students, 113 of 128 are available to both types of undergraduates. Twelve are specifically for Canadian/permanent residents and three are catered to international students (Dalhousie University and UBC only). Based on the frequency counts of the study, Canadian/permanent residents and international students have similar access to apprenticeships as per eligibility requirements, with smaller numbers catering towards particular groups.

FUNDING SOURCE

Conference and undergraduate research journal websites lack funding information. It is unclear if a fee is required for students to participate or be able to present at conferences and/or submit to relevant research journals. There is also no financial information on these websites to determine how much funding is needed to host undergraduate research conferences and maintain journal operations. Conference travel grants are provided by the university and are intended to offset students' travel costs. They are also funded by Faculties/departments and as such, most (eight of ten) are discipline-specific in funding eligibility. Grants range from $200 to $500 with $500 being the most frequent subsidy. Overall, the number of conference travel grants (total of ten) is small compared to the other types of UROs for this study.

Apprenticeships are primarily funded by the institution (internal), and in some cases, there is external support from companies and other universities (**Table 25**)**.** Larger universities like University of Toronto and UBC have more apprenticeships that are funded internally compared to the smaller institutions (Dalhousie University and the University of Alberta).

Table. 25 Apprenticeships – Funding Source (Internal vs. External)

Institution	Internally Funded	Externally Funded	Source – Not applicable (i.e. volunteer/unpaid)
Dalhousie University	6	3	2
University of Alberta	12	10	1
University of Toronto	25	4	6
University of British Columbia	40	3	16

This discrepancy may be due to the greater monetary funding that larger universities receive in contrast to smaller research-intensive universities. With institutions like Dalhousie University and the University of Alberta, almost half of their apprenticeships are externally supported. Paid apprenticeships generally offer some compensation to the student in the form of a "stipend" or "honourium". However, this amount varies greatly in quantity and whether a top-up from the

faculty supervisor is required. **Table 26** provides a breakdown of the number of apprenticeships that impose a faculty top-up. Most apprenticeships do not require one, however, there is a sizeable number of apprenticeships in each institution that expect some financial commitment from the supervisor. Top-up amounts are generally a few thousand dollars.

Table. 26 Count of Apprenticeships that Require a Top-Up Amount from Faculty Supervisor

Institution	Top-Up Required	Paid Apprenticeship-UROs	Percentage (%)
Dalhousie University	4	9	44.0
University of Alberta	3	22	13.6
University of Toronto	9	30	30.0
University of British Columbia	7	23	30.0

IMPLICATIONS

Recommendations are outlined in this section to identify ways to better support and enhance UR in Canada. These considerations primarily focus on the issue of access to UROs by undergraduates. What is evident from the findings is that the challenges highlighted in the literature review are also apparent in this study. Reducing these barriers is one step to ensuring universities can achieve their institutional goals and provide UR experiences for all.

Information from institutional strategic plans calls for increasing the number of opportunities for students. However, there is no other directive on how this is accomplished besides leveraging existing programs and scaling them up. Due to the high-level nature of these documents, they provide generic information and lack specificity. Further direction is needed from leadership to provide clarity and guidelines around increasing the number of UROs – including the type of UROs, which undergraduates require additional opportunities, and for what disciplines. Considering the goal of broadening UR access to all undergraduates, having specific guidelines is important for Faculties and departments, staff, and faculty members when thinking

about increasing the number of UROs, especially if finance and other resources are limited. This may be better facilitated by creating a document for UR that describes in detail the specific priorities as well as resource allocation and distribution. This may be beneficial as it provides a balance between giving Faculty and departments autonomy while ensuring alignment across different units within an institution. If the document is not feasible, including a sub-section under the Research institutional strategic plans may be a more tangible alternative.

It is no doubt that more work can be done to effectively promote UROs to students. Outlined in the University of Toronto's strategic plan, a challenge that current students encounter is learning about the existence of UROs[35]. Further, one of the themes identified from the study among Faculties and departmental webpages is the inconsistency of where UROs are advertised within institutions. Even as the researcher looking for UROs, I spent a considerable amount of time reviewing numerous webpages since finding information on such opportunities was not intuitive. Although it is unrealistic for different Faculties within an institution to coordinate where they should be promoting UROs, it is a reasonable recommendation to have departments within a Faculty/School to determine how best to highlight these opportunities to students and increase their awareness. Student consultations in this area may also be useful for administrators to streamline their webpages for the intended audience.

Current apprenticeships advantage upper year undergraduates and those who have a strong academic record, which makes these opportunities competitive and inaccessible for certain students. New program offerings (or changes to eligibility criteria) should be developed, primarily supporting year one and two undergraduates and those with lower GPAs. Existing and new UROs should also consider other measures when evaluating apprenticeship applications so it is not solely based on academic merit. A couple of apprenticeships in this study specifically

target junior students. Such opportunities can ensure more undergraduates are exposed to research early on in their degree.

Overall, more UROs should be offered to arts and humanities students, especially when it comes to conferences and apprenticeships. Conferences can provide a platform to recognize the work of arts and humanities students that can be used to promote and encourage UR within the discipline. Allocation of additional funding towards increasing the number of paid arts and humanities apprenticeships is another strategy to fill a current gap. Alternatively, a similar funding model like the University of Toronto's Excellence Summer Research Award can be used by other Canadian institutions, providing more monetary funding to arts and humanities students compared to those in the sciences and engineering (and requiring faculty top-up for disciplines that have adequate funding). Furthermore, additional efforts should be made in promoting UR in the arts and humanities. One method is to highlight opportunities in Faculty and departmental webpages, including ways to get involved within and outside of the institution. Digital resources to support students in finding UROs in the arts and humanities and how to connect with faculty may enhance student engagement in UR. Consultations with faculty (and undergraduates) can also surface additional strategies to build an UR culture within the arts and humanities.

In thinking about the strategic plan and increasing the number of UROs, universities can focus on providing additional research-specific opportunities to certain student groups – women, students of colour, Indigenous students, and students with disabilities – instead of for the entire undergraduate population. Some of the existing literature have demonstrated benefits to participating in undergraduate research for women and racialized students. With the few existing UROs available in the current landscape supporting these groups, more offerings should be created to enhance their access to UR. An alternative is to set quotas among current UROs to

ensure such groups are equitably represented. Considering nationality, findings from this study

indicate that most UROs are open to all students, suggesting there are minimal barriers in access

between Canadian/permanent resident and international students based on program eligibility.

However, it may be interesting to conduct further research and acquire data on *who* actually

obtains these UROs and whether specific student groups are more likely to acquire these

opportunities compared to others. This requires consistent data collection processes (including

consensus on the type of data to be gathered) across Faculties within universities for comparison.

Collecting URO student participation data can provide meaningful insights, especially when

cross referenced with institutional undergraduate experience surveys for further analysis. Based

on these future findings, they can inform additional programs and/or if policy changes are

needed to promote access.

      With the majority of paid apprenticeships offering a mere stipend to students, this begs

the question of whether the monetary amount provided is financially adequate. In the last few

years, the provincial minimum wages across Canada have gone up to address the increased costs

of living[36]. Assuming stipend values remain as is, will they be sufficient in the long-term to

financially support postsecondary students? How should these UROs be administered in order to

provide adequate financial support for students *and* faculty supervisors? If the stipend amount

increases, does this mean there will be less opportunities available for students in order to offset

the higher honourium amount? Alternatively, more UROs can impose a faculty top-up

requirement to supplement the student's stipend. If that is the case, this puts financial burden on

the faculty supervisor which increases faculty barriers to participate. Regardless of the strategy,

all these considerations impact access to UROs – increasing the stipend may make these

opportunities more competitive among students if there is a reduced number available; if more

UROs require faculty to supplement the honourium, some faculty may not be able to afford it. Careful attention and further research in this area is important to determine how best to support students and faculty supervisors in UR. One way to expand funding and access to UROs is to leverage industry and external partnerships (as seen in the smaller research universities in this study) especially when institutional financial resources are constrained. These organizations can provide the financial funds with universities promoting the opportunities to students and providing administrative support. This strategy can be used for apprenticeships and conferences. Specifically, partnering with external organizations is beneficial for larger universities since it can increase the number of opportunities available to a larger student population, reducing some competition. Conferences can be sponsored or hosted by companies with universities promoting the event and providing travel grants. Furthermore, larger stipends for research abroad opportunities should be provided to students since they are primarily full-time, unpaid positions. Currently, most stipends only support travel costs without contributing to the students' living expenses. Larger stipends mean that students are more likely to pursue research abroad, reducing the financial barrier to participate in such opportunities.

