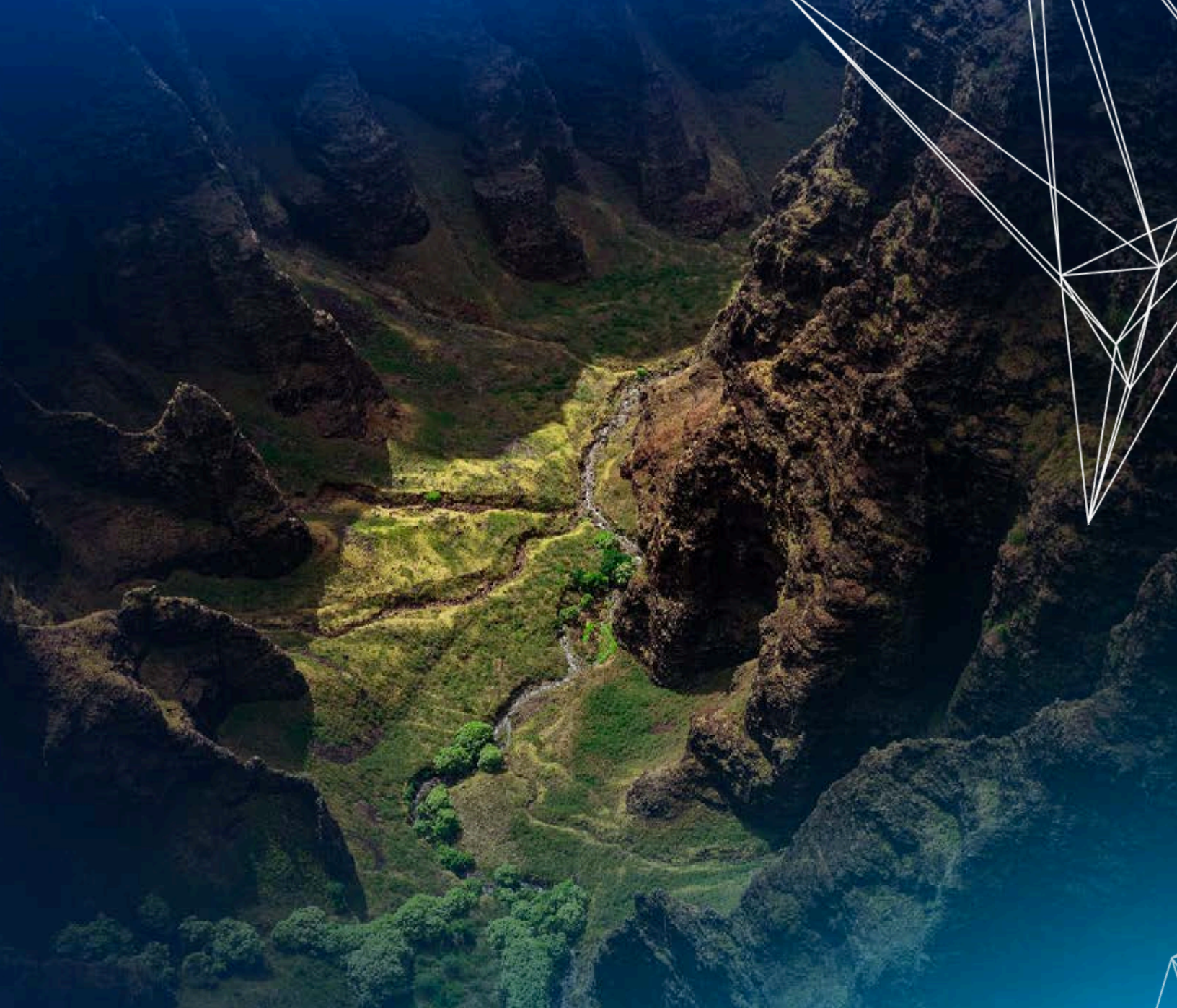

UBC Applied Science Research and Partnerships

2023-24 Annual Report

THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Applied Science

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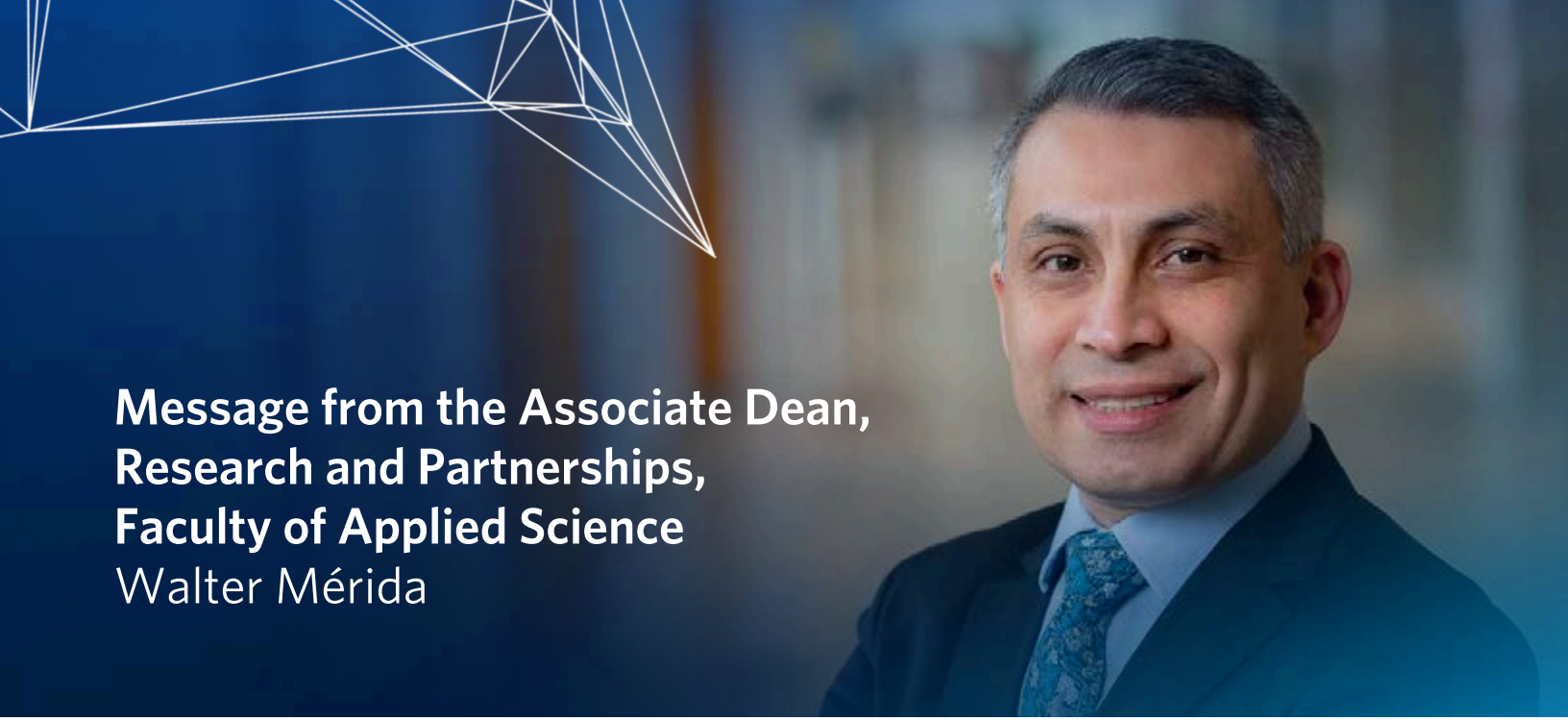


Message from the Associate Dean, Research and Partnerships, Faculty of Applied Science

Walter Mérida

“The world finds itself at the intersection of several global challenges. The breakthrough research conducted by APSC across both campuses is accelerating scalable solutions for a just transition to a net-zero future.”

Canada continues to emerge as a **leader in global solutions**, with competitive advantages that include a robust financial system, channels to global investment, abundant natural resources and low-carbon electricity, and world-leading innovation ecosystems. Our nation hosts more than 10 per cent of the top 100 clean technology companies, including leaders in hydrogen technologies, water purification, zero-emission vehicles, nuclear fusion and quantum computing—many of them centred around Vancouver. Further, one of the world’s top 25 startup ecosystems (the Cascadia Innovation Corridor) links British Columbia to Washington, Oregon and California.

This corridor has a large, diverse population and a sizable economy, the three largest ports on the continental West Coast, and leading higher education institutions including the University of British Columbia, which is consistently ranked as one of the world’s top 40 public universities.

UBC’s current strategic plan Shaping UBC’s Next Century emphasizes research and innovation to address global challenges through interdisciplinary collaboration, industry partnerships and cutting-edge facilities. It prioritizes sustainability, technological advancements and societal impact. Strongly aligned with these priorities, UBC’s Faculty of Applied Science (APSC) stands at the **forefront of innovation**, with nearly 300 patents issued in the past five years, exemplifying our commitment to accelerate the implementation of real-world, economically sustainable and socially beneficial solutions. Leveraging world-class **infrastructure investments** and using our campus as a living lab, we have fostered an environment that attracts industry investment into co-developing tangible proofs of concept, critical for commercialization and economic development. We are also increasingly engaging with governments, community and non-profit groups, and Indigenous Nations and communities to co-develop solutions that **respect traditional knowledge and promote environmental sustainability.**

Our Faculty is often described as a "constellation of disciplines" given that it includes six engineering departments (Electrical & Computer, Chemical & Biological, Materials, Civil, Mechanical and Mining) and five schools (Architecture and Landscape Architecture, Biomedical Engineering, Community and Regional Planning, Nursing, and the School of Engineering at our Okanagan campus). This **diversity of expertise** allows our researchers to work in concert to address the pressing challenges of our time via collaborative, multidisciplinary initiatives. With nearly 500 world-class faculty members, cutting-edge facilities funded by significant government investments and strong industry and community partnerships, APSC tackles pressing societal challenges, from sustainable infrastructure and clean energy to biomedical advancements and artificial intelligence. The Faculty's interdisciplinary approach fosters groundbreaking discoveries that shape industries, support communities and improve lives worldwide. Bolstered by increasing grant funding, a robust support environment via the Dean's office Research & Partnerships team, and collaborations across academia, industry and society, APSC is uniquely poised to help **transform tomorrow**.

In this year's annual report, we are proud to illustrate the curiosity- and mission-driven research initiatives in the Faculty of Applied Science that are advancing the innovative solutions our world needs. Highlights include **doubling our research funding since 2017** (reaching $108 million in 2023), securing the highest proportion of industry funding of any Faculty at UBC (15 per cent of the total in 2023), deriving **half of our research publications from international collaborations** and engaging in increasingly high-value, mutually collaborative partnerships with diverse stakeholders and rightsholders.

Dr. Walter Mérida, FCAE, PEng
Associate Dean, Research and Partnerships
Professor, Department of Mechanical Engineering
UBC Faculty of Applied Science

APSC STRATEGIC OBJECTIVES

From the APSC Strategic Plan

"Transforming Tomorrow"

RESEARCH, INNOVATION AND PARTNERSHIPS ARE CENTRAL TO MANY OF OUR 17 STRATEGIES

7 **INNOVATIVE SPIRIT**
Create time and space for innovation.

