

GROWING BRITISH COLUMBIA'S BIO-ECONOMY

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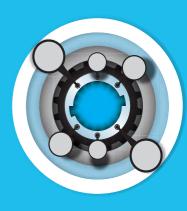
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STARTING FROM SCRATCH

Answers await discovery in B.C.'s collaborative research environment

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Science world

Paul Drohan brings international connections to his new role as LifeSciences BC boss



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MANAGING PUBLISHER: Gail Clark
EDITOR-IN-CHIEF: Fiona Anderson
ASSIGMMENT EDITOR: Nelson Bennett
GRAPHIC DESIGN: Randy Pearsall
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Peter Mitham

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MY MEDICINE is my hope



My name is
Tiko Kerr
I'm a visual artist
I'm from Vancouver
and I am an HIV survivor

I was diagnosed with HIV in 1984 and it was the beginning of my journey of survival. In 2005, after 20 years of taking various medications, I was declared completely drug resistant – it was a death sentence. My doctor and I worked tirelessly to obtain the right to a clinical trial for a new medicine. We succeeded, and in January 2006 I started the new treatment. Within a week my symptoms were improving. After three months the HIV virus could no longer be detected in my system. I have made a full recovery. My life is now full of hope and the possibilities are endless. My life was saved because of ongoing research to develop new, more effective medicines.

Gordon McCauley, chair



Paul V. Drohan, president and CEO

CHAIR AND PRESIDENT'S MESSAGE

Gordon McCauley, chair, and Paul V. Drohan, president and CEO

the predicted outcome will materialize.
Our members have believed for several years that the fundamental strengths of the life sciences community in British Columbia will return to prominence if we follow a deceptively simple recipe: start with truly novel, groundbreaking science; add management personnel preseasoned by global biotech and life sciences experience;

ometimes one wonders if the strategy is true, whether

groundbreaking science; add management personnel preseasoned by global biotech and life sciences experience; mix in public policy that encourages innovation, entrepreneurialism and capital risk taking; and keep refining until you get it right

until you get it right.

The data are pretty clear that the banquet served up by this recipe has the potential to feed the industry for some time. Once again, our life sciences companies are striding a global stage, attracting pharma partnerships of size and potential, attracting serious capital from well-regarded, sophisticated investors and generating business outcomes that hint at longer-term sustainability. We have seen public policy makers respond to our calls for measures that encourage capital risk taking – certainly no panacea among the measures offered but solid, complementary efforts nonetheless.

The pages of this magazine are filled with these data that validate the energy and policy: spin-outs from the Centre for Drug Research and Development; sizable initial public listings and capital raises from some of our marquee companies; clinical data from medical technologies; the emergence of new revenue-focused businesses; and tangible examples of the integration of biotech, med tech, and info tech into nascent digital enterprises that will further transform our health-care environment.

And we have seen and are grateful for resurgence among our sponsors too, surely as strong a sign as any to the economic impact and future potential of this industry.

It is tempting to say that we are benefiting from the proverbial high tide that lifts all boats. Without question, the dramatic return of public investors to biotechnology and life sciences narratives over the last 12 months has provided welcome fuel to a capital-intensive industry. Yet I would argue that the data also clearly say that this return of

capital has been quite geographically focused. Focused in clusters such as B.C. with the magic combination of great public research institutions, strong national and provincial funding agencies supportive of early, novel and challenging research, a pool of talented and battle-hardened management and a vibrant entrepreneurial spirit.

So, yes, the strategy is true and the predicted outcome does seem to be materializing. However, I feel like a coach whose team has started winning when I say: do not forget why we are winning. We need to continually challenge ourselves, reinvest in the science, attract the personnel; and provide returns for investors.

Some of these returns will come from our remarkable and unique strengths of integration. This integration is at both the micro and macro levels.

At the micro level a single-payer health system, a provincial clinical research enterprise, anonymous manipulable patient data, all within globally recognized teaching hospitals, provides a remarkable set of investigative tools that we should continue to exploit to attract science, people and capital to B.C.

At the macro level we are blessed with endowed research organizations, and opinion leaders, independent of public policy makers, who as leaders recognize the need to work together as a community, for the community – and, better yet, do so in a profoundly collaborative manner.

Given all these strengths and positive signs, we now need to focus on two basic tasks. First, keep the energy focused on our original strategy. It is working and will continue to work if we stick to it. Second, and increasingly more important, we need to start generating sustainable returns through sustainable businesses that will replace the historic and lamented anchors that built this industry in B.C. Through multiple sustainable businesses, with leading innovators who want to build their businesses here, and keep their businesses here, we will emerge to our rightful place alongside the two or three global clusters about which we all talk.

