



UBC Applied Science Research and Partnerships

2023 Annual Report



THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Applied Science

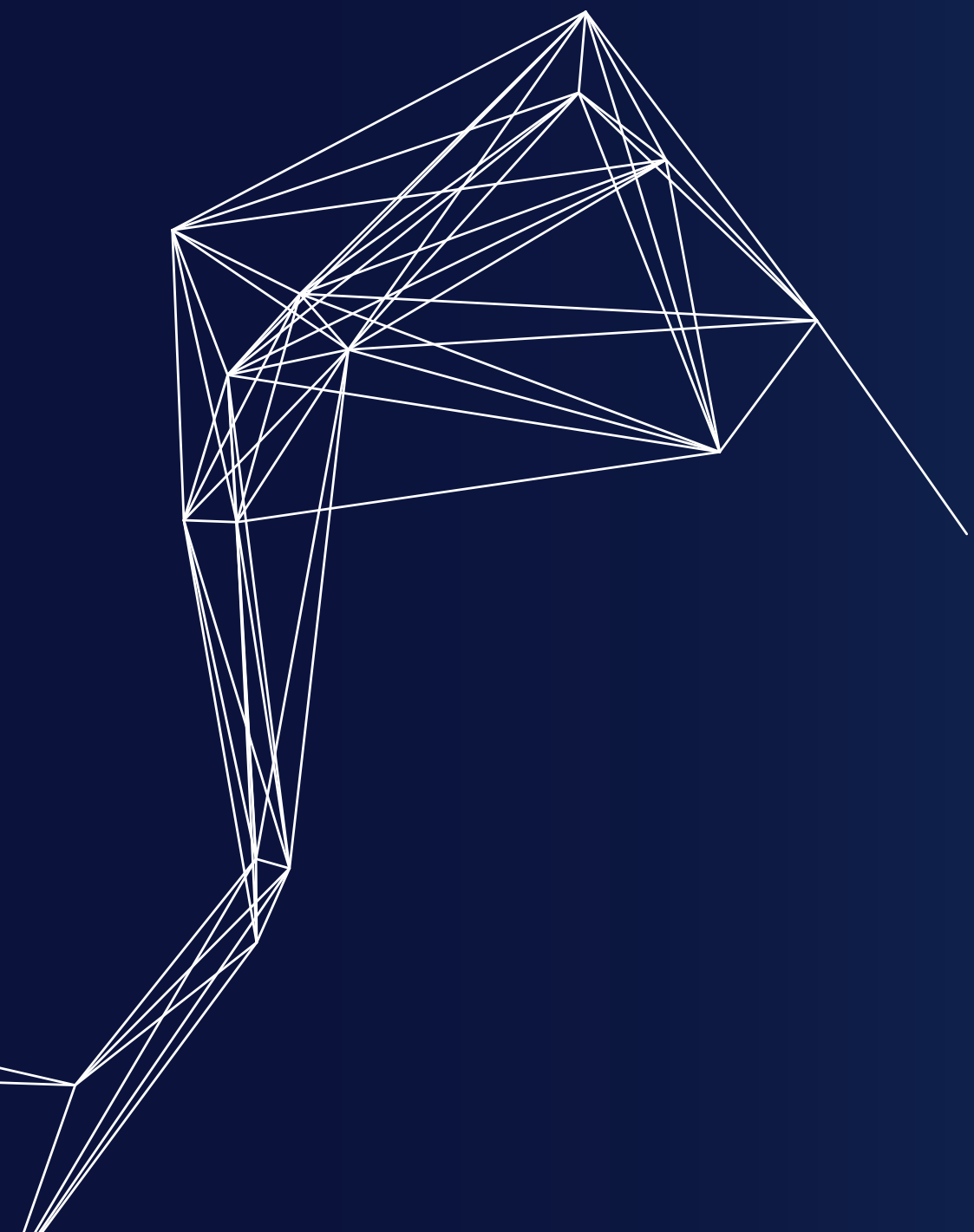


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Message from the Associate Dean, Research and Partnerships, Faculty of Applied Science Walter Mérida

“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. **Canada hosts more than 10% of the world's top 100 clean technology companies**, including leaders in hydrogen technologies, zero-emission vehicles, electrolysis, water purification, carbon capture devices, synthetic fuels, 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 population and a sizable

economy, an established immigration culture, the three largest ports on the continental West Coast, and leading higher education institutions. It has achieved global brand recognition as the birthplace of carbon taxes, Google, Boeing and Greenpeace.

UBC's Faculty of Applied Science (APSC) stands at the **forefront of innovation**, with nearly 300 patents issued for novel technologies developed by Applied Science researchers, exemplifying our commitment to accelerate the implementation of real-world, economically sustainable innovations. Using our campus as a **living lab**, and enabling new platforms to accelerate technology readiness, we have fostered an environment that attracts industry investment into co-developing tangible proofs of concept, critical for commercialization and economic development. Strongly aligned with UBC's strategic priorities as Canada's **leading university on climate action**, APSC research is well-positioned to support a just transition to a net-zero future.

Our research spans the design of built environments with a focus on human health and well-being as exemplified by the School of Nursing. The School of Community and Regional Planning and the School of Architecture and Landscape Architecture are developing scalable design, planning and engagement frameworks across cities,

regions and communities. Each of these schools is ranked number one in Canada in their category and they are complemented by world-class expertise across seven engineering departments, including specialized knowledge at the School of Biomedical Engineering.

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.

The **Research and Partnerships** team at APSC provides customized assistance to support researchers' individual funding requirements. To complement these efforts, we have initiated co-ordinated approaches to develop strategic partnerships and research clusters. As we look toward the future, and building on our strategic plan "**Transforming Tomorrow**", we have developed proactive research strategies focused on three priorities:

 **Solutions for People**

 **Thriving Cities and Communities**

 **Planetary Health**

The new strategies are supported by an expanded team under two functional structures (Development and Partnerships), additional support programs exclusive to APSC, improved outreach and engagement mechanisms, and internationalization efforts. This work benefits from leading equity, diversity, inclusion and Indigeneity initiatives within the Faculty.

Building on the success of the Discovery Grant Bootcamp (in operation since 2017), APSC has developed **new research support programs**, including the Research Leadership Program, the Cluster Advancement Program, an NSERC Alliance Bootcamp and a streamlined SSHRC Institutional Grant program. To support strategic priorities such as inter-campus collaboration, the team has also introduced an ad-hoc research support fund for faculty members. These new and existing programs aim to support our colleagues with the skills, resources and individualized attention they need to lead impactful research initiatives.

Our **outreach and engagement mechanisms** have been refined into repeatable processes that enable the co-creation of research objectives with regional (BC government), national (Rogers 5G) and international (Fraunhofer-Gesellschaft) stakeholders. Through facilitated workshops, we can now identify challenges and opportunities that can be rapidly converted into long-term partnerships and high-impact collaborative research efforts.

A new approach to **international partnerships** recognizes the challenges of reactive engagement models and the scarcity of bilateral or multilateral funding mechanisms in Canada. To address these challenges, and while continuing to manage our global research portfolio, we have focused on expanding our partnerships with key jurisdictions: Germany, the United Kingdom and the United States. Our focus has been informed by recent developments in policy alignment, legislative announcements, sectoral roadmaps and, more importantly, the availability of structured funding programs to activate these partnerships - including the potential for Canada to fully participate in the Horizon Europe program. We actualized these strategies this year by hosting a number of workshops and events with our international collaborators, including welcoming Frank-Walter Steinmeier, the President of Germany, to UBC in April 2023.

These initiatives have yielded significant results, including doubling our research funding since 2017 (reaching \$100 million in 2022), securing the highest proportion of industry funding of any Faculty at UBC (18% of total in 2023) and deriving half of our research publications from international collaborations, bolstering our reputation and ability to compete on the global stage.

Sincerely,

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”




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

RESEARCH, INNOVATION AND PARTNERSHIPS ARE CENTRAL TO MANY OF THE 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.

STRATEGIC PRIORITIES

The six priority areas that emerged from the identified drivers of change directly align with our Faculty’s vision and mission.

-  **University for the future**
-  **Future of work**
-  **Inclusive leadership and respectful engagement**

-  **Solutions for People**
-  **Thriving Cities and Communities**
-  **Planetary Health**

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 PEOPLE

5 SCHOOLS

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

6 ENGINEERING DEPARTMENTS

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

370 TENURED AND TENURE-STREAM FACULTY MEMBERS AND INSTRUCTORS
(30 new faculty hires in 2022/23)

500 STAFF

2,811 GRADUATE STUDENTS

176 POSTDOCTORAL RESEARCH FELLOWS

115

of the **world's most-cited researchers** across all scientific fields in 2022

TOP 2%

of **most-cited scientists** in their respective subfields
(source: Elsevier database)

OUR FUNDING

\$85M

in funding in 2022/23, including \$35 million from the Tri-Council

18% of UBC's total industry funding

32% of UBC's total NSERC funding

23 Canada Research Chairs

3 New/renewed in 2022/23

4 NSERC Industrial Research Chairs and one Canada Excellence Research Chair

OUR IMPACT

~9,800 Publications
(2018-2023)

>160K citations
>560 patents filed

1,620 Publications
(2022)

>12K citations count
106 patents filed
28 patents issued

TOP 1%

of papers and citations in topic areas spanning health care, information and communications technology, and clean energy

OVER 5,000 Publications
(2018-2023)

With 51% resulting from **international collaboration** and over 1,00 (18%) resulting from **national collaboration**

NEARLY 850

instances of media coverage across newspapers, radio, TV and online (June 2022 - May 2023)

APSC Research Support Landscape

Growing our in research funding and partnerships continues to be a key strategic priority for our Faculty. In support of this, the development and expansion of the **Research and Partnerships** team within the Dean’s Office has been a substantial and strategic investment by the Faculty. The team’s reputation for excellence in research support drives access to funding and maximizes the multiplying factor of grants and other sources to benefit our researchers and partners. We actively seek collaboration with industry, non-profit and municipal, provincial and federal government partners to accelerate solutions for the future.