11 **ENTREPRENEURIAL THINKING**
Nurture the entrepreneurial mindset and venture creation to support innovative and transformational solutions.

12 **IMPACTFUL RESEARCH**
Advance disciplinary knowledge and the translation of research and innovation for societal impact.

13 **COMPLEX CHALLENGES**
Tackle complex local and global challenges with an interdisciplinary and systems-based approach.

14 **STRATEGIC PARTNERSHIPS**
Collaborate with purpose in strategic, long-term partnerships.

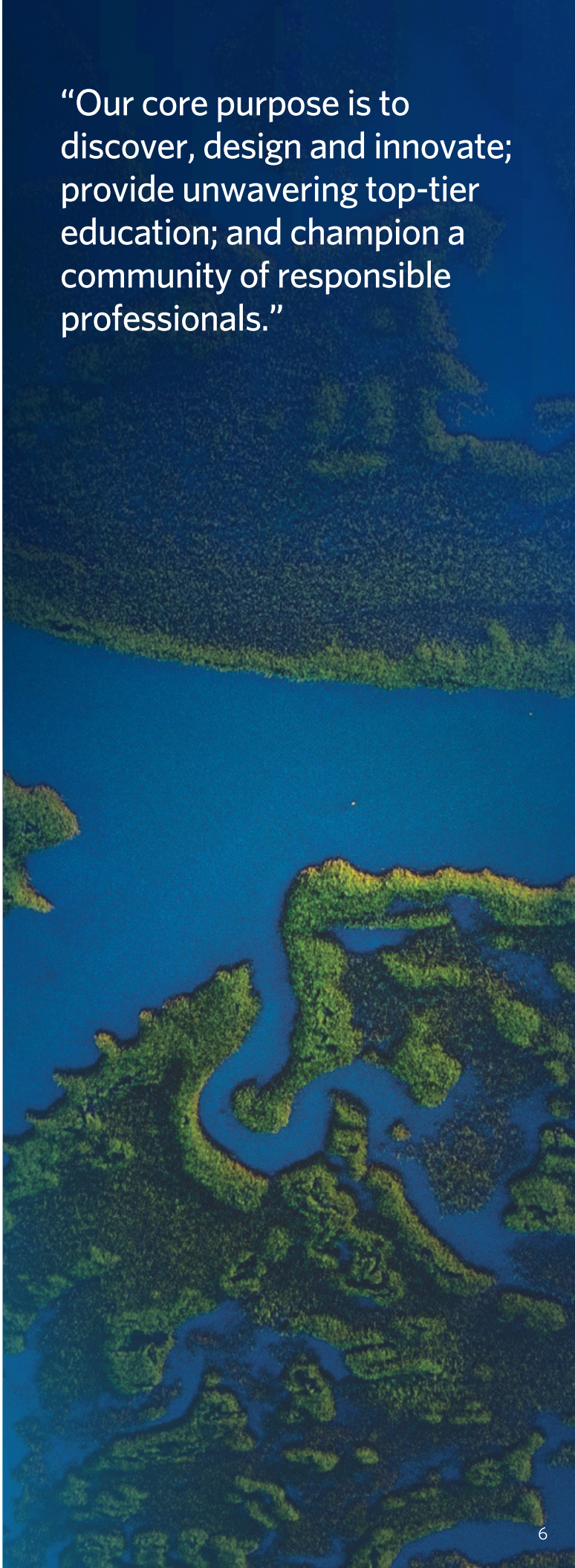
TRANSFORMING THE WORLD:

Solutions for People
Developing the health, technology and equity solutions that serve our communities and the individuals within them.

Thriving Cities and Communities
Improving how we move, work and connect to create healthier, safer and more productive communities.

Planetary Health
Spearheading efforts to accelerate global environmental action.

"Our core purpose is to discover, design and innovate; provide unwavering top-tier education; and champion a community of responsible professionals."



OUR PEOPLE

5 SCHOOLS

- School of Architecture and Landscape Architecture (SALA)
- School of Community and Regional Planning (SCARP)
- School of Biomedical Engineering
- School of Engineering (Okanagan)
- School of Nursing

6 ENGINEERING DEPARTMENTS

- Chemical and Biological Engineering
- Civil Engineering
- Electrical and Computer Engineering
- Materials Engineering
- Mechanical Engineering
- Mining Engineering

ACROSS BOTH CAMPUSES

2,682 Graduate students
10,422 Total students
279 Researchers
471 Faculty
574 Staff

OUR IMPACT

~9,500 PUBLICATIONS (2019-2024)

>175,000 citations
>590 patents filed

TOP 1%

of papers and citations in topic areas spanning engineering, computer science, energy and the environment and health care

1,004 INSTANCES OF MEDIA COVERAGE

across newspapers, radio, TV and online (June 2023 – May 2024)

1,567 PUBLICATIONS (2023/24)

~11,000 citations
117 patents filed
25 patents issued

OVER 5,000 PUBLICATIONS (2019-2024)

(>50% of total) resulting from **international collaboration** and over 1,700 (18% of total) resulting from **national collaboration**

OUR FUNDING

$108M

in funding in 2023/24, including $35 million from the Tri-Council

15% of UBC's total industry funding

27% of UBC's total NSERC funding

31 CANADA RESEARCH CHAIRS

7 newly allocated (net new) in 2024
4 NSERC Industrial Research Chairs and one Canada Excellence Research Chair
1 (of UBC's 24) Clarivate Highly Cited Researchers

RANKINGS IN 2024

QS World University Rankings

UBC overall: 34th in the world

Engineering: 25th in the world, 2nd in Canada (33rd in 2023)
Nursing: 13th in the world, 3rd in Canada (25th in 2023)

Architecture and the Built Environment: 43rd in the world, 2nd in Canada
Civil and Structural Engineering: 30th in the world, 2nd in Canada
Mineral and Mining Engineering: 11th in the world, 3rd in Canada (tie)

TrustML research cluster

Our Strategies: Impactful Research and Complex Challenges

By drawing on our expertise across diverse fields, APSC researchers thrive in large, multidisciplinary team efforts that deliver meaningful research and address some of today's most **pressing challenges**, including the energy transition, housing affordability and resilience, and the growing influence of artificial intelligence, among others (see highlight story on page 16). The Faculty is increasingly successful at attracting funding across all sectors, as well as **diversifying our funding sources** (Figure 1). While we remain competitive with Tri-Council grants—averaging ~$32 million annually from the Natural Sciences and Engineering Research Council (NSERC), Social Sciences and Humanities Research Council (SSHRC) and the Canadian Institutes of Health Research (CIHR) over the past five years—we have recently seen notable increases in engagement with, and funding from, non-profit organizations, reaching a **five-year high of $21 million** in 2023/24, reflecting the important societal impact of, and need for, APSC research. The Faculty continues to **lead UBC in industry funding** as well, capturing 15 per cent of the university's total in 2023/24.

TOTAL FUNDING ACROSS APSC 2023/24

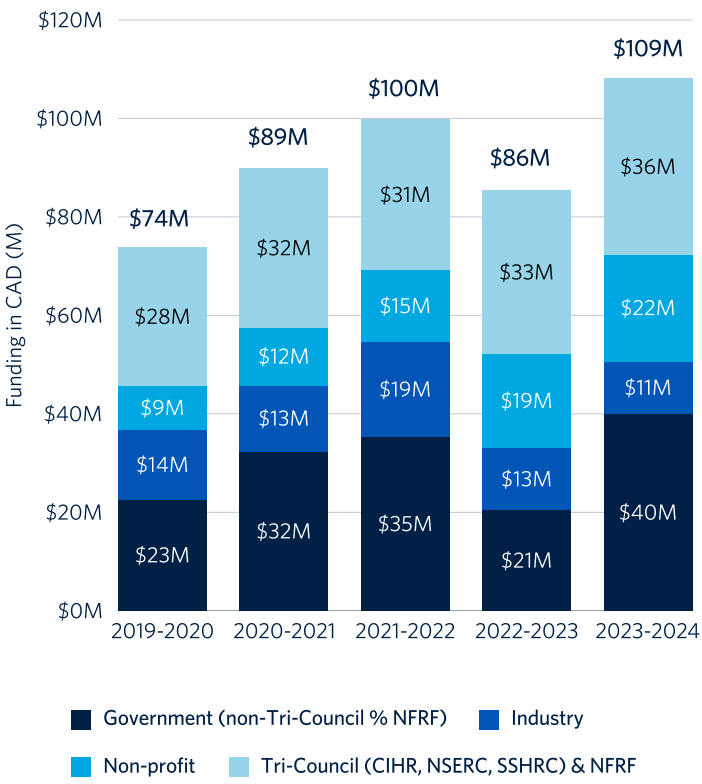


Figure 1: Overall research funding amount across APSC Vancouver & Okanagan campuses, 2019-2024.

Data is obtained from UBC's RISE system and is organized by fiscal year (e.g., 2019-2020 = April 2019 to March 2020 = Grant Year 2020).

Tri-Council = NSERC, SSHRC and CIHR. Industry = for-profit organizations. NFRF = New Frontiers in Research Fund.

COMPLEX CHALLENGES

Seeding and Supporting Research Clusters

UBC's annual Grants for Catalyzing Research Clusters (GCRC) and Eminence competitions enable the formation and growth of interdisciplinary clusters by awarding up to $200,000 per team. Capitalizing on the Faculty's diverse strengths, **APSC researchers currently lead 12 clusters across both campuses** that are addressing the complex challenges of our time.

UBC-Vancouver GCRC Clusters

RETURNING CLUSTERS

Reducing Male Suicide: Dr. John Oliffe, School of Nursing

Disaster Resilience: Dr. Carlos Molina Hutt, Civil Engineering, and Dr. Sara Shneiderman, Anthropology

TrustML: Dr. Julia Rubin, Electrical and Computer Engineering

Future Minerals Initiative: Dr. Nadja Kunz, Mining Engineering/School of Public Policy & Global Affairs

Transformative Health & Justice: Dr. Helen Brown, School of Nursing

NEW CLUSTERS

Thriving in Community: Re-Imagining Supports for Children with Medical Complexity and their Families: Dr. Jennifer Baumbusch, School of Nursing

Smart Infrastructure and Construction: Dr. Tony Yang, Civil Engineering

2023/24 RECIPIENTS (SECOND YEAR OF TERM)

Bionics Network: Dr. Karen Cheung, Electrical Engineering/Biomedical Engineering

Re-ROW: Dr. Kelly Clifton, School of Community and Regional Planning

Awardees in the 2023/24 GCRC competition include both new and returning teams spanning research across our Faculty's priority areas: **planetary health** (*Disaster Resilience*, Dr. Carlos Molina Hutt, Civil Engineering, and Dr. Sara Shneiderman, Anthropology), **solutions for people** (*Thriving in Community*, Dr. Jennifer Baumbusch, Nursing) and **thriving cities and communities** (*Smart Infrastructure and Construction,* Dr. Tony Yang, Civil Engineering).