Gordon McCauley, chair, and Paul V. Drohan, president and CEO

We are blessed with endowed research organizations, and opinion leaders ... who as leaders recognize the need to work together as a community





WHEN GENOMICS RESEARCH HELPS TO REDUCE THE BURDEN ON THE HEALTHCARE SYSTEM, EVERYBODY WINS.

Genomics research is leading the way towards a sustainable healthcare system and improving care for patients through the development of faster, more accurate tests and treatments based on individual DNA.

Since 2000, Genome BC has invested over \$625 million in 180 research projects and science and technology platforms to establish a world-class genome sciences infrastructure. These investments are generating jobs, creating and advancing new companies and attracting national and international investments to help address challenges facing BC's key economic sectors.









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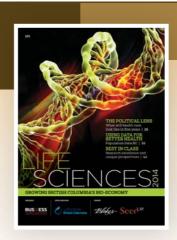
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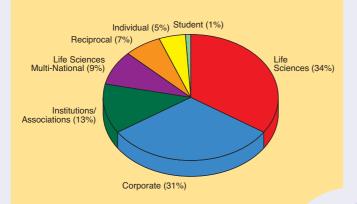
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LifeSciences BC

Membership **Composition** 2013



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Events

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- Monthly Breakfast Speaking Series
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- LifeSciences British Columbia Awards Dinner
- Sanofi BioGENEius Challenge Canada
- Salmon BBQ
- Industry-focussed Seminars and Workshops
- BIO International Convention

Committees: Finance, MedTech, Membership, Policy

B.C.'s Life Sciences Sector Statistics

Number of life sciences organizations:

Total life science expenditures:

\$902 million

Total estimated employment:

14,000 FTES

Total estimated wages and salaries

Average annual life sciences industry wage

\$68,000

Total life sciences research \$424 million

Total estimated impact on \$1.03 billion

Partnerships

Top ten investments of 2013

- \$35.9 M Celator Pharmaceuticals, Inc.
- **2.** \$33.1 M Tekmira Pharmaceuticals Corp.
- 3. \$19.9 M (tie) Aguinox Pharmaceuticals

\$19.9 M (tie) - Boreal Genomics Inc.

- **5.** \$7.8 M EnWave Corporation
- **6.** \$5.5 M Tekmira Pharmaceuticals Corp.
- \$5.4 M DelMar Pharmaceuticals, Inc.
- **8.** \$3.6 M viDA Therapeutics Inc.
- **9.** \$3.4 M iCo Therapeutics Inc.
- **10.** \$3.1 M Response Biomedical Corp.

Total investment dollars:

\$157 million



Briefs

Former Aspreva executives' new company nets \$56m in private placement

A urinia Pharmaceuticals Inc.
(TSX-V:AUP), a Victoriabased biotech whose team
includes the founders of one of
B.C.'s most successful biotechs
– Aspreva Pharmaceuticals –
secured \$56 million in private
placements in February.

Aurinia is developing a drug for treating lupus-related kidney infection.

The financing was led by ven-Bio, New Enterprise Associates, Redmile Group, RA Capital Management, Great Point Partners and Apple Tree Partners. Other institutional investors include existing shareholders Lumira Capital, ILJIN Life Science Co. Ltd. and Difference Capital.

The company said it planned to use the financing to move its chief drug candidate, voclosporin, into phase 2 clinical trials.



"This has provided us with the necessary resources to begin implementing our strategic plan, including the launch of a phase 2B study of voclosporin in lupus nephritis," said Aurinia CEO Stephen Zaruby.

According to Aurinia, voclosporin has potential as a drug for preventing organ rejection in kidney transplant patients. But the company plans to focus on using it to treat lupus nephritis – inflammation of the kidney caused by lupus erythematosus.

Aspreva was sold to the Galenica Group for \$915 million in 2007, the biggest acquisition in B.C. biotech history.

Aquinox Pharmaceuticals going public on Nasdaq

A quinox Pharmaceuticals Inc., a clinical-stage pharmaceutical company, filed an initial public offering on the Nasdaq in January.

The Vancouver company filed with the U.S. Securities and Exchange Commission to raise \$58 million through an initial public offering of common stock under the symbol AQXP. The last B.C. biotech to list on the Nasdaq was Tekmira Pharmaceuticals Corp.

Aquinox rased \$25 million in series B financing in 2010 and another \$18 million in April 2013.

Its lead drug candidate, AQX-1125, has several potential applications. The drug is currently in phase 2 trials for treating chronic obstructive pulmonary disease and chronic bladder disease.

There have been a number of IPOs by biotechs in the U.S. recently, a sign of recovery in a



sector that has been in a trough in recent years. It's part of a broader trend, with money moving away from sectors like mining and into knowledge-based industries, said Graeme Falkowsky, managing director of corporate finance for Deloitte.

"In 2013, we've had the largest amount of capital raised in IPOs since the year 2000, and knowledge-based industries were about 40% of the IPOs that were done," Falkowsky said. "It gives you a sense of how important the knowledge-based industries are now becoming again."

