

# Undergraduate Researcher Stipend (URI Stipend) Program Evaluation Report September 2021

## Summary

Undergraduate research is well-established as a high-impact educational practice, and is an integral part of the experiential learning landscape at a research-intensive university. Since 2011, the Undergraduate Research Initiative (URI) has supported the involvement of University of Alberta undergraduate students in research and creative activities. The work of the URI is student-focused, aiming to minimize barriers to undergraduate research by helping students overcome constraints of time, money, confidence, or access to meaningful opportunities. To this end, the URI designed the Undergraduate Researcher Stipend (hereafter URI Stipend) as a funding program with relatively broad eligibility criteria, to facilitate research opportunities for students regardless of discipline, year of study or academic standing. From 2012-2020, the URI Stipend supported 459 students from 14 faculties, with an average application success rate of 29%. To better understand students' experiences with the URI Stipend, we undertook a qualitative analysis of 20 URI Stipend recipient final reports (selected by maximum variation sampling from students who completed their Stipends between 2016-2020), and identified several themes:

- 1) **Professional Socialization:** Students highlighted mentorship and networking opportunities as important aspects of their URI Stipend experience, supporting their sense of belonging in the research community and an understanding of professional or disciplinary norms.
- 2) **Interdisciplinarity:** URI Stipend recipients expressed appreciation for interdisciplinary research as an approach that brings together different perspectives, and highlighted some of the challenges associated with collaborating and integrating knowledge across disciplines.
- 3) **Learning Outcomes:** URI Stipend recipients developed a variety of technical/discipline-specific and transferable skills, including communication, time management, conflict resolution, and interpersonal/teamwork skills. Students expressed both the benefits and challenges of a greater degree of independence afforded by undergraduate research, as well as the need for resilience in light of the unpredictable nature of the research process. The transferable skills identified by students align closely with career readiness competencies, and students recognized the importance of these skills for their future careers.
- 4) **Teaching-Research Nexus:** URI Stipend recipients described complementary connections between their classroom learning and research experiences, including application of

their classroom learning to research, and research providing helpful preparation and context for advanced classes. Students also articulated their enjoyment of independent and creative research over classroom learning.

- 5) **Better Understanding of Self:** URI Stipend recipients described having increased confidence, increased understanding of their potential capabilities, and a deepened sense of purpose or motivation based on the impact of their research. Students also highlighted their individual likes and dislikes about the research process, which provided insight into themselves as learners. Some students indicated a need for more support to combat social isolation of research, particularly in environments where students work independently rather than in teams.
- 6) **Impact on Future Plans:** URI Stipend recipients recognized the value of hands-on research experience as an opportunity to explore and clarify career options. Whether their research experience confirmed their career intentions or caused them to question or change their future plans, students recognized the skills gained through their Stipend experience as supporting their future career goals.

URI Stipend recipients also expressed appreciation for the broad eligibility criteria for the URI Stipend, particularly the relaxed GPA requirement, which can otherwise be a barrier to research for many students. Overall, students described their URI Stipend experience as having significant impacts on their academic and career goals, and contributing to their enjoyment of their student experience at the University of Alberta.

While the current qualitative study provides important insight into the firsthand experiences of URI Stipend recipients, further evaluation is needed to determine whether the impacts articulated immediately following their Stipend experience were sustained long-term (i.e. post-graduation). A follow-up study examining longer-term academic and career outcomes for URI Stipend alumni is currently underway. Secondly, although the broad eligibility criteria for the URI Stipend was designed to reduce barriers to research, and some URI Stipend recipients did mention this in their personal accounts, more evaluation work is needed to fully assess the academic and demographic characteristics of URI Stipend applicants and recipients relative to the undergraduate population at large.

This study also highlights the value of undergraduate research for students' career development and employability skills, regardless of their particular career intentions at the time they undertake their research experience. Undergraduate research confers a variety of academic, social, and career readiness benefits for students. The URI, by virtue of its administrative relationship with the Career Centre, embeds career development principles throughout its programming to support students in gaining the knowledge, skills, connections, and experiences to advance their career goals.

The current emphasis on experiential learning and career readiness for post-secondary students provides an opportunity to showcase undergraduate research as a form of experiential learning unique to research-intensive universities, with similar benefits to work experience, internships, co-op, and work-integrated learning.

## URI Background

Since 2011, the Undergraduate Research Initiative (URI) has supported the involvement of University of Alberta undergraduate students in research and creative activities. The work of the URI is student-focused, emphasizing interdisciplinarity, progressive skill development, discovery learning, knowledge translation, and the integration of teaching and research.

Undergraduate research is an integral part of the experiential learning landscape at a research-intensive university. Immersive, hands-on experience with research is critically important for students' academic and professional development, as well as for entry to professional schools and careers both within and beyond academia. For many students, an undergraduate research experience is a catalyst, providing skills, experience, and mentorship that help students clarify their career goals and identify their next steps. The URI aims to minimize barriers to undergraduate research by helping students overcome constraints of time, money, confidence, or access to meaningful opportunities.

To achieve these goals, the URI has five main functions:

- To raise undergraduate students' awareness of and interest in research
- To support undergraduate students in developing the knowledge and skills needed for participation in research
- To facilitate opportunities for undergraduate students to engage in research
- To assist undergraduate students in disseminating and celebrating research results and achievements
- To create and sustain a culture of undergraduate research at the University of Alberta

The URI offers individual advising about undergraduate research opportunities, administers undergraduate research funding programs, provides skill development workshops for groups and classes, and collaborates with various partners across campus to support undergraduate student involvement in research and creative activities across all disciplines. For more details about URI programming, please visit [www.uab.ca/uri](http://www.uab.ca/uri).

## About the URI Stipend

The URI Undergraduate Researcher Stipend (hereafter URI Stipend) was established in 2012 to enable undergraduate students to undertake mentored, interdisciplinary research projects 4-12 months in duration. The URI consulted with faculties and other stakeholder groups across campus, and was intentional in structuring the URI Stipend in a way that complements other undergraduate research funding programs, while providing a potential pathway into research for students who may not qualify for other types of awards.

Most well-established undergraduate research funding programs at the University of Alberta (see Table 1 for examples) are discipline-specific, and are restricted either explicitly or competitively to full-time, continuing students in an advanced year of study and with superior academic performance. This creates potential barriers for students seeking opportunities to engage in research in their first or final year, those who have experienced academic difficulties or have merely “average” GPAs, and those seeking to try research outside of their home discipline. Many programs also have an explicit goal of encouraging students to pursue graduate studies, which may prompt students to self-select into research experiences based on pre-existing academic interest or intent to pursue advanced studies. This emphasis on future academic pursuits potentially excludes students without such intentions, who could nevertheless benefit from research as an experiential learning opportunity, regardless of their future career goals.

Undergraduate research is considered to be a high-impact educational practice (HIP) (Kuh, 2008), associated with increased student engagement, retention and improved academic outcomes. Research on HIPs in general and undergraduate research in particular, suggest the importance of early and sustained involvement (Sell et al, 2018; Ishiyama, 2002, Hathaway et al, 2002, Haave & Audet, 2013). There is also a growing body of research suggesting that underrepresented students, including minorities, first-generation students, and those academically at-risk, may particularly benefit from undergraduate research opportunities, despite systemic barriers that often limit their participation (Carpi et al, 2017; Hathaway et al, 2002; Finley & McNair, 2013).