Leveraging this seed funding, APSC clusters have achieved notable successes, including growth into a Global Research Excellence Institute (BPI: the BioProducts Institute, home of APSC's $10-million Canada Excellence Research Chair award) and the successful $24-million New Frontiers in Research Fund (NFRF) Transformation "Mend the Gap" project (the Bionics Network).

UBC-Okanagan Eminence Clusters

RETURNING CLUSTERS

Battery Innovation: Dr. Jian Liu, Mechanical Engineering

Build Better: Dr. Lisa Tobber, Civil Engineering

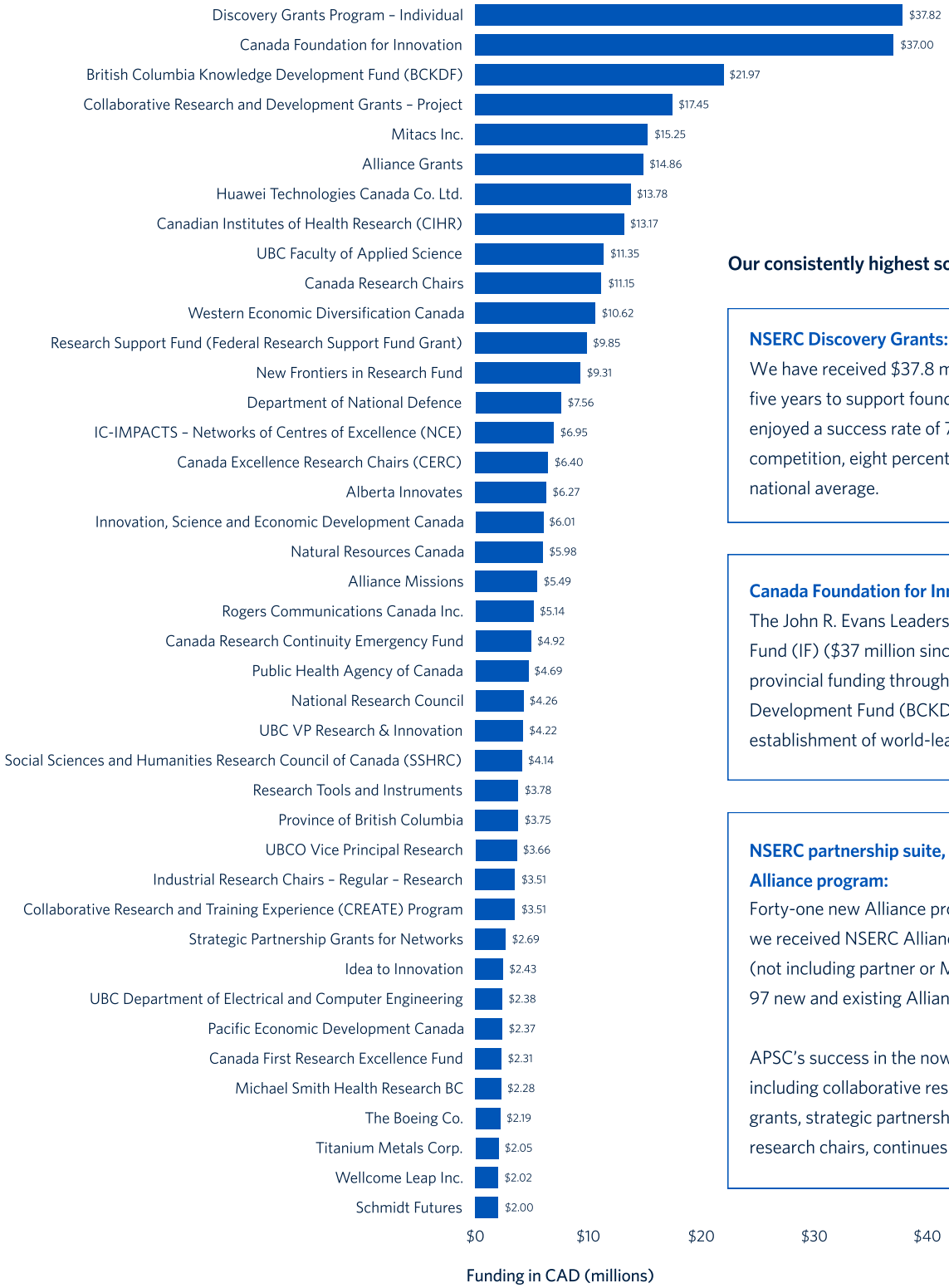
Solar Energy for Net Zero: Dr. Alexander Uhl, Electrical Engineering, and Dr. Robert Godin, Chemistry

Note that the Eminence program has been paused for 2023/24

Together with our Department & School-embedded colleagues, the APSC Research and Partnerships team has extensively supported the GCRC and Eminence competition since its inception in 2018. In addition to pre-award services—including team and partnership development, reaching out to partners and providing reviews and resources—our team, primarily Kyra Laverdiere, Senior Manager, Research Partnerships, administers the APSC Cluster Advancement Program to ensure our clusters receive the ongoing support and resources they need to expand their reach, success and impact.

Funding

APSC receives funding from diverse sources, again highlighting the Faculty's strengths in addressing **complex challenges** of interest to a range of funders and partners across society and industry. We receive over $2.0 million in funding from more than 40 programs/sponsors, in addition to funding from over 100 other sources (Figure 2).



Our consistently highest sources of funding include:

NSERC Discovery Grants:
We have received $37.8 million in funding over the past five years to support foundational research. The Faculty enjoyed a success rate of 71 per cent in the 2023/24 competition, eight percentage points higher than the national average.

Canada Foundation for Innovation (CFI):
The John R. Evans Leaders Fund (JELF) and Innovation Fund (IF) ($37 million since 2019) and matching provincial funding through the BC Knowledge Development Fund (BCKDF) have enabled the establishment of world-leading labs and facilities.

NSERC partnership suite, including the Alliance program:
Forty-one new Alliance projects started in 2023/24, and we received NSERC Alliance funding worth $7.4 million (not including partner or Mitacs matching funds) from 97 new and existing Alliance projects in this fiscal year.

APSC's success in the now-defunct partnership suite, including collaborative research and development grants, strategic partnership grants and industrial research chairs, continues to be reflected in 2023/24.

Figure 2: Funding programs/sponsors with a total funding amount >$2.0 million for APSC Vancouver and Okanagan campuses (2019-2024). There are also 100+ programs/sponsors with a total funding amount <$2.0 million (e.g., Connect, Catalyst grants) over the same time period (not shown).

HIGHLIGHT STORY

Transforming bitumen into carbon fibre

Dr. Yasmine Abdin's project was one of five selected for Phase III of the Carbon Fibre Grand Challenge, receiving $4 million in funding from Alberta Innovates and Emissions Reduction Alberta.

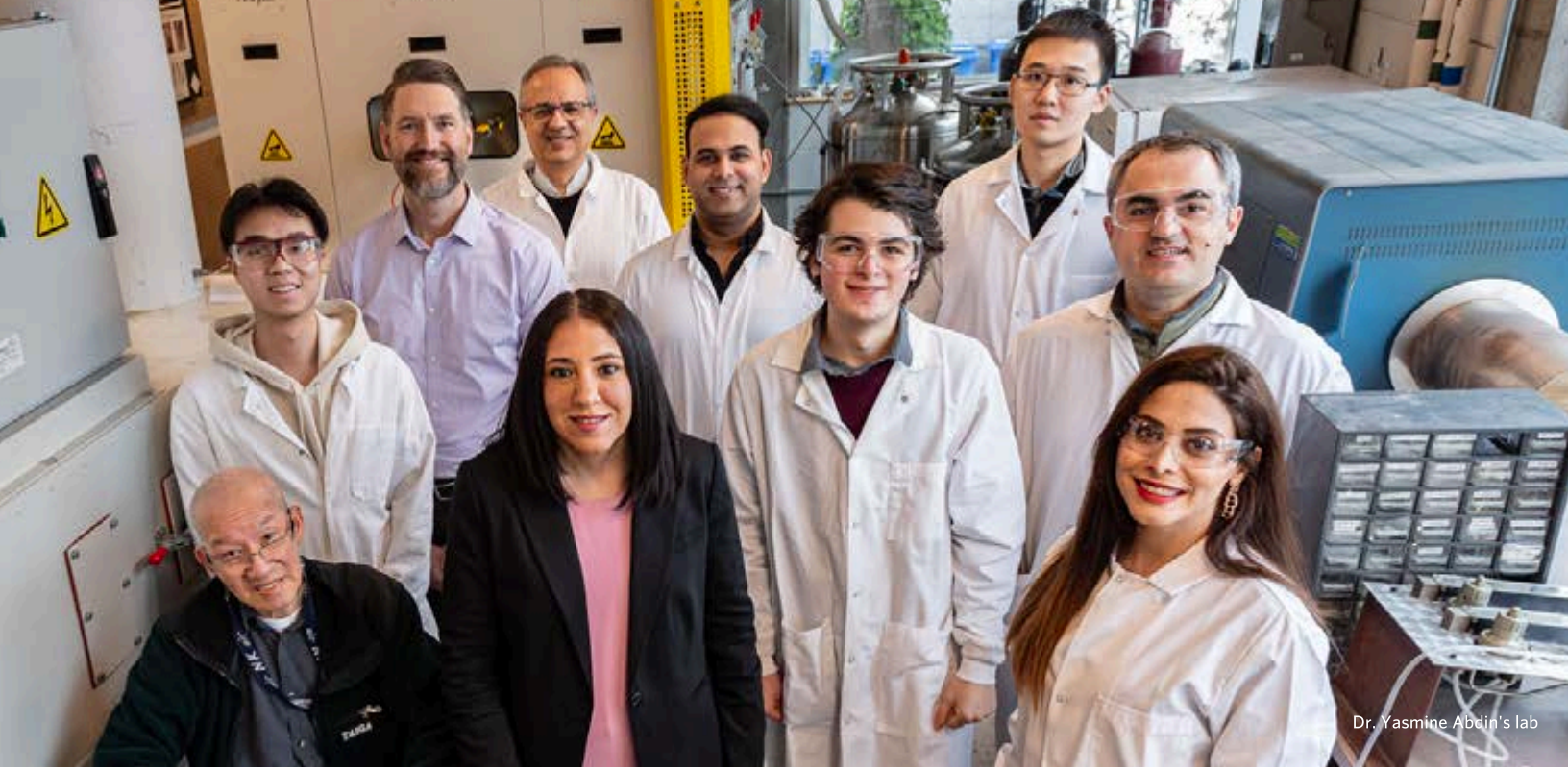
A new process developed at UBC to make lightweight electric cars is steering closer to reality. At her lab in APSC's Materials Engineering Department, Dr. Yasmine Abdin and her team have successfully transformed bitumen (a tar-like, sticky byproduct of Alberta's oil sands) into **low-cost carbon fibres—a crucial product for the energy transition**. Electric vehicles are generally 30 per cent heavier than gasoline-powered cars due to the weight of their batteries. Building car parts out of lightweight, yet very strong carbon fibres can compensate for the heavy battery pack while also enhancing the battery's ability to stay cool and extending driving range. Other beneficial effects could include less damage to roadways and enhanced passenger safety.