Aquinox was spun out of the University of British Columbia and BC Cancer Agency in 2004.

American venture capital firm building new biotech in Vancouver

Versant Ventures, an American venture capital firm focused on life sciences, has chosen Vancouver to create new early-stage drug development companies that are built to be sold to big pharmaceutical companies on Versant's "build to buy" model.

In December 2013, Versant announced a \$10 million investment in a new company, Inception 4, based in Vancouver.

The venture is working with Bayer HealthCare to develop a drug to treat macular degeneration and related eye diseases.

"Bayer has partnered up front on that program to commit research funding, commit to providing their capabilities, and they have an option on the program as well," Versant Ventures principal Jerel Davis said.

Inception 4 is the Canadian version of Versant Ventures' Inception Sciences, which has spun out six pharma companies in San



Diego in recent years.

"We wanted to start a unit in Canada, primarily based around the talent in Canada," Davis said.

Versant Ventures has more than \$1.6 billion in assets invested in life sciences. An early investment was Amira, which was sold to Bristol-Myers Squibb in 2011. Versant used the profits to found Inception Sciences, which has since created six new companies and 100 new jobs.

Under the "build to buy" model, Versant invests in early drug discovery companies and inks deals with large pharmaceutical companies up front to develop a specific drug or device. The pharmaceutical company has the right to acquire the company, but not its talent team, which moves on to the next biotech startup.

First implant of Vancouvermade heart device done at St. Paul's

device developed by Vancouver's Neovasc Inc. (TSX-V:NVC) for fixing leaky heart valves without requiring openheart surgery has had its first successful implant performed at St. Paul's Hospital.

The device, called the Tiara, has been nearly a decade in the making. It was successfully implanted in a 73-year-old patient by a team of surgeons at St. Paul's on January 30.

It was designed to fix a condition called mitral regurgitation, in which the mitral valve in the heart does not close properly, allowing blood to leak from the left ventricle to the left atrium – a condition that typically requires cardiac bypass surgery.

Similar devices have been used for years to fix problems in the aortic valve, but the mitral valve is more problematic.

The patient who received the device was considered a "no



option" patient who would not likely have survived open-heart surgery.

The Tiara was designed as an alternative to bypass surgery, a highly invasive four-hour procedure. The device is inserted using a transcatheter, which requires only a small incision.

"The people that we would treat really would be those that are refused for surgery," Neovasc CEO Alexei Marko told *Business in Vancouver*. "So they're essentially non-operable patients."

Formed in 2008, Neovasc is a medical device company specializing in devices for cardiovascular diseases and conditions. Its one revenue-generating product is tissue made from cows and pigs that is used in cardiac and vascular surgery.

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SCIENCE

Paul Drohan, who spent the last eight years in the U.K. working for Genzyme before returning to Canada, brings international connections to his new role as LifeSciences BC boss

NELSON BENNETT

wo small flags – one British, one Canadian - sit in a holder on Paul Drohan's desk in his office at LifeSciences BC. On one wall hangs a framed, ornate Aboriginal boomerang.

Paul Drohan, CEO, LifeSciences BC: "I think what is really going to put Vancouver on the map, if we do it right, is the convergence of the IT sector with life sciences" | RICHARD LAM

Fitting symbols for the 52-year-old Canadian-born businessman, who spent eight years in the U.K. as senior vice-president for Genzyme's Commonwealth and South African group of companies before returning to Canada in Ianuary.

As the new president and CEO of LifeSciences BC, he plans to use his international connections and deep knowledge of the pharmaceutical and biotechnology industries to help expand B.C.'s life sciences sector beyond what it is now: an incubator for biotechs that end up being acquired or moving.

"I asked this of the board when they hired me: 'Are we trying to build a life science world-class industry sector, or are we just trying to get companies to a level where they can be big enough and sold off?' Because B.C. has been very good at doing that - it's very entrepreneurial."

B.C.'s once-thriving biotech sector is now recovering from a prolonged contraction - battered by a drought of investment capital and a series of bankruptcies and downsizing.

"We saw a contraction of the industry around the world," says Drohan. "Biotech was decimated in the United States as well - this is not just a Canadian or Vancouver phenomenon."

But there have been encouraging signs of recovery, including a number of American biotechs going public recently.