The URI Stipend was therefore designed with relatively open eligibility criteria, to allow students from any academic program or background, in any year of study, and with any research focus, to compete on equal footing based primarily on their research proposal. The URI Stipend operates within a suite of experiential learning programs offered by the University of Alberta, with the express goal of allowing undergraduate students to “enrich their university experience through hands-on discovery and skill development in a research-intensive university.” The framing of the URI Stipend as an experiential skill development opportunity (vs. explicitly framing it as an opportunity for students to gain experience for graduate school, or to develop technical skills for research careers) was intentional, to encourage participation from students who may not have a pre-existing inclination toward graduate school or research careers prior to applying. For similar reasons, previous research experience is not considered in the adjudication criteria.

Students apply with a supervisor (normally a University of Alberta faculty member, but graduate students, post-doctoral fellows, and staff are also eligible to supervise, with a faculty member’s support). Unlike many funding applications that are driven by the supervisor, students are responsible for writing the research proposal, in plain language that is accessible to a multidisciplinary adjudication committee. URI provides support (e.g. seminars, individual advising) to assist students in the application process.

**Table 1. Comparison of eligibility criteria for major undergraduate research awards at the University of Alberta.**

	<b>NSERC USRA<sup>1</sup></b>	<b>Roger S Smith<sup>2</sup></b>	<b>Alberta Innovates SRS<sup>3</sup></b>	<b>URI Stipend<sup>4</sup></b>
<b>Discipline(s) or Faculties</b>	Natural Sciences & Engineering	Arts Native Studies Kinesiology, Sport & Recreation Campus Saint Jean Augustana Campus Education	Health & Medical Sciences; priority areas related to digital health (as defined by Alberta Innovates)	Any; interdisciplinary
<b>Year of Study</b>	Completed at least 1 year, at least one of the last two semesters must be full-time	Minimum of 30 credits, not more than 90 credits; must be continuing in fall, must be full-time	Undergraduate or MD, any year of study	Any year of study; must not hold a previous degree
<b>Citizenship</b>	Canadian Citizen or Permanent Resident	International students permitted (with valid work/study permit)	International students permitted (with valid work/study permit)	International students permitted (with valid work/study permit)
<b>Academic Standing</b>	Min. cGPA of 2.7 to apply; competitive GPA varies by department.	Min. GPA varies by faculty (3.0-3.3)	Min. satisfactory standing to apply; competitive GPA varies (typically >3.5)	Min. satisfactory standing to apply; GPA not considered in adjudication
<b>Supervisor Eligibility</b>	Faculty member	Faculty member, typically from same faculty; may have co-supervisor from another faculty	Faculty member with A1.1 or C1.1 appointment (excludes supervisors with clinical appointments)	Faculty member (any discipline), or non-faculty with a faculty sponsor

1: [https://www.nserc-crsng.gc.ca/students-etudiants/ug-pc/usra-brpc\\_eng.asp](https://www.nserc-crsng.gc.ca/students-etudiants/ug-pc/usra-brpc_eng.asp)

2: [https://www.ualberta.ca/arts/media-library/research/documents/smith/rss\\_programguide2020.pdf](https://www.ualberta.ca/arts/media-library/research/documents/smith/rss_programguide2020.pdf)

3:

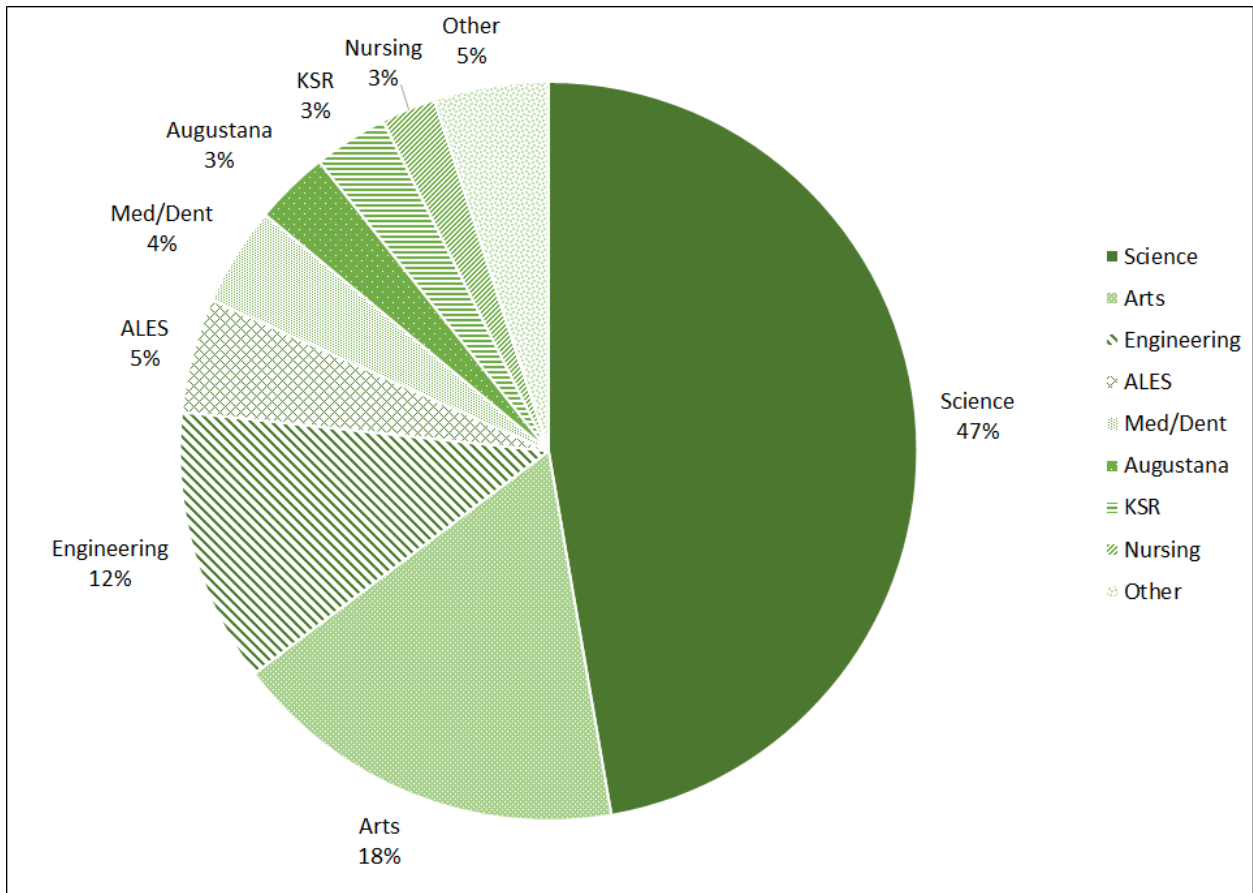
<https://www.ualberta.ca/current-students/undergraduate-research-initiative/funding/alberta-innovates-summer-studentships.html>

4: <https://www.ualberta.ca/current-students/undergraduate-research-initiative/funding/researcher-stipend.html>

