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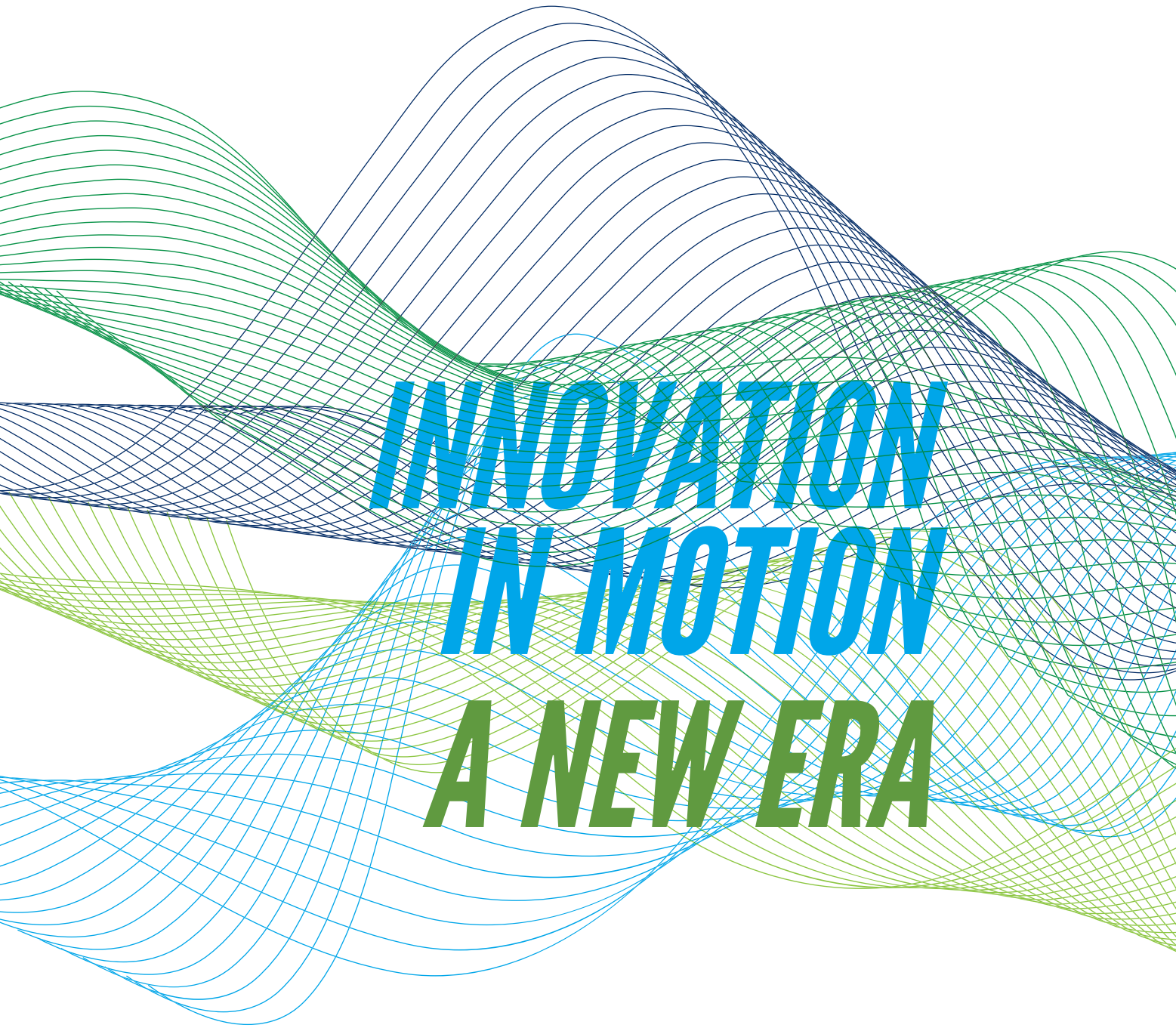

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US-CHINA PHASE ONE TRADE DEAL: CHINA'S IP COMMITMENTS TO THE LIFE SCIENCES INDUSTRY

Written by Jayde Wood & Jennifer Marles

A STRONGER INTELLECTUAL PROPERTY REGIME IN THE MAKING

On 15 January 2020, China and the US signed an agreement on a Phase One trade deal, which could significantly improve the ability of life sciences companies to protect their intellectual property in China. The first chapter of the Agreement addresses inadequacies in China's IP regime. The Agreement states that China recognizes the importance of IP protection and believes that enhancing IP protection and enforcement will boost innovation, grow innovation-driven enterprises, and promote high quality economic growth. Some specific IP concerns addressed by the Agreement are pharmaceutical-related intellectual property and patent term adjustment and extension.

MORE PHARMACEUTICAL PATENT RIGHTS

China agrees to provide "effective protection and enforcement of pharmaceutical-related intellectual property rights, including patents and undisclosed test or other data submitted as a condition of marketing approval".

China will be required to permit pharmaceutical patent applicants to rely on supplemental data to satisfy patentability requirements, including sufficiency of disclosure and inventiveness. This change will bring China in line with practices in other countries such as the US and Europe, although such data is not currently admissible in Canada. This may help pharmaceutical patent applicants to secure patent protection in China.

China will also be required to establish an effective mechanism for early resolution of patent disputes, which includes a system to provide notice to a patent holder that a generic drug company is seeking approval of a version of its patented drug. Such a regime would be similar in concept to the *Patented Medicines (Notice of Compliance)* regime that exists in Canada.

PATENT TERM ADJUSTMENT AND EXTENSION

China agrees to provide (i) patent term adjustment to compensate for unreasonable delays that occur in granting a patent and (ii) patent term extension to compensate for unreasonable delays during pharmaceutical product marketing approvals. Patent term adjustment and extension are particularly important for pharmaceutical patents because it often takes a long time to bring a drug to market.

Patent term adjustment is not available in Canada but patent term extension of up to two years has been available since 2017 for patents pertaining to new medicinal ingredients or new combinations of medicinal ingredients for human or veterinary use. Canada will also have to add provisions relating to patent term adjustment to account for delays in the examination of patent applications to comply with its obligations under the Canada-US-Mexico Agreement (CUSMA). So the effect of these international agreements will be to move Canada and China closer in this area.

OPPORTUNITIES FOR LIFE SCIENCES COMPANIES

China's IP commitments under this Agreement will likely create new opportunities for life sciences companies wishing to market their innovative products in China, the world's second-largest life sciences market. Companies should closely watch the developments of China's IP regime so that they can assess the potential impact on their business and patenting strategies.

As intellectual property lawyers, we help life sciences companies define and protect their innovations. We also help our clients to seize opportunities arising from changing IP regimes. If you have questions about securing your intellectual property in Canada, China or other markets, we can help.

Jayde Wood, Associate Intellectual Property Lawyer

Jennifer Marles, Partner Intellectual Property Lawyer

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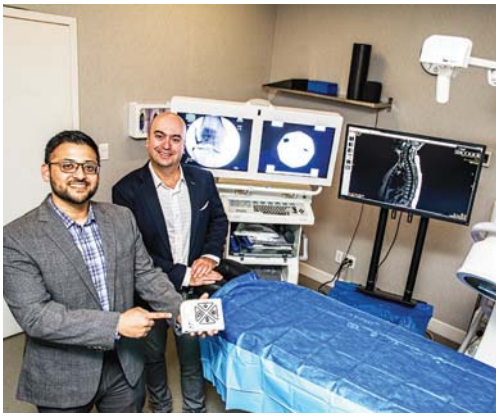

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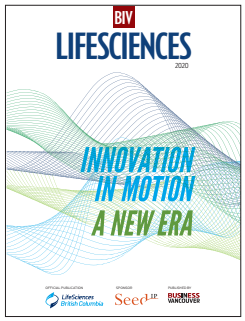

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LifeSciences is published by BIV Magazines, a division of BIV Media Group, 303 Fifth Avenue West, Vancouver, B.C. V5Y 1J6, 604-688-2398, fax 604-688-1963, *biv.com*.

ISSN 1205-5662

Publications Mail Agreement No.: 40069240.
Registration No.: 8876.
Return undeliverable Canadian addresses to
Circulation Department:
303 Fifth Avenue West,
Vancouver, B.C. V5Y 1J6
Email: subscribe@biv.com

Cover: Tim Gottschick/Bay6 Creative Inc.

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MESSAGE FROM CANADA'S MINISTER OF INNOVATION, SCIENCE AND INDUSTRY

NAVDEEP BAINS, CANADA'S MINISTER OF INNOVATION, SCIENCE AND INDUSTRY

We believe that strong science makes for a strong Canada; and when it comes to Canada's life science sector, British Columbia is a true leader. This province has an internationally acknowledged and respected base of expertise that we are proud to support and partner with. Recently, our government announced a big round of investments in genomics and stem cell research; no surprise that large portions of that funding will be dedicated to the important work going on at many of British Columbia's world-class research institutions.

To stimulate innovation, our government must also play the role of regulator in the life sciences, such as Health Canada's Regulatory Review of Drugs and Devices. This process allows our government to review information on new drugs and devices for priority diseases quickly, so that Canadians have faster access to new and innovative treatments. To build on this, we are working to develop regulatory road maps for many of our high-potential sectors – including health. We want to make regulatory systems more agile, transparent and responsive, with a focus on supporting innovation and business investment.

We also understand that our government's policy and funding programs must help spur private-sector innovation. As part of our Innovation Superclusters Initiative, our Digital Technology Supercluster, based in British Columbia, is bringing together companies and researchers to collaborate on generating innovations in areas where Canada can lead globally. For example, using bigger, better data sets and cutting-edge applications of augmented reality, cloud computing and machine learning to improve service delivery in precision health, among other areas. Over the next 10 years, our supercluster investments are expected to help create thousands of middle-class jobs and establish British Columbia as a 21st-century global leader in life science innovations.

In all this, our government is fortunate to be guided by the recommendations of our health and bioscience Economic Strategy Table experts. This blue-ribbon panel, lead by Quark Venture's Karimah Es Sabar, leverages insights from industry leaders to support transformative growth in the sector. I am pleased to report that we are implementing a major portion of the group's recommendations with more work to follow.

None of this would be possible without the steadfast support of organizations like yours. On behalf of the Government of Canada, I would like to thank LifeSciences BC and your members for all you do to keep British Columbia's life science sector world-class. Together, we are advancing a strong life science sector in B.C., making for a healthier and more prosperous country.

MESSAGE FROM THE MINISTER OF JOBS, ECONOMIC DEVELOPMENT AND COMPETITIVENESS

MICHELLE MUNGALL, MINISTER OF JOBS, ECONOMIC DEVELOPMENT AND COMPETITIVENESS

British Columbia has a strong history in innovation and leading life sciences initiatives that result in promising advances for people and the life sciences ecosystem. For example, in 1955, the BC Cancer Agency established the first cervical cancer screening program in the world, and as a result, it has successfully reduced the rate of cervical cancer by 70%. The team at the BC Centre for Excellence in HIV/AIDS proved that it was possible to nearly eliminate HIV transmission using the "treatment-as-prevention strategy," which is the inspiration behind the United Nations 90-90-90 global HIV treatment target.

Today, we are still taking the lead. Our Crown agency Innovate BC posted a story online about the remarkable work being done by Vancouver's Precision NanoSystems Inc. Their team is taking on the next era in drug development, nanomedicine, to create drugs with improved performance, reduced side-effects and new treatment strategies. The passionate people who work at this company, and many other life sciences companies throughout B.C., are committed to finding ways to improve the lives of our loved ones.

People with skill and determination are creating life-saving products against a beautiful mountain backdrop with a government committed to supporting this success into the future. In April 2018, together with the federal government, we invested $45 million in Vancouver-based Stemcell Technologies to help the company build a state-of-the-art advanced manufacturing facility. This investment will support the development of products for clinical trials with the aim of curing cancer and other serious diseases.

Over the last few years we invested more than $30 million for state-of-the-art equipment at post-secondary institutions through the B.C. Knowledge Development Fund. Nearly $18 million of this funding has been dedicated to the health and life sciences sector. These investments encourage better patient outcomes and services for people, and also help attract and retain high-quality researchers and skilled workers to the province.

The future of B.C.'s life sciences sector is on solid ground with over 300 companies solving some of the most complex health challenges that people face. At the forefront of the sector is an immense sense of pride for the remarkable work being done by the researchers and entrepreneurs who work endlessly to be the pioneers of innovation and discoveries that shape our lives.

THE FUTURE OF B.C.'S LIFE SCIENCES SECTOR IS ON SOLID GROUND WITH OVER 300 COMPANIES SOLVING SOME OF THE MOST COMPLEX HEALTH CHALLENGES THAT PEOPLE FACE

MESSAGE FROM THE PRESIDENT AND CEO

WENDY HURLBURT, PRESIDENT AND CEO, LIFESCIENCES BC

If I had to choose one word to summarize our B.C. life science ecosystem right now, it would be *momentum*.

Life sciences in British Columbia grew substantially in 2019 and, early into 2020, is moving with equal velocity. With strong anchor companies in place, small and medium-sized enterprises (SMEs) growing, world-class research occurring and capital flowing in, we are attracting interest from around the globe. With rising tides lifting all boats, it is truly an exciting time.

In the midst of this increasing momentum, it is important to take a moment to recognize what we have accomplished and celebrate our successes.

Since joining the LifeSciences BC team in April 2019, I have been struck by the number of brilliant people in this province who are moving the needle forward to develop and scale innovation and are truly impacting lives. It is thanks to the years of hard work, determination and collaboration of many that our sector is in the favourable position it is today. People from academia, research institutions, SMEs and large companies have all come together to advance our ecosystem and the life science economy.

Among the many success stories of this past year are two B.C. companies that reached the $2-billion-market-cap milestone. Aurinia Pharmaceuticals and Zymeworks both made significant progress to advance their therapeutic products, with Aurinia closing a public offering of US$191.7 million and Zymeworks raising US$201.3 million. Meanwhile, AbCellera and StarFish Medical were both on the *Globe and Mail*'s list of fastest-growing companies in Canada, and as we go to press, AbCellera is working to help solve the COVID-19 viral infection by working alongside the Pentagon's Defense Advanced Research Projects Agency, or DARPA. Neoleukin Therapeutics announced a US$75 million public offering. Chinook Therapeutics likewise raised $65 million and signed a significant global licensing deal. This is simply years of hard work paying off and pushing a new era in life science forward in B.C.

Digital health continues to emerge as a major player in our space, with rapidly expanding companies like Molecular You, Equicare Health and PHEMI Systems all applying digital technology to support better health delivery and support systems. And in medical technology, BioLytical Laboratories, named B.C. Exporter of the Year, has emerged as a global leader in point-of-care patient testing.

These success stories are just a small sample of the many achievements of the past year – not to mention the impressive scientific advances of our research institutions.

Throughout all this growth and velocity, LifeSciences BC has remained committed to supporting our membership – from academia to institutions and industry.

We have done this by bringing together key players to connect, exchange ideas and work together. In total, we hosted 27 events with almost 3,000 attendees. This included the Sweden-British Columbia Digital Health Initiative, the largest-ever LifeSciences BC Investor Summit, presented by Lumira Ventures, our first LifeSciences BC-BioTalent Canada Career Connect Day and our always sold-out annual awards gala, among others.

We also have worked to promote the sector internationally. We attended the BIO International Convention in Philadelphia along with a strong B.C. government delegation, and hosted over 20 international missions to Vancouver, specifically interested in building strategic partnerships with B.C. companies. To further define and elevate the knowledge of the sector, we are also collaborating on an economic impact sector report with the Ministry of Jobs, Economic Development and Competitiveness.

Finally, we have worked diligently to forge strong partnerships and build relationships with our entire sector across the province. We designed and delivered a regional showcase series that took us to all corners of B.C. to shine the spotlight on the quality of research and innovation happening from Prince George to Kelowna, Surrey and Victoria. It's wonderfully exciting! LifeSciences BC was also a participant at the B.C. Innovation Roundtable discussions, worked closely with Creative Destruction Lab and expanded our partnerships with adMare BioInnovations, Clinical Trials BC, the Michael Smith Foundation for Health Research, Genome BC and many more.

The growing speed of our ecosystem is exhilarating.

You can feel the momentum, you can feel the energy, you can feel the tides changing. Years of hard work by many are paying off, and now is the time for our community to seize the opportunity.

With this momentum, LifeSciences BC remains committed to working on behalf of all members. We are here to ensure our membership has the resources and support it needs to thrive in this new era. Most importantly, we are here to assist our members as they advance health innovation, making a difference in people's lives for a healthier world.

I look forward to working with you all, including our generous sponsors, in what is sure to be another exciting year.

LifeSciences British Columbia

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B.C.'S AMAZING LIFE SCIENCE ASSETS

The strength and growth of B.C.'s life sciences sector wouldn't be possible without its invaluable array of anchor assets – organizations that are doing the work to advance the sector, improve patient outcomes and position B.C. as a life sciences leader. In this edition of *LifeSciences*, we profile seven of these key organizations.

ALLIES INTERACTIVE/SHUTTERSTOCK

BC ACADEMIC HEALTH SCIENCE NETWORK: BRIDGING ACADEMIA AND HEALTH CARE

CHUCK CHIANG

B.C.'s life science sector is continuously developing innovations in the medical field, but how do researchers translate their work to applicable situations – where these innovations can result in real improvements to the existing health system and patient care practices?

That's where the BC Academic Health Science Network (BC AHSN) has been focusing its work since coming into existence officially in 2016. The organization, initiated by the B.C. Ministry of Health as "a key enabler of a scientific and learning approach" to transforming B.C.'s health system, has been working diligently behind the scenes for years on the cause, says BC AHSN's president, Stirling Bryan.

"I see a lot of researchers who are frustrated because they feel they have some great ideas and have actually tested out some great innovation, and yet they don't see it being taken up in the [local health-care] system," Bryan says.

"What we are trying to do is to build a bridge between the academic world and the health sector."