Overseen by the Associate Dean, Research and Partnerships, and the Dean, the two parts of the Research and Partnerships team provide co-ordinated and complementary support to increase research funding success, real-world impact and commercialization activities.

Contact us: research@apsc.ubc.ca



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, Partnerships

Yaser Roshan
Senior Manager, Partnerships

Not pictured:
Ripandeep Grewal
Research Data & Communications Assistant

Our Strategies: Impactful Research and Complex Challenges

BioProducts Institute

Leveraging our strengths across diverse fields, APSC researchers excel in large, multidisciplinary team projects that are producing impactful research and tackling the complex challenges of our time — the energy transition, housing affordability and resiliency, and the rise of AI to name just a few (see *the story on APSC research clusters on the next page*). The Faculty is increasingly successful at **attracting funding across all sectors**, as well as diversifying its funding sources (Figure 1). While we remain competitive with Tri-Council grants, averaging ~\$30 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, and continue to attract significant industry funding (representing 18% of UBC's total in 2022/23), we have recently seen notable increases in funding from non-profit organizations, reaching a **five-year high of \$19 million** in 2022/23, reflecting the important societal impact of, and need for, APSC research.

TOTAL FUNDING ACROSS APSC 2022/23

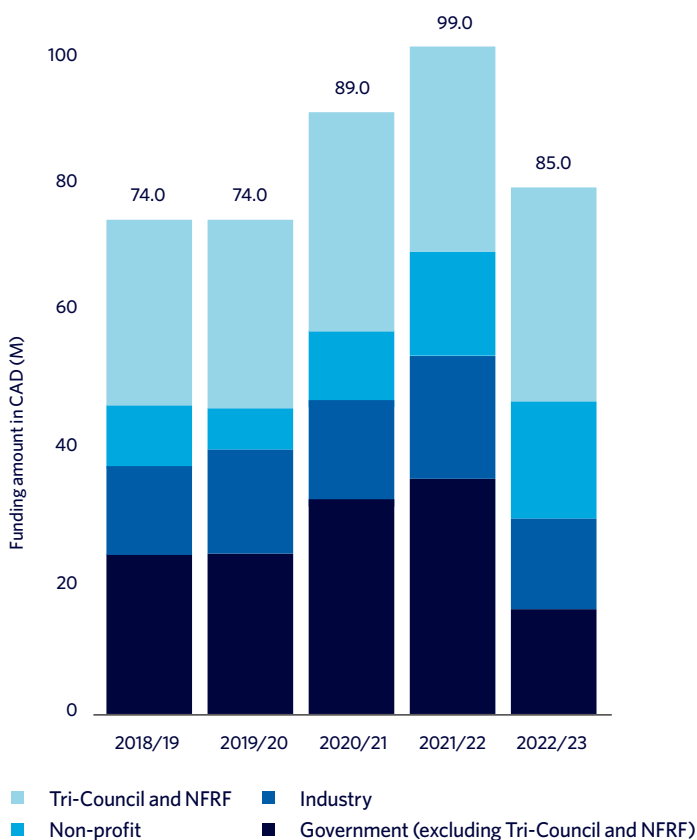


Figure 1 - Overall research funding amount across APSC Vancouver & Okanagan campuses, 2018-2023

Data is obtained from UBC's RISE system and is organized by fiscal year (e.g., 2017-2018 = April 2017 to March 2018 = Grant Year 2018)

Tri-Council = NSERC, SSHRC, CIHR

NFRF = New Frontiers in Research Fund

Industry = for-profit organizations

Okanagan campus = School of Engineering (SoE)

COMPLEX CHALLENGES

Seeding and Supporting Research Clusters

Mend the Gap - Karen Cheung lab

UBC's annual Grants for Catalyzing Research Clusters (GCRC) and Eminence competitions enable the formation and growth of interdisciplinary research excellence clusters by awarding up to \$200,000 per cluster. Capitalizing on the Faculty's diverse strengths, APSC researchers currently lead 10 clusters across both campuses that are addressing the complex challenges of our time. Awardees in the 2022/23 competition include both emerging (new) and established (returning) teams spanning research across our Faculty's priority areas - **planetary health** (Battery innovation, Dr. Jian Liu, SoE), **solutions for people** (Bionics,

Dr. Karen Cheung, ECE) and **thriving cities & communities** (Rethinking the Right of Way, Dr. Kelly Clifton, SCARP).

Leveraging this seed funding, APSC clusters have achieved notable successes, including growth into a Global Research Excellence (GReX) Institute (the BioProducts Institute) and a successful application to the New Frontiers in Research Fund (NFRF) Transformation competition (the Bionics Network).



PLANETARY HEALTH

Re-ROW:

Dr. Kelly Clifton, SCARP

Battery innovation:

Dr. Jian Liu, School of Engineering

Solar Energy for Net Zero:

Dr. Alex Uhl, Dr. Robert Godin, Materials Engineering, Chemistry

Quantum Computing:

Dr. Lukas Chrostowski, ECE



SOLUTIONS FOR PEOPLE

Bionics Network:

Dr. Karen Cheung, ECE/SBME

Reducing Male Suicide:

Dr. John Oliffe, School of Nursing

Transformative Health & Justice:

Dr. Helen Brown, School of Nursing

TrustML:

Dr. Julia Rubin, ECE



THRIVING CITIES AND COMMUNITIES

Build Better:

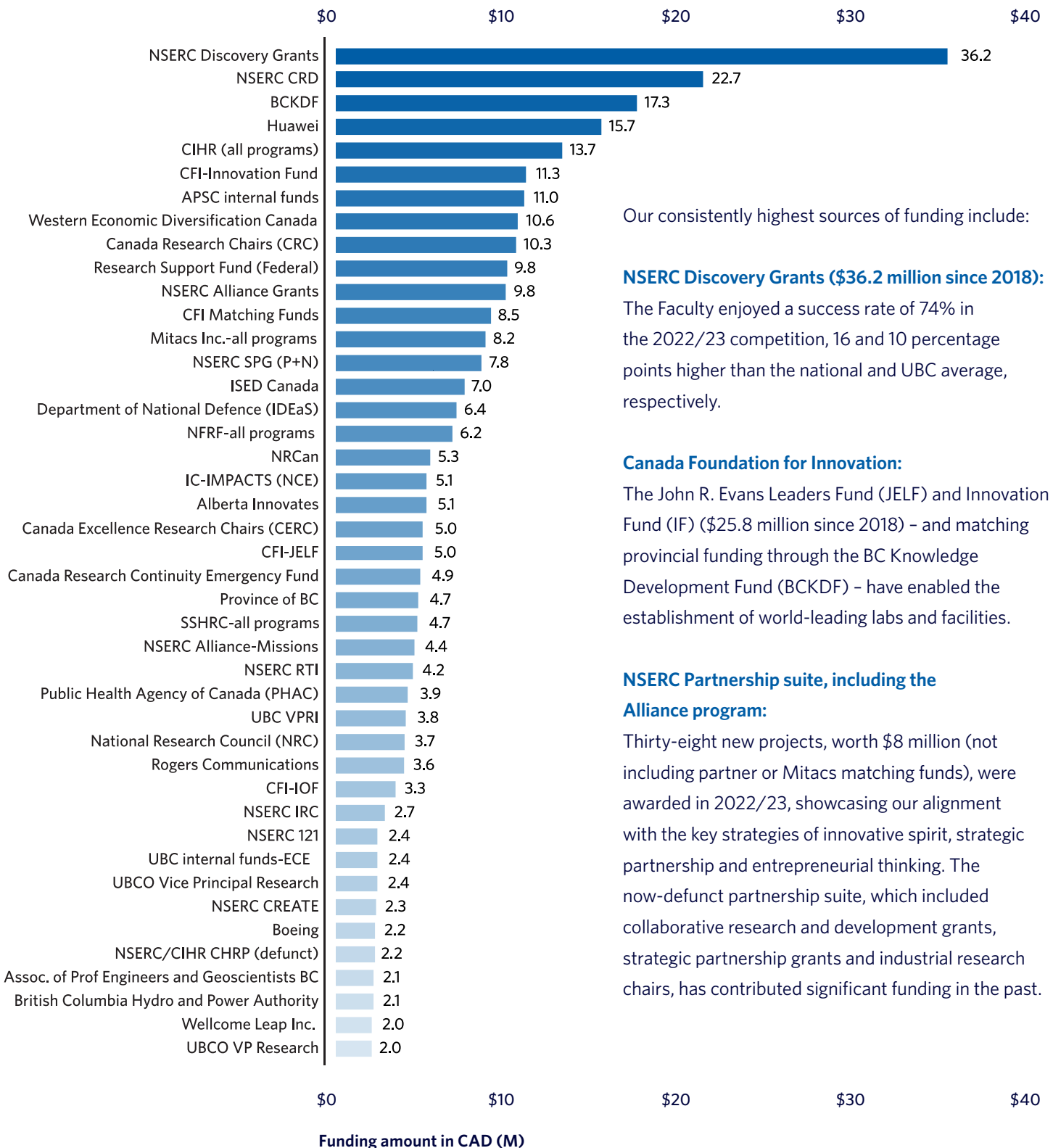
Dr. Lisa Tobber, Civil Engineering

Disaster Resilience:

Dr. Carlos Molina Hutt, Dr. Sara Shneiderman, Civil Engineering, Anthropology

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 development, reaching out to partners, and providing reviews and resources, our team has recently launched the APSC Cluster Advancement Program (see details on pg. 29) to ensure our clusters receive the ongoing support and resources they need to expand their reach, success and impact.