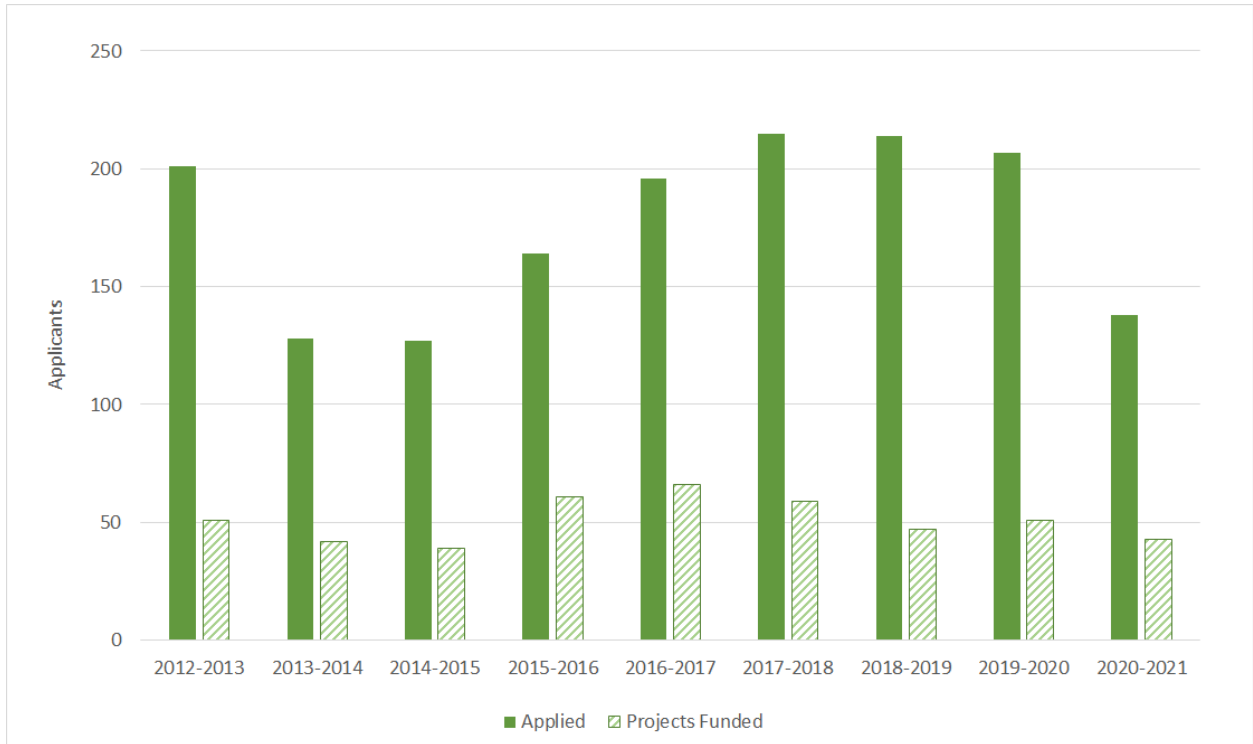
The proposal must clearly describe the proposed research project, the student's role and potential skill development, and the interdisciplinary aspects of the project. Projects may be student-initiated, or aligned with a supervisor's ongoing research program. In either case, students are expected to have an integral role in the proposed project, with a clear connection to their skill development, as opposed to providing general research assistance to the supervisor. Supervisors are responsible for a brief section outlining their plan for mentoring the student and ensuring that the proposed learning and research outcomes are feasible for the student.

Each application is normally reviewed by at least 2 PhD-level (faculty or PDF) and 2 student adjudicators, representing a range of disciplines. Applications are assessed based on the quality of the proposal, merit of the project, student role & skill development, supervisor commitment, and interdisciplinary aspects ([see rubric for details](#)). Since 2012, the URI Stipend has supported over 450 students from 14 University of Alberta faculties (Figure 1). The success rate for the URI Stipend is normally in the range of 25-30%, based on an average of 175 applications per year (Figure 2). The distribution of recipients by year of study is generally proportional to the number of applicants by year of study (Figure 3), as is the distribution of awards between international and domestic applicants (Figure 4). The average success rate for both international and domestic students is 29%.

URI Stipend projects normally span a term of 4-12 months. Students are invited to participate in supportive programming offered by URI during the term of their award, including social events with other Stipend recipients, and various professional skill development workshops, which complement offerings at the faculty or department level. At the end of their project term, students are required to submit a brief written report summarizing their research activities and learning outcomes.

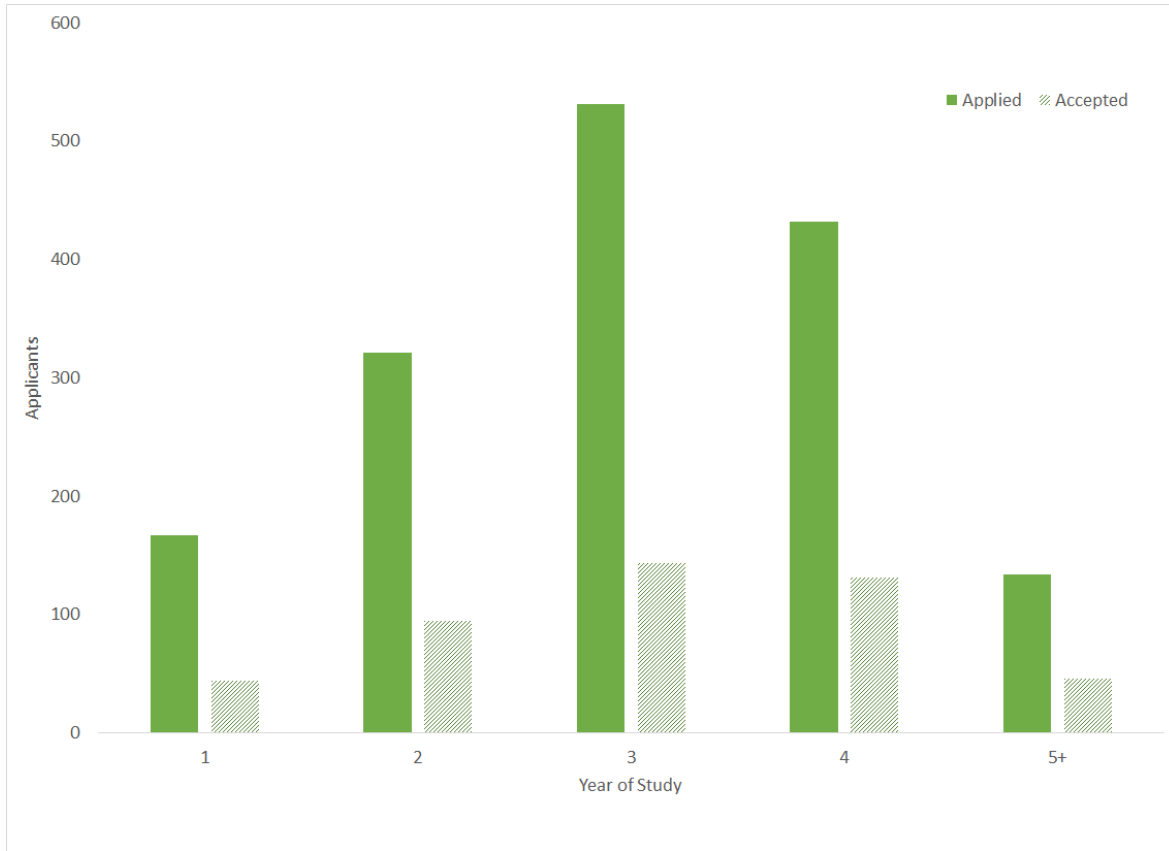


**Figure 1. Distribution of URI Stipends awarded by student faculty, 2012-2020 (n=459). “Other” includes faculties with an average of less than one award per year (Pharmacy & Pharmaceutical Sciences, Law, Native Studies, Education, Campus Saint Jean, Business).**