BC AHSN has three main components, each responsible for a different area of promoting that link between academia and B.C.'s health system. The BC SUPPORT (Support for People and Patient-Oriented Research and Trials) Unit, for example, is responsible for bringing patients' voices to researchers and making sure the innovations being developed are meeting specific needs in the health market.

The other two branches, Clinical Trials BC and Research Ethics BC, are tasked with establishing and streamlining the necessary infrastructure to make B.C. an attractive market for researchers to carry out trials here. The challenge, Bryan says, has been to improve the research culture in the B.C. health-care system – for medical professionals and health authorities to be more in tune with the research being conducted locally, as well as for researchers to proceed down a research path with an application in mind.

"It's a bit of a two-way street," Bryan says, but he adds that things are consistently improving. "One of the key things we have to recognize is the challenge that the people running health-care systems face. If we have innovations ... that solve true problems for some people, then I think implementation becomes fairly straightforward. But if we have innovations that solve problems but also create new challenges, then implementation becomes more challenging. We have to be very, very responsive to the fiscal environment in which health care operates."

Even with the challenges, BC AHSN has been able to rack up a number of major achievements in only a few years of work. First, the organization sponsored the launch of a clinical trials management system provincewide, introducing a unified system for hospitals and clinics to manage clinical trial patients and collect related data.

Stirling Bryan, president of the BC Academic Health Science Network, says his organization aims to "build a bridge between the academic world and the health sector" • SUBMITTED

In fact, the organization has invested about $30 million since inception to boost the provincial health data system infrastructure. While it's not quite there yet, the goal is to eventually bring clinical data and patient experiences into a research data environment – which would make B.C. much

more attractive as a clinical trial market.

Another major accomplishment was the establishment of ethics harmonization for clinical trials throughout B.C., dramatically reducing the red tape involved for researchers to conduct clinical trial research here.

"If there's a provincewide study someone wants to take, then getting ethics approval at one institution means you have ethics approval across the province. This is a major step forward, because they now don't have to go to every hospital and every major B.C. university for separate ethic approvals. It's a one-stop shop," Bryan says.

Other achievements include the creation of the BC Emergency Medicine Network, which connects all emergency departments in B.C. and allows emergency room medical staff anywhere in the province to connect with other experts working in ERs throughout B.C.

The biggest change brought about by BC AHSN, however, may be the culture change starting to take root in B.C.'s research community, Bryan says.

"We are now seeing research teams that never engaged patients as partners previously starting to do so," he says.

"We recognize now that we actually should be listening more carefully to people with lived experiences, because they know what their priorities for change should be. They know what their needs are for improvements in the system."

WE ARE NOW SEEING RESEARCH TEAMS THAT NEVER ENGAGED PATIENTS AS PARTNERS PREVIOUSLY STARTING TO DO SO

Stirling Bryan
President, BC Academic Health Science Network

BC CANCER: LEADING IN PHILANTHROPY, RESEARCH AND CARE

BRIGITTE PETERSEN

It began with $50,000 from an anonymous donor more than 80 years ago.

The donation allowed BC Cancer, originally the British Columbia Cancer Institute, to open its first cancer treatment centre in Vancouver in 1938. Focusing on everything from causes and detection methods to new ways to manage and treat cancer, BC Cancer has become world renowned for its discoveries.

None of the breakthroughs would have been possible without the agency's fundraising partner, the BC Cancer Foundation, and donors. The foundation is the province's largest funder of cancer research and the biggest in Western Canada. It's earned its spot among the top three cancer charities in the country along with the Canadian Cancer Society and the Princess Margaret Cancer Foundation.

With the help of 100,000 donors, the foundation broke a record in 2019, raising $63.7 million. The funds paid for research and care enhancements including 309 active clinical trials offered to 34,573 patients and two new PET/CT scanners in Victoria and Kelowna.

Sarah Roth, the foundation's president and CEO, says donations help fund research much as venture capital helps startup companies attract more investment dollars.

"Every dollar we raise goes directly to support research and care in British Columbia," Roth says. "We support leading-edge research that then helps scientists apply for other grants. So, our money is often leveraged four times over."

Fundraising events include an annual gala, a fashion show and the Ride to Conquer Cancer, the largest fundraiser in the country. The annual bicycle ride has raised more than $105 million for cancer research over the last 11 years. And while direct mail programs are declining elsewhere, the foundation continues to run a robust program and a successful gift-planning program, raising about $12 million last year through estate donations. Online donations have grown by about 400% over last year, and more than 200 community partners raise funds through events around the province.

The foundation was established in 1935 by a committee of business and community leaders to provide cancer care and treatment at a time when B.C. had the worst cancer outcomes in Canada. Today, the province has the lowest incidence rates for all cancers combined and boasts among the lowest rates of cancer mortality in Canada.

The organization has welcomed significant donations in recent years. In 2012, it received the largest charitable bequest to a single beneficiary in B.C.'s history when William P.J. McCarthy, owner of Burnaby-based real estate firm W.P.J. McCarthy and Co., donated $21.4 million to the foundation through the estate of his grandfather, John Jambor.

In 2018, the foundation received an anonymous $18 million donation – one of the largest to cancer in the province's history. Funds are being used to fuel a molecular imaging and therapeutics program at BC Cancer for research and development of radiopharmaceuticals and clinical trials in partnership with University of British Columbia-based TRIUMF, Canada's national particle accelerator centre.

Sarah Roth, president and CEO of the BC Cancer Foundation, speaks at a 2018 media conference announcing a historic $18 million anonymous donation • BC CANCER FOUNDATION

The first project will be focused on prostate cancer and developing a chemical compound for use in radiation treatment that doesn't damage healthy tissue. Some of the new compounds being developed will also be used for patients who are metastatic and have run out of options.

"It's bringing hope to people who never had hope before," Roth says.

A Provincial Health Services Authority program, BC Cancer works to reduce the number of cancer cases and mortality rates and to improve the quality of life of those with cancer. Its cancer control program works with community partners to deliver a range of oncology services, including prevention, early detection, diagnosis and treatment, research, education, supportive care, rehabilitation and palliative care.

Through the BC Cancer Research Centre, the organization is leading in genomics, single-cell and circulating tumour DNA research, as well as research in immunotherapy and treatments for rare cancers.

Over the years, BC Cancer has reached numerous milestones. In 1955, it launched the world's first cervical cancer screening program, and in 2007 it invented an advanced form of radiation therapy now used worldwide. In 2010, it implemented the world's first prevention strategy for ovarian cancer through removal of Fallopian tubes and became the world's first to treat a patient based

WE ARE IN THE MIDST OF EXCITING TIMES AS WE UTILIZE NEW TECHNOLOGIES THAT CAN GREATLY IMPROVE OUR ABILITY TO UNDERSTAND CANCER

Dr. François Bénard
Vice-president, research, BC Cancer

on the DNA/genomic profile of cancer. Two years later, its scientists were the first to identify 10 unique subtypes of breast cancer.

BC Cancer collaborates with health authorities and primary care providers to plan, co-ordinate and evaluate cancer care. Its six treatment centres in Abbotsford, Kelowna, Prince George, Surrey, Vancouver and Victoria provide assessment and diagnostic services, chemotherapy, radiation therapy and supportive care, while its Community Oncology Network serves patients throughout B.C. by linking regional and community hospitals to programs and specialists.

"Our everyday work is driven by our vision of a world free from cancer," says Dr. François Bénard, vice-president of research for BC Cancer.

"We are in the midst of exciting times as we utilize new technologies that can greatly improve our ability to understand cancer," he says. "From the use of machine learning for early cancer diagnosis and image analysis, the development and implementation of single-cell genomics, development of new cell therapies and radiopharmaceuticals, to advanced clinical trials using cutting-edge technologies, we strive to identify more tailored approaches to delivering personalized cancer care."

Dr. François Bénard, vice-president of research, BC Cancer • BC CANCER

BC CENTRE FOR EXCELLENCE IN HIV/AIDS: A TasP SUCCESS STORY

MARKE ANDREWS

World AIDS Day arrives each December 1 with a sense of sadness, but there was cause to celebrate in British Columbia last December. That was when provincial Health Minister Adrian Dix officially declared that AIDS was no longer an epidemic in British Columbia, but an endemic concern.

Accompanying Dix that day at the opening of the new laboratory of the BC Centre for Excellence in HIV/AIDS (BC-CfE) was BC-CfE's executive director, Dr. Julio Montaner, the man who has spearheaded research and treatment in reducing rates of HIV infection, mortality and transmission.

What a difference from the 1980s, when Argentina-born Montaner first started at Vancouver's St. Paul's Hospital, epicentre of HIV/AIDS in this country. A pulmonary physician, he encountered numerous AIDS patients whose compromised immune systems often meant pneumonia became a death sentence.

Invited to Canada by James Hogg, a University of British Columbia pulmonary physiologist whom he met at a medical conference in Uruguay, and mentored by the clinical pharmacologist John Ruedy, Montaner decided to devote his life to alleviating and preventing HIV, or human immunodeficiency virus, and stopping AIDS, acquired immune deficiency syndrome – often called Stage 3 HIV – from killing people. And he used an approach that his father, also named Julio, employed to tackle tuberculosis: try different things, including different drugs, to fight the dragon.

He first had success with prednisone, a corticosteroid. Then he, along with other HIV experts from Italy, the Netherlands, Canada, Australia and the U.S., researched and tested an antiretroviral cocktail of three drugs: nevirapine, didanosine and zidovudine. This treatment, known as HAART and unveiled in 1996, vastly reduced mortality rates and curtailed progression from HIV to AIDS. HAART reduces HIV in the blood to undetectable levels, making the person healthier, and similarly decreases HIV in sexual fluids, reducing the risk of transmission by 95%.

"The controversy over this was huge," Montaner recalls. "People were worried about long-term harm. But what we found was the more you treated people, the less infectious they became."

OPPOSITE PAGE: **Dr. Julio Montaner, executive director of the BC Centre for Excellence in HIV/AIDS** • CHUNG CHOW

BC-CfE utilized HAART as part of a broader strategy, Treatment as Prevention (TasP). The TasP mandate calls for increased testing and using HAART or other antiretroviral drugs. BC-CfE also supports a controlled environment for users of injectable drugs to prevent them from sharing needles.

The successes of both HAART and TasP are numerous. In 2010, the B.C. government put $48 million into a pilot program called STOP HIV/AIDS (Seek and Treat for Optimal Prevention of HIV/AIDS) to advance the gains of TasP, adding another $19.9 million to that amount four years later. In 2011, a U.S. study of heterosexual couples where one person was HIV-positive showed a 96% decrease in HIV transmission. China adopted TasP in 2011, followed by major U.S. cities in 2012, Brazil and France in 2013, and then Panama, Spain, Swaziland, Argentina, the Australian state of Queensland, South Africa and Sierra Leone.

More recently, a 2018 study involving almost 1,000 gay couples in 14 European countries tracked 77,000 instances of condom-less sexual intercourse between an HIV-positive partner using antiretroviral treatment and an HIV-negative partner. The result? Not one transmission of HIV.

Yet no other province in Canada has converted to treatment as prevention.

"It takes political will," Montaner says. "Because we were the most affected province, and had a smaller population than some other provinces, it was easier for us to move ahead with this."

He adds that an increasing number of B.C.'s new HIV cases (about 350 annually) are incurred outside the province.

Looking forward, Montaner hopes to duplicate the TasP success story to treat those with hepatitis C and opioids dependency – but his first aim is to get rid of HIV.

"I want to finish that movie," Montaner says.

WHAT WE FOUND WAS THE MORE YOU TREATED PEOPLE, THE LESS INFECTIOUS THEY BECAME

Dr. Julio Montaner
Executive director, BC Centre for Excellence in HIV/AIDS

CENTRE FOR HEALTH, EVALUATION & OUTCOME SCIENCES: CHÉOS ELIMINATING CHAOS

MARKE ANDREWS

The acronym is CHÉOS, and its members pronounce it "chaos." Talk about irony; the Centre for Health, Evaluation & Outcome Sciences helps *remove* chaos in health care.

Its members – 130 staffers and 70 scientists – are embedded within the health-care system and see daily the problems they face and the outcomes of treatments. Their research helps find a better way to do things.

One example: in the late 1990s, CHÉOS members noticed that drug users being treated for infections from syringes kept checking themselves out of Vancouver's St. Paul's Hospital on Wednesdays before their treatment was finished. The reason? If they didn't pick up their monthly welfare cheque in person, they received only a fraction of the amount.

Members' advocacy led the provincial government to change its welfare distribution system.

"CHÉOS is one of the first [health sciences] groups to get patient input into our research," says Dr. Aslam Anis, CHÉOS director, from his office at St. Paul's Hospital.

"Why do we do research in hospitals?"asks the Bangladesh-born Anis, a health economist who came to British Columbia in 1995. "We need front-line people to provide evidence-based findings in population health."

The range of health-care subjects CHÉOS members have dealt with in recent years includes how heart attacks in women differ from those in men, cost-effective treatments for rheumatoid arthritis, and the high percentage of physical and emotional burnout (46.3%) of staff members involved in long-term care of patients at five Providence Health Care facilities.

CHÉOS has also involved itself in the epidemic of the last decade, opioid use and addiction.

Last May the federal government announced approval of injectable hydromorphone (HDM) for the treatment of opioid addiction. This came after a three-year study by a CHÉOS team, led by Dr. Eugenia Oviedo-Joekes, that found HDM was as effective as pharmaceutical-grade heroin and methadone to safely deal with severe opioid addiction. CHÉOS concluded that methadone treatment in the long run is costlier owing to street crime and hospitalizations.

Though prescribing pharmaceutical-grade heroin is legal in this country, it is rarely done, and addicts take their chances on street drugs, which can be cut with all kinds of substances, many of which are lethal. Legal heroin and HDM provide a safer alternative.

"We recommend legalization of heroin to cut out [people using] fentanyl," Anis says. The legal use of heroin would save money in the long run, Anis says, eliminating hospital care for overdoses, reducing property crime and increasing productivity of users well enough to work.

As a health economist, Anis focuses attention on the cost of health care. To this end, he keeps searching for the best pharmacare solution, be it a big-name product or a generic drug. Like many Canadians, Anis says he hopes to see a national pharmacare program someday.

CHÉOS IS ONE OF THE FIRST [HEALTH SCIENCES] GROUPS TO GET PATIENT INPUT INTO OUR RESEARCH

Dr. Aslam Anis
Director, Centre for Health, Evaluation & Outcome Sciences

Dr. Aslam Anis, director of the Centre for Health, Evaluation & Outcome Sciences • ROB KRUYT

GENOME BC: 20 YEARS OF EXCELLENCE

DENE MOORE

In 2016, researchers at the BC Centre for Excellence in HIV/AIDS, in collaboration with Vancouver Coastal Health, announced a world-first genomic monitoring system to identify outbreaks of the disease in near real time.

By monitoring an anonymized database of HIV genotypes, the system could detect clusters of genetically similar infections. That gave public health officials and front-line health-care workers the ability to identify and reach immediately vulnerable populations with targeted outreach, testing and treatment.

Genome BC awarded $1.2 million in funding in 2017 toward further development of the monitoring platform.

So when a new coronavirus, COVID-19, emerged earlier this year, the BC Centre for Disease Control asked Genome BC for funding to apply the phylogenetic analysis to the virus.

"It's using an expertise that we have in British Columbia and applying it to the coronavirus," says Dr. Pascal Spothelfer, president and CEO of Genome BC.

That work on HIV and hepatitis C was "absolutely world-class and has informed infectious disease practices across the world," he says.

It took just four days for the organization to commit $150,000 to the COVID-19 work.

"It's not many organizations that could do that, if any," Spothelfer says. "We have the connections and the networks to do that."

Genome BC, a non-profit research organization funded primarily by the province and the federal government, through Genome Canada, is celebrating its 20th anniversary this year with many such stories under its belt.

In two decades, Genome BC has funded more than $1 billion worth of projects.

"We fund genomic projects across all sectors," Spothelfer says. "Health accounts for about 60%, but then there are other sectors like forestry, agri-foods, fisheries and aquaculture, environment ..."

While the agency's original mandate was to fund research, that mandate has evolved as the science spurred by the agency has matured.

Genome BC now, in addition to research funding, oversees a K-12 education initiative and public outreach that included a series of gene talks. Five years ago the agency added a commercialization program aimed at supporting growth in life science entrepreneurship in B.C.

Genome BC is far from alone in this, Spothelfer says. The BC Cancer Foundation, universities, BC Centre for Disease Control, government ministries, hospitals and private companies all come together to create a cluster of genomic excellence here, he says.

"We truly have an extraordinary scientific community here."

That is owed largely to Dr. Michael Smith, the late B.C. researcher who won the Nobel Prize in chemistry in 1993 for his work on site-directed mutagenesis, a technique that allowed for altering specific parts of genes. Smith lobbied hard for Canadian governments to invest in this science.

In 2000, Genome Canada and Genome BC – one of six genome centres across the country – came of his efforts.

"Genomics is one of the few areas where scientifically we are truly world-class," Spothelfer says.

Genome BC has added innovation to its mandate in order for this very successful science to lead to real-life applications, he says.

"Academic papers are an important output, but in day-to-day life it doesn't really make a difference in British Columbians' lives. Unless we can push the uptake of genomics and take that science and translate it into practical benefits, I think we're missing part of our mandate," Spothelfer says.

Dr. Pascal Spothelfer, president and CEO of Genome BC, says part of his organization's mandate is to make sure "genomics is being applied every day to benefit British Columbians" • AURA MCKAY/GENOME BC

"We want to make sure that both from an economic point of view – and that's where commercialization comes in – but also from a health-care point of view, that genomics is being applied every day to benefit British Columbians."

Not that that hasn't happened. Today, almost every new cancer drug is developed with the assistance of genomics and with companion tests to genomically profile patients. That has allowed clinicians to optimize drug choices, reduce side-effects and improve drug efficacy.