This section included various recommendations to increase access to UROs. It involves seeking further direction and clarity around increasing the number of UROs from senior executives. Other ways to increase access to UR include creation of UROs that cater to certain student identity groups (or policy revisions), provision of additional support in the arts and humanities, and securement of adequate financial funding for students and faculty supervisors. In the concluding section, a research summary and future research topics are discussed.

CONCLUSION

This research study set out to gain a holistic view of Canada's landscape in facilitating UROs in higher education. Research questions included the rationale for promoting UROs, identification of the URO types available, and determination of differences across selected Canadian postsecondary institutions. Basic content analysis was used as the methodology for the study. Four Canadian research-intensive universities were selected from U15 as well as by region within Canada: Dalhousie University (Atlantic), University of Alberta (Prairies), University of Toronto (Central Canada), and the University of British Columbia (West Coast). For this study, UROs were defined as *optional* research-based activities outside of formal classroom settings and not for academic credit. Thus, apprenticeships, conferences, and research journals were the focus, using written text from public websites as the primary data source.

Universities promote UROs due to perceived student benefits in skill development and enhancement of the overall student experience. For faculty members and the institution, UR facilitates the recruitment of potential graduate students and generation of new disciplinary knowledge. One predominant way to enhance UR is to increase the number of opportunities available to students, as outlined in institutional strategic plans. Further, administration of UROs is facilitated by the Faculties/Schools and departments, who determine if UROs should be promoted on their webpages. Overall, consistency of how UROs are highlighted on websites is absent, which poses challenges for students who may want to know about these opportunities.

From the findings, the University of Toronto and the UBC are tied for the highest number of UROs (89), with Dalhousie University having the least number (twenty-nine) of opportunities. Comparing the three types of UROs in this study, apprenticeships (128) are most frequently found on websites, followed by research journals (64), and then conferences (41) (ten of which

are conference travel grants). Furthermore, most paid, full-time positions are offered in the summer term for a minimum of sixteen weeks; paid, part-time positions occur during the academic year for the same duration. Paid positions often provide a stipend or honourium to the student, although some require faculty supervisors to top-up the amount. Unpaid, full-time positions are typically research abroad opportunities. With apprenticeships, most do not specify a minimum grade average and/or year level in order to participate. However, the ones that do often advantage undergraduates with a "B" average and who are in their upper years of studies (year three or four). Among apprenticeships, few opportunities support specific student identity groups (i.e. Indigenous students and women) and most permit both Canadian/permanent residents and international students to apply. Apprenticeships tend to provide more opportunities for undergraduates in the sciences and engineering compared to those in the arts and humanities. Moreover, conferences and opportunities to publish in research journals occur during the academic year. Conferences tend to gear towards the sciences and engineering but there are more conference travel grants and research journals supporting arts and humanities students.

Overall, different universities provide their own suite of URO offerings to their undergraduates, varying in quantity and types available. For example, the University of British Columbia has the highest count of apprenticeships, but many of these include research abroad and volunteer opportunities (both are unpaid). In contrast, the University of Toronto has the highest number of paid (full-time and part-time) positions. Additionally, the University of Alberta has a central unit, Undergraduate Research Initiative, that provides funding and services to students interested in acquiring undergraduate research experiences. Though there are general themes and patterns evident from the study, there is no unified approach to facilitating UROs among the selected Canadian postsecondary institutions. Recommendations have also been

outlined based on the findings to enhance UR in Canadian higher education. These suggestions are included to address increase of and access to UROs for *all* undergraduates.

FUTURE RESEARCH

Additional research can be done to gain deeper insights around UR in Canadian higher education and are highlighted here as potential next steps. Given the small sample size in this study (lacking generalizability), how are other Canadian postsecondary institutions facilitating UR and UROs? Do these institutions use similar or different approaches compared to the findings here? A larger sample size can provide a more holistic picture of the Canadian UR landscape by expanding this study to the other U15 Canadian institutions. Additionally, including qualitative interviews of undergraduates, faculty supervisors, and practitioners can explore the perspectives of students regarding the UR experience. Another alternative for future research is to expand the research scope and include research-intensive courses and ones that provide students with academic credit. How do credit-based UROs compare and fit with the other types of UROs in this study? How do credit-based UROs relate to overall institutional URO offerings? Participation of UROs would also warrant an interesting research topic as mentioned earlier. UROs identified in this study are based on what is publicly available online. However, this may not translate in terms of involvement. In particular, for UROs that are available to all students, it would be interesting to determine which student identity groups participate in apprenticeships, present at conferences, and publish in research journals. What are the student demographics of these URO types by discipline? Nationality? Year level? Grade? Considering students with more than one identity (intersectionality), how do they compare when obtaining UROs? Having a consistent data collection process and understanding who is currently involved in these UROs can help universities determine the adequate support and resources

required. Lastly, from the findings, it is clear that UR and the opportunities that may be available significantly differ depending on the discipline and Faculty. For some disciplines, such as arts and management/business, having a better understanding of whether undergraduate research is a priority for them may provide additional insights into the current landscape. The research may shed light on what is needed to better engage students and faculty in those disciplines.

FINAL REMARKS

Undergraduate research has been an increasingly popular tool in higher education to enhance the overall student experience (Bauer & Bennett, 2003) through different types of opportunities (UROs). Existing literature highlights the array of benefits to participating in undergraduate research, contributing to positive gains for students, faculty, the institution, and the economy. As a student-centred pedagogical approach (Hosein & Rao, 2017; Zimbardi & Myatt, 2014), UR promotes deep learning through discovery and transformation (Hunter *et al.*, 2017; Kardash, 2000; Murray, 2017). However, issues of access to UROs pose significant challenges to enhancing and building a culture of UR. Future research on this topic should be thoughtfully considered to advance UR in Canadian higher education.

Conducting this initial study has allowed me to gain a better understanding of UR as well as the different types of URO that exist in the current Canadian higher education landscape. Of course, there are opportunities for me to continue expanding on this knowledge. Gaining deeper understanding of these UROs and how they relate and fit in with each other has been professionally insightful. I hope to continue reflecting, learning, and begin creating positive change, so that all undergraduates can acquire a meaningful, high-impact UR experience.

REFERENCES

Alderton, E., & Manzi, M. (2017). Engaging students: An authentic undergraduate research experience. *Professional Educator*, 42(1), 1-12.

Bauer, K. W., & Bennett, J. S. (2003). Alumni perceptions used to assess undergraduate research experience. *The Journal of Higher Education*, 74(2), 210-230. doi:10.1080/00221546.2003.11777197

Billett, S. (2009). Realising the educational worth of integrating work experiences in higher education. *Studies in Higher Education*, 34(7), 827-843. doi:10.1080/03075070802706561

Brew, A. (2013). Understanding the scope of undergraduate research: A framework for curricular and pedagogical decision-making. *Higher Education*, 66(5), 603-618. doi:10.1007/s10734-013-9624-x

Brew, A., & Mantai, L. (2017). Academics' perceptions of the challenges and barriers to implementing research-based experiences for undergraduates. *Teaching in Higher Education*, 22(5), 551-568. doi:10.1080/13562517.2016.1273216

Drisko, J., & Maschi, T. (2015). *Content analysis*. New York: Oxford University Press. doi:10.1093/acprof:oso/9780190215491.001.0001

Dvorak, A. L., & Hernandez-Ruiz, E. (2019). Outcomes of a course-based undergraduate research experience (CURE) for music therapy and music education students. *Journal of Music Therapy*, 56(1), 30-60. doi:10.1093/jmt/thy020

Eagan, M. K., Hurtado, S., Chang, M. J., Garcia, G. A., Herrera, F. A., & Garibay, J. C. (2013). Making a difference in science education: The impact of undergraduate research programs. *American Educational Research Journal*, 50(4), 683-713. doi:10.3102/0002831213482038

Estrada, M., Hernandez, P. R., & Schultz, P. W. (2018). A longitudinal study of how quality mentorship and research experience integrate underrepresented minorities into STEM careers. *CBE Life Sciences Education*, 17(1), ar9. doi:10.1187/cbe.17-04-0066

Evans, D. R. (2010). The challenge of undergraduate research. *Peer Review*, 12(2), 31.

Falconer, J., & Holcomb, D. (2008). Understanding undergraduate research experiences from the student perspective: A phenomenological study of a summer student research program. College Student Journal, 42, 1–13.