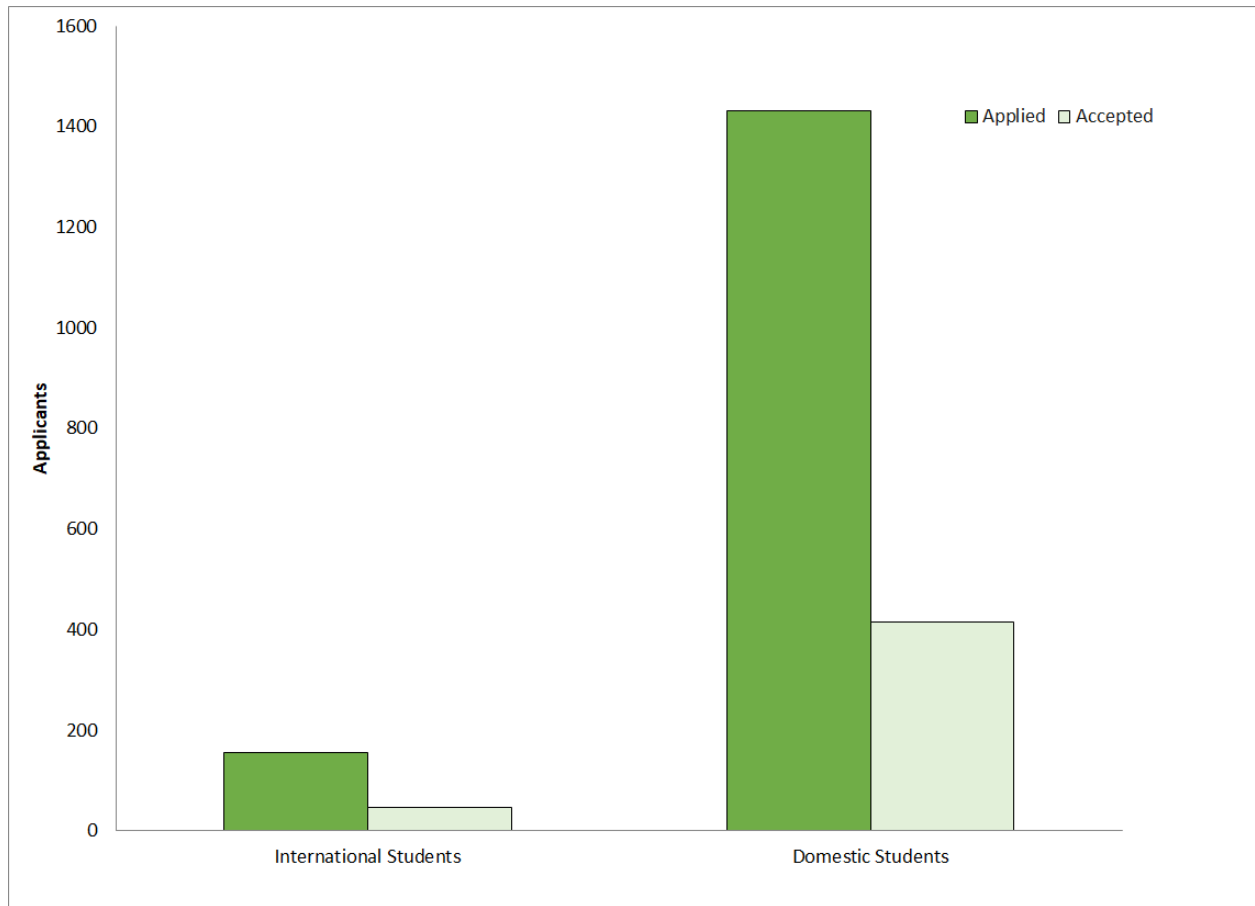


**Figure 2. URI Stipend total applications (solid bars) vs. funded projects (hashed bars), 2012-2020. Total: 1590 applications; 459 projects funded (overall success rate 29%; range 22-37%). Note that 2020-2021 only had one application cycle (vs. two cycles for all other years).**





**Figure 3. Distribution of URI Stipend applications (dark bars) to URI Stipend recipients (light bars) by year of study, 2012-2020 (n=1590 applicants, 459 recipients)**



**Figure 4. Distribution of URI Stipend applicants (dark bars) vs. recipients (light bars) by international status, 2012-2020 (n=1590 applicants, 459 recipients). The success rate for both international and domestic applicants was 29% on average.**

## Purpose

The purpose of this evaluation is to determine the short-term impacts and benefits resulting from undergraduate students' experience as recipients of the URI Stipend. We are interested in exploring the outcomes and themes evident in the perspectives of URI Stipend recipients as described in their URI Stipend final written reports, with a specific focus on the unique qualities of the URI Stipend noted above.

## Evaluation Question

What are the research experiences of undergraduate students at the University of Alberta who received the Undergraduate Research Initiative (URI) Stipend from 2016-2020?

## Objectives

1. To better understand undergraduate student experiences with interdisciplinary research, and the impacts of participation in the URI Stipend on interdisciplinary understanding.
2. To explore the influence of the URI Stipend on students' career decisions, choices, goals, and further opportunities
3. To assess how involvement in undergraduate research impacted students' perception of themselves as learners, specifically what skills, knowledge, and attitudes students gained from their research experience
4. To contribute to the current scholarship on undergraduate research by exploring the personal accounts of undergraduate students from a range of disciplines, academic standings, and years of study, which is made possible through the broad criteria of the URI Stipend.

## Sampling Approach

We utilized a purposeful sampling method that selected information-rich cases for in-depth study (Patton, 1990). Specifically, a maximum variation sampling method was used, where a purposeful selection was based on selecting participant reports that provided a range of variation (Patton, 1990). The selection criteria for the following reports were based on giving variation in 1. Project timing (summer vs. during the academic year); 2. Year of Study; 3. Faculty/School of students; 4. Department of Students; 5. Faculty of supervisor.

A total of 20 reports were selected from a total of 267 available reports obtained between 2016-2020. This timeframe was chosen due to the large number of reports to select from, and availability of reports in a consistent, standardized format (i.e. Google Form introduced in 2016).

All three University of Alberta campuses (North Campus, Augustana and Campus Saint Jean) were represented in the chosen sample. The reports include undergraduate students enrolled in their 1<sup>st</sup> year to 5+ years of university studies. Students were from 9 faculties and 13 departments/programs. Twelve supervisor faculties are represented within the sample. Indigenous and international student experiences are represented as well. While international student status information was available for all award recipients within the date range, Indigenous status was only available from 2017 onward.

## Research Themes

A qualitative analysis allowed for rich and meaningful narratives of students' experiences. After qualitative analysis and coding of the 20 reports, six themes were developed. The six themes are as follows: Professional Socialization; Interdisciplinarity; Learning Outcomes; Teaching-Research Nexus; Better Understanding Of Self; Impacts on Future Plans.

These themes provide a better understanding of students' experiences with undergraduate research, specifically with the URI Stipend that emphasizes interdisciplinary research. The themes provide insight into students' understanding of themselves as learners, the skills they obtained through their experience, and ultimately how the URI Stipend impacted students' career and academic plans moving into the future. As the final reports are normally completed within 10 days of the award end date, the student reflections are indicative of the short-term, immediate impacts of their participation.

### Professional Socialization

Professional socialization is the social and cultural process through which students join a community of practice, and develop an understanding of the norms, values, and behaviours of a profession (Thiry & Laursen, 2011). In their URI Stipend reports, students spoke to the opportunities for types of professional socialization through their diverse experiences with networking, relationship building, collaboration, and mentorship. Mentorship is a significant feature of undergraduate research, supporting students' intellectual, emotional, and professional growth (Thiry & Laursen, 2011), and mentoring relationships can take many forms (e.g. faculty-student, graduate student-undergraduate student, or peer-mentorship between undergraduate students). Mentoring supports professional socialization in a variety of ways, including through transmission of disciplinary norms, supporting students in networking opportunities, and building community among researchers at all levels (Shanahan et al, 2015).

*"To complete my project, I had to rely on the generosity of many other people who made reagents and offered guidance on my project. I learned that research often relies on these little collaborations, and part of it is contributing back through various lab jobs such as cleaning, organizing, and making reagents and whatever is needed to make a lab work efficiently." (Year 4, Biological Sciences)*

*"I'm not sure that I've ever been able to watch top scholars hash out ideas and brainstorm like they did at the meeting. It's enriched my understanding of my field, and of the power of academic collaboration more generally." (Year 1, Philosophy)*

The URI Stipend resulted in opportunities to network with various community stakeholders such as health care practitioners, colleagues, professors, and research participants.