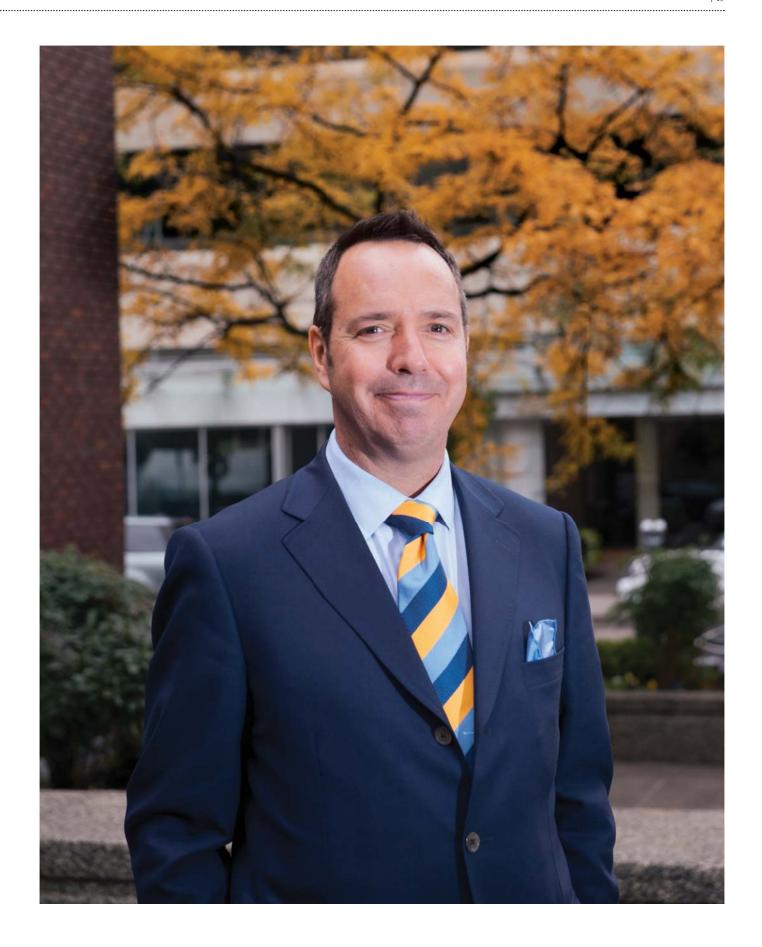
"There's a real rebirth of biotech, and the venture capitalists in the U.S. are actually going back into biotechnology," Drohan says. "It's a very positive sign for us."

LifeSciences BC is the umbrella organization for 185 life sciences companies and organizations - two-thirds of which are small companies with two to 20 employees. Drohan believes some of those small companies have the potential to become the next Stemcell Technologies Inc., which employs 500.

MISSION | TO SIGNIFICANTLY CONTRIBUTE TO B.C. AND HEALTH CARE IN THE PROVINCE

ASSETS | PERSONAL ENERGY, GLOBAL EXPERIENCES AND INTERNATIONAL CONNECTIONS

YIELDS | POSITIONS OF INFLUENCE IN THE GLOBAL BIOTECHNOLOGY WORLD



"We need to be doing things to help the startups," Drohan says. "We need to look for ways to bring venture [capital] here. We need to help them with business acumen, because a lot of them are scientists [and] some of them don't have the acumen to run a company."

Drohan says Vancouver's life sciences sector has several real advantages over some other biotech hubs. One is the amount of high-quality research done at B.C. universities, research hospitals and agencies like the BC Cancer Agency, the BC Centre for Excellence in HIV/AIDS and the Michael Smith Foundation for Health Research. Another asset is Vancouver's vibrant information technology sector.

"I think what is really going to put Vancouver on the map, if we do it right, is the convergence of the IT sector with life sciences," says Drohan.

"If you look at Telus Health, that's a great example. One of the larger employers in the province, headquartered in Vancouver, they've made big bets in what digital health is going to look like.

"We need to get behind organizations like Wavefront and Telus Health, because if we really want to be a sector that is world class, we have an opportunity to bring that IT sector and the life science sector together, and there's not a lot of places around the world that have that opportunity like we have today."

He also believes genomics-based research will provide tremendous opportunities and says B.C.'s Chinese and Indian populations provide some important genetic data sets that could be used for genomics-based research and medicine. With China's and India's populations exceeding two billion, that is a huge market for any genomics-based medicines or therapies developed here.

"We need to get behind organizations like Genome BC because that is the future of medicine," says Drohan.

There are roadblocks to research in B.C., however. The B.C. government sits on a treasure trove of medical history that could provide important data for researchers and biotechs working on new drug therapies, but does not readily share it.

"We really need the curators of data to loosen the strings," says Drohan. "We have 20 years of data here in B.C. that no one can get access to. I think what we should do is start allowing people to interrogate that data to help them generate faster research outputs as a result of having those patient populations characterized.

"It could be a revenue stream for the province. The U.K. has done it."

Drohan hopes to use his international connections to help B.C. biotechs and researchers gain access to global markets. He sees potential opportunities, for example, for the HIV vaccine Vancouver's Network Immunology is developing in Sub-Saharan Africa, where 20% of the population aged 15 to 45 is HIV-positive.