Fechheimer, M., Webber, K., & Kleiber, P. B. (2011). How well do undergraduate research programs promote engagement and success of students? *CBE-Life Sciences Education*, 10(2), 156-163. doi:10.1187/cbe.10-10-0130

Goldenberg, M., & desLibris - Documents. (2006). Employer investment in workplace learning in Canada: *How we are doing. why it matters. what the key issues are. how we can do better Canadian Council on Learning*.

Haan, M. (2012). *Learning in the Workplace: A Literature Review*. New Brunswick, Canada: Department of Post-Secondary Education, Training and Labour.

Harvey, L. (2000). New realities: The relationship between higher education and employment. *Tertiary Education and Management*, 6(1), 3-17. doi:10.1080/13583883.2000.9967007

Healey, M., & Jenkins, A. (2018). The role of academic developers in embedding high-impact undergraduate research and inquiry in mainstream higher education: Twenty years' reflection. *International Journal for Academic Development: Special Issue: Academic Development in Support of Mentored Undergraduate Research and Inquiry. Guest Editors: Jessie L. Moore and Peter Felten,* 23(1), 52-64. doi:10.1080/1360144X.2017.1412974

Hosein, A., & Rao, N. (2017). Students' reflective essays as insights into student centred-pedagogies within the undergraduate research methods curriculum. *Teaching in Higher Education*, 22(1), 109-125. doi:10.1080/13562517.2016.1221804

Hu, S., Kuh, G. D., & Gayles, J. G. (2007). Engaging undergraduate students in research activities: Are research universities doing a better job? *Innovative Higher Education*, 32(3), 167-177. doi:10.1007/s10755-007-9043-y

Hunter, A., Laursen, S. L., & Seymour, E. (2007). Becoming a scientist: The role of undergraduate research in students' cognitive, personal, and professional development. *Science Education*, 91(1), 36-74. doi:10.1002/sce.20173

Johnson, W. B., Behling, L. L., Miller, P., & Vandermaas-Peeler, M. (2015). Undergraduate research mentoring: Obstacles and opportunities. *Mentoring & Tutoring: Partnership in Learning*, 23(5), 441-453. doi:10.1080/13611267.2015.1126167

Jones, C. K., & Lerner, A. B. (2019). Implementing a course-based undergraduate research experience to grow the quantity and quality of undergraduate research in an animal science curriculum 1. *Journal of Animal Science*, 97(11), 4691-4697. doi:10.1093/jas/skz319

Judge, S., Pollock, M., Wiles, G., & Wilson, M. (2012). Mentored undergraduate research in the geosciences. *Eos, Transactions American Geophysical Union*, 93(36), 345-346. doi:10.1029/2012EO360001

Kardash, C. M. (2000). Evaluation of an undergraduate research experience: Perceptions of undergraduate interns and their faculty mentors. *Journal of Educational Psychology*, 92(1), 191-201. doi:10.1037/0022-0663.92.1.191

Kinash, S., Crane, L., Judd, M., & Knight, C. (2016). Discrepant stakeholder perspectives on graduate employability strategies. *Higher Education Research & Development*, 35(5), 951-967. doi:10.1080/07294360.2016.1139555

Kuh, G. D. (2003). What we're learning about student engagement from NSSE. Change, 35(2), 24.Lei, S. A., & Chuang, N. K. (2009). Undergraduate research assistantship: A comparison of benefits and costs from faculty and students' perspectives. *Education*, 130, 1–11

Lester, S., & Costley, C. (2010). Work-based learning at higher education level: Value, practice and critique. *Studies in Higher Education*, 35(5), 561-575. doi:10.1080/03075070903216635

Lopatto, D. (2010). Undergraduate research as a high-impact student experience. *Peer Review*, 12(2), 27.

Moore, S. E., Hvenegaard, G. T., & Wesselius, J. C. (2018). The efficacy of directed studies courses as a form of undergraduate research experience: A comparison of instructor and student perspectives on course dynamics. *Higher Education*, 76(5), 771-788. doi:10.1007/s10734-018-0240-7

Murray, L, J. (2017). *Undergraduate research for student engagement and learning*. Milton: Routledge Ltd. doi:10.4324/9781315692159

Parker, J. (2018). Undergraduate research, learning gain and equity: The impact of final year research projects. *Higher Education Pedagogies*, 3(1), 145-157. doi:10.1080/23752696.2018.1425097

Petrella, J. K., & Jung, A. P. (2008). Undergraduate research: Importance, benefits, and challenges. *International Journal of Exercise Science*, 1(3), 91-95.

Reisberg, L. (1998). Research by undergraduates proliferates, but is some of it just glorified homework? *Chronicle of Higher Education,* May 22, A 45.

Russell, S. H., Hancock, M. P., & McCullough, J. (2007). The pipeline. benefits of undergraduate research experiences. *Science (New York, N.Y.)*, 316(5824), 548-549. doi:10.1126/science.1140384

Russell, C. B., Weaver, G. C., & Wink, D. J. (2008). Inquiry-based and research-based laboratory pedagogies in undergraduate science. *Nature Chemical Biology*, 4(10), 577-580. doi:10.1038/nchembio1008-577

Seymour, E., Hunter, A., Laursen, S. L., & DeAntoni, T. (2003). Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education*, 88(4), 493-534. doi:10.1002/sce.10131

Walkington, H., Walkington, H., Hill, J., & Kneale, P. E. (2017). Reciprocal elucidation: A student-led pedagogy in multidisciplinary undergraduate research conferences. *Higher Education Research & Development*, 36(2), 416-429. doi:10.1080/07294360.2016.1208155

Wallin, P. & Adawi, T. (2018). Entry points when undergraduate research mentors reflect on their role: A qualitative case study. *International Journal for Academic Development*, 23(1), 41-51. doi:10.1080/1360144X.2017.1414053

White, M. D., & Marsh, E. E. (2006). Content analysis: A flexible methodology. *Library Trends*, 55(1), 22-45. doi:10.1353/lib.2006.0053

Zimbardi, K., & Myatt, P. (2014). Embedding undergraduate research experiences within the curriculum: A cross-disciplinary study of the key characteristics guiding implementation. *Studies in Higher Education*, 39(2), 233-250. doi:10.1080/03075079.2011.651448

Zydney, A. L., Bennett, J. S., Shahid, A., & Bauer, K.W. (2002). Impact of undergraduate research experience in engineering. *Journal of Engineering Education*, 91(2), 151-157. doi:10.1002/j.2168-9830.2002.tb00687.x

APPENDIX

Appendix. A Dalhousie University – List of Faculties Relevant to Study

DALHOUSIE UNIVERSITY
Faculties
• Agriculture
• Arts and Social Sciences
• Computer Science
• Engineering
• Management
• Science

Appendix. B University of Alberta – List of Faculties Relevant to Study

UNIVERSITY OF ALBERTA
Faculties
• Agriculture Life and Environmental Sciences
• Alberta School of Business
• Arts
• Augustana Campus
• Engineering
• Kinesiology, Sport, and Education
• Native Studies
• Science

Appendix. C University of Toronto – List of Faculties Relevant to Study

UNIVERSITY OF TORONTO
Faculties
• Applied Science and Engineering
• Arts and Science
• Kinesiology and Physical Education
• Management
• Music
• University of Toronto Mississauga
• University of Toronto Scarborough

Appendix. D University of British Columbia – List of Faculties Relevant to Study

UNIVERSITY OF BRITISH COLUMBIA
Faculties/Schools – UBC-Okanagan
• Arts and Social Sciences
• Creative and Critical Studies
• School of Engineering
• Management
• Science
Faculties/Schools – UBC-Vancouver
• Applied Science
• Arts
• Sauder School of Business
• Forestry
• Kinesiology
• Land and Food Systems
• Music
• Science
• Vancouver School of Economics