*“One of the most impactful experiences for me, was speaking with other researchers about their experiences and barriers in their own research, and being able give each other ideas when support was needed” (Year 3, Education)*

*“Attending the team meeting in Calgary (held during the Canadian Historical Association Conference) was a real treat. It afforded me the opportunity to meet top scholars in my field and to present to them.” (Year >4, Sociology)*

Students also voiced the long-lasting relationships cultivated and fostered, such as friendships with fellow undergraduate students and a long-term mentorship with professors.

*“The relationship-building aspect of this proposed project worked towards creating lifelong friendships at the University of Alberta, enriched my undergraduate student experience.” (Year 1, Pharmacy and Pharmaceutical Sciences)*

*“I hope that I will be able to work again with [name redacted] and [name redacted], as they were inspirational to me as researchers, supervisors, and as individuals.” (Year 2, Psychology)*

These findings are consistent with other evaluation literature on undergraduate research. Across a range of undergraduate research programs and evaluation approaches, students have reported gains in becoming part of the learning or research community (Loppato, 2004; Nadelson, et al, 2015), and developing a sense of professional identity (Hunter et al, 2007). The ability to collaborate and communicate effectively within diverse team structures is a major competency supporting students’ career readiness (NACE, 2021, Conference Board of Canada, n.d.).

## **Interdisciplinarity**

The URI Stipend program is designed to expose students to interdisciplinary research. Interdisciplinary research, as applied to the URI Stipend, “integrates or synthesizes information, methods, concepts and/or theories from two or more disciplines to address research questions that are beyond the scope of a single discipline.” (Definition adapted from Facilitating Interdisciplinary Research. Washington, D.C.: National Academies Press, 2005.). The emphasis on interdisciplinary research in the URI Stipend is not only intended to complement other existing discipline-specific academic and co-curricular opportunities for students, it is also intended to support students’ broader career development, as many students may find future employment in areas outside of their academic discipline, or involving diverse multi-disciplinary or interdisciplinary teams in the workplace.

URI Stipend recipients were enrolled in a range of disciplines/programs, and worked with professors across a variety of disciplines. For example, there was interdisciplinary collaboration across fields such as biological science to arts and art and design to medicine and dentistry. Students generally spoke about their experiences with interdisciplinarity, in which they

identified the various perspectives and knowledges that were brought together to create diverse research teams. Students defined interdisciplinarity as encompassing diversity in the research team, perspectives, disciplines, fields, and opinions.

*“Our interdisciplinary research team included my supervisor coming from a clinical psychology background, and myself coming from an education and kinesiology background. Together we brought perspectives and knowledge from these disciplines to our research.”(Year >4, Education)*

*“I used to think interdisciplinary required a bunch of completely different people meeting and working together and had doubts about the functionality of such a team with nothing in common. However, I realized that although people are from different backgrounds, they are all passionate about learning and improving treatments for cancer.” (Year 2, Biological Science)*

*“This process allowed me to conduct research outside of my area of knowledge. Originally I assumed interdisciplinary work involved groups contributing only in their area of expertise. My experience was very collaborative in that I worked with Information Services Technology to help develop code, even though they had much more expertise in the area. I am extremely pleased to have learned the value of interdisciplinary research through my URI research project.” (Year >4, Kinesiology, Sport and Recreation)*

Students identified interdisciplinarity as both necessary and appreciated, which expanded their understanding overall. Interdisciplinarity was essential in the sense that the research being conducted inherently required an interdisciplinary approach. Students appreciated the opportunity to learn from various schools of thought.

*“Interdisciplinarity played a huge role in my project. I spoke with many professors and students, particularly in the Agricultural/BioSci departments, that I would normally never have interacted with in my regular degree. I learned how valuable it is to converse with members of varying schools of knowledge to maximize the outcome of a project. I knew nothing about plants, farming, and sustainable agriculture, but through this project and speaking to others, I’ve learned so much!” (Year >4, Mechanical Biomedical Engineering)*

*“One thing that I learned about interdisciplinarity, is that Indigenous research is inherently interdisciplinary because it does not work within the constraints of contemporary institutional disciplines.” (Year 3, Education)*

Lastly, students may have already had a foundational understanding and/or experience with interdisciplinary research, and their experience resulted in no change or impact on their overall knowledge. There were very few accounts of students mentioning the difficulty of interdisciplinary research. These difficulties were generally explained as slowing the process down, difficulty in switching back and forth between different disciplines, and tension regarding integrating various schools of knowledge.

*“As a result, being interdisciplinary also means slowing down a project as often it requires setting up meetings, and as the nature of collaborations go, it is often a side project for the other group.” (Year 4, Biological Sciences)*

Much of the assessment literature on undergraduate research has focussed primarily on programs within STEM fields, or with a large majority of STEM participants. A recent systematic review of 286 articles in the undergraduate research evaluation literature found only 11 studies examining interdisciplinary programs (Heager et al, 2020). The Boyer Commission Report (1998), widely cited as a guiding document for institutional undergraduate research programs in North America, recommended removing barriers to interdisciplinary education at the undergraduate level. The report identified institutional administrative boundaries as one of the major barriers to promoting such opportunities. Similarly, the National Academy of Sciences et al (2005) noted that despite strong interest in interdisciplinary education among undergraduate students, structural barriers persist. As a co-curricular interdisciplinary program, the URI Stipend explicitly encourages interdisciplinary work, and requires students to articulate the interdisciplinary aspects of their project in the application. In doing so, the URI Stipend not only provides a pathway for students to cross disciplinary boundaries; we hope that it also helps foster greater awareness and appreciation of the value of interdisciplinary approaches to complex problems. The experiences of students outlined above generally support this direction.

## **Learning Outcomes**

Experiential learning opportunities such as undergraduate research provide hands-on opportunities for students to develop workplace-relevant skills. Career readiness is an important issue in higher education and extending into the labour market (NACE, 2021). Various efforts have been made to catalogue desired learning outcomes or competencies to ensure students are prepared for the workplace (NACE, 2021; Conference Board of Canada, n.d.; AAC&U, 2020), with broad similarity in the types of outcomes regarded as essential for future employability. Some of the leading skills desired by employers include critical thinking/problem solving, teamwork/collaboration skills, and oral & written communication skills (NACE, 2018).

URI Stipend recipients indicated skill development that aligns well with these career readiness competencies, such as critical thinking, leadership, communication, presentation, interviewing, public speaking, and social skills. They also identified more specific technical and research skills such as scientific literacy, using specific software or tools, and literature review writing.

*“I developed the ability to pay attention to details and resolve conflicts.” (Year 1, Neuroscience)*

*“By balancing work in two different research jobs I have showcased my ability to work independently and within a team, while meeting strict deadlines and remaining self-accountable.” (Year 2, Animal Health)*

Often students spoke of the opportunities to develop accessible language writing and speaking to reach a broad audience.

*"...I practiced the effective communication needed for diverse groups of people with varying educational and ethnic backgrounds to decipher their options." (Year 1, Pharmacy and Pharmaceutical Sciences)*

*"Through the development of grant applications, abstracts, and a systematic search protocol, I have both attained and proven new written communication skills for a broad range of audiences as well." (Year 2, Animal Health)*

Skills were often described as being transferable life skills. The URI Stipend gave opportunities for students to obtain and put into practice a diverse set of skills identified as beneficial for future employment and pursuits. Students felt that these skills were invaluable and would transfer to multiple facets of their lives, including the workforce, future research opportunities within their community, and obtaining acceptance into academic programs like veterinary and medical school. Given the rapidly evolving nature of the workplace, and the likelihood that most students will make several career transitions in their lifetime, developing such transferable skills and understanding how to apply them in different contexts, is a critical career management skill that students are developing through their undergraduate research.