Most importantly, Dr. Abdin's process, based on original research published in Advances in Natural Sciences: Nanoscience and Nanotechnology, is inexpensive, producing the fibres for less than $12 per kilogram, in contrast to typical costs of $33 per kilogram, and uses a readily available feedstock, potentially leading to an increased uptake of carbon fibre by Canadian automakers.

"Currently, composite materials like carbon fibres comprise only about 15 per cent of a car's composition" says Dr. Abdin. *"Affordable carbon fibres can potentially double this figure, which could be a game changer. Our carbon fibre manufacturing breakthroughs pave the way for other innovations that can revolutionize electric car production and other manufacturing sectors, with profound implications for both economic growth and carbon emission reduction."*

The Carbon Fibre Grand Challenge aims to fund the development of technologies that can convert Alberta oil sands asphaltenes (bitumen, etc.) into carbon fibre. Open to a wide range of applicants from industry, research and development organizations and labs, academia, and not-for-profit organizations, Dr. Abdin's project was the only successful one led by a university.

Find out more about her groundbreaking work: **The Globe and Mail**



Dr. Yasmine Abdin's lab

IMPACTFUL RESEARCH

Alliance Grants

Building on the success they enjoyed in NSERC's previous suite of partnership programs, APSC researchers lead UBC in the number of Alliance grant submissions and awards. Our researchers have been successful in all streams of the Alliance program, from high-value, industry-relevant "Advantage" (formerly Option 1) consortia to community-based "Society" (formerly Option 2) projects and international special calls in strategic areas such as quantum technologies. This year, 50 new and 48 existing projects led by researchers across the UBC Vancouver and Okanagan campuses were awarded **nearly $7.4 million in NSERC Alliance funding**, in addition to partner cash contributions and other leveraging sources such as Mitacs via joint programs. A wide variety of projects were supported, including those in artificial intelligence, resilient buildings and infrastructure, and solutions to help achieve a more sustainable future.

In collaboration with colleagues across UBC, the Research and Partnerships team provides extensive partnership and grant development support for Alliance grants. Led by Dr. Atif Hussain, Research Development Associate, the team supported over 20 projects in 2023/24.

Recent highlights include:

Dr. Alexandra Fedorova, Electrical and Computer Engineering: *Transformative server architectures for next generation AI Systems.* $900,000 from NSERC (Alliance Advantage); Partner - Intel of Canada Ltd.

Dr. Maria Holuszko, Mining Engineering:
Recovery of gallium and rare earth elements from LED waste using sustainable bioprocess. $439,000 from NSERC (Alliance Missions); Partners: BC Electrical Services Ltd., Contact Environmental Inc., NeoCtech Corp.

Dr. Rachel Scholes, Civil Engineering:
Development of iron-biochar amendments for oxidation of toxic contaminants in urban stormwater runoff. $25,000 from NSERC (Alliance International – Catalyst); Collaborator: University of Washington

Dr. Tony Yang, Civil Engineering:
Performance assessment and enhancement of reinforced concrete elements with use of welded wire mesh. $635,200 from NSERC (Alliance-Mitacs); Partner: Sacks Industrial Corp.

Funding facts

Tri-Council funding within the Faculty is led by **NSERC** ($20.2 million, 30 per cent of UBC's total in 2023/24), followed by **NFRF** ($3.1 million), **CIHR** ($2.5 million) and **SSHRC** ($0.9 million). Electrical & Computer Engineering captured the largest share of NSERC funding this year, while the School of Nursing captured the largest share of both CIHR and SSHRC funding.

Over the past five years, the average funding per project has increased from $38,800 to $57,200—representing **47.5 per cent growth** and indicating that APSC faculty are applying for and succeeding at obtaining larger, higher-value grants, in alignment with UBC's strategic research priorities.

APSC captured 12.2 per cent of UBC's total funding in 2023/24, and continues to **lead all Faculties at UBC in industry funding** (14.8 per cent).

APSC FUNDING

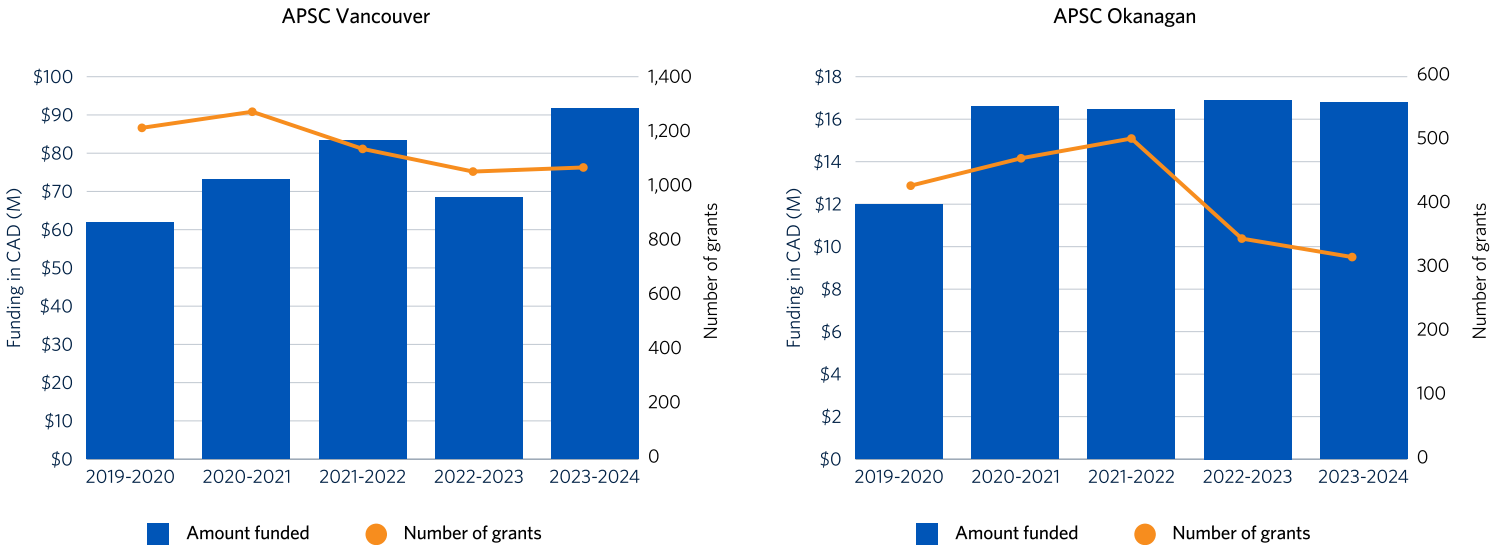


Figure 3: Total funding amount (blue bars) and number of grants (orange line) at the APSC Vancouver and APSC Okanagan campuses (2019-2024). Total funding = sum of government (non-Tri-Council and NFRF), industry, non-profit and Tri-Council (NSERC, SSHRC, CIHR).

IMPACTFUL RESEARCH

Infrastructure

The Faculty of Applied Science hosts world-class infrastructure and facilities across its centres, departments and schools, funded in part by Canada's national infrastructure program, the CFI, and its provincial counterpart, the BCKDF. Notable CFI-funded infrastructure includes the clean room at the **Stewart Blusson Quantum Matter Institute**, the **Smart Hydrogen Energy District** (SHED; see photo), the **Biorefining Research and Innovation Centre** and the facilities available at the **Advanced Structural Simulation & Experimental Testing** group at our Okanagan campus.

APSC has been successful in both individual (JELF) grants, with a greater than 90 per cent success rate since 2016 and $950,000 in awards in 2023/24, and the team-based Innovation Fund (IF). The Faculty received substantial funding from the past two cycles of the IF, with our highest-ever total of $12.1 million in CFI funding in the 2022 competition (results announced in 2023; see Figure 4). With another IF call launched in 2024, we look forward to continued success next year.

2023/24 JELF AWARDEES: $950,128

Dr. Kiana Amini, Materials Engineering
Dr. Govind Kaigala, Biomedical Engineering
Dr. Dominic Liao-McPherson, Mechanical Engineering
Dr. Alexandra Tavasoli, Mechanical Engineering
Dr. Kefei Wen, Mechanical Engineering

APSC CFI FUNDING

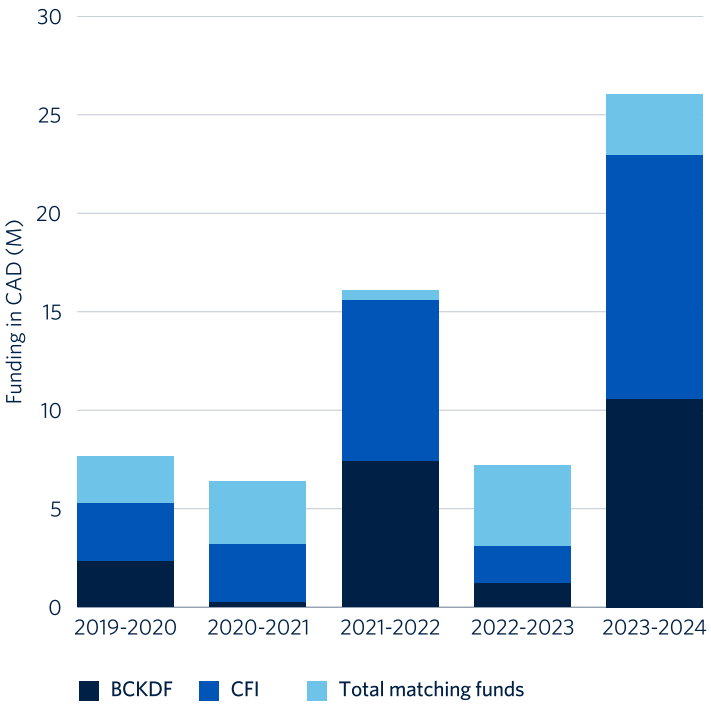


Figure 4: CFI funding across APSC Vancouver & Okanagan campuses (2019-2024). CFI = Infrastructure Operating Fund, Innovation Fund, Innovation Projects, JELF, JELF-Partnerships.

Matching funds = Government (Canadian and US), industry and UBC internal funding. Note total project is ~2.5x CFI portion.

IMPACTFUL RESEARCH

Research Chairs

The results of the 2024 federal and institutional Canada Research Chair (CRC) reallocation processes led to the awarding of **seven net-new CRCs to the Faculty, bringing the total from 24 to 31**. This outstanding result—APSC's largest-ever single-year increase—highlights our researchers' exceptional ability to capture an ever-growing share of Tri-Council funding. We are particularly pleased with the results of the UBC internal CRC competition to allocate four new Chairs, in which both of APSC's two applications (1 NSERC T2 and 1 CIHR T2) were successful. The Faculty boasts a 100 per cent success rate on CRC awards since 2016, and is proud to host Chairs across all three councils and in all of our departments and schools. **New and successfully renewed CRCs in 2023/24 are highlighted below.** These Chairs showcase the Faculty's diverse strengths across strategic priority areas, including sustainability, advanced manufacturing, health technologies and machine learning/AI.