Appendix. E Coding Scheme – Apprenticeships

APPRENTICESHIPS		
Code Category	**Coding Names**	**Description**
Employment Type	Paid	Paid: Student receives monetary payment
	Unpaid	Unpaid: Volunteer; student receives no monetary payment
Employment Type – FT/PT	Full-time	Full-time: Full-time as deemed by the institution
	Part-time	Part-time: Less than 35 hours/week
	FT or PT	FT or PT: can be done full-time or part-time
When URO is offered	Summer	Summer: May – August
	Academic Year	Academic Year: September – April (Fall & Winter term)
	Year Round	Year Round: Both summer and academic year
Discipline	All Disciplines	All Disciplines: All disciplines (science, engineering, health/medicine, arts, social sciences, and humanities)
	Discipline-Specific (ScienceEng)	Discipline-Specific (Science): Includes discipline – sciences, engineering, health/medicine fields
	Discipline-Specific (Arts)	Discipline-Specific (Arts): Includes arts, social sciences, and humanities fields
	Discipline-Specific (Other)	Discipline (Other): Disciplines other than "ScienceEng" and "Arts"
Who	All	All: All undergraduate students
	Canadian/PR	Canadian/PR: Canadian or permanent residents only
	International	International: International students only
Special Group	SG – (*who*)	SG – (*who*): specific student group (*specify who*)
	SG - N/A	SG – N/A: Does not specify URO is for specific group
Year Level	1	1: Year One
	2	2: Year Two
	3	3: Year Three
	4	4: Year Four
	Year – N/A	Year – N/A: Does not specify year level
Letter Grade Requirement (Minimum)	Letter Grade	Letter Grade
	Grade - N/A	Grade – N/A: No minimum letter grade requirement or none specified
URO Duration	Duration - (*Min. weeks*)	Duration: (*Minimum duration requirement – number value in weeks*)
	Duration Unknown	Duration Unknown: Duration not specified
Location	Canada	Domestic: URO within Canada
	Research-Abroad	Research-Abroad: International URO
Funding – Source	Internal (*amount*)	Internal: URO funded by the institution
	External (*amount*)	External: URO not funded by the institution
	N/A – Source	N/A – Source: Not applicable; employment type is unpaid
Funding by Faculty Supervisor	Full	Full funding: Fully funded under the URO
	Partial (*amount*)	Partial funding: Top-up required from faculty supervisor (*specify minimum amount*)
	N/A – Faculty	N/A – Faculty: Not applicable; employment type is unpaid

Appendix. F Coding Scheme – Conferences

CONFERENCES		
Code Category	**Coding Names**	**Description**
Conferences - Discipline	Multidisciplinary Discipline-Specific (ScienceEng) Discipline-Specific (Arts) Discipline-Specific (Other)	Multidisciplinary: Open to more than one discipline/field Discipline-Specific (ScienceEng): Includes discipline – sciences, engineering, health/medicine fields Discipline-Specific (Arts): Includes arts, social sciences, and humanities fields Discipline-Specific (Other): Disciplines other than "ScienceEng" and "Arts"
Travel Grants	Travel - Multidisciplinary Travel - Discipline-Specific (ScienceEng) Travel - Discipline-Specific (Arts) Travel - Discipline-Specific (Other)	Travel – Multidisciplinary: Funding open to all disciplines Travel - Discipline-Specific (ScienceEng): Funding only within sciences, engineering, health/medicine fields Travel - Discipline-Specific (Arts): Funding only within arts, social sciences, and humanities fields Travel - Discipline-Specific (Other): Funding for disciplines other than "ScienceEng" and "Arts"

Appendix. G Coding Scheme – Research Journals

RESEARCH JOURNALS		
Code Category	**Coding Names**	**Description**
Discipline	Multidisciplinary Discipline-Specific (ScienceEng) Discipline-Specific (Arts) Discipline-Specific (Other)	Multidisciplinary: Open to more than one discipline/field Discipline-Specific (ScienceEng): Includes discipline – sciences, engineering, health/medicine fields Discipline-Specific (Arts): Includes arts, social sciences, and humanities fields Discipline-Specific (Other): Disciplines other than "ScienceEng" and "Arts"

Appendix. H Dalhousie University – List of UROs

APPRENTICESHIPS	
URO Name	**Website Source**
NSERC Undergraduate Student Research Award	https://www.dal.ca/faculty/science/research/undergrad_ops/summer_research.html https://www.dal.ca/faculty/agriculture/research/usra.html
Sobey Agricultural Undergraduate Research Award	https://www.dal.ca/faculty/agriculture/research/usra.html
Faculty of Arts and Social Sciences Undergraduate Research Stipend	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Michael J. Keen Award	https://www.dal.ca/faculty/science/earth-environmental-sciences/programs/funding-and-awards/keen-award.html
Sarah Lawson Research Scholarship	https://www.dal.ca/faculty/science/biology/undergraduate/scholarships-and-awards.html
Imhotep's Legacy Academic (ILA) Summer Student Research Award Scholar	https://www.dal.ca/faculty/science/imhotep/programs/summer_research_studentship.html

Chemistry (Paid Positions)	https://www.dal.ca/faculty/science/chemistry/programs/undergraduate-research-opportunities/undergraduate-research-for-pay-or-as-a-volunteer.html
Chemistry (Volunteer Positions)	https://www.dal.ca/faculty/science/chemistry/programs/undergraduate-research-opportunities/undergraduate-research-for-pay-or-as-a-volunteer.html
International Student Work Experience Program	https://www.dal.ca/campus_life/career-and-leadership/job-resources-services/international-student-work-experience-program.html
Summer Research Program for Non-Medical Students	https://medicine.dal.ca/research-dal-med/capacity/ssrp.html
Dalhousie Psychology and Neuroscience Volunteer Opportunities	docs.google.com/spreadsheets/d/1t4u8TD6ZoHzWH_eUt6LtQ0onQrOkP2NYleZcdbro/edit#gid=0
CONFERENCES	
Faculty of Arts and Social Sciences Annual Conference	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Annual Science Atlantic Conference – Computer Science, Mathematics and Statistics	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – Geoscience	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – Physics and Astronomy	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – Environment	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – Aquaculture and Fisheries, Biology	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – Nutrition	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – Pyschology	https://scienceatlantic.ca/conferences/
Annual Science Atlantic Conference – ChemCon	https://scienceatlantic.ca/conferences/
Conference Travel Funding (Science)	https://www.dal.ca/faculty/science/research/undergrad_ops/conference_travel.html
RESEARCH JOURNALS	
Babel	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Pangaea	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
The Podium	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Pseudo-Dionysius	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Tooth and Claw	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Verso	https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html
Journal of Undergraduate Ethnography	https://ojs.library.dal.ca/JUE/
Journal of Undergraduate Science Today	https://www.dal.ca/faculty/science/just.html

Appendix. I University of Alberta – List of UROs

APPRENTICESHIPS	
URO Name	**Website Source**
Roger S. Smith Undergraduate Researcher Award	https://www.ualberta.ca/arts/research/undergraduate-student-research/applying-for-the-roger-smith-undergraduate-award.html https://www.ualberta.ca/native-studies/students/student-awards https://www.ualberta.ca/kinesiology-sport-recreation/programs/undergraduate-programs/scholarships-and-awards/roger-s-smith-undergraduate-research-award.html https://www.ualberta.ca/augustana/media-library/research/student-research/summer-student-research-assistantship.pdf
Community Outreach Student Internship	https://www.ualberta.ca/community-service-learning/csl-student-info/csl-internships.html
NSERC Undergraduate Student Research Awards	https://www.ualberta.ca/psychology/undergraduate-studies/awards.html https://www.ualberta.ca/engineering/research/undergraduate-student-research/nserc-undergraduate-student-research-awards.html https://www.ualberta.ca/cellbiology/undergraduate-program/awards-and-scholarships.html https://www.ualberta.ca/biological-sciences/undergraduate-studies/awards-and-scholarships.html https://www.ualberta.ca/chemistry/undergraduate-program/summer-employment-opportunities/nserc.html https://www.ualberta.ca/earth-sciences/undergraduate-studies/research-opportunities-for-undergraduates.html https://www.ualberta.ca/mathematical-and-statistical-sciences/undergraduate-studies/research-opportunities.html https://www.ualberta.ca/physics/undergraduate-studies/research-opportunities/undergraduate-research-awards.html
Human Performance Fund Undergraduate Research Scholarship	https://www.ualberta.ca/kinesiology-sport-recreation/research/student-research-experience/human-performance-fund-undergraduate-research-scholarship.html
Endowment Fund for the Future Undergraduate Research Scholarship	https://www.ualberta.ca/kinesiology-sport-recreation/research/student-research-experience/endowment-fund-for-the-future-undergraduate-research-scholarship.html
Ken Holt Memorial Undergraduate Research Scholarship	https://www.ualberta.ca/kinesiology-sport-recreation/research/student-research-experience/ken-holt-memorial-undergraduate-research-scholarship.html
Summer Studentship Program (Women and Children's Research Institute)	https://www.wchri.org/summer-studentship-program
Dean's Research Award (Engineering)	https://www.ualberta.ca/engineering/research/undergraduate-student-research/deans-research-awards.html
Skyes Summer Studentship	https://www.ualberta.ca/biochemistry/undergraduate/research-opportunities.html
Undergraduate Summer Students' Research Program	https://www.ualberta.ca/medicine/research/studentships
Alberta Innovates Summer Research Studentships	https://www.ualberta.ca/cellbiology/undergraduate-program/awards-and-scholarships.html https://www.ualberta.ca/current-students/undergraduate-research-initiative/funding/alberta-innovates-summer-studentships.html
Donald W. Clarke Summer Undergraduate Research Fellowship	https://www.ualberta.ca/biological-sciences/undergraduate-studies/awards-and-scholarships.html
RISE-Globalink Research Internship	https://www.mitacs.ca/en/programs/globalink/rise-globalink-research-internship?utm_source=call&utm_medium=email&utm_campaign=RISEDAAD-Nov12017-Programcontacts