*"I also have learned valuable interpersonal skills that will allow me to interact with other scientific professionals in the future." (Year 1, Kinesiology, Sport & Recreation)*

*"I believe all research skills that I've learned over the course of the summer will be applicable within academia as I go forward into my graduate and doctorate degrees. Beyond further education, these hands-on skills will be essential in effective interpersonal community work." (Year 3, Sociology)*

Students' participation in the URI Stipend provided knowledge and insight, most specifically into the research process. Students felt they understood how the research process is carried out, which would provide immediate and long-term benefits for their careers. This knowledge and insight was described as enriching, expansive, and powerful.

*"I got a much clearer picture of what research in the field is actually like, right from developing my own questions, to getting ethics approval and now collecting my own data." (Year 3, Biological Sciences)*

*"...over the summer through the URI project have given me a much better picture of what research involves and how I may be able to incorporate that into my professional career, whether that be right after I graduate or 20 years down the line." (Year 2, Animal Health)*

Students also identified an appreciation for independence, where they were afforded opportunities to be more creative. Independence was described as self-directed and a hands-on



experience. There were opportunities for independent thinking, which involved developing their own ideas, holding themselves accountable, and actively learning through critical engagement. Their learning was increased due to the independent nature of research and having to complete many different tasks on their own, such as poster creation, meeting deadlines, interacting with participants, organizing the project, and tracking data.

*“It also felt more significant to me in terms of learning: I did a great amount of learning on my terms and of my interest. It fit my learning style exactly since the more hands-on things have always been something I really excelled in learning through but there’s so few opportunities to get to do it in academia.” (Year 4, Sociology)*

Students also described some challenges associated with the higher degree of independence and the unpredictability of the research process. Students spoke about their ability to overcome the challenges that arose. More generally, these challenges were met with a sense of increased resiliency, where students found ways to solve problems, overcome adversities, manage and resolve conflict, and develop flexibility in the face of challenges. These skills not only support students in coping with the inherent difficulties that arise in the research process; resiliency also supports students in their overall career development by helping them adapt to setbacks, disruptions or other unexpected events that are a natural part of most people’s careers.

*“First, I have learned how to manage conflicts and resolve issues. I realized that things may not go with the way you had intended/planned, and you should rapidly figure out an alternate solution.” (Year 4, Psychology)*

*“...by overcoming multiple challenges over the course of the project I have shown drive and adaptability and increased my capability to face similar adversities in the future.” (Year 2, Animal Health)*

That students are developing employability skills through their research and also recognizing the importance of these skills to their future careers is encouraging, particularly in the context of increased pressures on institutions to ensure graduates are workplace-ready. Hands-on, applied, project-based learning such as that offered through undergraduate research, is also highly valued by employers -- in a recent survey of executives and hiring managers, 81% indicated that they would be more likely to hire a recent graduate with research experience (AAC&U, 2018). Intentional, structured integration of career education with undergraduate research is also emerging in the literature as a beneficial practice (McClure-Brenchley et al. 2020), and URI is well-positioned to build on existing strengths in this area, arising from its close administrative relationship with the Career Centre.

## Teaching-Research Nexus

At a research-intensive university, teaching and research as distinct academic activities often intersect in both challenging and productive ways, a phenomenon described as the “teaching-research nexus” (Sub-committee of the Committee on the Learning Environment, 2009). While the term is frequently used (and debated) in the context of curricular integration of research and influences of research on teaching (Tight, 2016), URI Stipend recipients also described various connections between their classroom and research experiences. Students often identified intersections of research and classroom learning that were complementary. For instance, students spoke to classroom learning and material being beneficial to their experience with research.

*“I was surprised by the base of knowledge that I already had from my university courses. Psychology sometimes has the reputation of being a field where “real” knowledge is only imparted come one’s Master’s or PhD. However, my courses gave me many of the rudiments necessary to delve deeper into subjects such as psychopharmacology or pediatric psychopathology. This was exciting to discover, as it told me that I chose a degree that not only fascinates and inspires me, but also will serve me in my future career opportunities.” (Year 2, Psychology)*

*“As a kinesiology student, this project was very different to my classroom learning. I often learn about the physiological results of research, and not often about the societal impact of this research. I applied research skills I had developed from my classroom experiences to gain insight on knowledge translation and dissemination, and how social media impacts them.” (Year >4, Kinesiology, Sport and Recreation)*

They also voiced that their research experience was then helpful for their future classroom learning and academic development.

*“The work I have done over the summer has been different in respect to its depth and complexity when compared to past class research, but overall they have intersected beautifully to contribute to my overall aptitude as both a student and researcher.” (Year 2, Animal Health)*

*“I was taking a cell biology class in which we were learning how to study proteins. I better understood the lecture material since I had already done many of the procedures in the lab. In turn, this allowed me to better understand why certain solutions are added and things are done in the lab. Both the lecture and my research experiments complemented each other well, and I felt lucky to physically carry out the processes learned in class.” (Year 2, Biological Sciences)*

Most students articulated their enjoyment of research over classroom learning. Students appreciated research for providing them autonomy and allowance for creativity. Some students very clearly critiqued classroom learning for being dry, far too theoretical with a lack of application, and traditional.

*“Learning in a classroom generally does not effectively prepare me for research to the extent I would like, because the context under which skills are learned is generally either not applicable, too narrow in scope, or purely theoretical and lacking tangible connections.” (Year 4, Renewable Resources)*

*“Being able to apply knowledge and critical thinking to real life problems is an incredibly valuable aspect that is missing in a lot of engineering classes, particularly the high level ones.” (Year >4, Mechanical Biomedical Engineering)*

High-impact practices, such as undergraduate research provide opportunities for students to understand the relevance of their coursework to real-world applications (Kuh & O’Donnell, 2013). The reflections of URI Stipend recipients are consistent with numerous studies (reviewed by Laursen et al, 2010) documenting a wide range of student gains from undergraduate research, including increased appreciation of coursework, increased capacity for working independently, increased interest in the discipline, and understanding the research process through hands-on experience. Direct academic gains, including increased GPA, increased graduation rates, and increased interest in pursuit of graduate studies, have also been reported in the literature (Jones et al, 2010; Kinkle and Henke, 2006). Although the URI Stipend does not collect or track students’ GPA over time, it would be an interesting follow-up to explore whether the perceived academic benefits of students’ undergraduate research experience translated similarly into direct gains in subsequent academic performance.

### **Better Understanding of Self**

Many students gave firsthand narratives regarding an increase in their understanding or perceptions of themselves as learners. Students described increased confidence in their potential capabilities, including gaining new skill sets to navigate new terrain, and overcoming challenges such as approaching professors. The URI Stipend experience also gave students insight into what they can improve on.

*“After mustering up the courage to send an email and getting the chance to interact with academia personnel—whether that be researchers, professors, or masters/PhD students, I overcame my irrational fear.” (Year 2, Psychology)*

*“It has really shown me what I am capable of as a student and what I lack and can improve upon as I continue on with my undergraduate degree.” (Year 1, Philosophy)*

The students also described passion and motivation that was fostered by the research experience. This was described as pursuing their goals further in combination with their new skill sets and increased competencies. Some students spoke to this passion as a sense of purpose and impact from their research, such as contributing to social issues like a sustainable future, value for Canadian society, and achieving childhood passions.

*“Many people view university and other institutions as disconnected from community, but in my experience this summer, I was able to experience firsthand the ways in which the knowledge we acquire at university can go a long way to build stronger communities.” (Year 3, Education)*

The URI Stipend experience also provided students insights into their dislikes about research, which is just as crucial for understanding themselves as learners. Most spoken about was the time-consuming nature of research that contributed to stress, the unpredictability of results, overwhelming feelings of forced independence and isolation, and lengthy administration tasks.