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 (\$36.2 million since 2018):

The Faculty enjoyed a success rate of 74% in the 2022/23 competition, 16 and 10 percentage points higher than the national and UBC average, respectively.

Canada Foundation for Innovation:

The John R. Evans Leaders Fund (JELF) and Innovation Fund (IF) (\$25.8 million since 2018) – 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:

Thirty-eight new projects, worth \$8 million (not including partner or Mitacs matching funds), were awarded in 2022/23, showcasing our alignment with the key strategies of innovative spirit, strategic partnership and entrepreneurial thinking. The now-defunct partnership suite, which included collaborative research and development grants, strategic partnership grants and industrial research chairs, has contributed significant funding in the past.

Figure 2 – Funding programs/sponsors with a total funding amount >\$2.0 million for APSC Vancouver and Okanagan campuses (2018-2023). Other = 100+ programs/sponsors with a total funding amount <\$2.0 million (e.g., Connect, Catalyst grants) over the same time period.



Dr. Yasmine Abdin lab

IMPACTFUL RESEARCH

Alliance Grants



Carrying on the success enjoyed in NSERC's previous suite of partnership programs, APSC researchers lead UBC in the submission and awarding of Alliance grants, with a **success rate nearly 10 percentage points higher than at UBC overall** in 2022/23 (62% versus 53%). Our researchers have been successful in all streams of the Alliance program, from high-value, industry-relevant Option 1 consortia to small, yet societally urgent community-based projects under Option 2 and international special calls in strategic areas such as quantum technologies. This year, 38 new projects led by researchers across the UBC Vancouver and Okanagan campuses were awarded **nearly \$8 million in Alliance funding**, often further leveraged by Mitacs and other sources. 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.

Recent highlights include:

Dr. Yasmine Abdin, Materials Engineering – Graphene-enhanced natural fibre reinforced composites for protective footwear and other high-performance applications: \$210,592 from NSERC (*Option 1*) + \$105,296 from industry

Dr. Ian Frigaard, Mechanical Engineering – Towards net-zero emissions: mechanics, processes and materials to support risk-based well decommissioning: \$1.2 million from NSERC (*Option 1*) + \$600,000 from industry

Dr. Madjid Mohseni, Chemical and Biological Engineering – PFAS removal using novel regenerable ion exchange resins: \$893,000 from NSERC (*Option 2*)

Dr. Joseph Salfi, Electrical Engineering – Consortium on quantum simulation with spin qubits: \$4.9 million total project (*Quantum Technologies special call*)

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 2022/23.

Funding facts



Tri-Council funding within the Faculty is significantly dominated by **NSERC** (\$25 million, 32% of UBC's total in 2022), followed by **CIHR** (\$2.9 million), **NFRF** (\$2.4 million) and **SSHRC** (\$0.7 million). Electrical & Computer Engineering captured the largest share of NSERC funding, while the School of Nursing captured the largest share of both CIHR and SSHRC funding.



The average grant size at APSC has increased by 20% over the past five years, suggesting that APSC faculty are aiming for – and achieving – larger, more lucrative grants.



APSC captured 11.4% of UBC's total funding in 2022/23, and **18.4% of the university's industry funding**.



APSC is closing the funding and success rate gap with the Faculty of Science, **capturing 77%** of the Faculty of Science's funding amount in 2022/23, compared to just over half in 2016/17. The faculty is increasingly being **chosen to lead** major institutional funding applications, including the Canada First Research Excellence Fund and three Canada Excellence Research Chair applications in 2022.

FUNDING BY CAMPUS

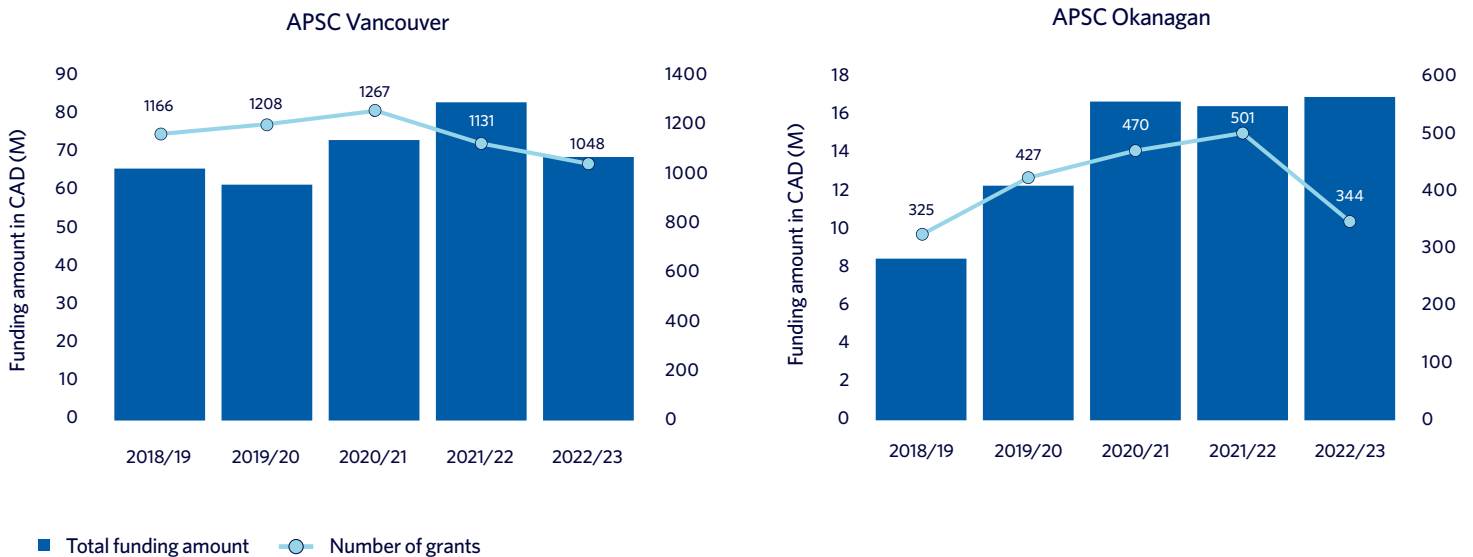


Figure 3 - Total funding amount (blue bars) and number of grants (blue line) across the APSC Vancouver and APSC Okanagan campuses (2018-2023). Total funding = sum of government (non Tri-Council and NFRF), industry, non-profit and Tri-Council (NSERC, SSHRC, CIHR).

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 Canadian Foundation for Innovation (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)** (*please see highlighted story on the next page*), the **Biorefining Research & Innovation Centre (BRIC)** and the facilities available at the **Advanced Structural Simulation & Experimental Testing (ASSET)** group. APSC has been successful in both individual grants (the JELF; >90% success rate since 2016; [\\$3.2 million in awards in 2022/23](#)) and the larger, more lucrative Innovation Fund. As seen in Figure 4, the Faculty received significant funding from the past two cycles of the Innovation Fund, with our **highest-ever total of \$16.1 million** in total project costs in the 2022 competition. We anticipate another Innovation Fund call in 2025 and look forward to supporting our researchers towards further success.

2022/23 INNOVATION FUND AWARDEES: \$12.4 MILLION

Ben Britton and Amanda Clifford: Towards a Net-Zero Future: Sustainable Materials Discovery for Clean Energy. \$7.5 million from CFI

Lacey Samuels and Orlando Rojas: BioSEED. \$3.8 million from CFI

Yusuf Altintas and Xiaoliang Jiang: Canadian Technology Accelerator for Digital Transformation of Manufacturing. \$6.1 million total from CFI, \$1.1 million to UBC

2022/23 JELF AWARDEES: \$3.2 MILLION

Sara Beck	Alyse Kiesser
Ben Britton	Xiaoxiao Li
Trevor Carey	Renjie Liao
Suliman Gargoum	Christos Thrampoulidis
Jonathan Holzman	Joe Salfi
William Hughes	Rachel Scholes

Led by Ms. Meisan Brown-Lum, who brings over 10 years of CFI experience to the group, the Research and Partnerships team provides extensive support for CFI programs – especially the Innovation Fund – ranging from team/project development to budget advice, partnership connections and iterative, in-depth reviews. With the CFI announcing a regular two- to three-year cadence of Innovation Fund calls, it's never too early to reach out if you're considering an Innovation Fund application.