Drohan says that the recently concluded Comprehensive Economic and Trade Agreement has provisions that will benefit Canadian pharmaceutical companies, and reductions of tariffs will benefit companies like Stemcell and StarFish Medical, both of which do business in Europe.

But he adds that Canada needs a reciprocity agreement with Europe on new drug approvals, because the process just takes too long in Canada. For 30 drugs recently approved by both Health Canada and the European Medicines Agency (EMA), Drohan says the EMA approval process was 267 days faster than Health Canada's.

"If we had reciprocity of approvals, we wouldn't have to worry about Health Canada."

Born and raised in Toronto, Drohan obtained a degree in biochemistry from the University of Toronto and diplomas in finance and marketing from York University. His first job was doing research at McMaster University in adult respiratory distress syndrome.

He went into the pharmaceutical industry, spending 10 years with the Upjohn Company, which was eventually acquired by Pfizer Inc. (NYSE:PFE). He left before that acquisition to join Genzyme – which specialized in developing orphan drugs – as general manager for Canadian operations.

"We started with two employees and just a little over \$2 million in revenue," says Drohan. "My boss left two years after I was hired in 1996 and left me holding the keys to the kingdom. We took the company up to 55 employees and \$55 million in seven years."

Based on that success – and a Canadian's knowledge of parliamentary government and universal health care – Genzyme then offered him a job that took him and his family to Oxford, England. There he became general manager for Genzyme U.K. and Ireland.

He later became senior vice-president in charge of Genzyme's South African and Commonwealth operations, which included Australia, New Zealand, Canada, the U.K. and Ireland – a business group with 300 employees and US\$300 million in revenue.

In 2011, Genzyme was acquired by Sanofi (NYSE:SNY) for \$20 billion. When Drohan's wife, Joyce Drohan, completed a major project for the U.K. government's department of national health, the couple had reached a career crossroads.

"We both hit the right inflection point," says Drohan. "It was either stay in the U.K. for another 10 years or come back to Canada."

With family in B.C., the couple decided to move to Vancouver. As an avid cyclist and a former Level 1 ski instructor, Vancouver appeals to his personal interests as well.

"To be close to the mountains is fantastic," he says.

PAUL DROHAN | CEO, LIFESCIENCES BC

There's a real rebirth of biotech, and the venture capitalists in the U.S. are actually going back into biotechnology. It's a very positive sign for us



HEDGING BETS WITH DRUG DISCOVERY PLATFORMS

Investors and big pharma appear to be taking a renewed interest in biotechs that take the platform approach

NELSON BENNETT

he biotech business can be a bit like roulette: some players go for the inside bet and the big payoff, while others hedge with outside bets.

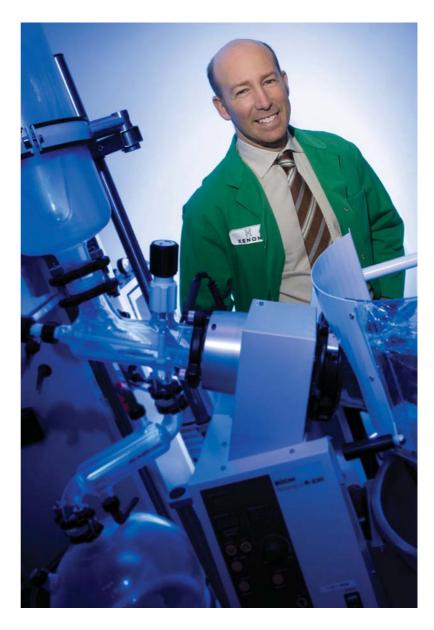
Bet on a single drug candidate, and you may hit the jackpot or go broke. Develop a proprietary platform for a whole class of drugs, and you may find a big pharma partner who wants to use it to develop its own products and, in the process, help finance your own research.

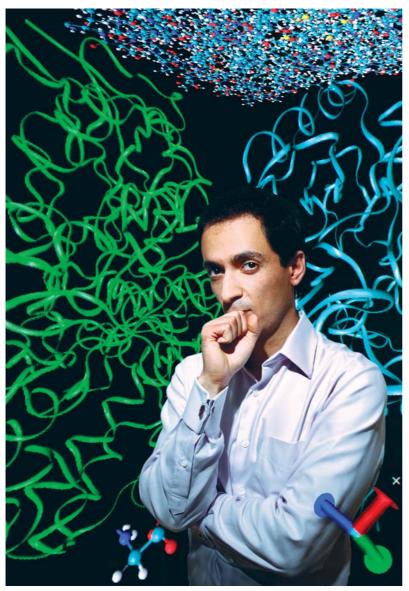
Judging by recent investment decisions and collaboration deals, the investment community and big pharma appear to be taking a renewed interest in small biotechs that are taking the platform approach.