*“I did not like that there were a couple weeks where I was very stressed about finishing on time. I did not like being overwhelmed by some aspects of the research: for example being left to make appointments and interview [participants] all by myself. I did not like the lengthy ethics application process however it made me appreciate dedicated individuals who do paperwork.” (Year 3, Art and Design)*

*“I excitedly did the experiments, but it was very disappointing when the results did not turn out as expected. It was more like an educational heartbreak.” (Year 2, Biological Sciences)*

Similar positive and negative reflections on undergraduate research were reported by Nadelson et al. (2015). In their study of students in a 10-week chemistry research program, participants expressed increased confidence, a sense of belonging in the research community, satisfaction and enjoyment of their research, but also expressed feelings of frustration, apprehension and overwhelm. Nadelson et al. (2015) also noted a shift in students’ goal orientation from performance focused to mastery focused, which is consistent with an evolving perception of themselves as learners and researchers.

## **Impacts on Future Plans**

Students’ involvement in the URI Stipend provided important insight into future plans. Students described the experience as an exploration into future interests through learning outside of the classroom, and exposure to different future possibilities in their careers and academic pursuits.

*“I think that the URI Stipend is extremely valuable to students as not just a way to gain research experience in a field of interest but also to take yourself out of the role of a “student.” This was important to me because it helped me put into perspective why I was spending the time and money to educate myself...”(Year 1, Philosophy)*

Some of these pursuits were described as potentially shifting, whether students had an opportunity to discover something new, or additional options and interests surfaced. Some students' initial plans changed as a result of taking part in the URI Stipend. Specifically, students showed newfound interests such as pursuing graduate studies or research-based careers.

*“My experience in research did change my mind, as I was originally hoping to work primarily internationally with communities. However, since learning about some aspects of indigenous research ethics, I have decided to work primarily with Canadian communities, though I may still work in connection to indigenous communities across borders.”(Year 3, Sociology)*

*“I was always interested in pursuing a career in medicine, however, because of this experience I am considering applying to a masters program to continue doing research.” (Year 2, Biological Sciences)*

*“This opportunity gave me hands-on experience with research and not only introduced me to the academia setting, but also highlighted a potential career path that I never anticipated I would want to pursue.” (Year 2, Psychology)*

Other times students' experience reinforced or confirmed the plans they initially had before the URI Stipend experience. This was described as the desire to continue pursuing graduate studies or continuing the career path they had always planned, such as work with children. Students also sought opportunities alongside their initial plans, and the URI Stipend resulted in students obtaining further opportunities.

*“I am now employed [as] an Aboriginal Student Peer Educator in a mentorship position, which was partially enabled by my new understandings in my research in Metis identity” (Year 3, Sociology)*

On a few occasions when students were asked about future directions or plans, they expressed feelings of uncertainty. This experience also resulted in students questioning their current career path. For example, exposure to a different field of research resulted in a student questioning whether they should pursue a career in another area or program. However, students still placed a high value on the skills obtained through the URI Stipend. Ultimately the URI Stipend experience provided valuable insight for the students into their future decisions about their career or academic pursuits.

*“I’m not sure exactly what my next steps are, but whether I go to grad school or pursue some other career in a history-related field, these skills are invaluable.” (Year >4, Sociology)*

*“This experience made me question my current career path in psychology and was part of the reason as to why I applied to a different program—engineering. Whether I really change programs, that’s a different story, but it opened my eyes to considering academia and research as a potential career path.” (Year 2, Psychology)*

Undergraduate research programs are often rationalized and framed around encouraging students to attend graduate school and/or pursue research-based careers, and unsurprisingly, many studies have shown these to be important outcomes of undergraduate research (Laursen et al, 2010; Lopatto, 2004; Carpi et al, 2007; Hathaway et al 2002). However, the selection

criteria for many undergraduate research programs may be designed to attract students who are already inclined to pursue postgraduate or professional education. Lopatto (2004) found that undergraduate research was most often confirmatory for students' pre-existing educational goals. A 2012 evaluation of the NSERC USRA program found similar confirmation of pre-existing interests among academically competitive awardees (NSERC, 2012).

From a career development standpoint, this focus on advanced study as a desired outcome potentially overlooks the broader benefits of experiential learning on students' career trajectories. While some URI Stipend recipients spoke to confirmation or clarification of existing interests or goals, many described their undergraduate research experience as opening up new possibilities, and saw value in their research experience regardless of their career intentions or immediate next steps. This development of divergent thinking about career options is a vital career management skill, and illustrates growth in students' sense of agency over their careers. This highlights the importance of making undergraduate research experiences accessible to a diverse range of students, who may or may not yet have a pre-existing interest in research careers or a recognized aptitude for research.

## **Conclusion & Future Directions**

This evaluation based on qualitative analysis of URI Stipend end-of-term reports provides a better understanding of URI Stipend recipients' personal research experiences with this program. Specifically, the URI Stipend's inherent focus on promoting interdisciplinary research fostered students' learning, perspective, and appreciation for this type of research approach. Other self-reported gains are largely consistent with other well-established outcomes of high-quality undergraduate research experiences in terms of fostering students' academic and professional development.

Because students complete their URI Stipend final report immediately following the project/award end date, this evaluation is limited to assessing short-term outcomes of participation in the URI Stipend program. The written report format also did not allow for follow-up interviewing or probing that might normally occur with interviews or focus groups. A future aim of the ongoing URI Stipend evaluation is to assess longer-term (including post-graduation) outcomes. Another limitation of the current project is that it focuses only on the experiences of students who received the URI Stipend. Beyond highlighting challenges they encountered with their research, students provided little in the way of constructive criticism of the URI Stipend program. A broader evaluation of students who did not apply, or who applied and were not successful, might highlight additional areas for potential program improvement.

There are several other aspects of the URI Stipend program that are worth assessing in more detail, but were beyond the scope of this report due to limited data availability. For example, the URI Stipend does not consider GPA as a criterion for receiving funding, and students spoke to the value of this for making undergraduate research opportunities accessible.

*“The URI stipend made my research possible. The URI is particularly important to student research because it does not reward students based on GPA, but instead on the strength of the proposal and merit of the research. Without this, it would be impossible for many students to get research experience, particularly because the other major source of student funding (NSERC USRAs) has very specific GPA requirements that can exclude many talented students from research opportunities. The generosity of donors to the URI program fosters budding young researchers from all walks of life with many different skill sets, interests, ambitions, and future goals.” (Year 4, Renewable Resources)*

While some students indicated that this criterion was crucial for them to be able to access funding for their research, we currently do not have systematic data on the pre-award GPA range for URI Stipend recipients to compare with competitive ranges for other programs. Given student comments about this criterion, as well as other research indicating academic performance gains from undergraduate research, particularly for students with lower starting GPAs (Haave & Audet, 2013; Kinkel & Henke, 2006), it would also be interesting to analyze URI Stipend recipients' GPA over time.

This evaluation also included self-identified Indigenous and international students' personal accounts; however, we currently have limited demographic data to explore these diverse perspectives in more depth. While the URI Stipend's open eligibility criteria is intended to reduce barriers to access for students of all backgrounds, advancing institutional equity, diversity and inclusion (EDI) requires more insight into the demographics of who is applying, who is successful, and what recipients are experiencing through their participation in the program. It is encouraging that the success rate for the URI Stipend did not differ between international and domestic students (Figure 4); however, international students only make up about 10% of total URI Stipend applicants, despite comprising approximately 20% of the total full-time undergraduate population at the University of Alberta.