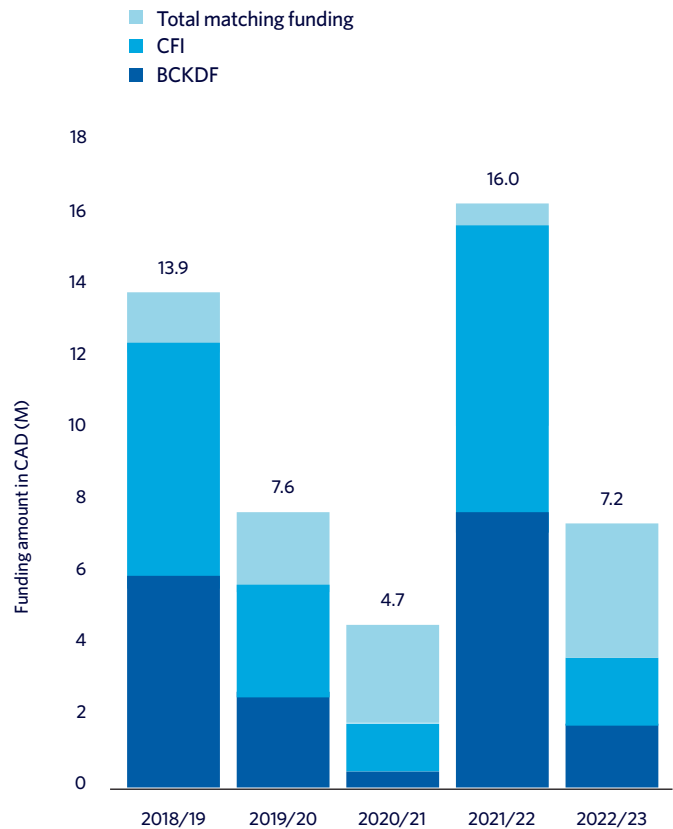


Figure 4 – CFI funding across APSC Vancouver & Okanagan campuses (2018-2023). CFI = Infrastructure Operating Fund, Innovation Fund, Innovation Projects, JELF, JELF-Partnerships and the (defunct) Leading Edge Fund. Matching funds = Government (Canadian and US), industry and UBC internal funding. Note total project is ~2.5x CFI portion.



IMPACTFUL RESEARCH

Smart Hydrogen Energy District (SHED)

With foundational funding secured in 2017 through the CFI Innovation Fund, UBC's world-unique, \$25-million renewable energy hub is now nearing completion. The project, led by Dr. Walter Mérida, Professor of Mechanical Engineering and APSC Associate Dean of Research and Industrial Partnerships, will explore the integration of renewable energy, transport, intelligent telecommunication and urban assets in a city-scale testbed as a living laboratory that includes BC's first-ever green hydrogen refuelling station for light and heavy-duty vehicles. The project will enable breakthroughs in renewable energy penetration for relevant economic sectors, and result in new business models for vehicle owners, cities and utilities.

Showcasing the Faculty's commitment to clean energy and advancing climate change solutions, SHED was toured by Germany's President Frank-Walter Steinmeier as part of his first visit to Canada in April 2023. "UBC

Applied Science researchers excel at collaborating across large, multidisciplinary projects that lead to relevant, practical solutions to the complex challenges of climate change and clean energy," remarked Dr. Mérida, who led the tour on behalf of UBC. President Steinmeier and the 70-member delegation also spoke to APSC researchers actively collaborating with their German counterparts in the area of digital manufacturing, including Dr. Anoush Poursartip (DLR@UBC) and Dr. Yusuf Altintas, who leads the UBC-Fraunhofer collaboration on industrial digital transformation.

[Read UBC Media's coverage of the event.](#)

IMPACTFUL RESEARCH

Research Chairs

Over the last five years, APSC has increased its number of Canada Research Chairs (CRCs) from 16 to 24, highlighting the exceptional ability of the Faculty's researchers and its increasing share of Tri-Council funding. New and successfully renewed CRCs in 2022/23 are highlighted below - including the successful awarding of the **School of Engineering's first T1 Chair** to Dr. William Hughes, SoE's new Director. The Faculty boasts a 100% 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. 2023 proved to be a very busy year, with one of the largest cohorts of new and renewing CRCs ever in the Faculty, and we look forward to the results. **APSC is expecting an increased allocation of CRCs** resulting from the latest federal distribution process, reflecting the Faculty's growing success in attracting funding.

APSC recognizes the continuing need to recruit top-level academics from **diverse fields and lived experiences** to enhance our research excellence and culture. The

Research and Partnerships team works closely with our Associate Dean, EDI.I, the central Equity & Inclusion Office and the Office of the Provost and Vice President to ensure we are following EDI.I best practices when providing support, and team members actively participate in the Provost's EDI in CRC working group and mentoring sub-committee. In 2022/23, this sub-committee ran a **pilot mentoring program**, which could inform a future program at APSC.

In addition to APSC's 24 Canada Research Chairs, the Faculty is proud to host four NSERC Industrial Research Chairs, one Canada Excellence Research Chair, one UBC President's Excellence Chair, six Principal's Research Chairs (UBC-O) and numerous endowed Chairs, including the recently awarded **Bombardier Chair of Regional Transportation Planning** (Dr. Kelly Clifton), the **Kaiser Chair in Power Conversion and Sustainability** (Dr. Martin Ordonez) and the **Teck Professorship in Mine Tailings Management** (to be recruited).

IMPACTFUL RESEARCH

New Canada Research Chairs in 2022/23



Dr. Will Hughes, Professor & Director, School of Engineering

CRC T1 in DNA Nanotechnology (new)



Priority area: **Solutions for People**



Dr. Amanda Giang, Assistant Professor, Mechanical Engineering/IRES

CRC T2 in Environmental Modelling for Policy



Priority area: **Planetary Health**



Dr. Ali Madiseh, Associate Professor, Mining

CRC T2 in Mine Energy Systems (renewal)



Priority area: **Planetary Health**

The Research and Partnerships team, in particular Dr. Joanne Moszynski, Senior Manager of Research Development, has actively supported CRC applicants since 2016. Our services have been acknowledged at APSC and other faculties as among the best at UBC.



COMPLEX CHALLENGES

COVID-19 and Post-Pandemic Recovery

Researchers and clinicians at APSC's **School of Nursing** (SoN) played a pivotal role in UBC's COVID-19 efforts during the pandemic – serving in hospitals, providing vaccinations and engaging in research that contributed to a better understanding of the virus, its impacts on health systems and public health responses. For example, **Dr. Farinaz Havaei** and her team published an influential and widely publicized study (see the [CBC news item](#)) on nurse anxiety and burnout during the pandemic that showed the urgent need to better detect, prevent and treat mental health among health-care workers, particularly nurses. In addition, **Dr. Lillian Hung**, CRC T2 in Senior Care, led an interdisciplinary team of nurses, engineers and doctors to design and build an origami-based ventilator that costs only \$100 and weighs six pounds.

This new device, ideal for use in remote care settings and patient transports such as ambulances, will make ventilators more accessible for low- to middle-income countries.

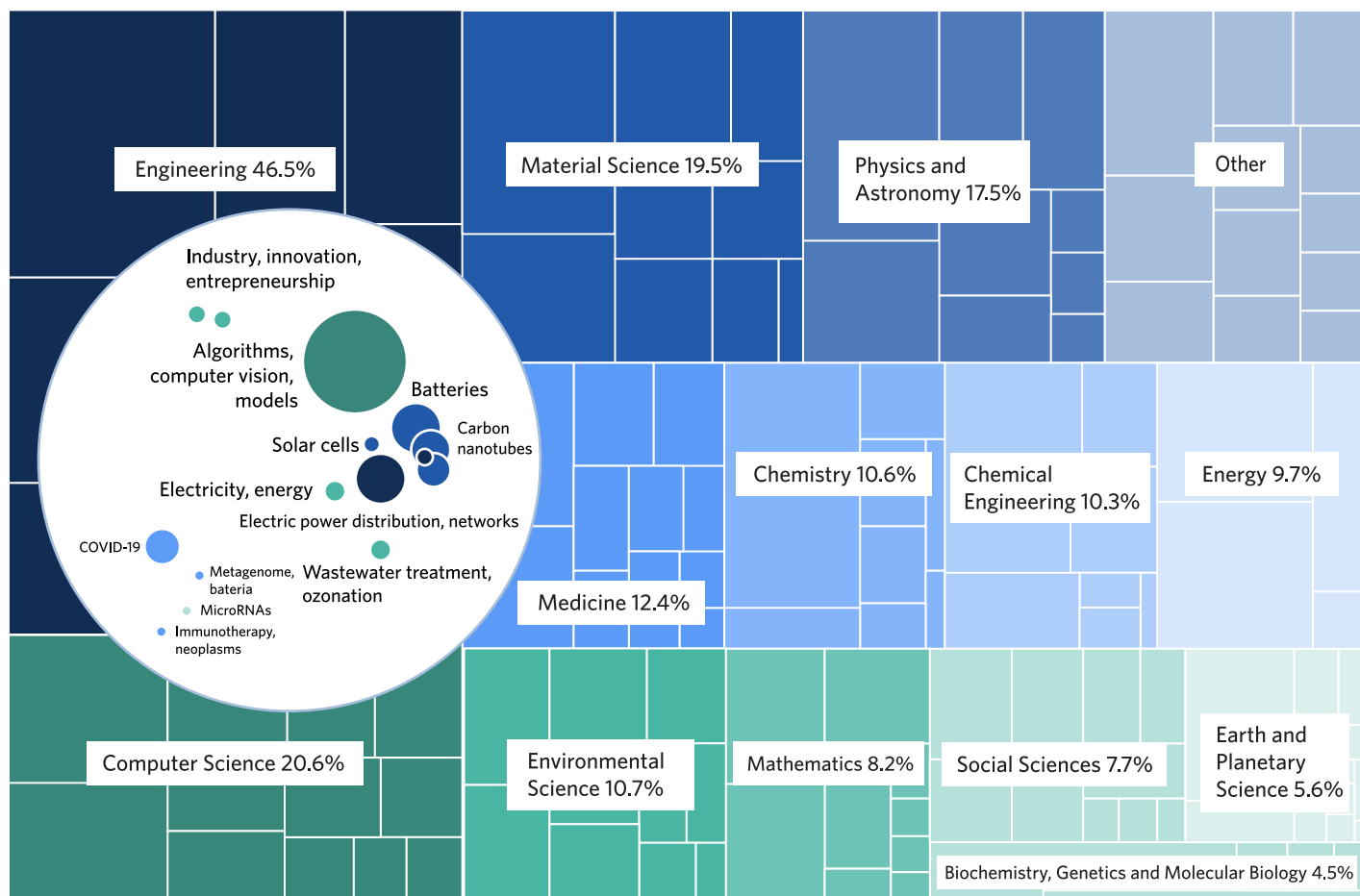
Please see the [SoN's annual research report](#) for more information on the School's leadership during this extraordinarily challenging time.