Canada Research Chairs Awarded at APSC in 2023/24

RENEWED CHAIRS

Dr. Xiaoliang Jin, Associate Professor, Mechanical Engineering: CRC T2 in Advanced Manufacturing

Dr. Nadja Kunz, Associate Professor, Mining/School of Public Policy & Global Affairs: CRC T2 in Mine Water Management and Stewardship

Dr. Naomi Zimmerman, Associate Professor, Mechanical Engineering: CRC T2 in Real-World Air Quality Sensing

NEW CHAIRS

Dr. Xiaoxiao Li, Assistant Professor, Electrical and Computer Engineering: CRC T2 in Reliable Machine Learning

Dr. Lyndia Wu, Assistant Professor, Mechanical Engineering: CRC T2 in Wearable Brain Injury Sensing

In addition to APSC's 31 Canada Research Chairs, the Faculty is home to four NSERC Industrial Research Chairs, one Canada Excellence Research Chair, one UBC President's Excellence Chair, six Principal's Research Chairs (UBC Okanagan) and numerous named/sponsored Chairs including the recently awarded Teck Professorship in Mine Tailings Management (**Dr. Luis Torres Cruz**), the Bombardier Chair of Regional Transportation Planning (**Dr. Kelly Clifton**), the FortisBC Smart Energy Chair (**Dr. Kasun Hewage**) and the Rosenblatt Professorship in Marine Engineering (**Dr. Patrick Kirchen**).

The Research and Partnerships team, in particular Dr. Joanne Moszynski, Senior Manager of Research Development, and Carrie Lam, Research Development Associate, has actively supported CRC applicants since 2016. Our services have been widely acknowledged at APSC and other Faculties as among the best at UBC. With our largest-ever cohort of new and renewing CRC applications due in 2025, we look forward to an exciting and busy year.

HIGHLIGHT STORY

Introducing AI-powered social robots into seniors care

Kiwi and Mango, two social "love" robots (LOVOTs) from Japan, are on loan to UBC for a new study exploring interactions between social robots and older adults.

Dr. Lillian Hung, T2 Canada Research Chair in Senior Care and Associate Professor at the School of Nursing, is leading the first pilot of LOVOTs—AI-powered "cuddly" robots that can learn, speak, recognize faces and voices, move around and even offer hugs—in seniors' homes in Canada. The study will provide insights into the psychological benefits of, and possible barriers to, employing social robots in Canadian long-term care (LTC) settings, comparing experiences with LOVOT usage in other countries. While LOVOTs are not yet available for purchase in Canada, the outcomes will shape future iterations of LOVOTs, ensuring inclusivity for different populations towards potential long-term use in seniors' homes and LTC centres. According to Dr. Hung, the ultimate goal of the study is to inform future directions in elder care: *"Our research at the Innovation in Dementia & Aging (IDEA) Lab focuses on examining how technology and the environment impact dementia care. In Japan, where isolation and loneliness are a huge problem for older adults, LOVOT robots...have gained popularity as companions. I wanted to study how these robots interact with older adults and individuals with cognitive challenges in a Canadian context."*

As societies begin to integrate social robots and other AI "companions" in day-to-day life, there are mounting questions about the implications of entrusting emotional and social support to machines. *"Does this redefine our humanity? Are robots and automation the answer to our elder care crisis? With this study, we hope to contribute some answers,"* says Dr. Hung. Thus far, the team reports that in their preliminary visits to care homes, neighbourhood houses and similar places in the Vancouver region, responses to the LOVOTs have been strongly positive. *"People have been warm and receptive,"* says Dr. Hung. *"In one care home, an initially reserved resident surprised us by reaching out and engaging with Kiwi. His happiness just shone out. Social robots are interesting because they're not purely functional—they're designed to respond to people. By their very nature, they raise questions around what it means for human beings, and specifically older adults, to seek companionship from machines in daily life."*

Read more: **CTV News**

Benchmarking and Reputation

The diversity of APSC research enables us to address complex challenges while producing impactful research across many domains. While engineering-related subjects make up nearly half of our publications, **APSC researchers publish across almost all subject areas**, including medicine (12 per cent of total publications), computer science (21 per cent) and many more (See Figure 5a).

Our areas of identified strength (Figure 5b) reinforce the multidisciplinary expertise within our departments and schools, including social and natural sciences, health research and engineering.

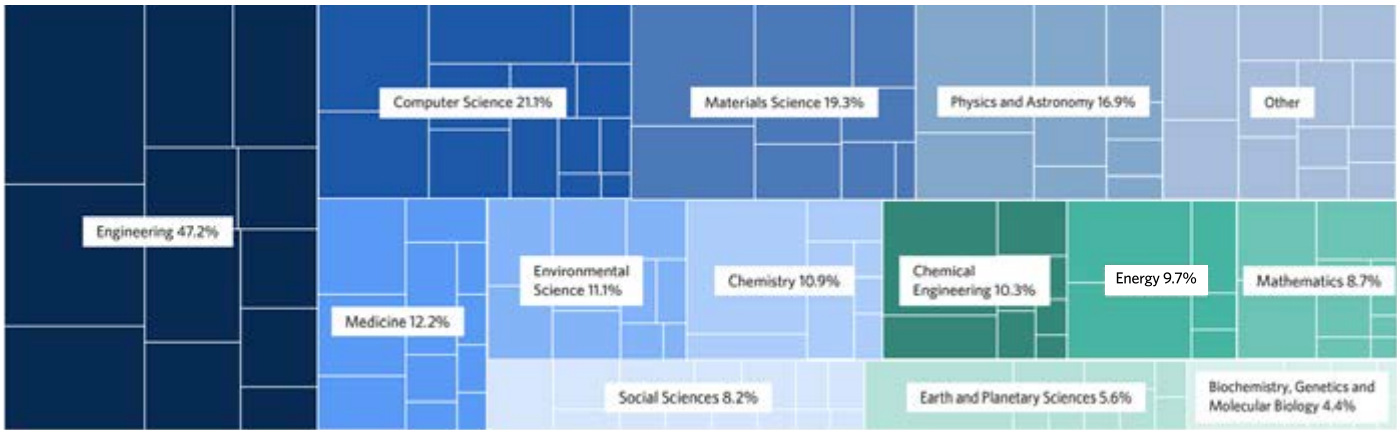


Figure 5a: Distribution of APSC publications across subject areas over the past five years (2019-2024) (Source: SciVal).

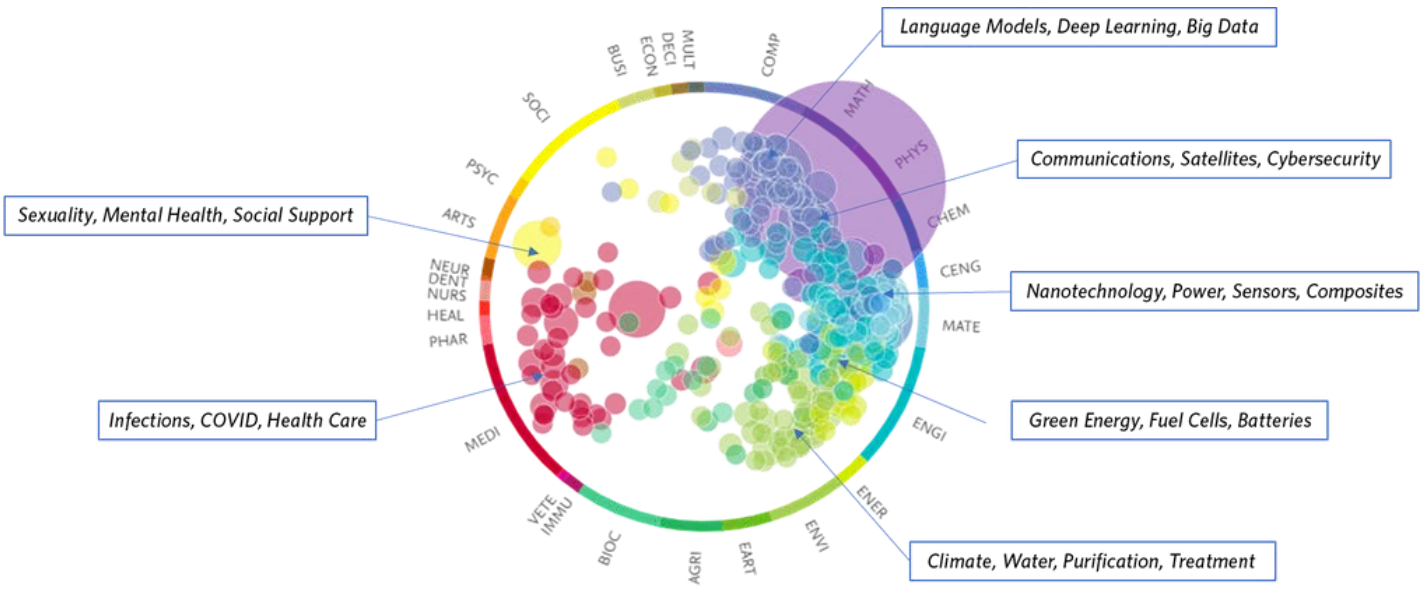


Figure 5b: The top 1% of worldwide topics APSC researchers have contributed to over the past five years (2019-2024) (Source: SciVal).

RANKINGS 2023/24

QS WORLD UNIVERSITY RANKINGS

Mineral and Mining Engineering:
11th in world, 3rd in Canada (tie)

Nursing:
13th globally (25th in 2023), 3rd in Canada

Engineering:
25th globally (33rd in 2023), 2nd in Canada

Architecture and the Built Environment:
43rd globally, 2nd in Canada

MACLEAN'S RANKINGS

Engineering & Nursing:
both tied for 2nd in Canada

APSC's individual research impact surpasses that of both UBC and the U15 (Canada's top 15 universities) in a number of metrics (Figure 6). These include views per publication (89 per cent and 55 per cent higher than the U15 and UBC average, respectively) and field-weighted views impact (51 per cent higher than the U15), indicating that the scientific community is accessing APSC publications more often than those of our counterparts. APSC research is also published in top-tier journals more often (24 per cent above the U15 average).

APSC has also maintained its strong research quality and output, maintaining an average of around 1,500 publications annually since 2019 (nearly 9,500 cumulatively), of which **19 per cent are in the top 10 per cent of the most cited publications worldwide.** APSC faculty members are also **highly collaborative**, with nearly 5,000 publications (52 per cent of the total) resulting from international collaboration and nearly 1,700 (18 per cent) resulting from national collaboration over the past five years.

In 2023/24, APSC researchers published 1,462 publications with international co-authors. Among the top collaborating institutions are the University of Melbourne, the US Department of Energy, France's Centre national de la recherche scientifique, Oxford University and Finland's Aalto University. **On average, papers published with international collaborators are cited three times more often than those without collaboration.**[1]

Views per publication	Field-weighted views impact	Output in top 10% citation percentiles	Publications in top 10% journal percentiles
55% above UBC average	**19%** above UBC average	**23%** above UBC average	**15%** above UBC average
89% above U15 average	**51%** above U15 average	**39%** above U15 average	**24%** above U15 average

Figure 6: The higher relative performance of APSC researchers compared to the UBC and U15 average in various scholarly metrics. Percentages generated with SciVal benchmarking averages over the past five years (2019-2024).