Xenon Pharmaceuticals Inc., Zymeworks Inc., Sirona Biochem Corp., Tekmira Pharmaceuticals Corp. and Qu Biologics are a few examples of B.C. companies that have developed proprietary platforms with multiple drug candidates.

Earlier this year, Zymeworks raised \$15 million in new financing and struck a collaboration deal with a subsidiary of Eli Lilly and Co. to use Zymeworks' Azymetric platform to develop antibody therapeutics for oncology. Zymeworks also signed a deal in 2011 with Merck and Co. Inc. worth up to US\$187 million.

Simon Pimstone of Xenon
Pharmaceuticals, which has
struck deals with big pharma
to use its genetics-based
platform | DOMINIC SCHAEFER





Zymeworks CEO Ali Tehrani: platform approach is like a machine to develop whole classes of new drugs | DOMINIC SCHAEFER

Xenon has also struck collaboration deals with Merck, as well as Teva Pharmaceutical Industries Ltd.

"Platform companies certainly are seeing greater investor and pharma interest than in the recent past," says Xenon CEO Simon Pimstone. "I think the concept of platforms being able to generate deals in a tough financing environment, as a business strategy – that has been hugely important for us."

Single-product-focused companies are often spun out of university research, says Zymeworks CEO Ali Tehrani, and there's no question the payoff can be huge when a company successfully gets a single blockbuster drug to market.

Victoria's Aspreva Pharmaceuticals Corp. focused on a single drug – CellCept, which prevents organ rejection in transplant patients – and was acquired in 2007 by Swiss drug wholesaler Galenica Holding SA for \$915 million.

On the other hand, Allon Therapeutics also focused on a single drug, davunetide, for treating progressive supranuclear palsy (PSP). It spent \$100 million on clinical trials, only to conclude davunetide didn't work for PSP, leaving the company in financial ruin and Montreal's Paladin Labs Inc. picking up the pieces.

Tehrani likens a proprietary platform to a machine designed to produce a whole class of drugs.

"These machineries serve different purposes, but the ultimate goal is to innovate, to solve a class of problems rather than a singular problem."

Considering how costly it is to take a new drug through clinical trials, having several products in the pipeline can be taxing for small biotechs.

But platform companies can finance their own products by striking collaboration deals with large pharmaceutical companies, which leverage those platforms for their own drug candidates.

"I think it's fair to state that, given the odds in drug development, a platform strategy does allow greater pipeline diversity and therefore is a good risk mitigation," Pimstone says. "However, it's not an essential ingredient for success, as Aspreva and AnorMED (acquired in 2006 by Genzyme Corp. for US\$584 million) showed us."

Xenon currently has eight drug candidates in the pipeline, based on its Extreme Genetics platform – a novel approach that identifies rare phenotypes to help tailor potential drug targets.

One of those drugs – an analgesic for treating a rare neurovascular pain disorder – was identified after Xenon studied people with a rare condition that makes them immune to pain, as well as people with an equally rare disorder that causes spontaneous pain. It is now being tested in clinical trials in partnership with Teva.

Zymeworks' approach was to first develop computerassisted molecular modelling – ZymeCAD – to eliminate

SIMON PIMSTONE | CEO, XENON PHARMACEUTICALS

Ithink it's fair to state that, given the odds in drug development, a platform strategy does allow greater pipeline diversity and therefore is a good risk mitigation



dead ends in the area of protein therapeutics, allowing the company to zero in on the more promising drug candidates. It has since developed three different "scaffolds" for developing drugs for a range of disease targets.

Sirona Biochem's platform is fluorination chemistry, used to stabilize carbohydrate molecules that are known to have potential therapeutic value but are unstable – some of them even toxic.

One recent example is an "antifreeze" glycoprotein found in Antarctic fish. It has long been known to have potential applications in humans – dermatology, for example, where it is thought to have anti-aging properties.

Sirona's lab in France, TFChem, managed to synthesize a stable glycoprotein using its fluorination approach. That has led to a licensing agreement with Cincinnati Children's Hospital, which developed a skin cream that will be used to deliver the Sirona anti-aging compound.

"It's not easy to fluorinate," says Sirona CEO Neil Belenkie. "It's an emerging science, and it's something that pretty much all drug development companies – especially the big ones – will be dabbling in. But it's all that we do."

Tekmira, meanwhile, uses RNA interference (RNAi) for gene silencing and has several drug candidates in the pipeline for everything from oncology to Ebola virus.

Tehrani and Pimstone say they are excited to see new biotechs forming around the platform approach – companies like Qu Biologics.

The company's proprietary platform is Site Specific Immunomodulators (SSI) – a novel approach to treating cancer and autoimmune diseases. Rather than develop drugs to treat the disease itself, it is developing chemical prompts that trigger innate immune responses to the disease.

"They're looking at the space of oncology from an entirely different perspective," Tehrani says.