For example, at BC Children's Hospital, Dr. Bruce Carlton and his colleagues are using pharmacogenomics testing to predict and prevent adverse drug reactions in pediatric cancer patients. There are certain drugs that, when given to patients with a certain genetic mutation, can cause deafness.

"By taking that pharmacogenomic test, Bruce and his team can determine whether that patient has that mutation or not, and if the patient does, then another drug is given to make sure that that terrible side-effect doesn't affect this patient," Spothelfer says.

"Those tools are being used in pediatric cancer patients right now."

In the future, genomics will merge with computational biology, bioinformatics and artificial intelligence to affect the greatest challenges of our times, he says.

It will provide the key to mitigating and combatting climate change, to feeding the world's population and to creating healthier populations, he adds.

"One day we'll be able to profile people genomically and make sure that they don't get sick in the first place," Spothelfer says.

EMPOWERING PEOPLE TO BRING INNOVATION TO LIFE

20YEARS

GenomeBritishColumbia

LEADING ▸ INVESTING ▸ CONNECTING

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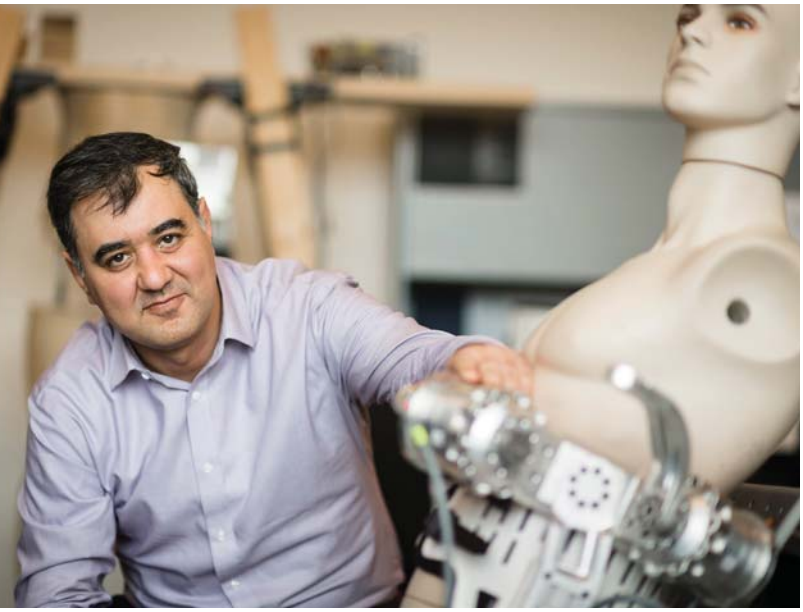
MICHAEL SMITH FOUNDATION FOR HEALTH RESEARCH: FUNDING B.C.'S TOP RESEARCHERS



BRIGITTE PETERSEN

As one of B.C.'s main health research funding agencies, the Michael Smith Foundation for Health Research (MSFHR) attracts, develops and retains researchers.

Through funding programs, the foundation addresses health-sector priorities, creates jobs and adds to the knowledge economy.

"Our focus is on people," says Bev Holmes, the foundation's president and CEO. "We call it health research talent development because it's really the people that are the foundation of that research system that contributes to the health system and social and economic benefits."

Over the past two decades, MSFHR has funded nearly 200 research teams and provided about 2,000 awards to nearly 1,600 researchers while supporting others through special projects and match funding. The foundation supports researchers in biomedical, clinical, population health and health services.

In the 1990s, B.C.'s health research system was performing poorly compared with the rest of Canada. The province had been receiving less than its per capita share of federal health research funding from the Medical Research Council of Canada, the Canadian Institutes of Health Research's (CIHR) predecessor.

"We were not able to attract researchers to B.C. or keep them because they were going where the dollars were," Holmes says. "A measure of how we're doing in the province is how much money we're attracting from national and international agencies, and we were way behind the other provinces."

The provincial government responded by creating MSFHR in 2001, naming the agency after the Nobel Prize-winning chemist and molecular biologist Michael Smith. This enabled B.C. to compete nationally, bringing the province's share of funding on par with other provinces. Agency scholars now receive more federal funding than non-MSFHR-funded researchers in B.C. and bring in more than four times the amount of their awards annually. In 2018-19, MSFHR scholars obtained an average of $483,000 in additional funding through provincial, national and international sources.

Today, about 90% of the agency-funded scholars stay in B.C., where they train an average of 10 next-generation innovators and hire about three full-time staff. Their published journal work receives about 17% more citations than the Canadian average for health science publications.

"Not only are the researchers who are here largely working on problems that are important to our province, but they're also really establishing their projects, their programs, as world-class," Holmes says.

The foundation runs eight targeted funding programs for individual and team-based researchers. For individuals, it offers the Health Professional-Investigator Program, the Health Policy Fellowship Program/Health System Impact Fellowship, the Innovation to Commercialization Program (I2C), the Research Trainee Program and the Scholar Program. Team funding programs include the Convening and Collaborating Program, the Implementation Science Team Program and the Reach Program.

Siamak Arzanpour, a professor at Simon Fraser University's School of Mechatronic Systems Engineering, received a 2018 I2C award, co-funded by Praxis Spinal Cord Institute, to develop a wearable robotic exoskeleton to help people with spinal cord injury walk.

"It's one of the really exciting things that we're able to support through our competitions," Holmes says.

MSFHR optimizes provincially funded research dollars by co-funding awards with hospital foundations, research institutes and centres. It also partners with funding agencies such as CIHR and Genome Canada on national competitions, enabling researchers to bring national and international project funds to B.C.

"Partnerships are so critical," Holmes says. "We have a dedicated partnership strategy. We want to make sure we're optimizing the funding we get from government and that we're supporting other people to fund research. It's about sharing resources, maximizing dollars and also reducing duplication."

As it moves forward, Holmes says, the foundation will continue evolving its programs to support researchers and to strengthen health research across the province.

"Gone are the days when researchers sat in labs in universities and worked by themselves," Holmes says. "Researchers are really out there with communities, identifying problems and solving them."

TOP LEFT: **Michael Smith Foundation for Health Research funding helped Prof. Siamak Arzanpour of Simon Fraser University's School of Mechatronic Systems Engineering develop a wearable robotic exoskeleton to help people with spinal cord injury walk** • SIMON FRASER UNIVERSITY

ABOVE LEFT: **Bev Holmes, president and CEO of the Michael Smith Foundation for Health Research: "our focus is on people"** • SUBMITTED

MICHAEL SMITH FOUNDATION
FOR HEALTH RESEARCH

BC's health research funding agency

DEVELOPING BC'S RESEARCH TALENT

Reimagining rural health research

DR. KATRINA PLAMONDON is bringing together people living and working in rural communities to define priorities for rural health research in BC and co-create a new vision for this work.

Interior Health
2019 Convening and Collaborating

Defeating depression

DR. JOSEPH PUYAT is exploring the treatment and prevention of depression to increase understanding of what works best for an individual and why, how access disparities affect outcomes, and how connections and community-based activities can help prevent depression.

University of British Columbia
2019 Scholar co-funded by the Centre for Health Evaluation and Outcome Sciences – Providence Health Care Research Institute

Eliminating tuberculosis

DR. JAMES C. JOHNSTON is using data to improve tuberculosis (TB) screening, prevention and treatment strategies to accelerate TB elimination in Canada.

BC Centre for Disease Control
2019 Health Professional-Investigator

Bioprinting brain tissue

DR. STEPHANIE WILLERTH is using 3D printing to produce living tissue samples from stem cells to enhance drug screening options for patients with Parkinson's disease and other neurological disorders.

University of Victoria
2019 Innovation to Commercialization co-funded by the Pacific Parkinson's Research Institute

The Michael Smith Foundation for Health Research (MSFHR) is British Columbia's health research funding agency.

Funded by the Province of BC, MSFHR helps develop, retain and recruit the talented people whose research supports better health outcomes, addresses health system priorities, creates jobs and adds to the knowledge economy.

Since 2001, MSFHR has supported nearly 1,600 researchers and 200 research teams as they develop new evidence, treatments and technologies that improve the health of British Columbians.

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Dr. Paul Schaffer, associate lab director of TRIUMF's life sciences division • MARTIN DEE/ TRIUMF

TRIUMF: CANADA'S PARTICLE ACCELERATOR CENTRE

DENE MOORE

When the TRIUMF particle physics lab was founded in 1968 on the campus of the University of British Columbia, its proponents could never have imagined where the project would go.

As ambitious as it was at that time, the depth and breadth of research and innovations born from the lab were likely beyond the wildest imaginations of the day. The cutting-edge nuclear physics lab has expanded its facilities and research reach over the past five decades well beyond nuclear physics to molecular materials science, life science and nuclear medicine.

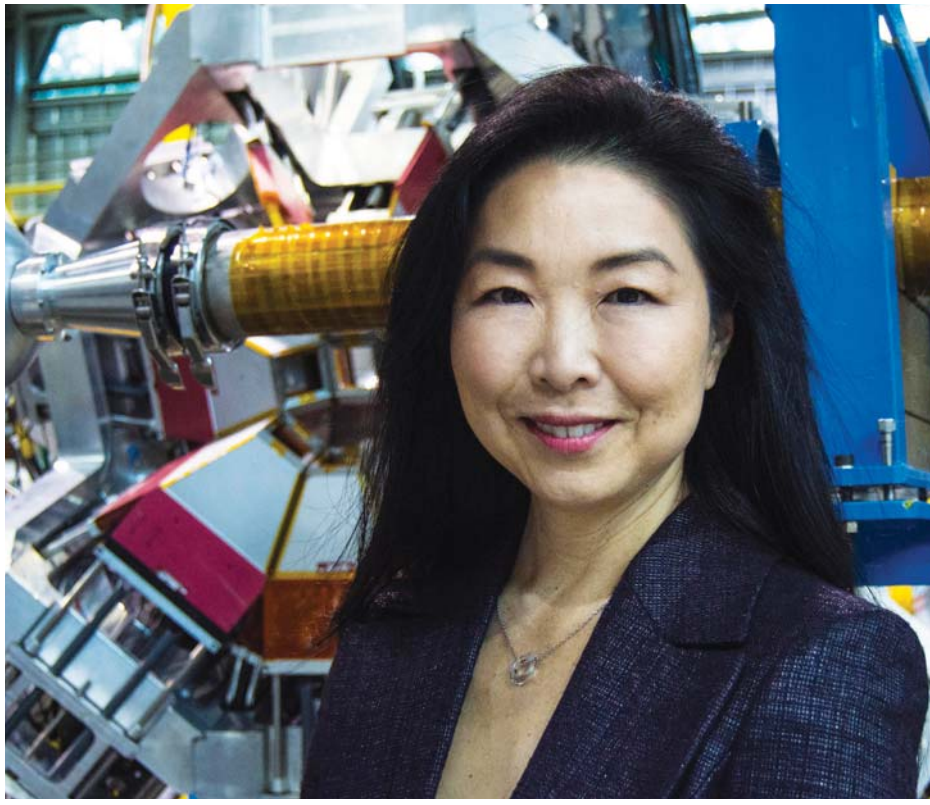
"There weren't people in a room 50 years ago dreaming up the medical isotopes that we're working on today as a focus for TRIUMF," says Kathryn Hayashi, president and CEO of TRIUMF Innovations, the business interface and commercialization arm of the organization. "We really have to credit the leadership of the lab over the years for continually innovating, evolving and continually trying to stay at the forefront of research."

And at the forefront it is. Today, TRIUMF is a consortium of 20 member and associate member academic institutions across Canada. Occupying 13 acres of the University of British Columbia campus in Vancouver, the facilities are home to almost 600 scientists, engineers and staff. The facility draws approximately 900 national and international users every year.

TRIUMF's 520 MeV cyclotron remains one of the largest in the world and has become a global resource in the production of medical isotopes – the key to advances in the field of nuclear medicine.

In April 2019, TRIUMF broke ground on construction of an Institute for Advanced Medical Isotopes, a state-of-the-art facility for the research and production of medical isotopes and radiopharmaceuticals.

"I think medical isotopes weren't even a footnote, honestly, in the original TRIUMF intent," says Dr.



Kathryn Hayashi, president and CEO of TRIUMF Innovations, the business interface and commercialization arm of TRIUMF • TRIUMF

Paul Schaffer, associate lab director of TRIUMF's life sciences division.

There are only two sources for the medical isotopes necessary for the ever-growing field of nuclear medicine: reactors and accelerators.

The reactor infrastructure around the world is aging. Indeed, the impending shutdown of the National Research Universal reactor at the Chalk River facility near Ottawa spurred concerns of a potential worldwide shortage of medical isotopes used in diagnostic scans. Chalk River, which once supplied 10% of the world's supply of technetium-99m, shut down on March 31, 2018.

Anticipating the shortage, the federal government asked officials at TRIUMF in 2009 if the facility could fill the gap.

Schaffer and his colleagues, leading a consortium involving the BC Cancer Agency, the Centre for Probe Development and Commercialization, the Lawson Health Research Institute and the University of British Columbia, came up with a cyclotron small enough to be located right within hospitals. His design has won myriad awards, including the Natural Sciences and Engineering Research Council of Canada's Brockhouse Canada Prize for Interdisciplinary Research in Science and Engineering.

A spinoff company, ARTMS Products Inc., has received seed funding and investments to move forward with commercialization. A submission to Health Canada for approvals is under review, and the technology will soon be implemented in certain jurisdictions around the world.

"It really is a disruptive technology," Hayashi says. "Now, that technology has been put into a spinoff company and it's off trying to scale up and spread the adoption. They've already had several successful installs in locations around the world, proving out that technology. And I think ARTMS is poised to become a new solution for how patients get this isotope."

In the fast-paced world of nuclear medicine, though, there is little time for celebration.

TRIUMF's Institute for Advanced Medical Isotopes is now at the forefront of another emerging treatment using the isotope actinium-225.

In early trials, actinium-225, when combined with a protein or antibody that targets cancer cells, appears to kill cancer cells without damaging surrounding healthy cells. Initial trials of this targeted alpha therapy on late-stage prostate cancer patients in Germany produced very exciting results.

The problem is that actinium-225 is extremely rare. Fortunately, the high-energy proton beam cyclotron at TRIUMF is the perfect energy and intensity to "make a bucketful of actinium every week or so here," says Schaffer.

TRIUMF and Canadian Nuclear Laboratories have partnered to pursue commercial production of actinium-225.

Schaffer expects the BC Cancer Agency to implement a therapeutic prostate cancer treatment in the "very near future," and the possibilities don't end there.

"I do believe late-stage colorectal cancers could be treated in a very similar way," Schaffer says. "Ovarian cancer, breast cancer, pancreatic cancer – a lot of these cancers are found late, and conventional therapies are difficult to find or in some cases don't exist at all. I do believe we're going to see a natural push to try known, targeted compounds labelled with actinium and other isotopes to treat these difficult-to-treat cancers."

The consortium at TRIUMF is exploring different combinations of isotopes and targeting vectors in the treatment of disease.

"Actinium is just one flavour that we can produce," Schaffer says. "There are several hundred flavours that are produced from the same irradiation that produces actinium. And we can tap into that here. That's what TRIUMF is designed to do."

I DO BELIEVE WE'RE GOING TO SEE A NATURAL PUSH TO TRY KNOWN, TARGETED COMPOUNDS LABELLED WITH ACTINIUM AND OTHER ISOTOPES TO TREAT THESE DIFFICULT-TO-TREAT CANCERS

Dr. Paul Schaffer
Associate lab director, life sciences division, TRIUMF

FROM LAB TO PHARMACY

B.C. biotechs find niches, shortcuts to drug discovery and development

NELSON BENNETT

Somewhere on the shelf of a big pharmaceutical company or university lab sits a small molecule that proved ineffective in treating a particular disease, but that may well work on some other disease.

And in our own bodies are antibodies and proteins that, with a bit of clever tweaking and retraining, could be recruited as deadly disease assassins.

The journey from the hospital, where a disease is diagnosed, to drug discovery, to development and, finally, to the pharmacy or hospital, is a long and expensive one, with clinical trials taking years and hundreds of millions of dollars to complete.

Some of the innovation taking place in B.C.'s life sciences space involves finding niches and shortcuts to that long and expensive process. One of those niches is kidney disease.

"There's probably only about 10 companies in the world that are focused on kidney disease, and I think we have two of the leaders here, between Aurinia and Chinook," says Tom Frohlich, operating principal with Versant Ventures, which has built a new

biotech company, Chinook Therapeutics Inc., from the ground up to focus on kidney disease.

Another niche is antibody discovery.

"Two of the largest new biotechs in Canada are based in Vancouver and also are focused on antibody discovery – Zymeworks and AbCellera," says Chadwick King, executive director of drug discovery at Amgen Canada.

Amgen Inc. is a large American biotechnology company with research labs and development companies around the world. In Canada, Amgen's drug discovery research is done in Burnaby, where 70 scientists are focused on antibody discovery.

The XenoMouse platform it uses to create new large molecules was developed here in B.C. In 2006, Amgen acquired Abgenix, the company that developed the XenoMouse platform, which uses "transgenic" mice to produce human antibodies. It is focused on three main areas: oncology, inflammation and cardiology.

"In Burnaby, we really are a centre of excellence for antibody discovery, which is the discovery of large molecules," King says.

Amgen's Burnaby lab has worked with Amgen Germany to develop a new weapon – the bi-specific T-cell engager, or BiTE. It uses two "warheads" – one that targets the tumour cell and one that targets T-cells – to search and destroy tumour cells.

The Burnaby team has developed the U.S. Food and Drug Administration-approved Repatha, a cardiovascular medicine that lowers cholesterol, and Aimovig, a treatment for migraines.

Once a molecule has been demonstrated at the lab level to be effective, researchers then have to develop a way of manufacturing it and test it to prove it is safe and effective in humans. In Chinook Therapeutics' case, the company was formed specifically by Versant Ventures to develop new drugs to treat kidney disease.