As societies shift to **post-pandemic recovery**, COVID-19 research remains an acknowledged strength at APSC (see Figure 6b). The pandemic has had profound impacts globally, necessitating comprehensive recovery efforts across many sectors including health care, the supply chain, manufacturing and others. Post-pandemic recovery is a complex and multifaceted process, requiring flexibility, innovation and a commitment to addressing both immediate and long-term challenges. APSC researchers have faced these challenges head-on, being awarded **\$2 million from the New Frontiers in Research Fund – special call for research on post-pandemic recovery**. Ranging from supporting men's mental health (**Dr. John Oliffe, SoN**) and preparing businesses for future pandemics (**Dr. Stephanie Chang, SCARP**) to securing sustainable supplies of critical commodities (**Dr. Yankai Cao, CHBE**), APSC researchers led four of UBC's five successful applications to this call.

Benchmarking and Reputation

The diversity of APSC research represents the broad range of disciplines within the Faculty and its ability 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 all subject areas**, including medicine (12% of total publications), computer science (21%) and many more (See Figure 6a). Our areas of identified strength (Figure 6b) reinforce the multidisciplinary expertise within

our Departments and Schools, including social and natural sciences, health research and engineering. Top worldwide research impact in **health care** (COVID-19, mRNA, men’s health), **ICT** (computer algorithms and models, quantum technologies) and **clean energy** (electric transmission, wind power, batteries) show the link between research and APSC’s strategic objectives, supporting Solutions for People, Thriving Cities and Communities, and Planetary Health.



Other: Nursing (3.0%), Agricultural and Biological Sciences (1.9%), Health Professions (1.5%), Business, Management and Accounting (1.5%), Decision Sciences (1.5%), Multidisciplinary (1.3%), Psychology (1.1%), Arts and Humanities (0.9%), Neuroscience (0.7%), Immunology and Microbiology (0.7%), Economics, Econometrics and Finance (0.6%), Pharmacology, Toxicology and Pharmaceutics (0.6%), Dentistry (0.1%), Veterinary (<0.1%)

Figure 6a – A “treemap” of APSC publications across subject areas over the past five years (2018-2023).

Segment size represents relative publication share per subject area. Note that a publication can be mapped to multiple subject areas.

Figure 6b (inner circle) – The top 1% of worldwide topic clusters APSC researchers have contributed to over the same time period (Source: SciVal).



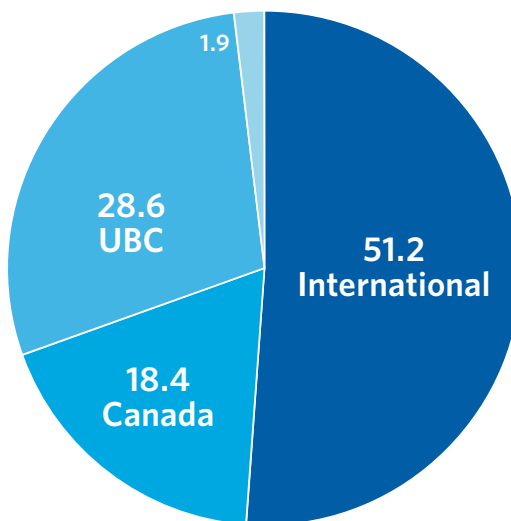
(Bioproducts Institute)

APSC's research impact surpasses that of UBC and the U15 (Canada's top 15 universities) in a number of metrics (Figure 7). These include views per publication (59% and 37% higher than the U15 and UBC average, respectively) and field-weighted views impact (34% 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 (20% above the U15 average). Accordingly, a study by Stanford University determined that over **100 APSC researchers** are among the top 100,000 most cited scientists across all scientific fields, or within **the top 2% most cited of their subfields**.

APSC has also maintained its strong research quality and output, maintaining an average of ~1,500 publications annually since 2018 (nearly 10,000 cumulatively), of which **20% are in the top 10% of the most cited publications worldwide** and nearly 50% are in the top 10% of journals. APSC faculty members are also **highly collaborative**, with over 5,000 publications (51% of total) resulting from international collaboration and nearly 1,800 (18%) resulting from national collaboration over the past five years. In 2022/23, APSC researchers published 1,599 publications with international co-authors. Top collaborating institutions include the University of Melbourne (8% of total), the US Department of Energy, France's Centre national de la recherche scientifique, Oxford University and Finland's Aalto University, with ~4%-5% of total publications each.³

Views per publication	Field-weighted views impact	Output in top 10% citation percentiles	Publications in top 10% journal percentiles
37% above UBC average	12% above UBC average	17% above UBC average	12% above UBC average
59% above U15 average	34% above U15 average	35% above U15 average	20% above U15 average

Figure 7 - The higher relative performance of APSC researchers versus the UBC and U15 average in various scholarly metrics. Percentages generated with SciVal benchmarking averages over 2018-2023.



Over half of APSC publications are with international co-authors. On average, papers published with international collaborators are cited **3.5 times more often** than those with no collaboration.

³The 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 fields. 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.

APSC in the Media

Applied Science research received 845 mainstream media mentions in 2022/23 in outlets including the Globe & Mail, Vancouver Sun, Global and CBC. This does not include the significant uptake 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, time range June 2022-May 2023).



THE WEATHER NETWORK

This van takes air pollution testing right to the source

Dr. Naomi Zimmerman (Mech) and her 'PLUME' air quality testing mobile lab.



VANCOUVER SUN

Will e-bike rebate program get people out of their cars? Here's what UBC research shows

Dr. Alex Bigazzi's (Civil) work on mobility devices, including e-bikes.



CBC NEWS

SALA researchers & students represent Canada at the Venice Biennale of Architecture



THE INDEPENDENT

New water treatment zaps forever chemicals 'once and for all'

Dr. Madjid Mohseni's (CHBE) innovative process to remove PFAS from water. Also featured on Global News.



VANCOUVER IS AWESOME

Canada's largest residential Passive House is at UBC and tenants just moved in

Dr. Adam Rysanek (SALA) land his leading research on the 'Evolve' passive house.



THE GLOBE & MAIL

Unlocking materials solutions from nature

A featured story on UBC's BioProducts Institute (BPI) (photo shows **Dr. Heather Trajano, CHBE**).



National Carbon Economy Consortium

Our Strategies: Strategic Partnerships

APSC researchers excel at attracting industrial funding, and the Faculty continues to lead UBC in this metric, attracting **18% (\$12.6 million) of UBC's total industrial funding** (\$68.2 million) in 2022/23. However, we have seen a significant drop in industry funding this past year across both campuses, and as such across UBC overall. While various factors are in play, this can be attributed mainly to the completion of a multi-million-dollar contract with one of our largest industrial partners. While

continuing to follow our strategy of securing long-term, mutually beneficial and lucrative partnerships, we aim to increase our share of industrial funding to over and above our five-year high of \$20 million in 2021/22 (Figure 8) by **diversifying our partners** and focusing on growing areas of (non-industrial) partnerships, such as with non-profit organizations, which brought in \$18.5 million in funding this year.