"We had originally developed it as a cancer treatment, but as it turns out it has broader applicability," says Qu Biologics CEO Hal Gunn. "That's a big advantage for a company that has a platform because all the eggs aren't in one basket and you can develop multiple partnerships or develop multiple indications."

Do you have Crohn's disease? Are you aged 18 or above?

Qu Biologics is recruiting for a Phase 1/2 clinical research trial for people living with moderate to severe Crohn's disease.



The clinical research trial takes place in Vancouver, BC.

Qu Biologics is working to develop a new platform of immunotherapeutic treatments. Our novel Site Specific Immunomodulators (SSIs) are being designed with the goal of activating the body's immune system to reverse the chronic inflammation underlying many conditions such as Crohn's disease.

To learn more about the trial and complete an online pre-screening questionnaire to assess your eligibility, visit www.qucrohnstrial.com



Don't miss your opportunity to learn more about this fresh approach to better health

Call 1.855.209.9680 or email qucrohnstrial.aa@gmail.com

What does nuclear physics have to do with neurodegenerative disorders?

In collaboration with the Pacific Parkinson's Research Centre and UBC, TRIUMF scientists leverage their expertise in producing medical isotopes and associated radiopharmaceuticals to investigate neurodegenerative disorders like Alzheimer's and Parkinson's disease.



Cyclotron

TRIUMF's cyclotron accelerates a proton beam, which is then directed at various targets to produce a variety of medical isotopes



Tracers

TRIUMF chemists combine medical isotope with a metabolically active molecule which is then sent to UBC for injection into a patient.



Positron Emission Tomography

The tracer migrates to active sites in the brain, where it decays. The PET scanner detects the radiation and creates an image of the neurobiological function.



STARTING FROM SCRATCH

Answers await discovery in B.C.'s collaborative research environment

PETER MITHAM

t's basic high school science: research that leads to groundbreaking discoveries begins by asking questions. But discoveries come by knowing what some of the possible answers are and putting data to the test.

Researchers working in the life sciences in British Columbia are blessed with perhaps the deepest pool of answers in the world: a diverse, multicultural population and a single-payer health-care system that has given the province a large pool of coherent patient data.

"We have access to all of our patients across the entire spectrum of the cancers that we deal with in British Columbia, and that results in an ability to actually generate information on how they respond to treatment," says Samuel Abraham, vice-president of research for the BC Cancer Agency. "That has become an invaluable tool in understanding how patients' diseases evolve and applying sciences like genomics so that we can make use of that information in trying to predict response."

While patients outside Canada may visit a plethora of health organizations, in B.C. the patient's history of care is streamlined in a single file.

Access to this data has helped attract researchers like Christian Steidl, a research scientist with the BC Cancer Agency studying genetic aspects of lymphoid cancers.

"A single-payer system that allows you to track and trace your patients enables you to apply genomics in a way that's difficult to do in most other jurisdictions," Abraham says. "The fact that we had this access to data and patients ... caused [Steidl] to decide that this was the place where he could effect much better outcomes from his work"

Genomics research at the Vancouver Prostate Centre (VPC) is also advanced by B.C.'s health-care system. Researchers enjoy access not just to patient data, but also to a library of tissues dating back 20 years. VPC COO Graeme Boniface notes that the centre's surgeons perform 250 to 300 surgeries a year, resulting in prostate tissues from more than 5,000 men.

"We have the largest biorepository of prostate cancer specimens in the world here at VPC. We have been squirrelling away tissues," he says proudly. "We have a lot of medical history related to those specimens, and so we can tweak out what we think are the interesting patient cohorts."

"The beauty about the system is that we have patients that come back and we follow them through their natural course of history, through their treatment, through whether they relapse or whether they don't," Boniface explains. "You can actually look at the [tumours' genetic] signatures to determine which of these individual patients

GRAEME BONIFACE | COO, VANCOUVER PROSTATE CENTRE

We have the largest biorepository of prostate cancer specimens in the world here at VPC. We have been squirrelling away tissues





will be responsive to a given drug or whether or not that patient actually needs active intervention."

Connections between researchers at VPC and the BC Cancer Agency receive funding from the Michael Smith Foundation for Health Research (MSFHR). Since 2002, funding from MSFHR has helped B.C. secure an additional \$300 million from the Canadian Institutes of Health Research (CIHR). This boosted the province's share of CIHR funding to 14% in 2012 from just 9% in 2002.

MSFHR funding has supported 12 researchers at the Vancouver Prostate Centre and scores more at other centres, including Julio Montaner and 19 colleagues at

the BC Centre for Excellence in HIV/AIDS.