Frohlich, Chinook's chief business officer, compares the state of kidney disease treatment today to that of cancer 30 years ago.

"We realized that kidney disease today is treated essentially a lot like where cancer was treated about 30 years ago," he says. "If you were diagnosed with a tumour … they'd just give you some very non-specific chemotherapy or radiation and hope for the best."

Genomics and proteomics have fostered precision medicine for cancer, but to date there hasn't been a lot of precision medicine in the area of kidney disease, which last year cost $114 billion in the U.S. for dialysis and kidney transplants.

"That was the premise – that there's this huge unmet need with kidneys. There's a lot of science that's emerging that makes it more druggable for specific patient types," Frohlich says.

There have also been regulatory changes in the U.S. that will help accelerate and lower the cost of drug development.

"We're applying some really interesting technology, like single-cell RNA sequencing, where you can really tease out what's causing that one individual patient's progression of kidney disease, and then our hope is to be able to treat that very specifically," Frohlich says.

Versant identified an enzyme that causes a rare kidney disease, and then identified a molecule with the potential to treat it. The molecule in question had been developed by Merck years ago and then "left on the shelf," Frohlich says.

Versant partnered with two other life sciences venture capital firms to found and finance Chinook with a US$65 million Series A financing round in July 2019.

"The idea was that we would really comb the landscape and develop the leading precision medicine for a kidney disease company to build out a pipeline," Frohlich says.

Chinook's lead drug is atrasentan. The biopharmaceutical company AbbVie had already conducted clinical trials to demonstrate that the molecule could prevent the need for dialysis.

Versant determined that it might be effective in treating a specific, rare kidney disease and licensed the drug. Atrasentan will enter Phase 3 clinical trials this year. Chinook has several other molecules at various stages of testing for other rare kidney diseases.

Meanwhile, Aurinia Pharmaceuticals is also focused on kidney disease, though not exclusively. Unlike Chinook, it has a single molecule that is believed to be effective in treating a number of conditions, including lupus nephritis, kidney inflammation caused by lupus.

The drug, voclosporin, is an immunosuppressant, which means it could be effective on a number of autoimmune conditions, from lupus nephritis to dry eye syndrome.

Aurinia was spun out after the US$915 million acquisition of Vancouver's Aspreva Pharmaceuticals by the Galencia Group in 2007.

Voclosporin had proven effective as an anti-rejection drug in kidney transplants, but it wasn't the only drug playing in that space. There were competing drugs that also proved effective. From a clinical standpoint it was a success, but from a commercial standpoint it wasn't, so it was abandoned.

But the co-founders of Aspreva and Aurinia suspected there were other possible indications for the drug.

"This drug had another life earlier on in renal transplant and some other indications," says Aurinia's chief operating officer, Michael Martin, who was an Aspreva co-founder. "We just really focused on finding the right indication for it and basically gave the drug a new life.

"Now I would argue that Aurinia is the most valuable biotech in Canada."

Judging by the company's stock performance, investors think so too. Aurinia's stock skyrocketed 77% in one day, from $11.13 per share on December 4, 2019, to $19.75 on December 5, and went as high as $28 per share.

The share spike was largely the result of a Phase 3 clinical trial study that showed that, compared against the standard-of-care treatment, voclosporin resulted in twice as many patients who were in renal remission in half the time.

"That really got the market excited," Martin says.

The company has raised more than US$600 million to date through a series of public offerings, the most recent one being a US$191.7 million raise in December.

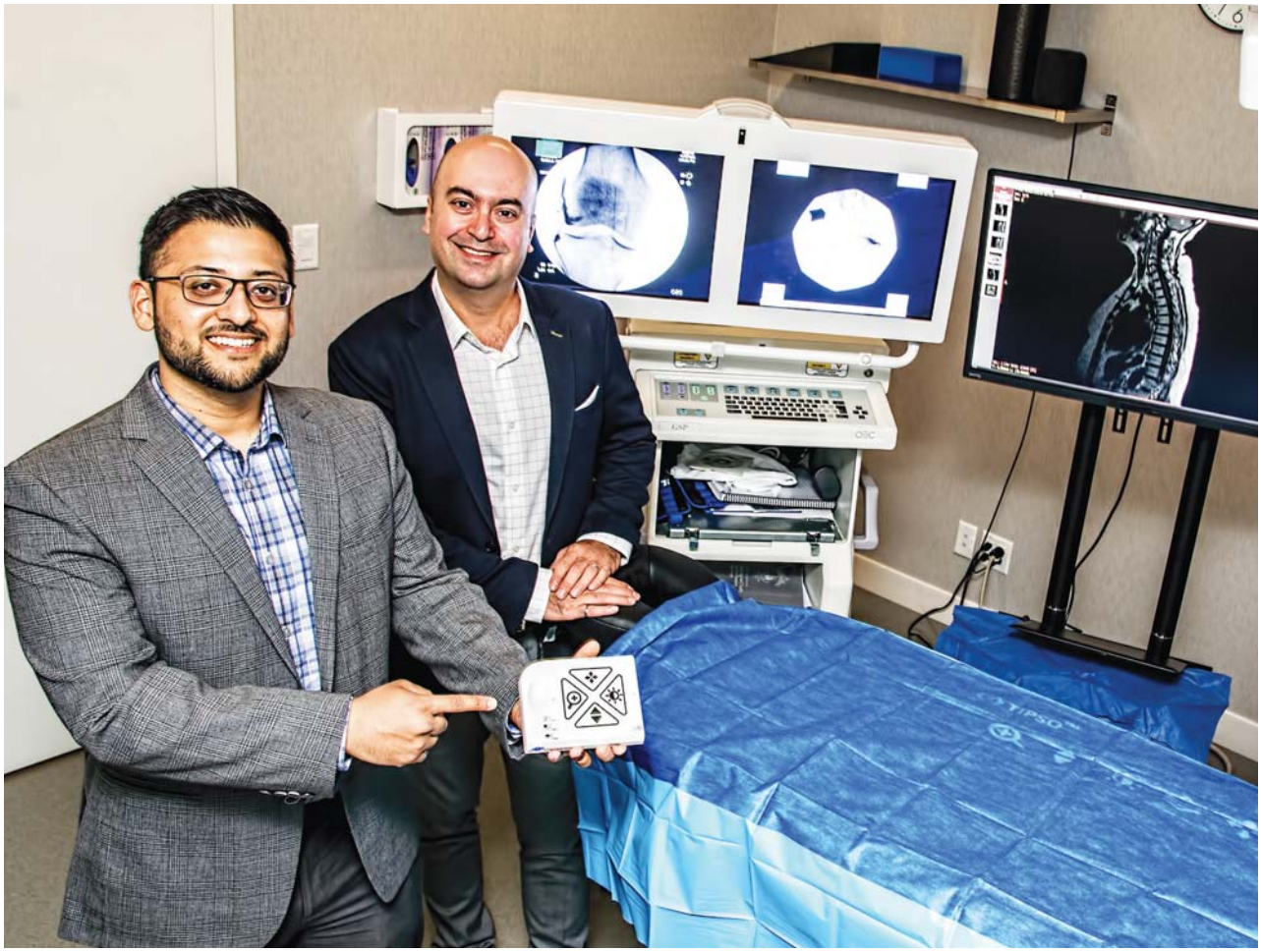
The company is planning a new drug application with the Food and Drug Administration in the second quarter of this year.

ABOVE: **Tom Frohlich, operating principal with Versant Ventures and chief business officer at Chinook Therapeutics, which Versant built from the ground up to focus on kidney disease** • CHUNG CHOW

OPPOSITE PAGE: **Renata Oballa, vice-president of chemistry at Chinook Therapeutics, holds up a potential novel therapeutic for a rare, severe kidney disease** • CHUNG CHOW

IMAGING INGENUITY

Touchless controls and light-speed MRI scans are among the innovations stemming from radiology that are changing how doctors do their jobs



NZ Technologies' Pranav Saxena (left), director of engineering and chief engineer, and Nima Ziraknejad, CEO and founder, demonstrate the company's TIPSO tool, which projects a holographic menu onto a drape within the sterile surgical area and allows surgeons to motion with their hands and fingers to review images on a monitor, instead of using the typical mouse and keyboard outside the sterile field • CHUNG CHOW

TYLER ORTON

Nima Ziraknejad could be considered a renaissance man of sorts within the tech sector, having spent much of his career developing products for the automotive, mining, and oil and gas sectors.

Though it was an innovation for car headrests the engineer had in mind in the mid-2010s, a solution for the medical community soon emerged as Vancouver General Hospital (VGH) surgeons shared their complaints with him about the surgery room.

"They need to have access and view radiology images," Ziraknejad says, referring to the mix of X-rays, CT scans and MRI imaging that guides decision-making during surgery.

The problem is that those scrub-clad surgeons can find themselves having to depart the sterile operating room for an adjacent space to use a mouse and keyboard to navigate images they need for reference.

"This might happen five, six different times sometimes, so it's a distraction," says Ziraknejad, the founder and CEO of NZ Technologies Inc.

"They're in scrub mode; they can't touch things, so they have to break the scrub."

Getting back into scrub mode can lengthen surgery times and create a higher risk of infection.

But NZ Technologies' TIPSO – which stands for touch-less interaction with PACS (picture archiving and communication system) in sterile operations – tool projects a holographic menu onto a drape within the sterile surgical area and allows surgeons to motion with their hands and fingers to review images on a monitor, instead of using the typical mouse and keyboard outside the sterile field.

The idea evolved as Ziraknejad was earning his PhD at the University of British Columbia, where he hoped to reduce the risk of whiplash in car accidents by developing a more advanced headrest that would automatically readjust its position through the use of sensors.

"The beauty of this sensor that I designed during this PhD was that it was, first of all, not too expensive ... and of course it was using the means of electric-field sensing and optics," Ziraknejad says.

"These doctors at VGH were aware of my research and they said, 'Hey, why don't we use this technology that you have to detect hand movements in real-time mode?'"

The headrest idea then springboarded into a medical application, which is now being used throughout North America and Asia.

NZ Technologies recently got regulatory approval for Europe and will begin selling its mix of hardware and software through a German distribution partner later this year.

Ziraknejad is among a growing number of West Coast engineers and radiologists recognizing needs in the medical community.

Radiologist Dr. Rajpaul Attariwala, who originally earned a PhD in engineering before returning to school to study medicine, has developed custom-engineered MRI technology to exponentially speed up the pace of these scans.

> THESE DOCTORS AT VGH WERE AWARE OF MY RESEARCH AND THEY SAID, "HEY, WHY DON'T WE USE THIS TECHNOLOGY THAT YOU HAVE TO DETECT HAND MOVEMENTS IN REAL-TIME MODE?"
>
> **Nima Ziraknejad**
> CEO, NZ Technologies

A typical MRI machine takes about half an hour to scan a portion of a patient's spine for cancer, but Attariwala's Prenuvo Inc. scan covers an entire human body in just over an hour and can detect nine of the top 10 cancers in Stage 1, he says.

The Prenuvo scanner has attracted patients ranging from Grammy winners to tech executives for radiation-free checkups created through customized hardware and proprietary software. The company plans to expand its scanning technology beyond a clinic in Vancouver to clinics in Toronto and San Francisco in May 2020.

Meanwhile, Emtelligent Software Ltd. has developed medical natural language processing technology powered by artificial intelligence (AI) to better understand data in medical records.

The company, founded by radiologist Tim O'Connell, commissions physicians to review notes and decode the sometimes head-scratching language used by fellow doctors.

But O'Connell says companies must also be aware of the ethical issues that can arise as AI becomes more ubiquitous. He points to questions about what should be done with historical medical data as AI shepherds in technology that could identify lung cancer more effectively than current methods.

"Should we not run it on the archives of chest X-rays that are sitting in every hospital in the world to find lung cancers that were missed?" he says.

"I think we should do anything that improves patient care, but I think we need some guidance from policy-makers and ethicists and, certainly, lawyers to help us understand the implications of what these things are."

INNOVATING FOR HEALTH

Hackathons and other innovations help health authorities improve patient care

Tracy Irwin, Fraser Health's executive director of innovation, research and transformation, leads her region's search for innovative ways to improve patient care • ROB KRUYT

GLEN KORSTROM

British Columbia's health-care system is maligned when suffering people endure long waits for surgeries, patients in gurneys clutter hallways for extended periods of time or physicians misdiagnose ailments.

The system is undoubtedly stretched thin with the population aging, government spending scrambling to keep pace with patient needs and, often, a shortage of physicians and hospital staff.

Health regions seek to innovate as a coping mechanism. Innovation is not a silver bullet, nor is it a fix-all, but doing things more efficiently, and sometimes with more attention on how to best relieve patient suffering, can go a long way toward enhancing the public's perception of health care.

Vancouver Coastal Health CEO Mary Ackenhusen lists a wide range of innovations that employees have put in place in her health region.

One, called ex vivo lung perfusion, is a new program created in partnership with BC Transplant that aims to increase the number of suitable lungs for transplants.

Staff use a machine to enable lungs to live outside the body for up to 12 hours after retrieval. They can then assess, repair and recondition the lungs that they may have initially rejected as unsuitable for transplant. They

OPPOSITE PAGE: Angela Wignall, one of the lead directors of Island Health's Innovation Lab • SUBMITTED

Deanne Taylor, corporate director of research at Interior Health, says more than 240 active studies are in various stages of development in her health region • SUBMITTED

then monitor how the lungs have improved and decide whether to use them in a transplant.

"The program is expected to reduce deaths on the transplant wait-list and improve patient outcomes," Ackenhusen says.

Among the things many health regions have done relatively recently is borrow a concept used for decades in the technology sector: hackathons.

Technology industry insiders often call these events "hack days" or "hack fests," even "code fests," but the portmanteau "hackathon," derived from combining the words "hacking" and "marathon," is used by many in B.C.'s health-care system.

Fraser Health's executive director of innovation, research and transformation, Tracy Irwin, says her health region was the first in B.C. to hold a hackathon in 2017. It invited about 80 local developers to a two-day hackathon, where they were tasked with devising solutions to nine problems that Fraser Health put forward. One of those, for example, was the crisis of opioid-related overdose deaths caused by addicts using tainted drugs.

Hosted in partnership with Simon Fraser University, the City of Surrey and Innovation Boulevard, with support from the Health Tech Innovation Foundation, OpenDataBC and Telus, health officials supplied 16 teams with publicly available and anonymized data for their projects. Telus Health then gave winners $1,500 in cash, a high-definition television and other prizes.

Irwin says the winner created an app "that would let people who were going to be using opioids connect with other people so they could say, 'I'm going to use opioids,' and then, a few minutes later, they could say, 'I'm still here.'"

Success at that first event prompted Fraser Health to evolve its hackathon into what it calls the Fraser Health Innovation Academy, or iCademy.

In late 2019, the health authority invited to its iCademy people who had what it considered great ideas, or products that are either in development or developed but still early in their use and evolving. They then whittled those who applied down to four.

Participants are going through a series of eight education sessions, which started on February 7. All will learn about how health authorities work, what kinds of innovations are needed and

INNOVATION BELONGS TO EVERYONE, AND WE BELIEVE IN BROAD INCLUSIVITY AROUND BRINGING PARTNERS IN TO DO THIS KIND OF WORK

Angela Wignall
Founding member, Innovation Lab, Island Health

how the ideas could be integrated into the system.

Fraser Health will select one winner who will be able to pilot their idea within the health system.

"This is the first one we've done, and it's the first of its kind as far as we know," Irwin says.

Island Health held its first hackathon last year, although its organizers were not inspired by Fraser Health's 2017 initiative.

"We didn't know it existed," says Angela Wignall, who is one of the lead directors of Island Health's Innovation Lab.

Instead, Island Health staff were inspired by their director of brand innovation and digital engagement, Matthew Miller, in 2018 winning a hackathon, dubbed Hatching Health, at the University of British Columbia.

About 50% of participants in that first hackathon worked within the health region. The rest were mostly entrepreneurs. The winner last year helped create a solution to reduce patients' readmission to the hospital after being discharged.

Island Health's most recent hackathon, Code Hack, was set to take place in March.

Not all innovations in health regions stem from hackathons.

Some come from proactive doctors. One doctor, for example, started letting children wear virtual-reality headsets when he was using sutures to stitch up their wounds.

"He found they were more relaxed and experienced less pain and distress and crying," Wignall says.

The region then bought and distributed 20 pairs of virtual-reality headsets for doctors to use across the region.

Meanwhile, in a hospital neonatal intensive care unit, a staff member conceived of replacing standard ventilator tubes with contraptions that resembled the remote mechanical Canadarm that astronauts have used in space, Wignall says.

Essentially, the new device enabled parents to lift babies out of the ventilators to hug them and provide loving skin-to-skin contact.

Sometimes innovation is not technology related.

Dementia patients often try to leave their ward, so one Fraser Health staffer envisaged painting a bookcase on the doors. Close examination would reveal that it was an exit, but the paint job did not as readily invite the patients to move toward the doors.

Over at Interior Health, where hackathons have also been one source of inspiration, Deanne Taylor, corporate director of research, says more than 240 active studies are in various stages of development.

"In 2014, we had just under 100 active studies," she says.

One advanced study, dubbed TEC4Home, first launched in the Vancouver Coastal Health region in 2018 and was partly funded by Telus and philanthropy. It provides devices for patients to use at home to monitor health indicators such as blood pressure and blood oxygen levels.

The tablet-like device can connect to a weight scale, a blood-pressure cup and a pulse oximeter to daily collect and send biometric data.

Taylor says the project is particularly important in her health region because the region contains remote areas, and many patients who leave the hospital after having heart operations are concerned about staying far from the hospital.

"Consider the rurality," she says. "It's a scary thing to go home, but people want to go home. It's more comfortable."

Hospital employees train the patients how to use all the contraptions that connect to the device to ensure measurements will be taken accurately. The devices provide the patients a sense of security that they are being cared for, because they allow hospital staff to monitor health indicators.