Globalink Research Internship	https://www.mitacs.ca/en/programs/globalink/globalink-research-award
Undergraduate Research Initiative (URI) Undergraduate Researcher Stipend	https://www.ualberta.ca/current-students/undergraduate-research-initiative/funding/researcher-stipend.html
i-STEAM Pathways	https://isteam-pathways.ualberta.ca/about/
Canadian Association of Gastroenterology Summer Studentship	https://www.cag-acg.org/summer-studentship-awards
Canadian Foundation for Infectious Diseases Undergraduate Summer Research Grant	https://www.researchid.com/topics/grants-and-studentships/cfid-undergraduate-summer-research-grant/
Parkinson's Foundation Summer Student Fellowship Program	https://www.parkinson.org/research/information-for-researchers/early-career-fellowships/summer
Diabetes, Obesity & Nutrition Strategic Clinical Network™ Undergraduate 2020 Studentship	https://www.albertahealthservices.ca/assets/about/scn/ahs-scn-don-2020-studentship-call.pdf
RWTH Aachen University - Undergraduate Research Opportunities Program (UROP) - Internship	https://www.rwth-aachen.de/cms/root/Studium/Im-Studium/Angebote-fuer-Studierende/UROP/~wmy/UROP-INternational/lidx/1/
Technische Universität Dresden Research Experience Program	https://www.ualberta.ca/international/go-abroad/programs/technische-universitat-dresden-research-experience-program
Technische Universität München Practical Research Experience Program	https://www.ualberta.ca/international/go-abroad/programs/tum-practical-research-experience-program
CONFERENCES	
Festival of Undergraduate Research	https://www.ualberta.ca/giving/projects/festival-undergraduate-research-creative-activities.html
Undergraduate Research Symposium (English and Film Studies)	https://www.ualberta.ca/english-film-studies/student-groups.html
Royce-Harder Research Conference	https://www.ualberta.ca/psychology/news-and-events/index.html
Student Academic Conference (Augustana Campus)	https://www.ualberta.ca/augustana/research/student/credit/sac.html
Research Revealed!	https://www.ualberta.ca/kinesiology-sport-recreation/research/student-research-experience/research-revealed.html
Student Life and Learning Enrichment Funding	https://www.ualberta.ca/arts/programs/undergraduate-programs/student-learning-enrichment-fund/index.html
RESEARCH JOURNALS	
Spectrum	https://spectrumjournal.ca/index.php/spectrum/about
Invoke	https://journals.library.ualberta.ca/invoke/index.php/invoke/about
Constellations	https://journals.library.ualberta.ca/constellations/index.php/constellations/index
Eureka	https://sites.ualberta.ca/~eureka/AboutEureka.pdf
Alberta Academic Review	https://journals.library.ualberta.ca/aar/index.php/aar/about
Compass	https://journals.library.ualberta.ca/compass/index.php/compass/about

Political Science Undergraduate Review	https://www.ualberta.ca/current-students/undergraduate-research-initiative/share-your-research.html
OTHER	
Research Certificate – Psychology (Arts)	https://calendar.ualberta.ca/preview_program.php?catoid=33&poid=37882
Research Certificate – Psychology (Science)	https://calendar.ualberta.ca/preview_program.php?catoid=33&poid=37869
Research Certificate – Biological Sciences	https://calendar.ualberta.ca/preview_program.php?catoid=33&poid=37373
Certificate in Applied Social Science Research	https://www.ualberta.ca/sociology/undergraduate-programs/certificateinappliedsocialscienceresearch.html
Undergraduate Certificate in Biomedical Research	https://www.ualberta.ca/cellbiology/undergraduate-program/undergraduate-certificate-in-biomedical-research.html
Undergraduate Research Initiative Undergraduate Research Support Fund	https://www.ualberta.ca/current-students/undergraduate-research-initiative/funding/uri-support-fund.html
Northern Research Awards	https://www.ualberta.ca/north/funding-awards/scholarships-and-awards/uanra/index.html
Northern Scientific Training Program	https://www.ualberta.ca/north/funding-awards/scholarships-and-awards/nstp.html
The Alberta Public Interest Research Group Event/ Project/ Research Grant	https://apirg.org/wp-content/uploads/2019/04/Event_Project_Research-Applicant-Information-2019-2020-1.pdf

Appendix. J University of Toronto – List of UROs

APPRENTICESHIPS	
URO Name	Website Source
Volunteer with a Faculty	https://www.utm.utoronto.ca/careers/sites/files/careers/public/shared/pdf/On-Campus_Opportunities_WEB_v191118.pdf
Summer Research: Beihang University	https://learningabroad.utoronto.ca/experiences/summer-research-beihang-university/
Summer Research Opportunities - Engineering	https://discover.engineering.utoronto.ca/internships/summer-research/
First Year Summer Research Fellowship	https://undergrad.engineering.utoronto.ca/wp-content/uploads/2020/02/2020-FY-Summer-Research-Fellowship-Application.pdf
NSERC Undergraduate Student Research Awards	https://mse.utoronto.ca/current/undergrad/scholarships/nserc-usra/ https://ibbme.utoronto.ca/prospective-student/undergraduate-research-award/ https://www.utm.utoronto.ca/math-cs-stats/current-students/financial-awards-and-scholarships/nserc-usra https://www.utm.utoronto.ca/psychology/undergraduate-studies/undergraduate-awardsscholarships https://www.utsc.utoronto.ca/psych/scholarships-and-awards https://www9.physics.utoronto.ca/undergraduate/intro-nserc-summer-student-program-physics-toronto/
Engineering Science Research Opportunities Program	https://engsci.utoronto.ca/experience/research/
Exceptional Opportunities Award (Engineering)	https://engsci.utoronto.ca/experience/awards/
Work Study	https://future.utoronto.ca/finances/financial-aid/work-study-program/
Latin American Studies Undergraduate Research Award	https://www.spanport.utoronto.ca/undergraduate/current-students/scholarships-awards

Mechanical and Industrial Engineering Summer Research Award	https://www.mie.utoronto.ca/programs/undergraduate/scholarships-funding/
University of Toronto Excellence (UTEA) Summer Research Award	https://www.mie.utoronto.ca/programs/undergraduate/scholarships-funding/ https://csb.utoronto.ca/wp-content/uploads/2020/03/2020-UTEA-guidelines.pdf https://www.utm.utoronto.ca/cps/utea
Summer Undergraduate Research Program	https://www.dunlap.utoronto.ca/training/surp/
Northrop Frye Summer Research Experience Scholarship in Ecology and Evolutionary Biology	http://www.eeb.utoronto.ca/undergrad/scholarships/northrop.htm
Koffler Scientific Reserve Undergraduate Student Research Award	http://www.eeb.utoronto.ca/undergrad/scholarships/ksrusra.htm
Centre for Global Change Science Summer Internship Program	http://www.cgcs.utoronto.ca/Assets/CGCS+Digital+Assets/fellowships.pdf
Summer Undergraduate Research Fellowship	https://www9.physics.utoronto.ca/undergraduate/2020-surf-general-information/
Experiential Learning Placements – Dept of Historical and Cultural Studies	https://www.utsc.utoronto.ca/hcs/experiential-learning-placements; supplement
Hurvitz Brain Sciences Summer Student Research Program	https://sunnybrook.ca/research/content/?page=sri-ed-summ-brain
Sunnybrook Research Institute Summer Student Research Program	https://sunnybrook.ca/research/content/?page=sri-ed-summ-uni
The SickKids Summer Research Program	http://www.sickkids.ca/Research/StudentandFellowResources/RTC/Training-Programs/Summer-Research-Program/
Research Training Centre Summer Research Program	http://research.lunenfeld.ca/rtc/DEFAULT.ASP?page=Summer%20Research%20Program
Keenan Research Summer Student (KRSS) Program - Paid	http://stmichaelshospitalresearch.ca/future-students-trainees/summer-student-krss-program/information-for-students/
Keenan Research Summer Student (KRSS) Program - Volunteer	http://stmichaelshospitalresearch.ca/future-students-trainees/summer-student-krss-program/information-for-students/
Summer Student Program – Medical Biophysics	https://medbio.utoronto.ca/summer-student-program-overview
Summer Student Research Program - Biochemistry	http://biochemistry.utoronto.ca/undergraduate-program/summer-students/
Undergraduate Research Opportunity Program – Molecular Genetics	http://www.moleculargenetics.utoronto.ca/summer-awards/2017/11/16/undergraduate-research-opportunity-program-urop
Graduate and Life Sciences Education Undergraduate Summer Research Project Studentships	https://glse.utoronto.ca/graduate-and-life-sciences-education-undergraduate-summer-research-project-studentships
Hannah Studentship	https://glse.utoronto.ca/research-opportunities
Summer Student Research Program – Women's College Research Institute	https://www.womensresearch.ca/trainees/undergraduate-summer-program/