[1]The Research and Partnerships team acknowledges that traditional metrics do not capture the outputs and impacts of our entire Faculty, and are geared much more strongly towards engineering and natural science. With the implementation of DORA standards, we are seeing a shift in how research impact is quantified and presented; for example, researchers are now asked not to provide their H-indices in Tri-Council grants or cite the impact factor of journals they publish in. While this report still relies heavily on bibliometrics supplied by databases such as SciVal, we continue to explore ways in which to present a more holistic, inclusive picture of research impact within our Faculty.

COMPLEX CHALLENGES AND IMPACTFUL RESEARCH

APSC in the Media

Applied Science research received **1,004 mainstream media mentions in 2023/24** in outlets including the *Globe & Mail, Vancouver Sun, Global News* and *CBC*. This does not include the significant uptake seen in specialized media outlets, trade publications, social media, etc.

Below, we've highlighted a few top stories, spanning our departments and schools, that showcase APSC's unique constellation of disciplines (source: APSC and UBC Media, over the time period of June 2023 to May 2024).

VANCOUVER IS AWESOME

'Smart gloves' could transform therapy for stroke patients, UBC researcher says

The gloves can track hand movement for a fraction of the cost of traditional motion-capture technology...

CBC NEWS

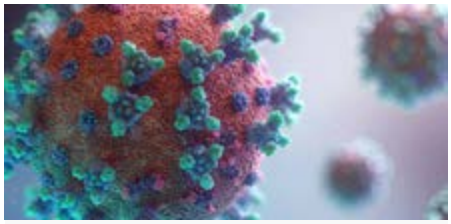
Fungi could one day make up the walls of our homes

UBC researchers melding microbiology, architecture to create 'engineered living materials' out of edible fungi...

THE PROVINCE

UBC researchers discover way to filter microplastics out of water using plants

Researchers at the University of B.C. have discovered a way to filter microplastics out of water using...



CASTANET KAMLOOPS

UBC Okanagan researcher is lifting virus detection to the next level

Researchers from UBC Okanagan School of Engineering and Michigan State University are developing...

HEALTHING.CA

Virtual reality transports seniors living with dementia to other worlds

Nursing professor Dr. Lillian Hung and student Joey Wong implemented virtual reality in long-term care settings...

CKNW MORNINGS WITH SIMI

A navigation app that suggests the safest route

A new algorithm is providing the safest and fastest routes could also be used for bike routing, with cyclists...

HIGHLIGHT STORY

COMPLEX CHALLENGES: CLIMATE ACTION

UBC and global experts grow the new carbon economy to combat the climate emergency

Our society heavily relies on carbon-intensive practices, such as burning fossil fuels to power cities, factories, cars and planes.

This has led to an increasingly destructive climate crisis, as recognized by the global scientific community. In response, a growing alliance of universities, national labs and NGOs, working in partnership with industry leaders, is coming together to build a carbon-conscious world. The vision for a new carbon economy is a thriving economy that not only reduces carbon emissions, but also captures and stores more carbon than it releases.

Led by APSC faculty members and supported by the Research & Partnerships team, particularly Dr. Yaser Roshan, Senior Manager, Research Partnerships, **UBC hosted the 2024 New Carbon Economy Consortium annual meeting** in late April. The Vancouver gathering brought together experts from universities, non-profits, national labs, industry and community groups from across the globe.

Their mission? To discuss engineered, biological and social solutions, review cutting-edge research, and brainstorm ways to transform challenges into pivotal opportunities for the energy transition. As highlighted during the event, **global collaboration and partnership are crucial to this transition** to accelerate data sharing, findings and best practices.

Bruce Ralston, the BC Minister of Forests at the time of the gathering, delivered the meeting's opening remarks, emphasizing that as of April 1, 2024, BC has transitioned to a carbon output-based pricing system. Additionally, a new net-zero industry policy is also under development, which will require large facilities to plan for, and achieve, net-zero energy. As Minister Ralston said: *"The carbon economy is active here in BC. There is a lot of deep thinking about it and, in some cases, practice and understanding. There are concrete actions to combat climate change and contribute to our government's CleanBC plan."*

Read more: **UBC News**
A full list of speakers and events is **available here.**

Our Strategies: Strategic Partnerships

INDUSTRY PARTNERSHIPS

APSC researchers continue to **lead UBC in industry funding**, attracting 15 per cent ($10.7 million) of UBC's total industrial funding ($72.2 million) in 2023/24 from major Canadian, US and international companies that include Boeing, Rogers, Canfor and Seaspan. In 2023/24, Canadian companies continued to be the largest source of industrial funding, investing $4.6 million, up from $3.7 million in 2022/23 (see Figure 7). While Canada's response to the climate crisis and to geopolitical security concerns are two levers driving applied research and innovation, they are also creating the need for APSC and our industry collaborators to re-evaluate partnerships and value propositions (Figure 8). For example, research funding from Huawei has declined significantly year-over-year, but new partnerships with Intel and Samsung are ramping up within the Department of Electrical and Computer Engineering. Although Teck Resources has also been a high-value research partner, its recent portfolio divestitures are accelerating the need to diversify our mining sector partnerships.

A new, groundbreaking collaboration with Rio Tinto is in development to leverage our world-leading expertise.

As mentioned, we have also strategically shifted our focus towards delivering **larger, higher-impact projects**. Over the past five years, the average funding per project has increased from $38,800 to $57,200—representing **growth of 47.5 per cent** that underscores our commitment to maximizing industrial impact and research scalability. This evolution not only streamlines our funding support efforts but also enhances the quality and continuity of our collaborations. Going forward, the Faculty will continue to work with our partners to build consortia and other models to maximize financial contributions, and target **increased engagement in global collaboration and partnerships** to access international markets, leverage complementary expertise and apply to funding opportunities (including the Horizon Europe program after Canada's official membership in the program in 2023).

FUNDING BY COMPANY LOCATION

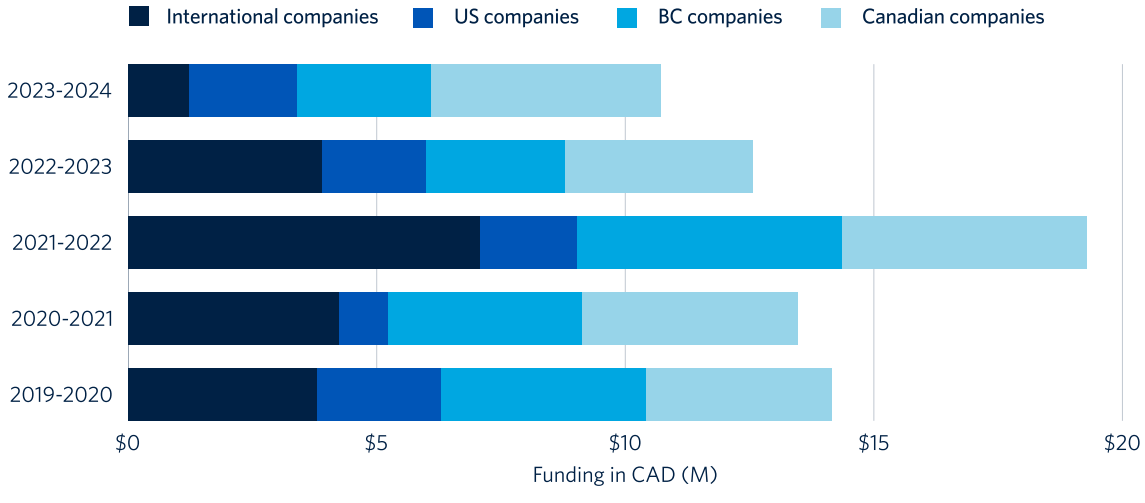


Figure 7: Industry funding across the APSC Vancouver and Okanagan campuses (2019-2024) based on companies' geographical distribution.

INDUSTRY FUNDING

Figure 8: Industry funding amount (blue bars) and number of industry-funded projects (orange line) for APSC Vancouver (left) and the School of Engineering (Okanagan) (right), 2019-2024. Includes contracts and grants.

COMMUNITY PARTNERSHIPS

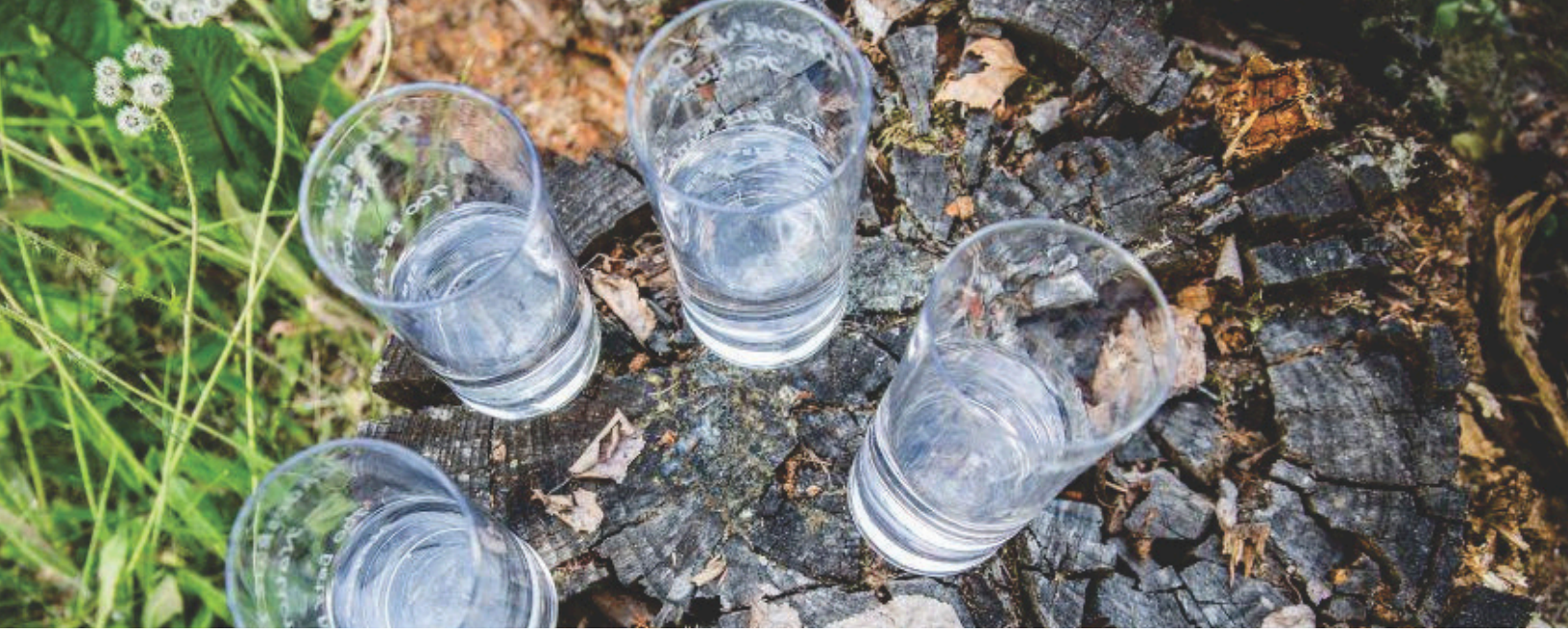
APSC is increasingly **engaging with community and non-profit partners in mutually beneficial, impactful research projects**. While funding into the Faculty is a key metric of success (reaching $21 million, a five-year high, in 2023/24; Figure 1), the ongoing social and economic benefits to our partners and their communities stemming from this work are equally important. A few highlighted projects include:

Building capacity in caregivers of neurodivergent children: A caregiver-clinician facilitated group program to support mental well-being. **APSC Principal investigator (PI):** Dr. Jennifer Baumbusch, School of Nursing. **Partner:** BC Centre for Ability – funded by UBC's Community-University Engagement Support (CUES) program.