One constant in all of the regions is that administrators are keen to hear from a wide range of sources to get ideas for how to do things more efficiently and smartly. And, more often than not, research projects are made possible by partnering with companies and foundations.

Wignall may sum it up best when she says: "Innovation belongs to everyone, and we believe in broad inclusivity around bringing partners in to do this kind of work."

DATA IS POWER

Health data – and access to it – is the beating heart of health-care innovation

ALBERT VAN SANTVOORT

Easy access to data and analytical tools has turned nearly everyone into an amateur data scientist.

The ubiquitous nature of data has ensured its infiltration into almost every aspect of life. The health care and life sciences industries are no exception. Over the past two decades an entire network of organizations focused on the collection of health-care data has spawned across Canada and the globe.

"What this is about is the ability to link data from multiple sources and for researchers not to have to be the one to drive the [data gathering]," says Kimberlyn McGrail, scientific director for Population Data BC, a multi-university data and education research resource. "It's making sure that we enable researchers to spend more time doing research rather than data gathering and curating."

McGrail highlights that all industries in the 21st century use data to ascertain whether they are meeting the needs of their customers. In addition to providing customer satisfaction insight, the health-care industry's vast database of linked and interconnected data is essential to the industry's innovation pipeline. A report out of Ryerson University in Toronto highlights the role data plays in fostering health-care innovation: "For Canada to establish itself as a leader in health-care innovation, it is important that its academic researchers are well supported with data access."

The report underscores how data accessibility is essential to turning Canada into a health-care innovation hub. It also emphasizes that innovation is fostered when universities and non-profit organizations are able to access aggregated data for research and development purposes. This in large part is the objective of Population Data BC.

New drugs and health-care technologies are not the only benefit of integrated health-care data. The analysis of large swaths of health data allows the industry to better understand what keeps people healthy and what could have negative health impacts. An example is how researcher Laura Schummers determined that an interval of one to two years between childbirth and conception of the next pregnancy is associated with optimal outcomes for both mother and child. The research examined data from almost 150,000 pregnancies in B.C. over 10 years with the aim of determining whether the relationship between pregnancy intervals and pregnancy complications varied with age.

According to McGrail, Population Data BC's data is now used to determine which segment of the population is not having its needs met and to compare rural and urban satisfaction levels. An important use of data analytics in health care is to determine the optimum allocation of capital and resources. Analyzing the population and

Kimberlyn McGrail, scientific director for Population Data BC: "We're quite good at talking about the risk associated with sharing data. But we're not very good at talking about the risks we pose by *not* sharing and using data to better understand the health-care system" • CHUNG CHOW

health data in the province helps assess which areas are underserved and warrant a reallocation of capital and resources.

Population Data BC and its predecessor, the BC Linked Health Database, have been around since 1996; however, now, along with the reset of the health-care system, it is interested in developing "learning health systems."

The goal of learning health systems is to allow real-time outcome evaluation. Currently, evidence from clinical research is applied unevenly and its application is often delayed. Learning health systems use technological tools and a supportive organizational structure to reduce the time between discovery and innovation and implementation in the health-care system.

Learning health systems take many forms, but all rely on the real-time analysis of health-care data. One system could build predictive models from electronic health records to forecast demand and allocate resources more effectively, while another could be a collection network drawing millions of patient records from providers to access the effectiveness of a particular treatment.

While Population Data BC has done a lot to collect and curate health data, its job is not yet done. McGrail says that for data systems to work most effectively, they need to link public data to the clinical data held by health authorities, to the electronic medical record systems held in physicians' offices, to information such as the glucose monitoring data that device manufacturers hold.

There are many important considerations when dealing with large amounts of data, particularly privacy. But McGrail says that should not be the only concern.

"I think a quite significant challenge is that we're quite good at talking about the risk associated with sharing data," McGrail says. "But we're not very good at talking about the risks we pose by *not* sharing and using data to better understand the health-care system and whether people are actually benefiting from it or not."

WHAT THIS IS ABOUT IS … MAKING SURE THAT WE ENABLE RESEARCHERS TO SPEND MORE TIME DOING RESEARCH RATHER THAN DATA GATHERING AND CURATING

Kimberlyn McGrail
Scientific director,
Population Data BC

BIGGEST LIFE SCIENCES COMPANIES IN B.C.

RANKED BY | Number of R&D employees in 2019

Rank '20	Company	Top local executive(s)	Areas of research	Ownership	Year founded	No. staff globally '19/'18	No. B.C. staff '19/'18	No. R&D staff '19/'18
1	**Stemcell Technologies Inc** 1618 Station St, Vancouver V6A 1B6 P: 604-877-0713 F: 800-567-2899 **stemcell.com**	**Allen Eaves**, president and CEO	Provides cell culture media, cell separation tools and accessory reagents for cell biology research, including stem cell biology, regenerative medicine, immunology and cancer research	Privately held	1993	1,483 1,136	1,058 898	**243** 231
2	**Zymeworks Inc** 1385 8th Ave W Suite 540, Vancouver V6H 3V9 P: 604-678-1388 F: 604-737-7077 **zymeworks.com**	**Ali Tehrani**, president and CEO	Antibody and protein therapeutics development with a primary focus in oncology	TSX, NYSE:ZYME	2003	256 187	NP 139	**157** 116
3	**Kardium Inc** 8518 Glenlyon Pky Suite 155, Burnaby V5J 0B6 P: 604-248-8891 F: 604-304-3478 **kardium.com**	**Doug Goertzen**, president and COO	Cardiovascular	Privately held	2007	NP 120	130 120	**90** 90
4	**AbCellera** 2215 Yukon St, Vancouver V5Y 0A1 P: 604-559-9005 F: NP **abcellera.com**	**Carl Hansen**, president and CEO	Drug discovery platform that combines high-throughput microfluidics, genomics, bioinformatics and machine learning to find antibodies from nature that can be developed as therapeutics	Privately held	2012	115 71	71 47	**84** 56
5	**Xenon Pharmaceuticals Inc** 3650 Gilmore Way Suite 200, Burnaby V5G 4W8 P: 604-484-3300 F: 604-484-3450 **xenon-pharma.com**	**Simon Pimstone**, CEO	Central nervous system, epilepsy, pain	Nasdaq:XENE	1996	NP 89	88 85	**56** 56
6	**Amgen British Columbia Inc** 7990 Enterprise St, Burnaby V5A 1V7 P: 604-415-1800 F: 604-676-8349 **amgen.ca**	**John Delaney**, executive director of research	Antibody therapeutics for the treatment of cancer, inflammation and infectious diseases	Nasdaq:AMGN	1980	22,000 19,000	NP 76	**50** 50
7	**Verathon Medical Canada ULC** 2227 Douglas Rd, Burnaby V5C 5A9 P: 604-439-3009 F: 604-439-3039 **verathon.com**	NP	Designs, engineers and manufactures respiratory and surgical devices	Privately held	NP	NP NP	NP NP	**32** NP
8	**Burrard Pharmaceuticals** 1021 Hastings St W Suite 900, Vancouver V6E 0C3 P: 604-281-2762 F: NP **burrardpharma.com**	**Kayhan Moayeri**, CEO	Drug development, manufacturing and formulation	Privately held	2005	NP 40	8 8	**25** 25
9	**ABM Applied Biological Materials Inc** 3671 Viking Way Unit 1, Richmond V6V 2J5 P: 604-247-2416 F: 604-247-2414 **abmgood.com**	**Peter Li**, CEO, **Lisa Young**, CFO, **Ryan Saranchuk**, chief administration officer	Products span everything from CRISPR gene editing tools and viral vectors/viruses to the world's largest collection of unique cell lines and the most advanced polymerase chain reaction and next-generation sequencing technologies and services	Privately held	2004	160 150	89 83	**21** 39
10	**Aspect Biosystems** 1781 75th Ave W, Vancouver V6P 6P2 P: 604-263-0502 F: NP **aspectbiosystems.com**	**Tamer Mohamed**, president and CEO, **Simon Beyer**, chief technology officer, **Sam Wadsworth**, chief scientific officer	Combine the power of microfluidics with 3D bioprinting to enable the creation of living, human tissues	Privately held	2013	NP NP	32 20	**20** 20
10	**Neovasc Inc** 13562 Maycrest Way Suite 5138, Richmond V6V 2J7 P: 604-270-4344 F: 604-270-4384 **neovasc.com**	**Fred Colen**, president and CEO	Develops, manufactures and markets innovative vascular devices offering pericardial tissue processing, vascular product development and design and manufacturing solutions to industry partners	TSX:NVC; Nasdaq:NVCN	2000	NP 88	NP NP	**20** 20
12	**bioLytical Laboratories** 13351 Commerce Pky Suite 1108, Richmond V6V 2X7 P: 604-204-6784 F: 604-244-8399 **biolytical.com, insti.com**	**Livleen Veslemes**, CEO	HIV test kit	Privately held	2002	101 73	88 67	**19** 11
13	**Artron BioResearch Inc** 3938 North Fraser Way, Burnaby V5J 5H6 P: 604-415-9757 F: 604-415-9795 **artronbio.com**	**Nilgun Demir**, vice-president	Antigen and antibody manufacturer	Privately held	2002	120 NP	94 115	**15** 30
13	**Response Biomedical Corp** 1781 75th Ave W, Vancouver V6P 6P2 P: 604-456-6010 F: 604-456-6066 **responsebio.com**	**Barbara Kinnaird**, CEO	Rapid immunoassay diagnostics for clinical cardiovascular applications, environmental infectious disease testing and bio-threat identification	Privately held	1991	NP NP	NP NP	**15**[1] NP
15	**GenomeMe Canada** 3691 Viking Way Unit 1, Richmond V6V 2J6 P: 604-244-9962 F: NP **genomeme.ca**	**Mohammad Tabesh**, CEO	Molecular pathology and molecular diagnostics	Privately held	2015	NP 20	20 19	**14** 14
16	**GenXys** 322 Water St Suite 200, Vancouver V6B 1B6 P: 778-895-9325 F: NP **genxys.com**	**Karl Pringle**, CEO, **Martin Dawes**, chief scientific officer, **Mark Gelfer**, chair	Automated digital tools for comprehensive precision prescribing software that improves medication safety, increases drug efficacy and reduces health-care costs	Privately held	2014	15 NP	15 10	**13** 12
17	**Alectos Therapeutics** 8999 Nelson Way, Burnaby V5A 4B5 P: 604-628-7129 F: 604-628-0137 **alectos.com**	**Ernest McEachern**, president and CEO	Neuroscience	Privately held	2007	NP NP	12 12	**11** 11
18	**Kinexus Bioinformatics Corp** 8755 Ash St Suite 1, Vancouver V6P 6T3 P: 604-323-2547 F: 604-323-2548 **kinexus.ca**	**Steven Pelech**, president and chief scientific officer	Proteomics and bioinformatics products and services	Privately held	1999	NP NP	13 13	**10** 10
19	**Neurodyn Life Sciences Inc** 439 Helmcken St, Vancouver V6B 2E6 P: 604-619-0990 F: 604-684-3350 **neurodyn.ca**	**Kenneth Cawkell**, CEO, **Daphne Gill**, CEO, CNS Contract Research Corp	Neurodyn's CNS Contract Research Corp is focused on preclinical animal models of neurodegeneration	Privately held	NP	NP NP	0 NP	**9** NP
20	**Qu Biologics Inc** 4475 Wayburne Dr Suite 305, Burnaby V5G 4X4 P: 604-734-1450 F: 604-676-2235 **qubiologics.com**	**Hal Gunn**, CEO	Treatment of cancer and immune-related diseases such as Crohn's disease and ulcerative colitis	Privately held	2007	7 19	7 19	**4** 14

Sources: Interviews with representatives of the above firms and *BIV* research. Other firms may have ranked but did not respond to information requests by deadline. NP Not provided **1** - *BIV* estimate

Business in Vancouver makes every attempt to publish accurate information in the List, but accuracy cannot be guaranteed. Researched by Anna Liczmanska, *lists@biv.com*.

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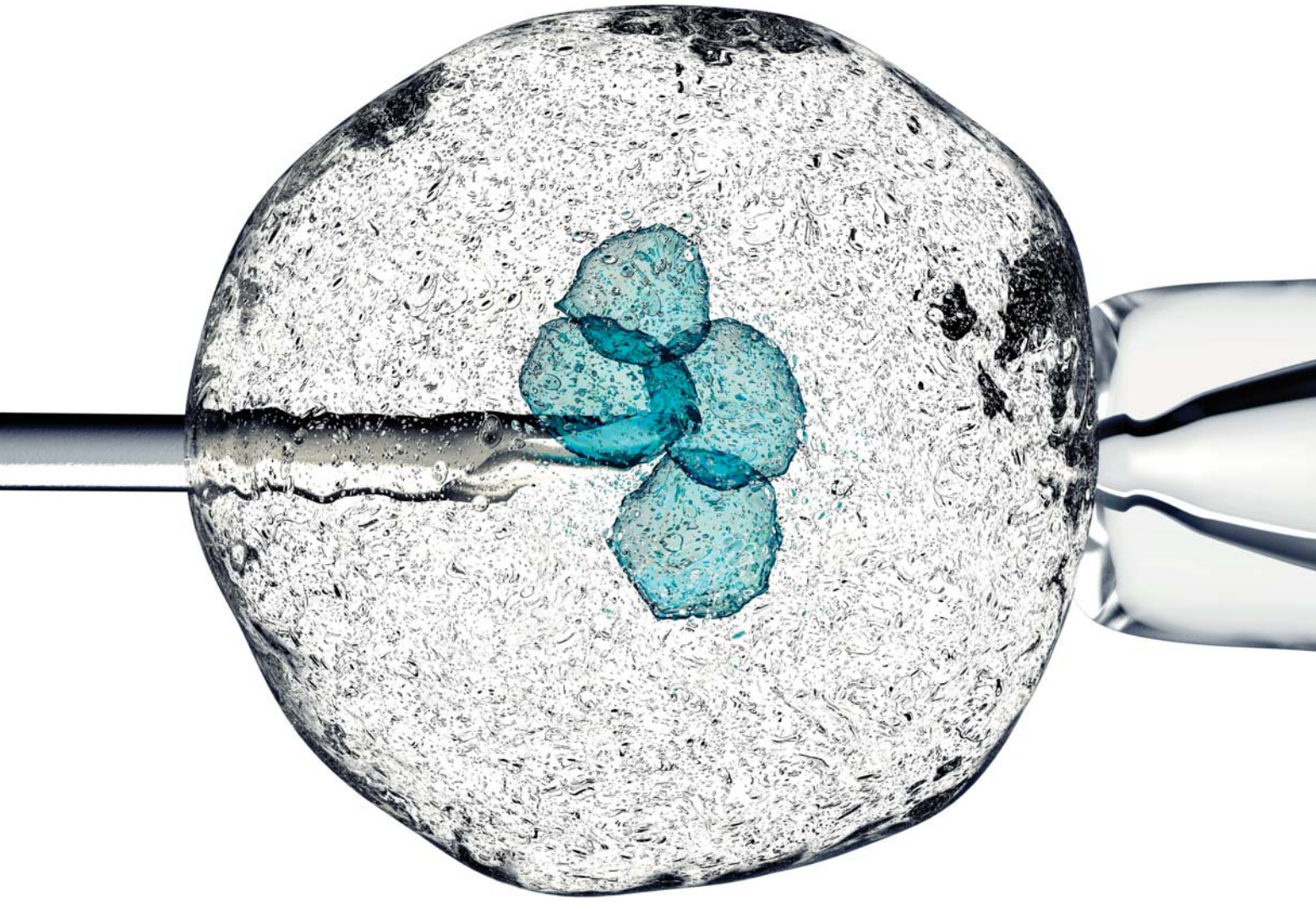

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*FAB*COUVER: THE EXTRAORDINARY STORY OF THERAPEUTIC ANTIBODY COMPANIES IN VANCOUVER

JENNIFER HAMILTON

Vancouver's biotech scene has yielded some incredible therapies – Angiotech's revolutionary drug-eluting stent (my husband wears two), QLT's pioneering macular degeneration treatment and Stemcell Technologies' understated but mighty reagent technology are a few. However, another type of technology has put B.C. on the map globally: therapeutic antibodies.

Antibodies are tiny Y-shaped warriors that make up a large part of your immune system. These proteins bind on the surfaces of cells and, when designed the right way, can be used to attack cancer or ward off immunological, metabolic or infectious diseases. The antigen-binding region of the antibody is called a "Fab."

B.C.'s excellence in antibodies started more than two decades ago when ImmGenics Pharmaceuticals' scientific founders, John Babcook, Kevin Leslie and John Schrader, developed a technology called SLAM (selected lymphocyte antibody method). This platform enabled scientists to quickly choose the right "needle in the haystack" antibody for specific therapeutic development. The technology was so revolutionary that the brilliant little company was acquired in 2000, only two years after launch, thanks to the business savvy of Kevin Leslie. The timing of the acquisition, by California-based Abgenix for a remarkable US$77 million, was fortuitous: soon thereafter, the biotech sector hit hard times.

What Abgenix did next with its newly acquired company was unexpected – instead of closing down operations in Vancouver, it doubled down and built the first "California-like" biotech facility in B.C. Michael Gallo moved north from California to lead the operation as vice-president, research, and the B.C. branch of the company flourished, doubling its staff in two years and eventually becoming Abgenix's sole antibody development site. An anti-PD-L1 checkpoint inhibitor antibody for the treatment of cancer was developed at the site during that time. Five years later, in 2006, the SLAM technology changed hands again, this time with the sale of Abgenix to global powerhouse Amgen.

Like Abgenix, Amgen opted to stay in B.C. and has since expanded hiring, making the facility Amgen's centre of excellence for therapeutic antibody discovery. The company continues to utilize ImmGenics' SLAM technology and is now headed by Chadwick King, a former ImmGenics scientist. The Vancouver site has been instrumental in developing Repatha for hypercholesterolemia and Aimovig for migraine.