Undergraduate Research Fund	https://learningabroad.utoronto.ca/experiences/undergraduate-research-fund-urf/
Centre for Urban Environments Undergraduate Research Award	https://www.utm.utoronto.ca/cue/cue-undergraduate-research-award
Exchange: National University of Singapore	https://engsci.utoronto.ca/experience/overseas/
Exchange: Osaka University	https://engsci.utoronto.ca/experience/overseas/
Exchange: Swiss Federal Institute of Technology (ETH) – Zurich	https://engsci.utoronto.ca/experience/overseas/
Daisy Ho Contemporary China Special Undergraduate Projects Fund	https://www.artsci.utoronto.ca/current/faculty-registrar/scholarships-and-awards/international-and-research-awards#daisy-ho-contemporary-china-special-undergraduate-projects-fund-accordion-1
CONFERENCES	
Bertha Rosenstadt National Undergraduate Research Conference	https://kpe.utoronto.ca/academics-researchconferences-seminars-symposia/national-undergraduate-research-conference
Mechanical and Industrial Engineering Undergraduate Student Travel Grants	https://www.mie.utoronto.ca/programs/undergraduate/scholarships-funding/
Advances in Earth Sciences Research Conference	https://www.es.utoronto.ca/association-of-graduate-earth-sciences-students-agess/advances-in-earth-sciences-research-conference/
Undergraduate Student Experience Fund (Anthropology)	https://www.utm.utoronto.ca/anthropology/undergraduate/undergraduate-awards
Anthropology Conference	https://www.utm.utoronto.ca/anthropology/news-events/anthropology-conference
UTSC Undergraduate Research Poster Forum	https://utsc.library.utoronto.ca/research-poster-forum
Undergraduate Research Day (Sociology)	https://www.utsc.utoronto.ca/sociology/student-research
Undergraduate Research Conference – Faculty of Arts and Science	http://assu.ca/2018/10/10/undergraduate-research-conference-2019/
UTSC Psychology Student Travel Award	https://www.utsc.utoronto.ca/psych/scholarships-and-awards
RESEARCH JOURNALS	
Almagest	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Anthropology Undergraduate Journal	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
(The) Foolscap Journal	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Galbraith Society Undergraduate Engineering Journal	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Goose	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Hard Wire	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Health Perspectives	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
IDIOM	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
in:cite	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Inkblot	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Interneuron	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Intra Vires	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc

Journal of Undergraduate Life Sciences	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Juxtaposition	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Knots	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Landmarks	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Noēsis	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
(The) PharmaChronicle	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Plebeian	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
POLIS	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Rapoport Journal for Peace, Conflict and Justice	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Re:locations	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Review of Undergraduate Computer Science	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Saeculum Undergraduate Academic Journal	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Shift Magazine	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Symposia	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Undergraduate Journal of American Studies	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Undergraduate Journal of Exercise Sciences	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Prandium	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Women, Culture, & Society Undergraduate Review	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
(The) Society	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
Young Anthropology	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
On the Move	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
ResPublica	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
(The) Scarborough Review	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
UTSC's Journal of Natural Sciences	https://guides.library.utoronto.ca/student_journals/journal-directory#utsc
OTHER	
Dr. David Chu Scholarship in Asia Pacific Studies	https://www.artsci.utoronto.ca/current/faculty-registrar/scholarships-and-awards/international-and-research-awards#eligibility-and-application-accordion-1
Walter and Mary Tuohy Award in Arts and Science	https://www.artsci.utoronto.ca/current/faculty-registrar/scholarships-and-awards/international-and-research-awards#eligibility-and-application-accordion-1
Andrea and Charles Bronfman Student Awards in Israeli Studies	https://www.artsci.utoronto.ca/current/faculty-registrar/scholarships-and-awards/international-and-research-awards#eligibility-and-application-accordion-1
Classical Civilization Research and Study Grant	https://www.utm.utoronto.ca/historical-studies/learn-more-about-what-we-offer/classical-civilization/cawt/summer-experiences
UTM Undergraduate Research Grant	https://www.utm.utoronto.ca/dean/undergraduates/utm-undergraduate-research-grants
Academic Travel Fund	https://www.utsc.utoronto.ca/studentaffairs/academic-travel-fund
Global Learning Travel Fund	https://www.utsc.utoronto.ca/studentaffairs/global-learning-travel-fund
Undergraduate Research Community	https://www.ulife.utoronto.ca/organizations/view/id/127069
Research Journal Club	https://www.ulife.utoronto.ca/organizations/view/id/126636

Appendix. K University of British Columbia – List of UROs

APPRENTICESHIPS	
URO Name	**Website Source**
Faculty of Creative and Critical Studies Undergraduate Student Research Award	https://fccs.ok.ubc.ca/resources/award-opportunities/undergraduate-student-research-award/ https://fccs.cms.ok.ubc.ca/wp-content/uploads/sites/92/2018/10/FCCS-USRA-Guidelines_Jan2020.pdf
Work Study	https://students.ok.ubc.ca/career-experience/hire-a-student/work-study/eligibility/
International Undergraduate Student Award	https://fccs.ok.ubc.ca/resources/award-opportunities/international-undergraduate-research-award/ https://management.cms.ok.ubc.ca/wp-content/uploads/sites/82/2020/03/2020-International-Undergraduate-Research-Award-FoM-Terms.pdf https://fass.cms.ok.ubc.ca/wp-content/uploads/sites/131/2019/11/GuidelinesxapplprocedNov2019.pdf
NSERC Undergraduate Student Research Awards	https://students.ubc.ca/career/campus-experiences/nserc-undergraduate-student-research-awards https://students.ok.ubc.ca/career-experience/get-experience/undergraduate-research/ https://students.ubc.ca/career/campus-experiences/nserc-undergraduate-student-research-awards https://science.ok.ubc.ca/awards/undergrad/nserc-usra/ https://hes.ok.ubc.ca/undergraduate/undergraduate-resources/nserc-undergraduate-research-award/ https://pd.engineering.ubc.ca/professional-development/usra/ https://www.civil.ubc.ca/academic-programs/undergraduate-program/civil-engineering-awards-scholarships-and-undergraduate-funding-opportunities/natural-sciences-and-engineering-research-council-nserc https://www.ece.ubc.ca/academic-programs/undergraduate/nserc-usra-information http://mtrl.ubc.ca/prospective-students/undergraduate-students/scholarshipsawards/ https://mech.ubc.ca/undergraduate/research-opportunities/ https://www.bme.ubc.ca/undergraduate/research-opportunities/ https://kin.educ.ubc.ca/research/student-opportunities/undergraduate-research-opportunities/ https://www.landfood.ubc.ca/undergraduate/campus/student-research/ https://science.ubc.ca/students/resources/research https://www.chem.ubc.ca/ubc-chemistry-summer-research-awards https://www.cs.ubc.ca/students/undergrad/research-and-conferences/undergraduate-student-research-awards https://www.eoas.ubc.ca/academics/ugrad/funding http://www.math.ubc.ca/Ugrad/NSERC/index.shtml https://www.microbiology.ubc.ca/undergraduate/opportunities/studentship https://www.phas.ubc.ca/undergrad-co-op-research-career https://www.stat.ubc.ca/summer-undergraduate-research-assistants
Aboriginal Undergraduate Research Mentorship Program	https://students.ok.ubc.ca/career-experience/get-experience/undergraduate-research/aboriginal-undergraduate-research-mentorship-program/
Undergraduate Research Awards	https://fass.ok.ubc.ca/awards/undergrad/ura/ https://science.ok.ubc.ca/awards/undergrad/ura/
Rogers Family Charity Trust Award in Biology	https://biology.ok.ubc.ca/undergraduate/awards/
Research Assistant – Earth and Environmental Sciences	https://eegs.ok.ubc.ca/research/#research
Research Assistant – Community, Culture, and Global Studies	https://ccgs.ok.ubc.ca/research/
Research Assistant – Biology	https://biology.ok.ubc.ca/research/
Research Assistant – History and Sociology	https://hs.ok.ubc.ca/research/