*“...in Indigenous research methodologies it would be important to explain the ways in which this history is impacting our lives in the modern day. This link to the contemporary would also transcend disciplines; it could be connected to a variety of research in Indigenous health, politics, linguistics as well as many other disciplines. This project was not constrained by traditional institutional disciplinary constraints.” (Year 3, Education)*

It is imperative to center the narratives of students whose lived experiences within university settings and research are generally invisible or hyper-visible. Follow-up interview questions that focus on EDI should be created from a critical lens, where diversity in world views and social positioning of students is considered and celebrated, while also acknowledging the very real difference in barriers that students may face based on the intersections of gender, race, class, Indigeneity, and nationality. Students' lived experiences with parts of their identity such as Indigeneity are also not generalizable from a small sample size. Follow-up interviews may provide further insight into improving inclusive approaches and breaking down systemic barriers for students from different social locations.

There has been extensive research, primarily in the American post-secondary context, on the impact of undergraduate research on underrepresented and equity-seeking populations. While program structures vary considerably across institutions, minimizing barriers to participation, facilitating high-quality mentoring relationships, and providing multi-domain support for students (e.g. financial, social/emotional, academic, career), are critical components of successful programs (Carpi et al, 2017; Hathaway et al, 2002). In addition to providing financial support for students through the URI Stipend, the URI also offers a suite of supportive programming, accessible to all undergraduates at the University of Alberta, including individual advising, skill development workshops, and dissemination opportunities. As a unit within the Dean of Students' Portfolio, the URI is also well-connected with other student services providing academic, career, and wellness support.

*"I am blessed to have the financial support from the URI to lead a research initiative which made a significant impact on my undergraduate career." (Year 1, Pharmacy and Pharmaceutical Science)*

*"Many times, and especially in many other universities in the world, undergraduates do not get such a chance to carry out such research experience, and as a result, UofA is an exceptional university in that regard and it is all thanks to the funding opportunities that exist." (Year 4, Biological Sciences)*

The URI is administratively housed within the University of Alberta Career Centre. From a student-facing perspective, URI operates as a distinct unit; however, career development and education is an undercurrent throughout URI's programming. This structure is advantageous for students to explore careers through research, and URI Stipend recipients expressed gains in the skills, knowledge and attitudes considered vital for career readiness.

*"...it allows undergraduate students to gain the skills necessary to advance their careers (regardless of whether they continue as researchers or not), it provides students with clarity on their career goals in a safe environment and it allows students to do all this without worrying too much about financial strain." (Year 3, Biological Sciences)*

One recommendation, currently being initiated, is to conduct follow-up interviews with URI Stipend recipients to assess how their URI Stipend experience impacted their longer-term career choices. For example, it would be worthwhile to investigate whether the career intentions expressed by students immediately following their URI Stipend experience were sustained post-graduation, and whether students' perspectives on their URI Stipend experience in relation to their career development evolve as they transition into the workplace.

The assessment literature on undergraduate research largely focuses on programs targeting students in STEM fields (Heager et al, 2020). Efforts have been made to expand access to undergraduate research opportunities to students in a wide range of disciplines, but less has been reported about the unique experiences of students in non-STEM areas. Craney et al (2011) explored students' perceptions of undergraduate research across disciplines, and found



variations in how students accessed or initiated research opportunities, differences in students' research environment, students' goals for research, and the perceived impact of research experiences on their careers. Students from STEM fields were more likely to approach a professor or be asked by a professor to join an ongoing project, while social sciences and humanities students were more likely to design their own project based on their interests or based on the suggestion of a professor (Craney et al, 2011). STEM students were also more likely to be working in an environment with other students, while social sciences and humanities students more often worked alone.

This is consistent with some of the comments from URI Stipend recipients, highlighting challenges that may be contextual to the particular disciplinary culture or environment students are working in.

*“One thing I did not like about the research process was the academic sense of isolation in knowledge in the subject area. It might be good for the URI to help make connections between URI scholars and other scholars or knowledge holders in their area through networking.” (Year 4, Sociology)*

Effectively supporting students in different disciplinary or interdisciplinary contexts requires a nuanced understanding of these different perceptions and challenges facing students (and faculty) across disciplines. There is no “one size fits all” approach. Much of URI’s individual advising focuses on helping students navigate specific disciplinary landscapes with respect to finding and accessing opportunities and applying for funding; however it may be valuable, particularly for social sciences and humanities students or students working alone on projects, to provide specific support to help combat social isolation. In response to the 2020 COVID-19 pandemic, in which undergraduate students rapidly migrated to remote summer projects, the URI supplemented its existing mixers and skill development workshops with informal virtual social activities. Although these generally had lower attendance than educational workshops, they were well-received by the students who chose to participate, and students expressed their appreciation for this additional informal support.

Considering the relative dearth of research on undergraduate research in non-STEM and interdisciplinary areas, it would also be valuable to explore the experiences of these students in more depth, to better understand student perceptions, attitudes, and needs for specific types of supports. This would not only better support students already engaged in research in these areas; it may also help encourage broader participation by addressing specific barriers and STEM-oriented stereotypes toward research.

*“I have truly enjoyed broadening my ideas and thoughts regarding [research topic redacted] and hope that my research might pique another philosophy student's interest in applying for the URI stipend next year.” (Year 1, Philosophy)*

Overall, this evaluation provides evidence in support of the benefits of the URI Stipend program, and identifies areas for more in-depth future assessment and program improvement.

Specifically, this assessment of short-term outcomes should be followed-up with an investigation of longer-term student outcomes, a more detailed examination of the academic and demographic characteristics of URI Stipend applicants and recipients, and further exploration of specific disciplinary and interdisciplinary barriers for students. It would also be worthwhile to assess faculty perceptions of the URI Stipend, particularly as faculty often have experience mentoring students supported by multiple funding programs, and may be able to provide insight into some of the relative strengths and weaknesses of the URI Stipend in relation to other programs.

The URI and URI Stipend program in particular continue to align well with important institutional strategic initiatives. Maintaining support for and broadening participation in interdisciplinary research through the URI Stipend aligns with the goals of the University of Alberta's current academic and administrative restructuring initiative, University of Alberta for Tomorrow (UAT). Enhancing the student experience through streamlined, centralized support services, and strengthening opportunities for interdisciplinary education and research are both stated goals of the UAT initiative (University of Alberta, 2021) that can be supported through the URI. UAT also has a goal to advance institutional EDI and expand enrolment across diverse student demographics, which underscores the need for broadly accessible, high-impact opportunities available to students from all backgrounds.

Broad access to undergraduate research, particularly when integrated with career services as URI is, will also support institutional and provincial goals to enhance students' career readiness through experiential learning. The recent Alberta 2030: Building Skills for Jobs initiative announced by the Government of Alberta presents an unprecedented opportunity to provide hands-on, high-impact experiential learning opportunities for all students, and as Alberta's leading research-intensive university, the University of Alberta is uniquely positioned to make undergraduate research an essential part of this effort.

*"The URI experience has contributed immensely to both my success and enjoyment as an undergraduate at the University of Alberta, and has provided me with a summer experience I will always remember." (Year 1, Kinesiology, Sport & Recreation)*

*"It was a research opportunity that I am grateful for. Through the several months, I learned tremendously about the research world and also made me all the more passionate about research." (Year 4, Psychology)*

*"I believe that doing this project will allow me to help to build capacity in my community, and hopefully to mentor other youth in my community or even other Indigenous Undergraduate students interested in research. Overall, I would just let them [URI donors] know how thankful I am to have had the opportunity to gain this amazing experience." (Year 3, Education)*

*"This research has meant the world to me: I have been able to pursue this amazing opportunity that has given me a solid direction in my studies and wonderful experience..." (Year 4, Sociology)*

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