At around the same time that Abgenix/Amgen was building its presence in Vancouver, a young University of British Columbia PhD student, Ali Tehrani, started a company focused on using computer simulation to rationally design antibodies with a hope to get better therapeutics to patients faster. In 2004 he launched Zymeworks on a shoestring budget. Tehrani then attracted both partnerships and investment from an impressive number of pharma partners. But it was a connection with one of the original ImmGenics founders, John Babcook, that would change Zymeworks.

After leaving Amgen, Babcook had joined the Center for Drug Research and Development (now adMare BioInnovations). There, in 2013, he used his deep antibody knowledge to start another company, Kairos Therapeutics, focused on antibody drug conjugates (ADCs). ADCs are antibodies that are prebound to a toxin, which is delivered to cancer cells via the antibody.

In 2018 Zymeworks merged with Kairos, cementing its position as a fully integrated drug discovery company and bringing Babcook into the fold as senior vice-president, research and development. Later that year Zymeworks went public, and it is currently one of the largest biotech companies in Canada. It is now a clinical-stage company with its own products in development.

Another milestone in British Columbia's antibody history occurred in 2008 with the founding of Innovative Targeting Solutions by Mike Gallo and Paul Kang – yet another ImmGenics/Abgenix alumnus. Innovative Targeting Solutions recreates the immune system in a petri dish, ultimately increasing the chance of finding an antibody against a specific target. The company has several pharma partnerships and recently launched a California-based spinoff oncology company, A2 Biotherapeutics, which raised US$57 million in a Series A financing.

Also that year, iProgen Biotech was founded by Ken Lee. iProgen is exploiting a method for delivering ADCs into cells, potentially making antibody therapeutics even more effective. The company has several programs and in 2018 signed a landmark deal with the South Korean company Celltrion Inc.

In 2012, Carl Hansen and colleagues founded another key Vancouver therapeutic antibody company, AbCellera Biologics. This company brings together microfluidics technology with deep antibody knowledge and artificial intelligence to create a platform for screening antibodies from single B cells. This allows identification of rare antibodies with specific qualities. AbCellera is currently one of a very select group of companies chosen by the U.S. government agency DARPA (Defense Advanced Research Projects Agency) to find antibodies capable of neutralizing the COVID-19 coronavirus.

Vancouver's therapeutic antibody companies have a common drive to make better drugs that meaningfully help patients. Beyond that, the companies want to build and grow in B.C. Many of the companies started with bare-bones funding. Partnerships with pharma companies played an important role to move B.C.'s industry forward by offering funding for the initial work needed to validate the technologies. Zymeworks, AbCellera and Innovative Targeting Solutions all have impressive lists of pharma partners. Now companies are evolving their models for value creation and growth by building their own portfolios of valuable pharmaceuticals and, as exemplified by Innovative Targeting Solutions, spinning off their own biotech companies.

The therapeutic antibody sector is one to watch in B.C. and has put Vancouver on the map. The group now has critical mass with nearly 600 jobs contributing to our economy and generating important medicines. It's a SLAM dunk.

Jennifer Hamilton, PhD (UBC), is senior director, new ventures, at Johnson & Johnson Innovation, covering pharma, medical devices and consumer products in Canada. She was on the board of ImmGenics Pharmaceuticals, representing an investor, in 2000. Janssen Pharmaceuticals Inc. (a Johnson & Johnson company) has a partnership with Zymeworks Inc.

ABCELLERA IS CURRENTLY ONE OF A VERY SELECT GROUP OF COMPANIES CHOSEN BY THE U.S. GOVERNMENT AGENCY DARPA TO FIND ANTIBODIES CAPABLE OF NEUTRALIZING THE COVID-19 CORONAVIRUS

2019

Clinical milestones in British Columbia's life science sector

Date	*Company/organization*	*Clinical milestone*
January	Phyton Biotech	Phyton Biotech partners with Agenus to revolutionize QS-21 production
January	Phoenix Molecular Designs	Phoenix Molecular Designs announces collaboration to develop diagnostic for triple-negative breast cancer
February	NZ Technologies Inc.	NZ Technologies announces sale of TIPSO image navigation systems to the Hospital for Sick Children
February	Xenon Pharmaceuticals Inc.	Behind the Seizure program expansion helps speed diagnosis of genetic epilepsy in younger children experiencing unprovoked seizures
April	Centre for Drug Research and Development (CDRD); TRIUMF	CDRD and TRIUMF announce collaboration to revolutionize the fight against cancer with targeted alpha therapy
April	DelMar Pharmaceuticals Inc.	DelMar Pharmaceuticals receives approval from MD Anderson Cancer Center's Institutional Review Board for protocol expansion to include maintenance-stage MGMT-unmethylated glioblastoma multiforme patients in ongoing Phase 2 trial of VAL-083
April	PharmAust Ltd.	PharmAust successfully reformulates cancer drug
May	Virogin Biotech Ltd.	Virogin Biotech to form joint venture with China's largest pharmaceutical company to commercialize oncolytic virotherapies
May	adMare BioInnovations	CDRD and NEOMED Institute join forces to create a new pan-Canadian enterprise, adMare BioInnovations
June	Aspect Biosystems	Aspect Biosystems partners with Merck, GSK, and McGill University to enable development of immuno-oncology therapeutics
July	Arbutus Biopharma Corp.	Arbutus announces preliminary Phase 1a/1b clinical trial results for AB-506, an oral capsid inhibitor in development for people with chronic hepatitis B
July	Qu Biologics Inc.	Qu Biologics publishes potentially paradigm-shifting results of its first randomized placebo-controlled trial for treatment of Crohn's disease
July	DelMar Pharmaceuticals Inc.	DelMar Pharmaceuticals enrols first patient in recently approved adjuvant setting arm of Phase 2 study of VAL-083 for treatment of MGMT-unmethylated glioblastoma multiforme
November	Augurex Life Sciences Corp.	Augurex announces launch of JOINTstat
December	Xenon Pharmaceuticals Inc.	Neurocrine Biosciences and Xenon Pharmaceuticals announce agreement to develop first-in-class treatments for epilepsy
December	Aurinia Pharmaceuticals Inc.	Aurinia announces positive AURORA Phase 3 trial results demonstrating voclosporin superiority over standard of care in lupus nephritis
December	InMed Pharmaceuticals Inc.	InMed receives clinical trial application approval for INM-755, a rare cannabinoid formulation under development for treatment of epidermolysis bullosa

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2019

Investments into British Columbia's life science sector

Month	*Company/organization*	*Type of investment*	*Amount (CAD)*
January	Quark Venture and GF Securities	Quark Venture and GF Securities participate in Keros Therapeutics' $23 million Series B financing for development of therapies to treat debilitating neuromuscular diseases	$23 million
March	TRIUMF	TRIUMF receives historic investment in 2019 federal budget	$297.7 million
April	GenXys Health Care Systems	GenXys Health Care Systems announces completion of oversubscribed seed-round financing to launch leading precision prescribing software into U.S. market	$1.77 million
June	DelMar Pharmaceuticals	DelMar Pharmaceuticals announces US$3.6 million registered direct offering	$4.8 million
June	Zymeworks	Zymeworks announces closing of US$200 million financing (public offering)	$264 million
August	DelMar Pharmaceuticals	DelMar Pharmaceuticals announces pricing of US$6.8 million underwritten public offering	$9 million
August	Chinook Therapeutics	Vancouver-based Chinook Therapeutics raises $65 million Series A financing to advance precision medicines for kidney diseases	$65 million
September	Terramera	Vancouver-based Terramera closes $60 million Series B financing	$60 million
November	A2 Biotherapeutics	Innovative Targeting Solutions and former Amgen executive team up to launch A2 Biotherapeutics with a $57 million Series A	$57 million
November	Phoenix Molecular Designs	Phoenix Molecular Designs announces $12 million in seed financing	$12 million
November	Sierra Oncology	Vancouver-based Sierra Oncology announces closing of $103 million financing and changes to its board of directors	$103 million
December	Neoleukin Therapeutics	Neoleukin Therapeutics announces pricing of US$75 million public offering	$100 million
December	Aurinia Pharmaceuticals	Victoria-based Aurinia Pharmaceuticals closes $250 million public offering of common shares	$250 million
Total			**$1.25 billion**

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LIFE SCIENCES COMPANIES AT A GLANCE

BIOPHARMACEUTICALS & BIOTECHNOLOGY

PLEASE REFER TO **LIFESCIENCESBC.CA** FOR FURTHER INFORMATION ON THESE COMPANIES

	Stage of development						Fields of study						Tools							Diseases						
	Drug discovery	Preclinical studies	Phase 1 clinical studies	Phase 2 clinical studies	Phase 3 clinical studies	On market	Bioproducts	Bioinformatics	Diagnostics	Environmental	Therapeutics	Vaccines	Bioprocessing	Drug delivery	Gene therapy	Genomics	High-throughput screening	Lab reagents	Proteomics	Autoimmune diseases	Cancer	Cardiovascular diseases	Infectious diseases	Inflammatory diseases	Metabolic diseases	Neurological diseases
AbbVie	•	•	•	•	•	•	•				•			•						•				•		•
AbCellera	•							•	•		•					•	•									
Acuitas Therapeutics Inc.	•	•	•			•					•	•		•	•					•	•	•	•	•	•	
Aequus Pharmaceuticals Inc.						•					•															
Alectos Therapeutics Inc.	•	•									•															•
Amgen Canada	•	•	•	•	•	•				•			•	•		•		•	•	•	•		•		•	
AstraZeneca	•	•	•	•	•	•					•	•								•	•	•	•	•	•	•
Augurex Life Sciences Corp.	•								•		•								•	•						
Aurinia Pharmaceuticals					•						•									•						
Bausch Health	•	•	•	•	•	•					•			•										•	•	
Celgene (subsidiary of BMS)	•	•	•	•	•	•					•									•	•	•		•		•
Chinook Therapeutics	•	•	•	•	•						•															
Cuprous Pharmaceuticals Inc.	•	•									•										•		•			
Cureimmune Therapeutics Inc.	•	•																								
DelMar Pharmaceuticals				•							•										•					•
Delta-Fly Pharma Inc.		•	•	•	•						•			•							•					
Dr. Ma's Laboratories Inc.											•							•		•		•		•		
EMD Serono			•	•	•	•					•										•					•
ESSA Pharma Inc.	•	•									•										•					
Eupraxia Pharmaceuticals Inc.	•	•	•	•							•			•						•	•		•	•		
Gilead Sciences	•	•	•	•	•	•					•	•									•	•	•	•	•	
GlaxoSmithKline	•	•	•	•	•	•					•	•								•	•		•	•		
ImStar Therapeutics Inc.	•	•									•															•
InMed Pharmaceuticals Inc.		•	•								•													•		•
Innovative Targeting Solutions Inc.	•										•									•	•			•	•	
Janssen	•	•	•	•	•	•					•	•								•	•	•	•		•	•
Me Therapeutics Inc.	•	•									•										•					
Merck	•	•	•	•	•	•					•	•									•	•	•		•	•
Microbion Pharma Corp.		•		•							•												•			
NervGen Pharma	•	•	•								•															•
New B Innovation Ltd.	•	•	•						•		•			•						•	•					•
Novartis Pharmaceuticals Canada Inc.	•	•	•	•	•	•	•				•				•						•	•			•	•
Novelogics Biotechnology Inc.	•	•									•										•			•		
Novo Nordisk Canada Inc.	•	•	•	•	•	•					•			•	•				•			•		•	•	
Pfizer	•	•	•	•	•	•	•				•	•			•					•	•		•	•		
Pramana Pharmaceuticals Inc.	•	•																							•	
Qu Biologics Inc.				•								•								•	•					
RepliCel Life Sciences Inc.				•							•			•												
Roche	•	•	•	•	•	•	•		•		•		•	•	•	•			•	•	•		•	•		•
Sanofi Canada	•	•	•	•	•	•					•	•								•	•	•			•	•
Sierra Oncology		•	•	•	•						•			•							•					
SignalChem LifeSciences Corp.	•	•	•						•		•						•				•					
Takeda Canada Inc.	•	•	•	•	•	•	•				•	•								•	•			•	•	•
ViroGin Biotech Canada Ltd.	•	•	•																							
Vitaeris					•						•									•				•		
WEX Pharmaceuticals Inc.				•	•						•															•
Xenon	•	•	•	•							•															•
Zymeworks Inc.	•	•	•	•			•	•			•									•	•			•		

CONTRACT RESEARCH ORGANIZATIONS & SCIENTIFIC/HEALTH SERVICES

PLEASE REFER TO **LIFESCIENCESBC.CA** FOR FURTHER INFORMATION ON THESE COMPANIES

	Preclinical sevices						Clinical services						General services							
	Drug discovery	Bioinformatics	Bioanalytical services	Analytical services	Pathology services	Toxicology	Phase 1 clinical studies	Phase 2 clinical studies	Phase 3 clinical studies	Phase 4 clinical studies	Study monitoring and reporting	Data management and statistics	Strategic consulting	Regulatory	Contract manufacturing	Product development	cGMP/GLP compliance	Quality assurance	Teaching and training	Communications
American Preclinical Services			•	•	•															
Anandia				•														•		
Aurora Biomed Inc.															•	•				
BC Academic Health Science Network/Clinical Trials BC													•	•				•	•	•
Biofilm MEDIA																			•	•
CEQAL Inc.				•									•			•				
Emergo by UL													•	•			•	•	•	
Emmes Canada		•					•	•	•	•	•	•	•	•				•	•	
FUJIFILM Diosynth Biotechnologies			•	•										•	•	•	•	•		
Immunomind	•	•				•	•				•	•	•			•	•	•	•	•
IonsGate Preclinical Services Inc.	•					•														
LifeLabs Medical Laboratory Services		•	•	•	•	•														
Metaphase Health Research Consulting Inc.													•							•
Microbiome Insights Inc.	•	•	•				•	•												
Novateur Ventures Inc.			•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Phyton Biotech															•	•				
PI Pharma Inventor Inc.	•			•											•	•	•			
Quality and Compliance Services Inc.														•			•	•	•	
Ramona Rea Consulting													•							
STEMCELL Technologies Inc.																			•	•
UBC Pre-Clinical Services	•				•	•														
Wax-it Histology Services				•	•											•				

MEDICAL TECHNOLOGIES & DEVICES

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	Fields of study							Company type		
	Dental device	Medical equipment	Medical supplies	Testing instruments	Imaging	Device design	Other(s)	Manufacturer	Distributor	Developer
A2Z Innovations Ltd.		•								•
ARC Medical Devices Inc.							Surgical adhesion prevention	•		•
Artron Bioresearch Inc.				•			Antibody, antigen, rapid diagnostic test kits	•	•	•
Aspect Biosystems Ltd.		•					Microfluidic 3D bioprinting technology	•		•
BioLytical Laboratories		•					Rapid HIV tests	•		
Claris Healthcare Inc.		•					Medical software			•
Contextual Genomics							Molecular diagnostics		•	•
Equicare Health							Health-care IT software vendor/manufacturer	•		•
Farabloc Development Corp.		•				•		•	•	•
Human in Motion Robotics		•					Rehabilitation robot			•
Ikomed Technologies Inc.		•						•		•
InnoTech Medical Industries Corp. (iMi Corp)	•	•			•	•	Digital radiography solutions specializing in X-ray imaging	•		•
Innovatek Medical Inc.			•					•	•	
Kardium		•				•		•		•
Lepzi Biotechnology Ltd.		•					Point-of-care			•
LightIntegra Technology Inc.		•					Thrombolux		•	•
LivaNova Canada Corp.		•					Heart valve	•		
Medident Technologies Inc.	•	•				•		•		•
NZ Technologies Inc.		•				•	Medical technology, hardware and software manufacturer		•	•
Ondine Biomedical Inc.	•	•	•			•		•		•
Peerforma		•								•
Rostrum Medical Innovations Inc.		•						•		•
StarFish Medical	•	•			•	•	Regulatory, Bio Services (microfluidics, microbiology and regenerative medicine)	•		•
Tel-Array Diagnostics Inc.		•					In vitro diagnostics			•
ViewsIQ		•			•				•	•

LIFESCIENCES BC MEMBERSHIP DIRECTORY

ACADEMIC & RESEARCH INSTITUTIONS

adMare Bioinnovations
2405 Wesbrook Mall, 4th floor, Vancouver, BC V6T 1Z3, 604-827-1147 admarebio.com

BC Cancer Agency
675 W. 10th Ave., Vancouver, BC V5Z 1L3, 604-877-6000 bccancer.bc.ca

British Columbia Centre for Excellence in HIV/AIDS
608 – 1081 Burrard St., Vancouver, BC V6Z 1Y6, 604-806-8477 cfenet.ubc.ca

Centre for Health Evaluation & Outcome Sciences (CHÉOS)
588 – 1081 Burrard St., St. Paul's Hospital, Vancouver, BC, V6Z 1Y6, 604-806-9958 cheos.ubc.ca

entrepreneurship@UBC
6163 University Blvd., Vancouver, BC V6T 2A1, 604-822-0600 start.entrepreneurship.ubc.ca

Genome BC
400 – 575 W. 8th Ave., Vancouver, BC V5Z 0C4, 604-738-8072 genomebc.ca

ICORD
Blusson Spinal Cord Centre, 818 W. 10th Ave., Vancouver, BC V5Z 1M9, 604-675-8800 icord.org

Michael Smith Foundation for Health Research
200 – 1285 W. Broadway, Vancouver, BC V6H 3X8, 866-673-4722 msfhr.org

Nanomedicines Innovation Network
5451 – 2350 Health Sciences Mall, Vancouver, BC V6T 1Z3, nanomedicines.ca

Praxis Spinal Cord Institute
818 W. 10th Ave., 6th floor, Vancouver, BC V5Z 1M9, 604-827-2421 praxisinstitute.org