Research Assistant – Psychology	https://psych.ok.ubc.ca/research/
Research Assistant – Economics, Philosophy, and Political Science	https://epp.ok.ubc.ca/research/
Research Assistant - Chemistry	https://chemistry.ok.ubc.ca/research/
Work Learn International Undergraduate Research Awards	https://students.ubc.ca/career/campus-experiences/undergraduate-research/work-learn-international-undergraduate-research-awards https://pd.engineering.ubc.ca/professional-development/usra/ https://mech.ubc.ca/undergraduate/research-opportunities/ https://www.bme.ubc.ca/undergraduate/research-opportunities/ https://kin.educ.ubc.ca/research/student-opportunities/undergraduate-research-opportunities/ https://science.ubc.ca/students/resources/research https://www.chem.ubc.ca/ubc-chemistry-summer-research-awards https://www.cs.ubc.ca/students/undergrad/research-and-conferences/undergraduate-student-research-awards https://www.eoas.ubc.ca/academics/ugrad/funding http://www.math.ubc.ca/Ugrad/NSERC/index.shtml https://www.microbiology.ubc.ca/undergraduate/opportunities/studentship https://www.stat.ubc.ca/summer-undergraduate-research-assistants
Summer Student Research Program	https://www.med.ubc.ca/current-learners/summer-student-research-program/?login
BC Children's Hospital Research Summer Studentship (Paid)	https://bcchr.ca/about-us/training-opportunities/undergraduate-medical-students/summer-student-research-program-1
BC Children's Hospital Research Summer Studentship (Unpaid)	https://bcchr.ca/about-us/training-opportunities/undergraduate-medical-students/summer-student-research-program
Summer Student Research Program	https://pathology.ubc.ca/education-resource/summer-student-fellowship-program/?login
Science Undergraduate Research Experience Awards	https://science.ubc.ca/students/resources/research https://www.cs.ubc.ca/students/undergrad/research-and-conferences/undergraduate-student-research-awards https://www.eoas.ubc.ca/academics/ugrad/funding https://www.microbiology.ubc.ca/undergraduate/opportunities/studentship
Work Learn	https://students.ubc.ca/career/campus-experiences/work-learn-program; https://facultystaff.students.ubc.ca/student-engagement/centre-student-involvement-careers/work-learn
Bamfield Marine Science Centre Undergraduate Research Fellowship	http://www.bamfieldmsc.com/research-overview/undergraduate-research
UBC Chemistry Summer Research Awards	https://www.chem.ubc.ca/ubc-chemistry-summer-research-awards
Erich Vogt First Year Summer Research Experience	https://www.phas.ubc.ca/erich-vogt-first-year-summer-research-experience-fysre
Quinn Research Assistantship Awards	https://quinn.psych.ubc.ca/endowment-initiatives/ ; https://quinn-psych.sites.olt.ubc.ca/files/2018/09/UBCPsych_QRA_Guide2018.pdf
Community-Based Research Project	https://sociology.ubc.ca/undergraduate/opportunities/experiential-learning/
BIE Research Internship	https://economics.ubc.ca/undergraduate/programs/bachelor-of-international-economics/experiential-learning/
Quantum Pathways	https://qmi.ubc.ca/learn/quantum-pathways

Amgen Scholars Program - Canada	https://amgenscholars.com/; https://www.glse.utoronto.ca/amgen-scholars-canada-program https://www.glse.utoronto.ca/amgen-scholars-canada-program/about
Integrated Student Program in Research Education	https://bcchr.ca/INSPIRE
Centre for Blood Research-School of Biomedical Engineering Summer Studentship Program	https://cbr.ubc.ca/research-and-training/summer-studentship-program/?login
Summer Student Research Program	https://pharmsci.ubc.ca/research/summer-student-research-program
Combining Research Experience and Technical Electives for Undergraduates (CREATE-U)	https://mech.ubc.ca/undergraduate/research-opportunities/ ; https://mech2.sites.olt.ubc.ca/files/2019/10/CREATE-U-Information-Session-Slides.pdf
Research Assistant (Kinesiology)	https://kin.educ.ubc.ca/research/student-opportunities/undergraduate-research-opportunities/
Volunteer (Land and Food Systems)	https://www.landfood.ubc.ca/undergraduate/campus/student-research/
Volunteer (Science)	https://www.microbiology.ubc.ca/undergraduate/opportunities; https://www.phas.ubc.ca/undergrad-co-op-research-career
Research Assistantship (Arts)	https://asia.ubc.ca/graduate/opportunities/assistantships/ https://linguistics.ubc.ca/research/research-interest-registration/ https://psych.ubc.ca/undergraduate/opportunities/student-research/
Multidisciplinary Undergraduate Research Projects in Heath	https://mmri.ubc.ca/multidisciplinary-undergraduate-research-projects-in-health-murph/
Self-Directed Research Abroad	https://students.ubc.ca/career/international-experiences/research-abroad/self-directed-research-abroad
Amgen Scholars Program - Asia	https://amgenscholars.com/ https://amgenscholars.com/asia-program
Research Abroad: Technical University of Munich	https://students.ubc.ca/career/international-experiences/research-abroad/technical-university-munich-%E2%80%93-practical-research-experience-program
Research Abroad: Ecole Polytechnique Federale de Lausanne – Research Internship	https://students.ubc.ca/career/international-experiences/research-abroad/%C3%A9cole-polytechnique-f%C3%A9d%C3%A9rale-de-lausanne-research-internship
Research Abroad: University of Tokyo Research Internship Program	https://students.ubc.ca/career/international-experiences/research-abroad/university-tokyo-research-internship-program-utrip
Research Abroad: RWTH Aachen University-Undergraduate Research Opportunities Program	https://students.ubc.ca/career/international-experiences/research-abroad/rwth-aachen-university-undergraduate-research-opportunities-program; https://www.rwth-aachen.de/cms/root/Forschung/Angebote-fuer-Forschende/Angebote-fuer-Studierende/UROP/~wmy/UROP-INternational/lidx/1/
Research Abroad: Université de Lausanne - SUR Program	Website: https://students.ubc.ca/career/international-experiences/research-abroad/universit%C3%A9-de-lausanne-sur-program
Research Abroad: University of Tokyo - Summer Internship Program in Kashiwa	https://students.ubc.ca/career/international-experiences/research-abroad/university-tokyo-summer-internship-program-kashiwa
Research Abroad: National University of Singapore - Undergraduate Research	https://students.ubc.ca/career/international-experiences/research-abroad/national-university-singapore-undergraduate-research-attachment-programme-science