INDUSTRY FUNDING ACROSS APSC

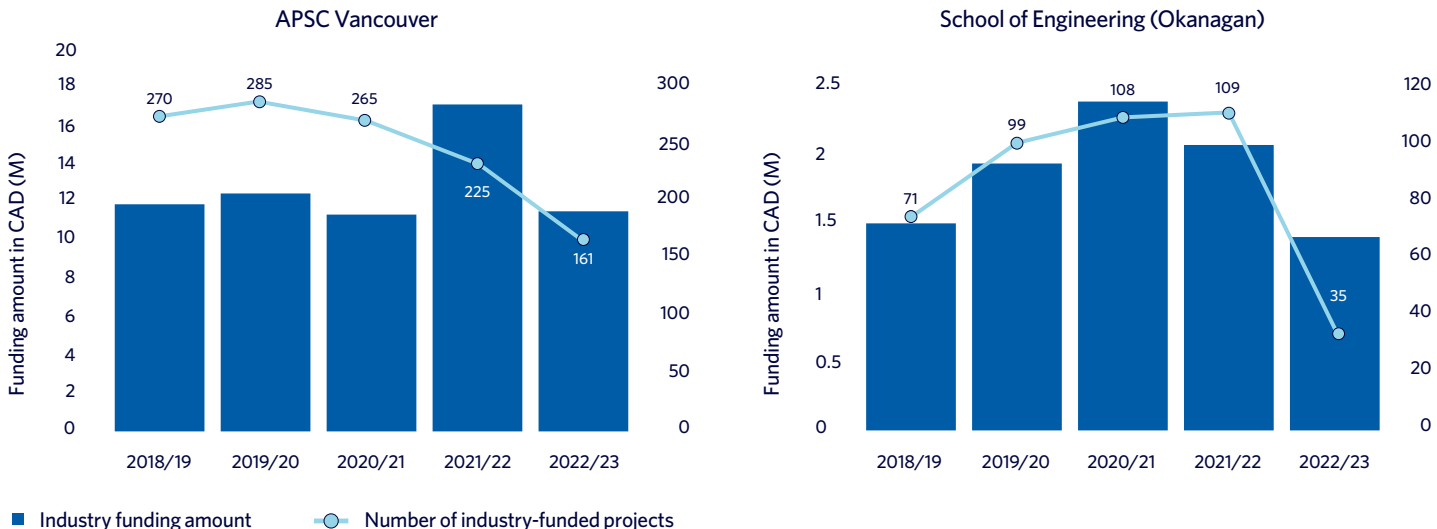


Figure 8 - Industry funding amount (blue bars) and number of industry-funded projects (light blue line) for APSC Vancouver (left) and the School of Engineering (Okanagan) (right), 2018-2023. Includes contracts and grants.



(Smart Hydrogen Energy District)

Canadian researchers are **increasingly engaging in global collaboration and partnerships** to access international markets, leverage complementary expertise and gain access to funding opportunities (including the eagerly awaited Horizon Europe program). Accordingly, APSC's funding partners are from diverse backgrounds, and our researchers have productive and collaborative relationships with major Canadian, US and international companies including Boeing, Rogers and Huawei. In 2022/23, non-US international ("foreign") companies continued to be the largest source of industrial funding (~\$3.9 million, down from ~\$7 million in 2021/22), followed by Canadian, BC and US companies (Figure 9).

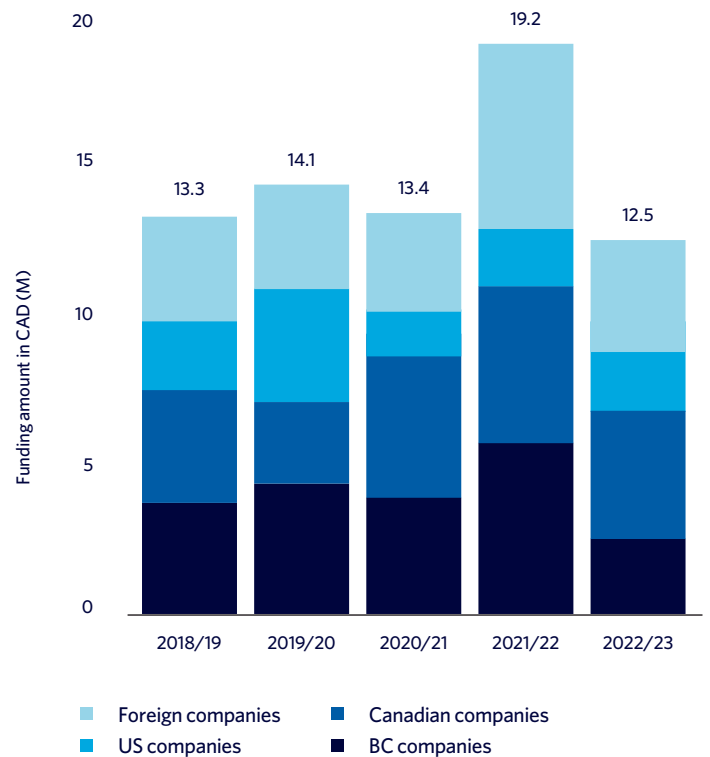
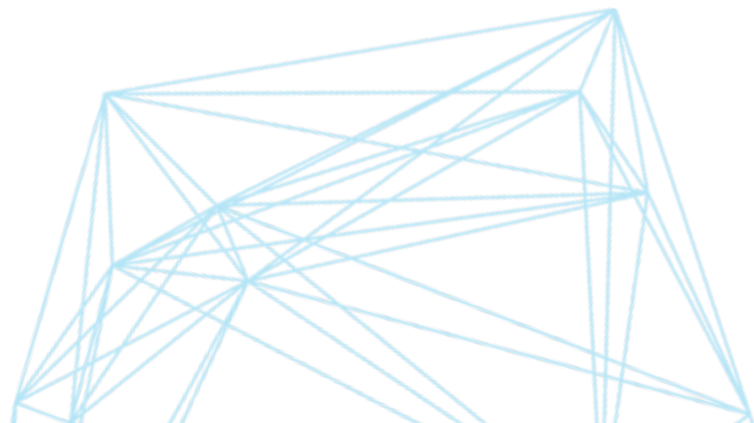


Figure 9 – Funding across APSC Vancouver and Okanagan campuses (2018-2023) from various companies based on geographical distribution.





STRATEGIC PARTNERSHIPS

AI-Powered “Smart” Robots for Faster, Safer Construction

Strongly supported by industry and partnered grants, **Dr. Tony Yang** (Civil Engineering) and his team have developed “smart” construction robots that can perform tasks such as lifting and moving objects around a job site, autonomously transporting materials and monitoring sites for safety issues. Moving quickly towards real-world application, the UBC team recently **demonstrated the concept** at a construction site in Richmond, BC. Aerial drones fitted with cameras captured details to create a “digital twin” simulation of the site, after which AI-equipped cranes and forklifts used this information to move construction materials around the actual site, navigating around obstacles without needing a human operator. According to Dr. Yang, this technology will lead to smarter and safer construction sites: “Our made-in-Canada technology is ready to deploy now and can be quickly scaled up, helping to elevate Canadian construction and making us more competitive on the global stage.”

Chris Atchison, president of the BC Construction Association, agreed with the project’s potential to keep job sites safer. “We lead with safety in construction,” he said, especially any new technology that can help “alleviate wear and tear on individuals’ bodies.”

Dr. Yang and his team are currently working with a number of BC construction companies to find opportunities to use smart robots in commercial building projects. [Read more about this project](#), which has also attracted widespread attention in the media, including a [story on CTV news](#).

The Research and Partnerships team, led by Dr. Yaser Roshan, Senior Manager, Partnerships, arranged a two-day networking and implementation workshop with approximately 35 industry, government and research representatives, which included the concept demonstration.



STRATEGIC PARTNERSHIPS

Disaster Resiliency



With climate change resulting in adverse environmental effects – including increased wildfires, earthquakes, flooding and elevated temperatures like the heat dome – collaborative efforts among researchers, practitioners, policy-makers and communities are essential for translating research findings into actionable strategies and policies. APSC researchers are acknowledged leaders in disaster resiliency research, successfully developing practical solutions and building more resilient societies that can effectively cope with the challenges posed by natural and human-made disasters. Funded by diverse sponsors including the CFI and the BC provincial government, and **in partnership with leading industries and non-profits, the work of Dr. Lisa Tobber**, SoE, and the Disaster Resilience Research Network led by **Dr. Carlos Molina Hutt**, Civil Engineering, are just two examples of the impactful research being done in this area.

Dr. Lisa Tobber and her Advanced Structural Simulation & Experimental Testing research group at the School of Engineering are advancing critical knowledge of how to design and construct disaster-resilient buildings. Awarded the BC Housing Professorship in Resilient Reinforced Concrete Buildings as well as a UBCO Principal's Research Chair, Dr. Tobber believes that **interdisciplinary partnerships** are central to achieving this goal. Working closely with engineering consulting firms and construction companies, she sees first-hand how research and industry

collaboration can lead to tangible change in our built environment. “The barriers to adopting new technology are not so much engineering challenges as they are the challenges of bringing together people from numerous disciplines to work towards making disaster resilience a priority,” she says.

The **Disaster Resilience Research Network** led by Dr. Carlos Molina Hutt (Civil Engineering) and Dr. Sara Shneiderman (Anthropology) also employs an interdisciplinary approach to disaster resilience research, leveraging expertise across both UBC campuses. According to Dr. Molina Hutt, “Our work is tremendously more powerful as a network than working in silos. Working together enables us to advance multi-hazard assessment and mitigation in support of an inclusive and equitable development of just disaster risk management in BC,” adding, “we are always open for more UBC experts in the field to join us.” Awarded \$450,000 from BC's Ministry of Emergency Management and Climate Readiness, **the outcomes from this partnership** will help BC and other jurisdictions prepare for and mitigate disaster and climate risks.