Providence Health Care Research Institute
178 – 1081 Burrard St., St. Paul's Hospital, Vancouver, BC V6Z 1Y6, 604-806-9464 providenceresearch.ca

Research Universities' Council of British Columbia
400 – 880 Douglas St., Victoria, BC V8W 2B7, 250-480-4859 rucbc.ca

Simon Fraser University
8888 University Dr., Burnaby, BC V5A 1S6, 778-782-3111 sfu.ca

Trinity Western University
7600 Glover Rd., Langley Township, BC V2Y 1Y1, 888-468-6898 twu.ca

TRIUMF
4004 Wesbrook Mall, Vancouver, BC V6T 2A3, 604-222-1047 triumf.ca

University of British Columbia Faculty of Pharmaceutical Sciences
2405 Wesbrook Mall, Vancouver, BC V6T 1Z3, pharmsci.ubc.ca

University of British Columbia Pre-Clinical Services
4145 Wesbrook Mall, Vancouver, BC V6T 1W5, 604-822-6283 animalcare.ubc.ca/pre-clinical

University of British Columbia Sauder School of Business
2053 Main Mall, Vancouver, BC V6T 1Z2, 604-822-8500 sauder.ubc.ca

University of Northern British Columbia
3333 University Way, Prince George, BC V2N 4Z9, 250-960-5555 unbc.ca

University of Victoria
3800 Finnerty Rd., Victoria, BC V8P 5C2, 250-721-7211 uvic.ca

Vancouver Coastal Health Research Institute (VCHRI)
2635 Laurel St., 6th floor, Vancouver, BC V5Z 1M9, 604-875-4372 vchri.ca

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Discovery Parks/Nimbus Synergies
610 Main St., 4th floor, Vancouver, BC V6A 2V3, 604-734-7275 discoveryparks.com

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AdvantageBC
520 – 1090 W. Georgia St., Vancouver, BC V6E 3V7, 604-683-6626 advantagebc.ca

Ag-West Bio Inc.
101 – 111 Research Dr., Saskatoon, SK S7N 3R2, 306-975-1939 agwest.sk.ca

BC Tech Association
101 – 887 Great Northern Way, Vancouver, BC V5T 4T5, 604-683-6159 wearebctech.com

BioAlberta
202 – 10055 106 St., Edmonton, AB T5J 2Y2, 780-425-3804 bioalberta.com

BioTalent Canada
650 – 130 Slater St., Ottawa, ON K1P 6E2, 866-243-2472 biotalent.ca

BIOTECanada
600 – 1 Nicholas St., Ottawa, ON K1N 7B7, 613-230-5585 biotech.ca

DigiBC – The Digital Media and Wireless Association of BC
210 – 577 Great Northern Way, Vancouver, BC V5T 1E1, 604-602-5237 digibc.org

E-Fund
Vancouver, BC, e-fund.ca

Greater Vancouver Board of Trade
400 – 999 Canada Pl., Vancouver, BC V6C 3E1, 844-208-8197 boardoftrade.com

Innovative Medicines Canada
1220 – 55 Metcalfe St., Ottawa, ON K1P 6L5, 613-236-0455 innovativemedicines.ca

Life Science Washington
150 – 188 E. Blaine St., Seattle, WA 98102, 206-456-9567 lifesciencewa.org

MedTech Canada
900 – 405 The West Mall, Toronto, ON M9C 5J1, 866-586-3332 medtechcanada.org

Mitacs
301 – 6190 Agronomy Rd., UBC, Vancouver, BC V6T 1Z3, 604-822-9189 mitacs.ca

New Ventures BC
900 – 1188 W. Georgia St., Vancouver, BC V6E 4A2, 604-602-5202 newventuresbc.com

VANTEC (Vancouver Angel Technology Network)
555 W. Hastings St., 11th floor, Vancouver, BC V6B 4N6, vantec.ca

BIOPHARMACEUTICALS

AbCellera
2215 Yukon St., Vancouver, BC V5Y 0A1, 604-559-9005 abcellera.com

Acuitas Therapeutics Ltd.
402 – 6190 Agronomy Rd., Vancouver, BC V6T 1Z3, acuitastx.com

Aequus Pharmaceuticals
2820 – 200 Granville St., Vancouver, BC V6C 1S4, 604-336-7906 aequuspharma.com

Alectos Therapeutics Inc.
8999 Nelson Way, Burnaby, BC V5A 4B5, 604-628-7129 alectos.com

Augurex Life Sciences Corp.
220 – 887 Great Northern Way, Vancouver, BC V5T 4T5, 604-637-3280 augurex.com

Aurinia Pharmaceuticals Inc.
1203 – 4464 Markham St., Victoria, BC V8Z 7X8, 250-744-2487 auriniapharma.com

Bold Therapeutics Inc.
515 – 850 W. Hastings St., Vancouver, BC V6C 1E1, 604-262-9899 bold-therapeutics.com

Celgene Inc.
600 – 6755 Mississauga Rd., Mississauga, ON L5N 7Y2, 877-923-5436 celgene.ca

Chinook Therapeutics Inc.
210 – 887 Great Northern Way, Vancouver, BC V5T 4T5, 604-343-1552 chinooktx.com

Cuprous Pharmaceuticals Inc.
2405 Wesbrook Mall, Vancouver, BC V6T 1Z3, cuprous.ca

Cureimmune Therapeutics Inc.
2 – 8755 Ash St., Vancouver, BC V6P 6T3, 778-379-6883 cureimmune.com

DelMar Pharmaceuticals Inc.
720 – 999 W. Broadway, Vancouver, BC V5Z 1K5, 604-629-5989 delmarpharma.com

Delta-Fly Pharma Inc.
801 – 1080 Howe St., Vancouver, BC V6Z 2T1, delta-flypharma.co.jp

Dr. Ma's Laboratories Inc.
4 – 8118 North Fraser Way, Burnaby, BC V5J 0E5, 604-439-6089 drmalabs.com

ESSA Pharma Inc.
720 – 999 W. Broadway, Vancouver, BC V5Z 1K5, 778-331-0962 essapharma.com

Eupraxia Pharmaceuticals Inc.
201 – 2067 Cadboro Bay Rd., Victoria, BC V8R 5G4, 250-590-3968 eupraxiapharma.com

Genevant Sciences Corp.
8900 Glenlyon Pky., Burnaby, BC V5J 5J8, 778-800-2363 genevant.com

ImStar Therapeutics Inc.
600 – 1285 W. Broadway, Vancouver, BC V6H 3X8, 604-551-6782 imstartx.com

InMed Pharmaceuticals Inc.
310 – 815 W. Hastings St., Vancouver, BC V6C 1B4, 604-669-7207 inmedpharma.com

Innovative Targeting Solutions Inc.
290 – 2985 Virtual Way, Vancouver, BC V5M 4X7, 604-433-6779 innovativetargeting.com

Lipont Pharmaceuticals
4211 No. 3 Rd., Richmond, BC V6X 2C3, 604-285-9975 lipontinvestment.com

Me Therapeutics Inc.
5520 – 2350 Health Sciences Mall, Vancouver, BC V6T 1Z3, metherapeutics.com

MedGenesis Therapeutix Inc.
730 – 730 View St., Victoria, BC V8W 1J8, 250-386-3000 medgenesis.com

Microbion Pharma Corp.
430 – 887 Great Northern Way, Vancouver, BC V5T 4T5, 604-428-5615 microbioncorp.com

MSI Methylation Sciences Inc.
300 – 15300 Croydon Dr., Surrey, BC V3S 0Z5, 778-806-4898 methylationsciences.com

NervGen Pharma
1703 – 595 Burrard St., Vancouver, BC V7X 1J1, 604-488-5421 nervgen.com

New Beta Innovations Canada Ltd.
168 – 8508 Glenlyon Pky., Burnaby, BC V5J 0B6, 604-421-7308 newbetainnovation.ca

Novelogics Biotechnology Inc.
Vancouver, BC, novelogics.com

Phoenix Molecular Designs
220 – 887 Great Northern Way, Vancouver, BC V5T 4T5, 604-674-1796 phoenixmd.ca

Pramana Pharmaceuticals Inc.
601 – 570 Granville St., Vancouver, BC V6C 3P1, 866-729-3511 pramanapharma.ca

Qu Biologics Inc.
305 – 4475 Wayburne Dr., Burnaby, BC V5G 4X4, 604-734-1450 qubiologics.com

RepliCel Life Sciences Inc.
900 – 570 Granville St., Vancouver, BC V6C 3P1, 604-248-8730 replicel.com

Sierra Oncology
2150 – 885 W. Georgia St., Vancouver, BC V6C 3E8, 604-558-6536 sierraoncology.com

SignalChem LifeSciences Corp.
110 – 13120 Vanier Pl., Richmond, BC V6V 2J2, signalchemlifesciences.com

Symvivo Corp.
102 – 4475 Wayburne Dr., Burnaby, BC V5G 4X4, 604-428-7474 symvivo.com

UCB Canada Inc.
401 – 2060 Winston Park Dr., Oakville, ON L6H 5R7, 877-504-7363 ucb.com

ViroGin Biotech Canada Ltd.
408 – 3800 Wesbrook Mall, Vancouver, BC V6S 2L9, 604-222-0591 virogin.com

Vitaeris
1500 – 355 Burrard St., Vancouver, BC V6C 2G8, 844-448-2580 vitaerisbio.com

Wex Pharmaceuticals Inc.
1150 – 1100 Melville St., Vancouver, BC V6E 4A6, 604-683-8880 wextech.ca

Xenon
3650 Gilmore Way, Burnaby, BC V5G 4W8, 604-484-3300 xenon-pharma.com

Zymeworks Inc.
540 – 1385 W. 8th Ave., Vancouver, BC V6H 3V9, 604-678-1388 zymeworks.com

BUSINESS CONSULTANTS

Canaan Group
11371 Twigg Pl., Richmond, BC V6V 3C9, 423-400-3405 canaangroup.com

Emergo by UL
130 – 13775 Commerce Pky., Richmond, BC V6V 2V4, 604-909-1265 emergobyul.com

Graphite Public Affairs
250-858-5191 graphite.ca

Kirke Management Consultant
642 – 777 Hornby St., Vancouver, BC V6Z 1S4, 604-787-3230 kirke-consulting.com

Metaphase Health Research Consulting Inc.
Vancouver, BC, 604-224-5925 metaphase-consulting.com

Northview Lifesciences
604-428-4641 northviewlifesciences.com

Quality and Compliance Services Inc.
119 – 2550 Argentia Rd., Mississauga, ON L5N 5R1, 877-877-5152 qualityandcompliance.com

Ramona Rea Consulting
416-903-6392 ramona.rea@gmail.com

Tian'en Consulting Group
246 – 3800 Wesbrook Mall, Vancouver, BC V6S 2L9, vitalic.cn

WestPAR Consultancy Inc.
600 – 1285 W. Broadway,
Vancouver, BC V6H 3X8 ,
604-319-9449 westpar.ca

World Courier, an AmerisourceBergen company
140 – 11120 Horseshoe Way, Richmond, BC V7A 5H7,
604-232-9444 worldcourier.com/about/locations/north-america

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8945 Evergreen Blvd., Minneapolis, MN 55433,
877-717-7997 americanpreclinical.com

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Vancouver, BC V5T 4T5,
778-945-8590 anandia.ca

BC Academic Health Science Network/ Clinical Trials BC
420 – 1367 W. Broadway,
Vancouver, BC V6H 4A7,
236-521-2064 clinicaltrialsbc.ca

BRI Biopharmaceutical Research Inc.
101 – 8898 Heather St., Vancouver, BC V6P 3S8,
604-432-9237 bripharm.com

CEQAL Inc.
307 – 2083 Alma St., Vancouver, BC V6R 4N6,
877-265-7024 ceqal.com

Emmes CANADA

Emmes Canada
200 – 4664 Lougheed Hwy.,
Burnaby, BC V5C 5T5,
778-806-4626 secure.emmes.com

FUJIFILM Diosynth Biotechnologies
101 J. Morris Commons Ln.,
Morrisville, NC 27560,
919-337-4400 fujifilmdiosynth.com

IMMUNOMIND

Immunomind
937 Tenth St., New Westminster, BC V3M 4A8,
604-700-4623 immunomind.com

IonsGate Preclinical Services Inc.
222 – 2176 Health Sciences Mall,
Vancouver, BC V6T 1Z3,
604-827-1733 ionsgate.com

LifeLabs Medical Laboratory Services
Vancouver, BC,
800-431-7206 lifelabs.com

Microbiome Insights
4068 W. 11th Ave., Vancouver, BC V6R 2L3,
888-862-3971 microbiomeinsights.com

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310 – 730 View St., Victoria, BC V8W 1J8

Novateur Ventures
2100 – 1055 W. Georgia St.,
Vancouver, BC V6E 3P3,
844-200-6682 novateur.ca

Phyton Biotech LLC
1503 Cliveden Ave., Delta, BC V3M 6P7,
604-777-2340 phytonbiotech.com

PI Pharma Inventor Inc.
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Vancouver, BC V6S 2L9,
604-339-3244 pharmainventor.com

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1100 – 1200 W. 73rd Ave.,
Vancouver, BC V6P 6G5,
855-847-7226 viewsiq.com

Wax-it Histology Services Inc.
202 – 2386 East Mall, Vancouver, BC V6T 1Z3,
604-822-1595 waxitinc.com

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201 – 2020 Yukon St., Vancouver, BC V5Y 3N8,
866-708-9075 equicarehealth.com

Molecular You
307 – 788 Beatty St., Vancouver, BC V6B 2M1,
800-380-1468 molecularyou.com

PHEMI Systems Inc.
300 – 157 Alexander St.,
Vancouver, BC V6A 1B8 ,
800-841-1609 phemi.com

Xco Tech Inc.
583 Duncan Ave. W.,
Penticton, BC V2A 8E1, xco.io

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Chernoff Thompson Architects
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Vancouver, BC V6E 3C9,
604-669-9460 cta.bc.ca

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1200 – 401 W. Georgia St.,
Vancouver, BC V6B 5A1,
604-688-4442 aon.com/canada/default.jsp

Deloitte
2800 – 1055 Dunsmuir St.,
Vancouver, BC V7X 1P4,
604-669-4466 deloitte.com

KPMG

KPMG LLP
777 Dunsmuir St., Vancouver, BC V7Y 1K3,
604-691-3000 home.kpmg/ca

PricewaterhouseCoopers LLP
1400 – 250 Howe St., Vancouver, BC V6C 3S7,
604-806-7000 pwc.com/ca

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Contextual Genomics Inc.
1 – 3661 W. 4th Ave., Vancouver, BC V6R 1P2,
604-484-4395 contextualgenomics.com

GOVERNMENT

Innovate BC
900 – 1188 W. Georgia St.,
Vancouver, BC V6E 4A2,
800-573-0488 innovatebc.ca

Ministry of Jobs, Economic Development and Competitiveness
730 – 999 Canada Pl., Vancouver, BC V6C 3E1,
800-663-7867 gov.bc.ca

National Research Council Canada
4250 Wesbrook Mall, Vancouver, BC V6T 1W5,
877-672-2672 nrc.canada.ca

NSERC Pacific
407 – 1138 Melville St., Vancouver, BC V6E 4S3,
877-767-1767 nserc-crsng.gc.ca

INTERNATIONAL PHARMACEUTICAL CORPORATIONS

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8401 Rte. Transcanadienne,
Saint-Laurent, QC H4S 1Z1,
888-703-3006 abbvie.ca

Amgen
7990 Enterprise St., Burnaby, BC V5A 1V7,
604-415-1800 amgen.ca

AstraZeneca
1004 Middlegate Rd.,
Mississauga, ON L4Y 1M4,
800-565-5877 astrazeneca.ca

Bausch Health
2150 Boul. St-Elzéar Ouest, Laval, QC H7L 4A8,
800-361-1448 bauschhealth.ca

EMD Serono
200 – 2695 North Sheridan Way,
Mississauga, ON L5K 2N6,
604-353-8356 emdserono.ca

Gilead Sciences
600 – 6711 Mississauga Rd.,
Mississauga, ON L5N 2W3,
905-363-8008 gilead.com

GlaxoSmithKline
7333 Mississauga Rd.,
Mississauga, ON L5N 6L4,
905-819-3000 ca.gsk.com

Roche

Hoffmann-La Roche Ltd.
7070 Mississauga Rd.,
Mississauga, ON L5N 5M8,
800-561-1759 rochecanada.com

Janssen
19 Green Belt Dr., Toronto, ON M3C 1L9,
800-387-8781 janssen.com/canada

Merck
16750 Trans-Canada Hwy.,
Kirkland, QC H9H 4M7,
800-361-7031 merck.ca

Novartis Pharmaceuticals Canada Inc.
385 Bouchard Blvd., Dorval, QC H9S 1A9,
514-631-6775 novartis.ca

Novo Nordisk Canada Inc.
101 – 2476 Argentia Rd.,
Mississauga, ON L5N 6M1,
800-465-4334 novonordisk.ca

Pfizer
17300 Trans-Canada Hwy.,
Kirkland, QC H9J 2M5,
877-633-2001 pfizer.ca

Sanofi Canada
2905 Place Louis-R.-Renaud, Laval, QC H7V 0A3,
800-265-7927 sanofi.ca

Takeda Canada Inc.
Bay Adelaide Centre, 3800 – 22 Adelaide St. W.,
Toronto, ON M5H 4E3,
866-397-4473 takeda.com/en-ca

INVESTOR/FUNDING AGENCIES

Lumira Ventures
1021 W. Hastings St., Vancouver, BC V6E 0C3,
604-558-5156 lumiraventures.com

Quark Venture
2500 – 1075 W. Georgia St.,
Vancouver, BC V6E 3C9,
604-262-8818 quarkventure.com

LEGAL SERVICES

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2600 – 595 Burrard St., Vancouver, BC V7X 1L3,
604-631-3300 blakes.com