Attachment Programme in Science	
Research Abroad: Lund University - Summer Research in Engineering	https://students.ubc.ca/career/international-experiences/research-abroad/lund-university-summer-research-engineering
Research Abroad: Singapore University of Technology and Design – IUROP	https://students.ubc.ca/career/international-experiences/research-abroad/singapore-university-technology-design-%E2%80%93-iurop
Research Abroad: University of Tokyo – Engineering Summer Education Program	https://students.ubc.ca/career/international-experiences/research-abroad/university-tokyo-%E2%80%93-engineering-summer-education-program
Research Abroad: Shanghai Jiao Tong University – International Summer Research Internship Program	https://students.ubc.ca/career/international-experiences/research-abroad/shanghai-jiao-tong-university-%E2%80%93-international-summer-research-internship-program
Research Abroad: Zhejiang University - Scholars Summer Research Program	https://students.ubc.ca/career/international-experiences/research-abroad/zhejiang-university-scholars-summer-research-program
Research Abroad: Stuttgart University – Program for Experiencing Research	https://students.ubc.ca/career/international-experiences/research-abroad/stuttgart-university-%E2%80%93-program-experiencing-research
Research Abroad: Technische Universität Darmstadt - International Research Experience Summer Program	https://students.ubc.ca/career/international-experiences/research-abroad/technische-universit%C3%A4t-darmstadt-international-research-experience-summer-program
Research Abroad: Chinese University of Hong Kong - Summer Undergraduate Research Programme	https://students.ubc.ca/career/international-experiences/research-abroad/chinese-university-hong-kong-summer-undergraduate-research-programme-surp
Research Abroad: The Hong Kong University of Science and Technology - International Internship Program	https://students.ubc.ca/career/international-experiences/research-abroad/hong-kong-university-science-technology-international-internship-program
Research Abroad: National Taiwan University - Laboratory Research & Culture Program	https://students.ubc.ca/career/international-experiences/research-abroad/national-taiwan-university-laboratory-research-culture-program
Research Abroad: Koç University Summer Research Program	https://students.ubc.ca/career/international-experiences/research-abroad/ko%C3%A7-university-summer-research-program
Research Abroad: Hebrew University – Summer Science Internship	https://students.ubc.ca/career/international-experiences/research-abroad/hebrew-university-%E2%80%93-summer-science-internship
CONFERENCES	
Undergraduate Student Travel Grant	https://fass.ok.ubc.ca/awards/undergrad/undergradtravel/; https://fass.ok.ubc.ca/awards/undergrad/
Tuum Est Student Initiative Fund	https://students.ok.ubc.ca/involvement-activities/funding-opportunities/tuum-est/
Undergraduate Research Travel Fund	https://www.eoas.ubc.ca/academics/ugrad/funding

Quinn Research Travel Grant	https://quinn.psych.ubc.ca/endowment-initiatives/
SOCI Undergraduate Conference Travel Grant	https://sociology.ubc.ca/undergraduate/funding/
Research Day	https://researchday.engineering.ubc.ca/about/ https://researchday.engineering.ubc.ca/program/poster-presentations/
Multidisciplinary Undergraduate Research Conference	https://students.ubc.ca/career/events-workshops/multidisciplinary-undergraduate-research-conference
Association for Computation Machinery (ACM) Student Research Competition	https://src.acm.org/submissions
Annual Consortium for Computer Sciences in Colleges Northwestern Regional Conference	http://www.ccsc.org/northwest/2020/studentposter.html
Arts Studies in Research and Writing Student Conference	https://asrw.arts.ubc.ca/research/undergraduate-research/asrw-student-conference-2/
Language Sciences Undergraduate Research Conference	https://blogs.ubc.ca/lsurc/
Microbiology and Immunology Undergraduate Research Symposium	https://jemi.microbiology.ubc.ca/UndergraduateResearchSymposium/
Psychology Undergraduate Research Conference	https://psych.ubc.ca/events/event/2019-psychology-undergraduate-research-conference-purc/
International Conference of Undergraduate Research	https://students.ubc.ca/career/international-experiences/international-conferences-special-programs/icur-international-conference-undergraduate-research
Neuroscience Undergraduate Research Conference	http://blogs.ubc.ca/neuroscienceclub/nurc-2020-2/
Three-Minute Thesis (Undergraduate)	https://ubc.3mt.ca/
RESEARCH JOURNALS	
That's What [WE] Said	https://ccgs.ok.ubc.ca/research/
Canadian Journal of Undergraduate Research	https://cjur.ca/about/
Undergraduate Journal of Experimental Microbiology and Immunology	https://ujemi.microbiology.ubc.ca/about_ujemi
Undergraduate Journal of Art and History Culture	http://www.ubcujah.com/
Eonia	https://philosophy.ubc.ca/undergraduate/opportunities/students-association/
UBC Journal of Political Sciences	https://politics.ubc.ca/undergraduate/students-association-pssa/ubc-journal-of-political-studies/
UBC Undergraduate Journal of Psychology	https://ubcujp.psych.ubc.ca/
Sojourners	https://blogs.ubc.ca/sojourners/
University of British Columbia Medical Journal	https://ubcmj.med.ubc.ca/
UBC Journal of International Affairs	https://ir.arts.ubc.ca/community/ubc-journal-of-international-affairs-jia/

IONA Journal of Economics	https://www.ionajournal.ca/
UBC Asian Canadian and Asian Migrations Journal	https://acam.arts.ubc.ca/
Atlas	https://ubcatlas.wordpress.com/
OTHER	
Undergraduate Research Opportunities	https://www.uroubc.com/

ENDNOTES

[1] https://discover.engineering.utoronto.ca/internships/summer-research/, accessed July 25, 2020

[2] *Ibid.*

[3] *Ibid.*

[4] *Ibid.*

[5] *Ibid.*

[6] http://u15.ca/, accessed July 25, 2020

[7] http://u15.ca/about-us, accessed July 25, 2020

[8] https://medicine.dal.ca/research-dal-med/capacity/ssrp.html, accessed July 26, 2020

[9] https://www.dal.ca/faculty/science/imhotep/programs/summer_research_studentship.html, accessed July 26, 2020

[10] https://www.dal.ca/faculty/science/earth-environmental-sciences/programs/funding-and-awards/keen-award.html, accessed July 26, 2020

[11] https://www.dal.ca/faculty/agriculture/research/usra.html, accessed July 26, 2020

[12] https://www.dal.ca/faculty/science/biology/undergraduate/scholarships-and-awards.html, accessed July 26, 2020

[13] https://www.dal.ca/faculty/arts/research/undergraduate-research-opportunities-in-humanities--arts---socia.html, accessed July 26, 2020

[14] https://isteam-pathways.ualberta.ca/about/, accessed July 26, 2020

[15] https://calendar.ualberta.ca/preview_program.php?catoid=33&poid=37869, accessed July 26, 2020

[16] https://calendar.ualberta.ca/preview_program.php?catoid=33&poid=37882, accessed July 26, 2020

[17] https://calendar.ualberta.ca/preview_program.php?catoid=33&poid=37373, accessed July 26, 2020

[18] https://www.ualberta.ca/sociology/undergraduate-programs/certificateinappliedsocialscienceresearch.html, accessed July 26, 2020

[19] https://www.ualberta.ca/cellbiology/undergraduate-program/undergraduate-certificate-in-biomedical-research.html, accessed July 26, 2020

[20] https://www.ualberta.ca/current-students/undergraduate-research-initiative/index.html, accessed July 26, 2020

[21] https://www.utm.utoronto.ca/cps/utea, accessed July 26, 2020

[22] https://undergrad.engineering.utoronto.ca/wp-content/uploads/2020/02/2020-FY-Summer-Research-Fellowship-Application.pdf, accessed July 26, 2020

[23] https://students.ok.ubc.ca/career-experience/get-experience/undergraduate-research/aboriginal-undergraduate-research-mentorship-program/, accessed July 27, 2020

[24] https://qmi.ubc.ca/learn/quantum-pathways, accessed July 27, 2020

[25] https://quinn.psych.ubc.ca/endowment-initiatives/, accessed July 27, 2020

[26] https://fccs.ok.ubc.ca/resources/award-opportunities/undergraduate-student-research-award/, accessed July 27, 2020

[27] https://www.uroubc.com/, accessed July 27, 2020

[28] *Ibid*.

[29] https://threepriorities.utoronto.ca/wp-content/uploads/2015/10/Three-Priorities-Discussion-Paper.pdf, accessed July 29, 2020

[30] https://cdn.dal.ca/content/dam/dalhousie/pdf/about/Strategic-Planning/ProjectCharter2-4.pdf, accessed July 29, 2020

[31] *Ibid*.

[32] https://threepriorities.utoronto.ca/wp-content/uploads/2015/10/Three-Priorities-Discussion-Paper.pdf, accessed July 29, 2020

[33] https://strategicplan.ubc.ca/wp-content/uploads/2019/09/2018_UBC_Strategic_Plan_Full-20180425.pdf, accessed July 29, 2020

[34] *Ibid*.

[35] https://threepriorities.utoronto.ca/wp-content/uploads/2015/10/Three-Priorities-Discussion-Paper.pdf, accessed July 29, 2020

[36] https://www.retailcouncil.org/resources/quick-facts/minimum-wage-by-province/, accessed July 30, 2020