In collaboration with our colleagues at UBC Okanagan, the Research and Partnerships team, in particular Ms. Kyra Laverdiere, Senior Manager, Partnerships, provided extensive support for APSC's disaster resiliency research, including holding workshops with communities and industrial partners, and supporting cluster development via the APSC Cluster Advancement Program.



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 170 patents issued in the past five years**, and an average of 100 patents filed per year (Figure 10). 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 entrepreneurial

thinking and **spinning out their research** into successful, lucrative companies, with 18 enterprises launched over the past five years (see *highlight on next page*). Finally, as mentioned previously, APSC captures the highest proportion of industry funding at UBC (18% in 2022/23) and is the leading recipient of NSERC’s Alliance grants, the Tri-Council’s flagship partnered research program. Looking ahead, we aim to increase our share of industrial funding to over and above 2021/22 levels, as discussed above (Figure 8).

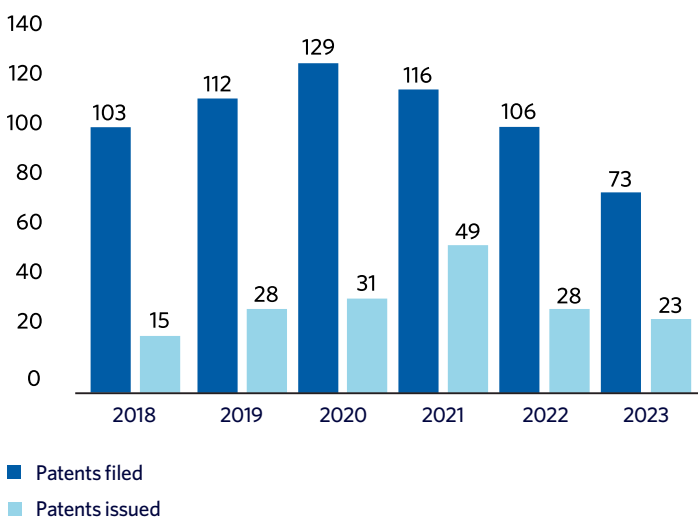


Figure 10 - Patents filed for and patents issued, APSC overall (2018-2023). Source: UBC UILO. Note that 2023 data does not reflect the complete year.

2022/23

23% of UBC's total filed patents

42% of UBC's total issued patents

1 of UBC's 4 new spinoffs

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

APSC researchers have long been at the forefront of technology transfer, developing their research into impactful, lucrative spinoffs readily taken up by industry and society. While a full list is available from UBC's UILO, recent successes include:

Dream Photonics

Dr. Lukas Chrostowski,
Dr. Sudip Shekhar, ECE



Founded in 2020 and combining decades of academic and industry experience in silicon photonics and CMOS electronics, Dream Photonics is actively engaged in process design kit development for silicon photonics foundries across the globe.

Bioform Technologies

Dr. Mark Martinez, CHBE



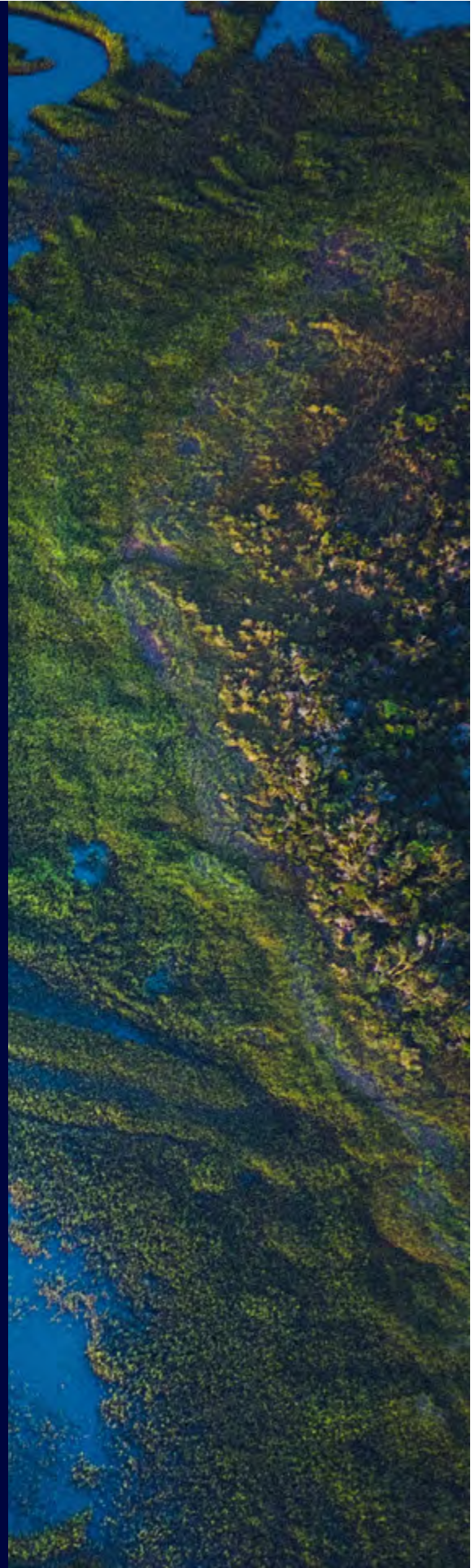
Founded in 2021 and already receiving significant funding and investor interest, Bioform uses the world's most regenerative materials (kelp, wood pulp) to create products that sustainably eliminate plastic waste.

Tersa Earth Innovations Inc.

Dr. Vikram Yadav, CHBE



Launched in 2023, APSC's latest spinoff provides innovative solutions to eliminating mining tailings ponds and recovering precious metals needed to power our society. Tersa's carbon-neutral processes will unlock new value and reduce the carbon footprint of mining operations.

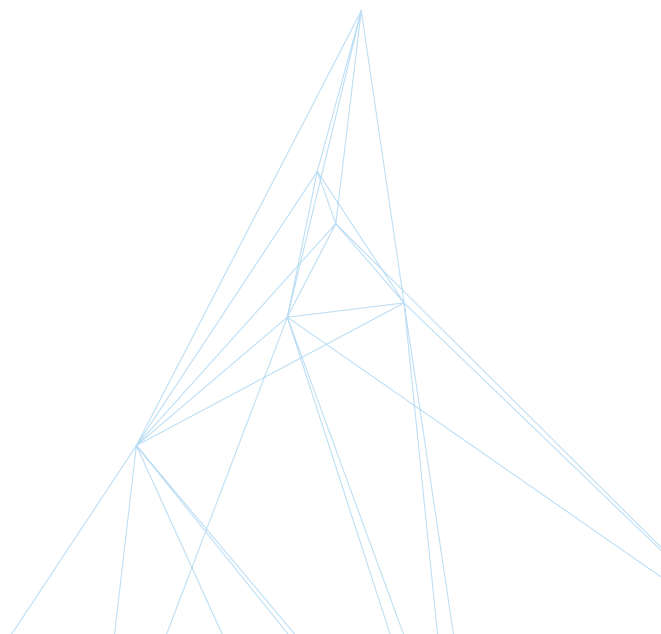




What we do

As discussed in the highlighted stories within this report, the Research and Partnerships team have been closely involved in supporting APSC researchers at all levels, from foundational needs such as securing their NSERC Discovery Grants and CFI JELFs, 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. In the future, **we will continue providing professional, expert support to our Faculty members and excelling at our core programs and services while strategically expanding our scope into new domains**, including increased support of international grants, increased engagement across Faculties in support of truly transdisciplinary and interdisciplinary research, and an enhanced focus on “big” opportunities to strengthen our areas of research expertise.

We also want to acknowledge the extensive expertise embedded within our Faculty at its departments, centres and schools. The Research and Partnerships 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 towards truly impactful, world-leading research.





New and Ongoing Capacity-Building Programs

(Dr. Yasmine Abdin lab)

DISCOVERY GRANT & ALLIANCE GRANT BOOTCAMPS

Over the last five years, the Research and Partnerships team has delivered annual bootcamps to provide guidance to researchers submitting Discovery and Alliance grant applications. These sessions have had a positive impact in boosting the success rate of APSC applicants compared to their national counterparts – 16 and 10 points higher than the national and UBC average, respectively. Sessions include general information, Q+As with past NSERC reviewers, and a chance for participants to workshop key sections of their grants with other applicants. Both the Discovery and Alliance grant bootcamps are combined with extensive resource packages (such as playbooks, videos and templates) to ensure applicants, especially early career researchers, secure these fundamental grants.

DISCOVERY GRANT SUCCESS RATE 2023

National	58%
UBC	64%
APSC	74%

In response to engagement with our departments and schools, the Research and Partnerships team is currently developing bootcamps and enhancing resource packages for additional grants including:

- CFI JELF & Innovation Fund
- SSHRC IG/PG suite
- CRC

RESEARCH LEADERSHIP PROGRAM (RLP)

In the summer of 2021, the Research and Partnerships team developed and launched a pilot of the Research Leadership Program to provide researchers with the knowledge, tools and skill sets to build capacity across grant writing, partnership management, knowledge exchange and leadership. Building on feedback from the pilot, the team rolled out revised versions of the program in 2022 and 2023, and continue to fine-tune and improve the offerings to ensure faculty are best served.