COJK CHRISTENSEN | O'CONNOR JOHNSON | KINDNESS

Christensen O'Connor Johnson Kindness
3600 – 1201 3rd Ave., Seattle, WA 98101,
206-682-8100 cojk.com

DUMOULIN BLACK

DuMoulin Black LLP
595 Howe St., 10th floor,
Vancouver, BC V6C 2T5,
604-687-1224 dumoulinblack.com

FARRIS

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700 W. Georgia St., 25th floor, PO Box 10026,
Pacific Centre South, Vancouver, BC V7Y 1B3,
877-684-9151 farris.com

Fasken
2900 – 550 Burrard St., Vancouver, BC V6C 0A3,
866-635-3131 fasken.com

Fisher Broyles LLP
4200 – 701 5th Ave., Seattle, WA 98104-5119,
866-211-5914 fisherbroyles.com

Global IP Asset Management
Vancouver, BC,
604-362-9019 digbyglobal.com

Gowling WLG
2300 – 550 Burrard St., Bentall 5,
Vancouver, BC V6C 2B5,
604-683-6498 gowlingwlg.com

McCarthy Tétrault
2400 – 745 Thurlow St., Vancouver, BC V6E 0C5,
877-244-7711 mccarthy.ca

NORTON ROSE FULBRIGHT

Norton Rose Fulbright Canada LLP
1800 – 510 W. Georgia St.,
Vancouver, BC V6B 0M3,
604-687-6575 nortonrosefulbright.com

Osler, Hoskin & Harcourt LLP
1700 – 1055 W. Hastings St., The Guinness Tower, Vancouver, BC V6E 2E9,
778-785-3000 osler.com

Oyen Wiggs Green & Mutala LLP
480 – 601 W. Cordova St.,
Vancouver, BC V6B 1G1,
866-475-2922 patentable.com

Seed IP

Seed Intellectual Property Law Group LLP
5400 – 701 5th Ave., Seattle, WA 98104,
206-622-4900 seedip.com

SMART & BIGGAR

Smart & Biggar/Fetherstonhaugh
2300 – 1055 W. Georgia St., PO Box 11115,
Vancouver, BC V6E 3P3,
604-682-7780 smartbiggar.ca

MEDIA – COMMUNICATIONS

biofilm MEDIA

Biofilm MEDIA
Science-Focused Digital Media,
604-724-3233 biofilmmedia.com

LIFESCIENCES BC MEMBERSHIP DIRECTORY

PR Associates
600 – 890 W. Pender St.,
Vancouver, BC V6C 1J9,
604-681-1407 prassociates.com

MEDICAL DEVICES

ARC Medical Devices Inc.
8 – 3071 No. 5 Rd., Richmond, BC V6X 2T4,
604-222-9577 arcmedicaldevices.com

Artron BioResearch Inc.
3938 North Fraser Way, Burnaby, BC V5J 5H6,
604-415-9757 artronbio.com

Biolux Research Ltd.
47669 Fremont Blvd., Fremont, CA 94538,
604-669-0674 bioluxresearch.com

BioLytical Laboratories Inc.
1108 – 13351 Commerce Pky.,
Richmond, BC V6V 2X7,
866-674-6784 biolytical.com

Claris Healthcare
201 – 1099 W. 8th Ave., Vancouver, BC V6H 1C3,
844-369-9977 clarisreflex.com

FARABLOC™

Farabloc Development Corp.
211 – 3030 Lincoln Ave.,
Coquitlam, BC V3B 6B4,
604-941-8201 farabloc.com

Human in Motion Robotics
Vancouver, BC,
604-418-9969 humaninmotion.ca

Ikomed Technologies Inc.
1375 McLean Dr., Burnaby, BC V5L 3N7,
604-258-0028 ikomed.com

Innovatek Medical Inc.
3 – 1600 Derwent Way, Delta, BC V3M 6M5,
800-563-3977 innovatekmed.com

Kardium Inc.
155 – 8518 Glenlyon Pky., Burnaby, BC V5J 0B6,
604-248-8891 kardium.com

Lepzi Biotechnology Ltd.
8 – 13511 Crestwood Pl.,
Richmond, BC V6V 2E9,
604-998-2626 lepzi.com

LightIntegra Technology Inc.
330 – 2285 Clark Dr., Vancouver, BC V5N 3G9,
844-858-9669 lightintegra.com

LivaNova Canada Corp.
5005 North Fraser Way, Burnaby, BC V5J 5M1,
604-412-5650 livanova.com

Medident Technologies Inc.
12968 21A Ave., Surrey, BC V4A 8H5,
604-542-2223

NZ technologies inc.
Innovating for better care

NZ Technologies
202 – 1401 W. Broadway,
Vancouver, BC V6H 1H6,
604-336-9464 nztech.ca

Ondine Biomedical Inc.
888 – 1100 Melville St.,
Vancouver, BC V6E 4A6,
604-669-0555 ondinebio.com

Peerforma
7434 Fraser Park Dr., Burnaby, BC V5J 5B9,
888-875-3039 peerforma.com

Rostrum Medical Innovations Inc.
3687 E. 1st Ave., Vancouver, BC V5M 1C2,
604-439-3054 rostrummedical.com

Sonic Incytes Medical Corp.
Vancouver, BC, sonicincytes.com

StarFish MEDICAL

StarFish Medical
455 Boleskine Rd., Victoria, BC V8Z 1E7,
877-822-3537 starfishmedical.com

Tel-Array Diagnostics Inc.
418 – 3800 Wesbrook Mall,
Vancouver, BC V6S 2L9,
604-221-9227 telarray.com

MEDICAL TECHNOLOGY

A2Z Innovations Ltd.
1500 W. Georgia St., Vancouver, BC V6G 2Z6,
778-938-3646 a2zinnovations.ca

Aspect Biosystems Ltd.
1781 W. 75th Ave., Vancouver, BC V6P 6P2,
604-263-0502 aspectbiosystems.com

HEALTH-AND-TECHNOLOGY DISTRICT
AN INNOVATION ECOSYSTEM

Health and Technology District
13737 96 Ave., Surrey, BC V3V 0C6, healthandtechnologydistrict.com

InnoTech Medical Industries Corp. (iMi Corp)
124 Garden Ave., North Vancouver, BC V7P 3H2,
800-756-4204 imixray.com

Manzanita Pharmaceuticals Inc.
400 – 2995 Woodside Rd., PMB 380,
Woodside, CA 94062,
408-348-3191 manzanitapharmaceuticals.com

Medtronic of Canada Ltd.
99 Hereford St., Brampton, ON L6Y 0R3,
800-268-5346 medtronic.com

SCIENTIFIC SUPPLIES

Aurora Biomed Inc.
1001 E. Pender St., Vancouver, BC V6A 1W2,
800-883-2918 aurorabiomed.com

Precision NanoSystems Inc.
50 – 655 W. Kent Ave. North,
Vancouver, BC V6P 6T7,
888-618-0031 precisionnanosystems.com

STEMCELL™ TECHNOLOGIES

STEMCELL Technologies
1618 Station St., Vancouver, BC V6A 1B6,
800-667-0322 stemcell.com

StressMarq Biosciences Inc.
PO Box 55036, Cadboro Bay,
Victoria, BC V8N 4G0,
250-194-9065 stressmarq.com

VWR International Ltd.
2360 Argentia Rd., Mississauga, ON L5N 5Z7,
800-932-5000 vwr.com

22nd ANNUAL LIFESCIENCES BC AWARDS

Innovation in Motion – A New Era

LifeSciences BC is pleased to announce the recipients of the 22nd annual LifeSciences BC Awards, presented by Farris. These awards are presented annually in recognition of the significant achievements of talented individuals and organizations that embody the life sciences community of British Columbia. Our award winners exemplify the full spectrum from discovery to commercialization and underscore the full breadth and depth of knowledge that impacts the B.C. bio-economy.

The 2020 LifeSciences BC award winners	
Dr. Aly Karsan	Genome BC Award for Scientific Excellence
Dr. Poul Sorensen	Michael Smith Foundation for Health Research – Aubrey J. Tingle Prize
Nancy Harrison	Milton Wong Award for Leadership
Canary Medical Inc.	Medical/Digital Technology Company of the Year
Xenon Pharmaceuticals Inc.	Deal of the Year
adMare BioInnovations Inc.	Strategic Life Sciences Partner of the Year
Chinook Therapeutics Inc.	Emerging Life Sciences Company of the Year
John Babcook	Dr. Don Rix Award for Lifetime Achievement

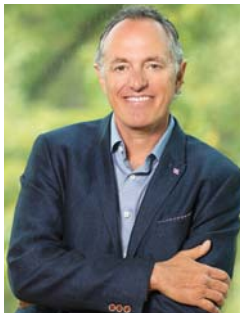
22nd ANNUAL LIFESCIENCES BC AWARDS

Innovation in Motion – A New Era

GENOME BC AWARD FOR SCIENTIFIC EXCELLENCE

DR. ALY KARSAN

Dr. Aly Karsan, professor of pathology and laboratory medicine at the University of British Columbia and distinguished scientist at Canada's Michael Smith Genome Sciences Centre, is a clinician-scientist at BC Cancer whose research is focused on the molecular basis of myeloid cancers. His research lab, which comprises a mix of wet-lab scientists and bioinformaticians, studies post-transcriptional mechanisms of resistance and relapse of myeloid cancers. His clinical interest centres on developing genomic methodologies and improving automation and quality assurance in clinical genomics. He established the Centre for Clinical Genomics, which was the first accredited laboratory in Canada to use next-generation sequencing techniques to deliver clinical testing. Dr. Karsan has been invited to give over 140 presentations, is an author on more than 165 publications and mentored 43 trainees at the graduate or post-doctoral level.



MICHAEL SMITH FOUNDATION FOR HEALTH RESEARCH – AUBREY J. TINGLE PRIZE

DR. POUL SORENSEN

Dr. Poul Sorensen is a molecular pathologist and biologist specializing in pediatric cancers. A leader in his field, his discoveries have changed the way researchers manage cancers. He is a professor of pathology at the University of British Columbia and holds the Johal Endowed Chair in Childhood Cancer Research. He is an investigator with BC Children's Hospital's Michael Cuccione Childhood Cancer Research Program, a founding member of the American Association for Cancer Research Pediatric Cancer Working Group and former chair of the Translational Research Committee of the Children's Oncology Group. His honours include the Bloom Burton Award and election as a fellow of the Royal Society of Canada.

MILTON WONG AWARD FOR LEADERSHIP

NANCY HARRISON

Nancy has nearly 30 years of professional and leadership achievement in British Columbia. As a partner at Ventures West, she was one of the early life science investors in Canada, making key and strategic investments in companies such as Angiotech, AnorMed, Celator, Xenon and many others, impacting the sector's long-term growth in this province. She is co-founder and former president of MSI Methylation Sciences, a private company with a unique treatment of depression in Phase 2. Harrison is a true innovator and demonstrates her dedication to Canadian biotech in mentoring the next generation of companies and leaders through roles that include Creative Destruction Lab, adMare BioInnovations, Canada's Digital Technology Supercluster and Knight Therapeutics. She has a bachelor of engineering from Queen's University and an MBA from McGill.

MEDICAL/DIGITAL TECHNOLOGY COMPANY OF THE YEAR

CANARY MEDICAL INC.

Canary Medical is a medical data company improving health-care outcomes through the continuous collection, analysis and monetization of data derived from proprietary, "smart" medical devices that self-report on function, diagnostic information, patient activity, side-effects and treatment failure for up to 20 years.

DEAL OF THE YEAR

XENON PHARMACEUTICALS INC.

Xenon Pharmaceuticals is a clinical-stage biopharmaceutical company committed to developing innovative therapeutics to improve the lives of patients with neurological disorders, including rare central nervous system conditions. Xenon is advancing a novel product pipeline of neurology therapies to address areas of high unmet medical need, with a focus on epilepsy.

STRATEGIC LIFE SCIENCES PARTNER OF THE YEAR

ADMARE BIOINNOVATIONS INC.

AdMare BioInnovations is Canada's global life sciences venture, building the Canadian life sciences ecosystem from sea to sea. It does this by sourcing therapeutically and commercially promising research from leading academic and biotech partners to create new companies of scale, providing specialized expertise and infrastructure to help existing companies scale up, and driving the growth of those companies into Canadian anchors by training the next generation of highly qualified personnel.

EMERGING LIFE SCIENCES COMPANY OF THE YEAR

CHINOOK THERAPEUTICS INC.

Chinook Therapeutics is a clinical-stage biotechnology company developing precision medicines for kidney diseases, focused on developing therapeutics for rare, severe kidney disorders with defined and rapid clinical development pathways. Its lead program, atrasentan, is a late-stage clinical program for the treatment of primary glomerular kidney diseases.

DR. DON RIX AWARD FOR LIFETIME ACHIEVEMENT

JOHN BABCOOK

John Babcook serves as Zymeworks Inc.'s senior vice-president, discovery research. For over 30 years, Babcook has made significant contributions to the international biopharmaceutical industry. In 1998, he co-founded ImmGenics Pharmaceuticals Inc. In 2000, ImmGenics was acquired by Abgenix Inc., which was subsequently acquired by Amgen. In 2010, he went on to establish the biologics division at the Centre for Drug Research and Development and became the founding president and chief scientific officer of Kairos Therapeutics Inc., where he led the strategic partnership and merger with Zymeworks. He has participated in the development of more than 100 therapeutic antibody-based programs.

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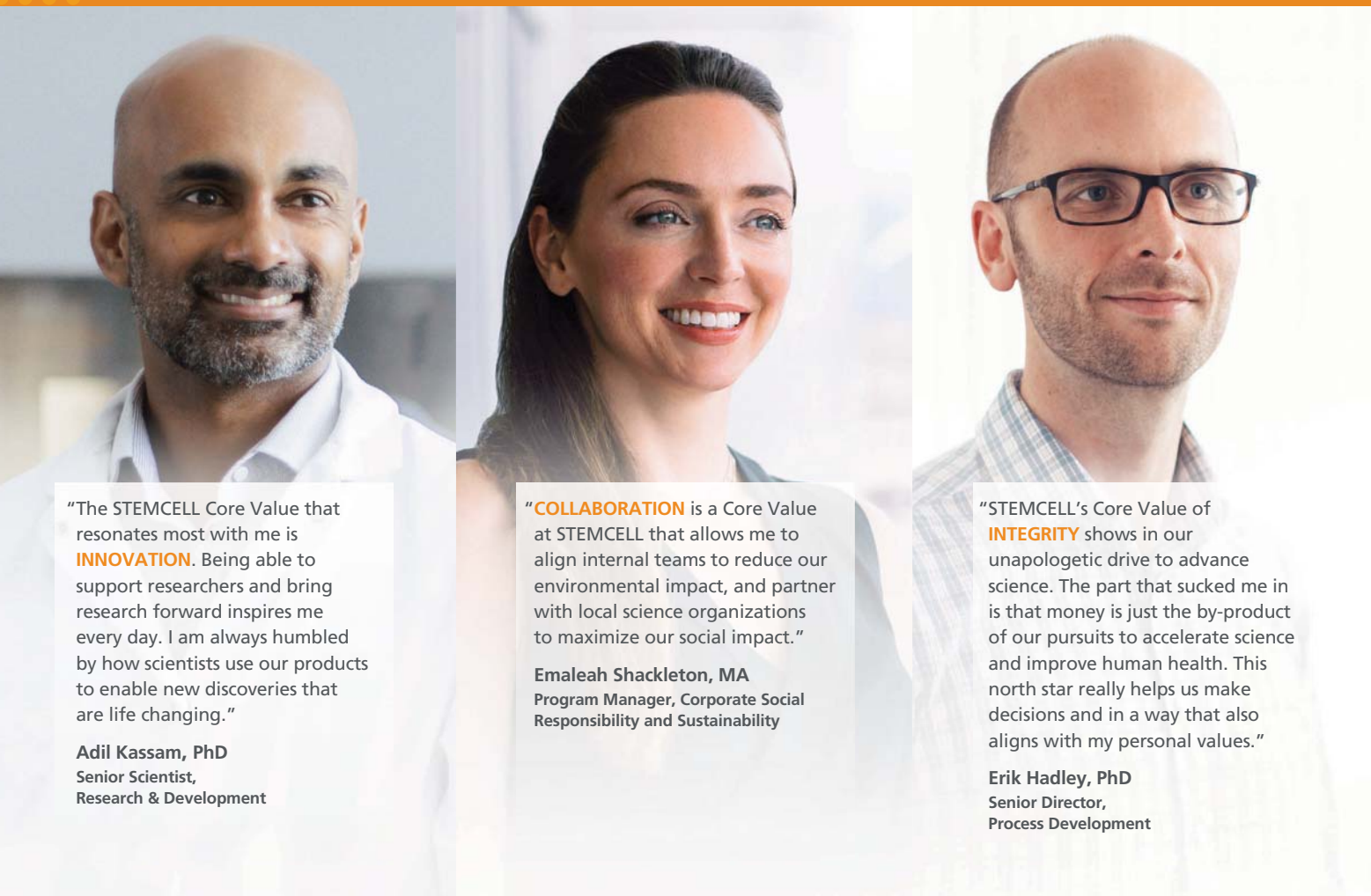

"The STEMCELL Core Value that resonates most with me is **INNOVATION**. Being able to support researchers and bring research forward inspires me every day. I am always humbled by how scientists use our products to enable new discoveries that are life changing."

Adil Kassam, PhD
Senior Scientist, Research & Development

"**COLLABORATION** is a Core Value at STEMCELL that allows me to align internal teams to reduce our environmental impact, and partner with local science organizations to maximize our social impact."

Emaleah Shackleton, MA
Program Manager, Corporate Social Responsibility and Sustainability

"STEMCELL's Core Value of **INTEGRITY** shows in our unapologetic drive to advance science. The part that sucked me in is that money is just the by-product of our pursuits to accelerate science and improve human health. This north star really helps us make decisions and in a way that also aligns with my personal values."

Erik Hadley, PhD
Senior Director, Process Development