Building Inclusive Communities of practice: Dialogue and engagement for health and social service integration in northern and remote communities. **APSC PI:** Dr. Vicky Bungay, School of Nursing. **Partner:** Brandi Trudell-Davis, Terrace Women's Resource Centre Society – CUES funding.

FC3: Healthy waters, healthy people / False Creek water quality community science in action. **APSC PI:** Dr. Ryan Ziels, Civil Engineering. **Partner:** Dr. Peter Ross, Raincoast Conservation Foundation – CUES funding.

Community water systems: Climate vulnerabilities and resilience opportunities (see story next page) **APSC PI:** Dr. Madjid Mohseni. **Partners:** Millennium Water Alliance, Oxfam, Urban-A, others. Funded by the NFRF International Joint Initiative for Research in Climate Change Adaptation and Mitigation ($1.5 million).



HIGHLIGHT STORY

STRATEGIC PARTNERSHIPS

Community water systems: Climate vulnerabilities and resilience opportunities

Dr. Madjid Mohseni was awarded $1.5 million in funding under the 2023 International Joint Initiative for Research in Climate Change Adaptation and Mitigation, New Frontiers in Research Fund, one of only four UBC-led projects that received funding through this program.

More than two billion people live in countries experiencing high water stress. By 2050, that figure may reach 3.2 billion. Changing climates affect water security for daily needs, livelihoods and culture and increase the frequency and severity of extreme weather, like floods and fires, which can disrupt critical infrastructure such as roadways and pipelines necessary to provide water for peoples' well-being. Understanding that **water security is a trans-disciplinary challenge** spanning health, livelihoods, security, culture and science, Dr. Mohseni's diverse team includes engineers, landscape architects, policy-makers, NGOs and Indigenous knowledge-holders, including four co-principal investigators from Canada, Norway and the US, five academic and three non-academic co-applicants, and five implementing partners including the Millennium Water Alliance, Oxfam and Urban-A.

The NFRF-funded project **will support partner communities in Kenya, South Sudan and Norway and Indigenous communities in Alaska and Western Canada** to develop a Water Security Action Plan, map their water systems and their climate vulnerabilities, and implement and evaluate interventions that augment the resilience of their water systems. Further, the team aims to create a Global Water Resilience Toolkit to inform policy-makers at the regional and local levels to advance similar water security action plans with vulnerable groups elsewhere to scale the approach across the globe. Dr. Mohseni is recognized as a world expert in sustainable water solutions and is currently the Scientific Director of Community Circle™ (formerly RES'EAU WaterNET), a not-for-profit Centre of Excellence that helps address unique and complex water-health and economic challenges in Indigenous and rural communities.

IMPACTFUL RESEARCH

Awards and Recognition

Selected awards and recognition received by APSC researchers in 2023.

EXTERNAL (NATIONAL AND INTERNATIONAL) AWARDS

Dr. Emily Cranston, Chemical and Biological Engineering – **Royal Society of Canada, College of New Scholars, Artists and Scientists**

Dr. Bern Klein, Mining – **Mitacs Award for Exceptional Leadership – Professor category**

Dr. Jian Liu, School of Engineering – **Royal Society of Canada, College of New Scholars, Artists and Scientists**

Dr. Mark Martinez, Chemical and Biological Engineering – **Fellow of the Canadian Academy of Engineering**

Dr. Sally Thorne, School of Nursing – **Order of Canada, Officers and Members**

Dr. Tony Yang, Civil Engineering – **Fellow of the Canadian Academy of Engineering**

UBC INTERNAL AWARDS

Dr. Amanda Giang, Mechanical Engineering – **Killam Research Prize**

Dr. Sina Kheirkhah, School of Engineering – **Killam Faculty Research Fellowship**

Dr. Sepideh Pakpour, School of Engineering – **Killam Faculty Research Fellowship**

Dr. Vikram Yadav, Chemical and Biological Engineering – **Killam Accelerator Research Fellowship**

APSC is proud of the scholarly contributions of its faculty members, and strives to recognize their achievements by encouraging nominations for awards that recognize demonstrated research, teaching and service excellence. To support this priority, in 2023/24, the APSC Research & Partnerships team ran the first internal competition to allocate UBC's **SSHRC Institutional Grant awards**, which provide seed funding for research and related activities in the social sciences and humanities. By administering our own competition, rather than integrating into UBC's overall process, the Faculty was able to secure a greater share (>3x) of available funding, with over **$55,000 awarded to eight successful projects** (in comparison to only around $15,000 over all previous competitions).

This initiative was well received by APSC schools and departments, with applications received from the School of Nursing, the School of Architecture and Landscape Architecture, the Department of Mechanical Engineering, the School of Biomedical Engineering, the Department of Electrical and Computer Engineering and the School of Engineering.

Our Strategies: Innovative Spirit and Entrepreneurial Thinking

By nurturing a vibrant ecosystem of innovation and entrepreneurship, APSC continues to play a significant role in advancing technological and social innovations, with broad implications for industry, policy and community development both within Canada and internationally. Showcasing our innovative spirit, APSC research has resulted in **over 190 patents issued in the past five years**, and an average of 100 patents filed per year (Figure 9).

The impact of APSC's patents is also far reaching, with higher citations per patent than both UBC and the U15. APSC researchers are also very active in translating their research into successful, productive companies, with 18 enterprises launched over the past five years (see highlight on next page).

PATENT DATA (2019-2024)

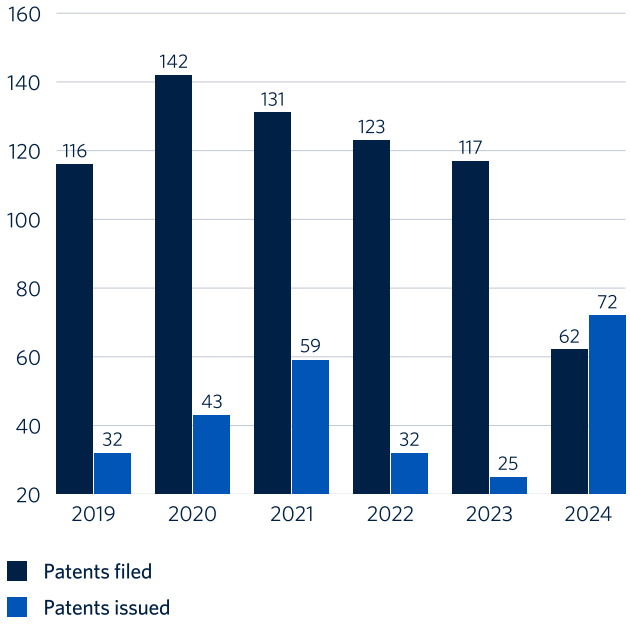


Figure 9: Patents filed for and patents issued, APSC overall (2019-2024). Source: UBC UILO. Note that 2024 data does not reflect the complete year.

This **entrepreneurial mindset** is being passed on to the next generation of Canada's researchers, policy-makers and innovators via APSC's incredible success in the **2023 NSERC CREATE** (Collaborative Research and Training Experience) program. UBC was awarded five of 20 CREATEs across Canada—**with APSC researchers leading three of UBC's five** and involved in one more—bringing in nearly $5 million in funding and equipping trainees with the skills and expertise needed to respond to society's urgent challenges. For example, the Net0MM Net-Zero in Materials and Manufacturing program, co-led by **Dr. Chad Sinclair** (Materials Engineering, APSC) and **Dr. Laurel Schafer** (Chemistry, Faculty of Science), will train over 100 students in making materials and manufacturing processes cleaner, helping Canada reach net-zero carbon emissions targets. See details about all funded CREATE projects here.

2022/23 APSC accounted for

24% of UBC's total filed patents

4 of UBC's 11 new spinoffs

38% of UBC's total issued patents

Three APSC spinoffs formed in the last decade have each raised >$20 million in funding

Acuva Technologies (Dr. Fariborz Taghipour, CHBE)

Aspect Biosystems (Dr. Konrad Walus, ECE)

Mangrove Lithium (Dr. David Wilkinson, CHBE)

INNOVATIVE SPIRIT AND ENTREPRENEURIAL THINKING

APSC spinoffs and associated companies

APSC researchers have long been at the forefront of technology transfer, developing their research into impactful, high-performing spinoffs readily taken up by industry and society.

While a full list is available from UBC's UILO, recent successes include:

Tersa Earth Innovations Inc.

Dr. Vikram Yadav, Chemical & Biological Engineering

Tersa provides innovative solutions to eliminating mining tailings ponds and recovering precious metals needed to power our society. Launched only last year, the company has already attracted significant investment and interest, and includes former BC Premier Glen Clark on its Board of Directors.

Advanced Mobility Analytics Group (AMAG)

Dr. Tarek Sayed, Civil Engineering

Founded in 2019 by Dr. Sayed and collaborators in Australia, AMAG is a digital platform provider for proactive road safety analytics and management. The company grew to over 40 employees by 2021 and was acquired in 2024 by Transoft Solutions, a large multinational transport solutions company.

VulcanX Energy Corp

Dr. Walter Mérida, Mechanical Engineering

Incorporated in 2022 with a mission to accelerate the transition to net zero by providing clean hydrogen and solid carbon, VulcanX has secured over $9 million in non-dilutive funding from sources, including Alberta Innovates and the BC Centre for Innovation and Clean Energy, to build a demonstration plant in Alberta.

Bioform Technologies

Dr. Mark Martinez, Chemical & Biological Engineering

Founded in 2021 and growing rapidly since then, Bioform uses the world's most regenerative materials (kelp, wood pulp) and modified pre-existing industrial processes to create products that sustainably eliminate plastic waste. In April 2024, leading pulp and paper producer Suzano announced an investment of up to US$5 million into Bioform to help build a demonstration facility.

SonicIncytes Medical Corp.

Founded by Dr. Rob Rohling and Dr. Edmond Cretu from UBC's Department of Electrical and Computer Engineering, SonicIncytes was named to Life Sciences BC's "Companies to Watch" list in 2023, one of four such awards across the province. The company has commercialized its technology into VELACUR™, an AI-guided 3D S-WAVE ultrasound elastography device that measures key indicators of fatty liver disease.

APSC Research Support Landscape

Overseen by the Associate Dean, Research and Partnerships, and the Dean, the two parts of the **APSC Research and Partnerships (R+P) team** provide co-ordinated and complementary support to increase research funding success, societal impact and commercialization activities.