The program features experienced speakers and facilitators from across APSC, UBC and beyond, and topics covered have included:

Evaluating the external environment	Developing a five-year funding plan
Creating a pitch and aligning goals, objectives and outcomes	Effectively managing research finances
Managing intellectual property at UBC	Translating knowledge for impact
Personal branding workshop: How to best leverage social media to present a personal brand	

We will incorporate feedback into the next iteration of the Research Leadership Program, which we will deliver in the year ahead.

CLUSTER ADVANCEMENT PROGRAM

Networked, interdisciplinary research clusters bring together experts from various disciplines to work on solutions to complex problems. UBC established the Grants for Catalyzing Research Clusters (GCRC) program in 2017, followed by UBC Okanagan's Eminence Program, both of which enable the formation and growth of interdisciplinary research excellence clusters.

In addition to grant development and review, in 2022 the Faculty of Applied Science introduced the Cluster Advancement Program (CAP) – a comprehensive approach to supporting our GCRC and Eminence clusters. In this process, the Research and Partnerships team work 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

The clusters are then expected to leverage this funding towards other opportunities. For example, the TrustML cluster used CAP funding to hire a program manager to assist with successful applications to the NFRF program and GCRC renewal. Use of this supplemental funding will be assessed over the coming years to gauge the return on investment and impact from this program.

RESEARCH ENABLEMENT FUND

In addition to the CAP funding available to APSC-led research clusters, and in response to identified needs, the Research and Partnerships team, with support from the APSC Dean's office, implemented the Research Enablement Fund in 2023. This program provides researchers the opportunity to apply for funding to promote activities aligned with APSC's Strategic Plan, including:

- Enhanced collaboration via inter-campus travel
- 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

The team is working with our colleagues in Finance to track the uptake and impact of this program to fine-tune it further as needed.



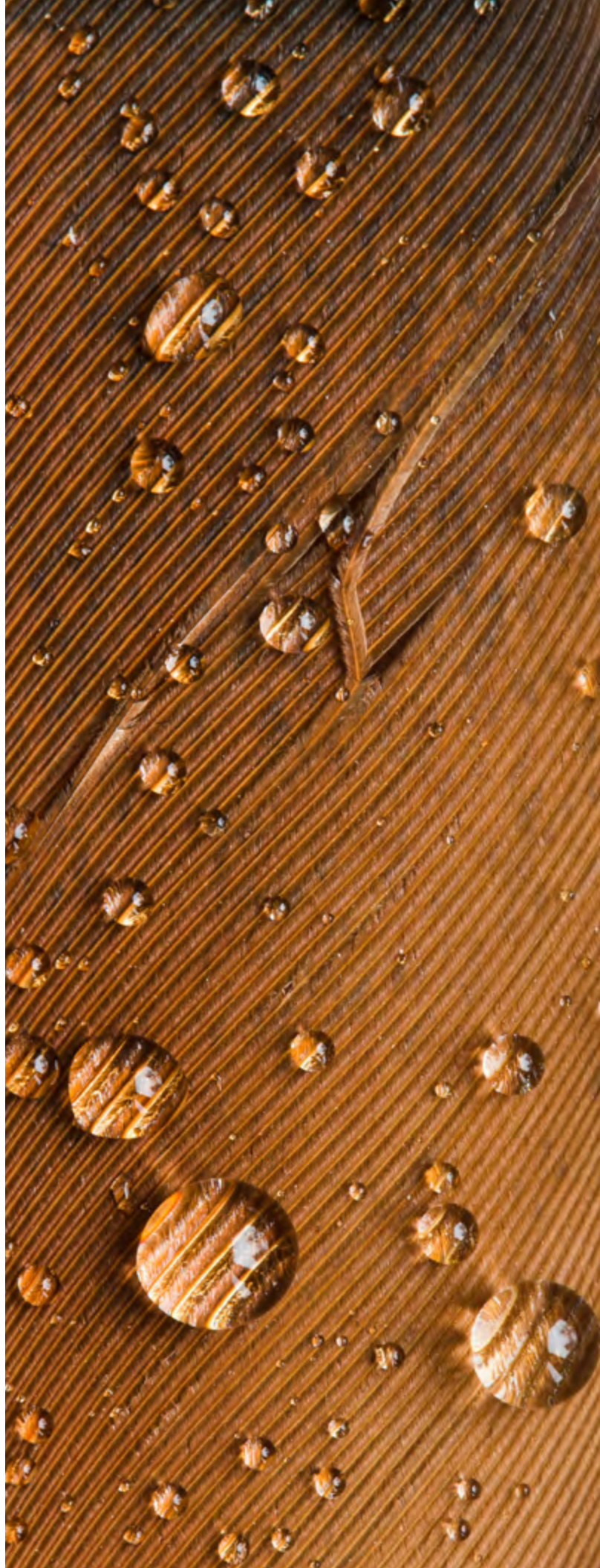
CONSORTIA-BUILDING PROCESS

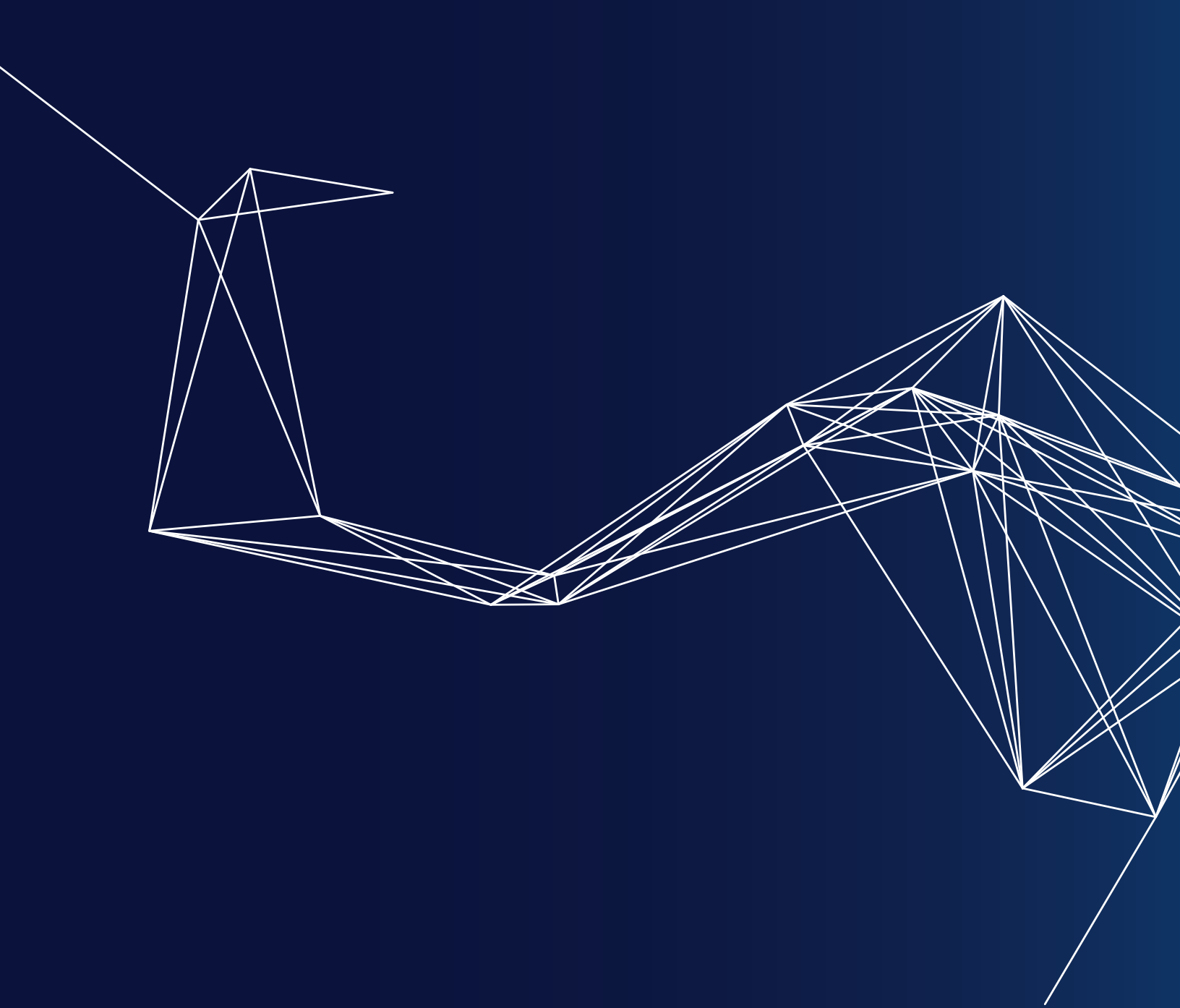
APSC has had repeated success engaging strategic partners to develop industrial co-led research consortia and bringing together players across value chains to share the risk and reward involved in tackling complex challenges that require novel solutions.

The process can be tailored as needed, but generally includes:



Formed consortia are then supported towards applications for large, team-based funding opportunities to ensure sustainability. The Natural Gas Futures consortium, the Transportation Futures consortium and the UBC Coastal Adaptation Lab were all born out of this process.





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