Leveraging expertise across multiple domains, we support APSC research at all levels, from providing *seed funding* and helping secure foundational *operating grants* to developing large, *interdisciplinary team projects* and identifying and engaging with *partners across all sectors*.

In addition to supporting grants and partnerships, we work collaboratively on Faculty-wide strategic projects, which have been built upon and expanded in 2023/24. Going forward, we will continue providing professional, expert support to our Faculty members while *strategically expanding our scope* into new domains, including increased support of international grants, increased engagement across Faculties in support of truly interdisciplinary research and an enhanced focus on "big" opportunities to strengthen our areas of research expertise and accelerate solutions for the future.

Meisan Brown-Lum
Research Development Associate

Atif Hussain
Research Development Associate

Carrie Lam
Research Development Associate

Walter Mérida
Associate Dean, Research and Partnerships

Joanne Moszynski
Senior Manager, Research Development

Kyra Laverdiere
Senior Manager, Research Partnerships

Yaser Roshan
Senior Manager, Research Partnerships

Research development support

Consultation & Strategy

- Project development
- Team building
- Application advice
- 5-year funding plan
- Internal processes

Outreach & Training

- RLP
- Bootcamps and workshops
- Communication intranet

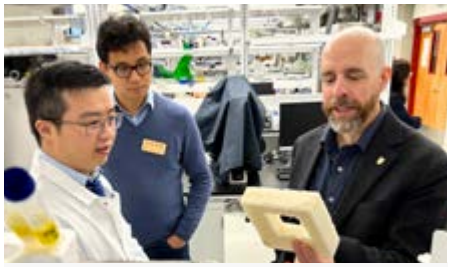
Resources & Reviews

- Templates, past grants, playbooks
- Editing, criteria/strategic review

Partnerships support

Awareness

- Shaping value propositions
- Creating connections
- Promoting research interests & outcomes



Engagement

- Stakeholder mapping
- Ecosystem engagement
- Defining shared vision
- Event planning/facilitation

Execution

- Contractual T&Cs
- Processes & reporting
- Knowledge translations
- Relationship management

We also acknowledge the extensive expertise embedded within our Faculty at its departments, centres and schools. The R+P team is fortunate to work within a productive and collegial support network consisting of program managers, grants facilitators, business development staff and many others, all with the mandate of supporting APSC researchers' capacities in working towards truly impactful, world-leading research.

Offerings

TRAINING AND WORKSHOPS

The R+P team puts on a number of events to help build teams, skills and capacity across the Faculty, delivered by experts across APSC, UBC and beyond. **These include a number of annual "bootcamps" focused on grants of strategic importance**, including the NSERC Discovery and Alliance Grants. Bootcamp sessions include general information, Q+As with past reviewers and a chance for participants to workshop key sections of their grants with their peers. The sessions have had a positive impact on application success rates, helping ensure that APSC faculty members, especially early career researchers, secure these fundamental grants.

These events are supplemented by extensive resource packages (such as playbooks, videos and templates) available on the **APSC Intranet**. We continue to add to our resource offerings in response to engagement with our departments and schools, with additional support materials and processes constantly being developed for Tri-Council, other government and non-profit, industry and internal opportunities.

CONSORTIUM DEVELOPMENT AND COLLABORATIVE RESEARCH

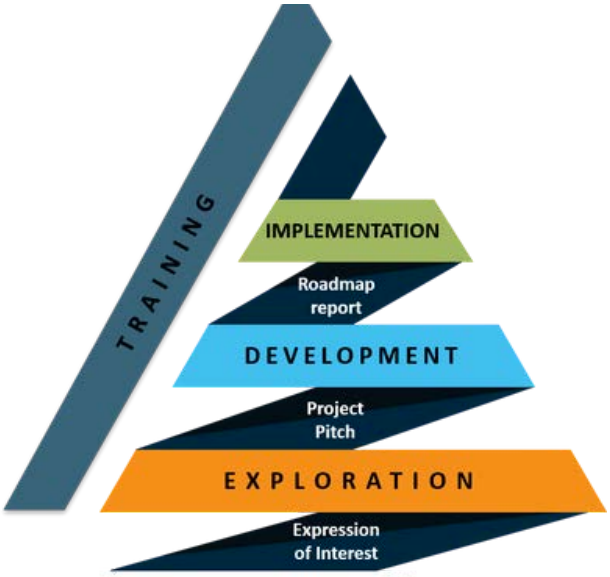
Leveraging our expertise in partnership management, our team also focuses on **shaping consortia** that bring together external partners from across industry and other sectors to address emerging research challenges. These consortia create a *collaborative framework* where researchers contribute to generate novel knowledge and intellectual property, while partners contribute towards enabling the research activities and converting the research results into impactful outcomes. By aligning research interests and pooling resources, we provide APSC researchers with a robust platform to **explore innovative projects** and **secure new funding opportunities**.

An example of this offering is in the intelligent construction domain, where we have engaged with industry leaders such as Mercer International, Rogers Communications, Bird Construction, WSP and a group of small and medium-sized businesses. These efforts have already led to multiple successful collaborative grant applications from the consortium, which is now focused on developing the next generation of building codes and guidelines for modular buildings.

RESEARCH LEADERSHIP PROGRAM

Launched in 2021, the Research Leadership Program provides researchers with the knowledge, tools and skill sets to build capacity across grant writing, partnership management, knowledge exchange and leadership. The program consists of three stages (exploration, development and implementation) carried out over two years, with ongoing training available throughout.

With targeted partnerships and financial and grants support, **the program enhances individual leadership skills and team research** capacity, focusing on high-value, interdisciplinary funding opportunities.



CLUSTER ADVANCEMENT PROGRAM

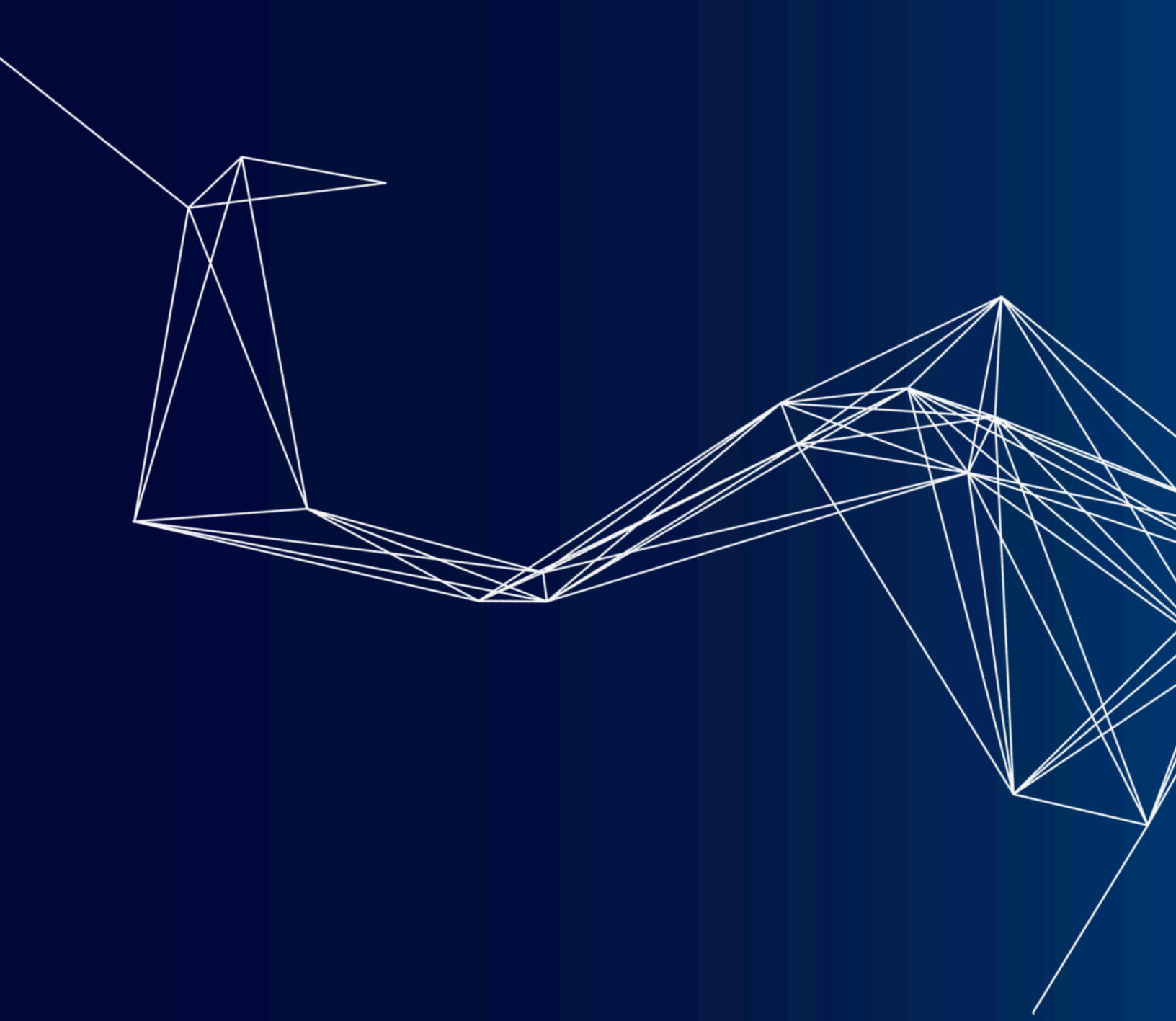
In addition to grant development and review, the R+P team supports APSC-led Grants for Catalyzing Research Clusters and Eminence clusters through the Cluster Advancement Program, **working with cluster leads to develop a tailored support model** with supplemental funding available to adequately cover:

- Establishing a robust resourcing model to enable cluster objectives
- Developing communication collateral and strategies to build awareness
- Facilitating professional workshops with external stakeholders

RESEARCH ENABLEMENT FUND

This initiative provides researchers with the opportunity to apply for funding to promote activities aligned with APSC's Strategic Plan, including:

- Travelling between the Vancouver and Kelowna campuses to promote enhanced collaboration
- Bridging funding between awarded funding and actual project costs and/or supplemental costs
- Seeding a new idea, collaboration or preliminary data collection in advance of a partnership or funding opportunity



This report was prepared by the APSC Research & Partnerships team, with support from the APSC Marketing & Communications team, UILO, APSC Faculty Affairs and many others. Special thanks go to:
Ripan Grewal, WL Research & Data Assistant
Atif Hussain, Research Development Associate
David McCaughan, Associate Director of Marketing & Recruitment
Joanne Moszynski, Senior Manager, Research Development
Devan Power, Creative Manager
Sue Yee, Senior Manager, Faculty Affairs

The team also acknowledges that we operate on the traditional, ancestral and unceded territories of the Coast Salish peoples including the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh Úxwumixw (Squamish) and səlilwətaɬ (Tsleil-Waututh) nations, as well as the traditional, ancestral, and unceded territory of the Syilx Okanagan Nation at our UBC-Okanagan campus.

Contact

If you have any questions regarding this report or would like further information, please contact:

research@apsc.ubc.ca
grants@apsc.ubc.ca

apsc.ubc.ca/research-partnerships