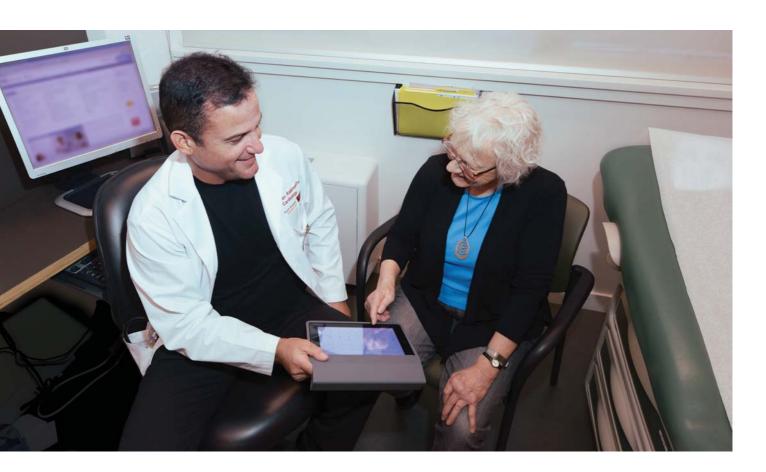
The funding doesn't support local research capacity alone; the ripple effects are felt around the globe as research being done in B.C. brings researchers to the attention of the international scientific community, enriching homegrown research and in turn attracting new talent. "We have established platforms that are often not only

"We have established platforms that are often not only collaborative in relation to ourselves and the prostate centre or people at the different universities in the Lower Mainland, but also critically important to our international collaborations," Abraham says. "Nobody's living in a bubble anymore."

Graeme Boniface, COO of the Vancouver Prostate Centre, shows off specimens stored in liquid nitrogen DOMINIC SCHAEFER

BIG DATA & THE CURE FOR

New B.C.-made technology puts real-time big data analysis of medical and patient data in hands of physicians, researchers



Dr. Alan Rabinowitz, co-founder of PHEMI Health Systems, and heart patient Mary Wright | DOMINIC SCHAEFER **NELSON BENNETT**

efore cardiologist Alan Rabinowitz sees a patient, a nurse or secretary can spend close to an hour pulling together information from several databases to create a patient chart. Rabinowitz calls it "death by clicking."

DEATH BY CLICKING

"If there's 13 keystrokes to get a little piece of data, then you may as well just use paper," he says.

Rabinowitz is one of the co-founders of a company that may have a cure for death by clicking: PHEMI Health Systems.

With the supercomputing genius of co-founder and CEO Paul Terry and the analytics expertise of SAP AG – an \$85 billion German enterprise software company – PHEMI has built a system that applies real-time big data analytics to medicine and puts it in the hands of physicians.

"At the front end, the secretary might spend 45 minutes gathering all the necessary patient data," Rabinowitz says. "In proof-of-concept trials, the PHEMI system does all that in 25 seconds."

PHEMI harnesses SAP's HANA "in-memory" computing system, which is 10,000 times faster than other systems.

Germany's MolecularHealth is using it to tailor individualized cancer treatments based on the genetically peculiar mutations in patients' DNA. What once took two days and cost \$100,000 per patient can now be done in one minute for \$4,000.

SAP's 1,200-person analytics lab happens to be in Vancouver. PHEMI's big data approach to medicine and medical research was just the kind of thing SAP looks for in new partners, says Dinesh Sharma, SAP's vice-president of corporate innovation.

"B.C.'s interesting to us because the breadth and depth and the quality of the information that is available inside of B.C. – because of the socialized medicine structure that's inherent here – is very rich, and we already have a huge presence here."

There are two versions of PHEMI: PHEMI Clinical for physicians and PHEMI Central for research. PHEMI Clinical pulls data from multiple sources to create a patient chart on an iPad.

"It also automates the extraction of relevant data," Rabinowitz adds. "It's a combination of workflow automation, task management and decision support."

Unfortunately, the medical profession can be slow to adopt new technology, according to Brendan Byrne, a pioneer in electronic medical records (EMR), so it may take a while before hospitals in Canada are using systems

Byrne's company, Wolf Medical Systems, built an EMR in 1998. It was acquired by Telus Health, where Byrne is now vice-president of physician solutions.

Sixteen years later, only 57% of Canadian doctors use EMRs, only 16% fully utilize them, and only 20% of medical data available exists in electronic form, Byrne says.

When Terry joined the board of directors at St. Paul's Hospital, he says, he was "appalled" at how far behind hospitals were in embracing digital technology, and he partnered with Rabinowitz to fix the problem.

He brought 18 of his best supercomputing scientists on board to create PHEMI, which is currently being tested at St. Paul's Hospital and Toronto's St. Michael's Hospital.

Adoption barrier is social, not technological

One of the more promising applications for big data in health care is personalized medicine, thanks to the ability to analyze vast amounts of medical and genomic data.

Illumina Inc. has developed a supercomputer system that can sequence a person's genome for \$1,000, so in the coming years, increasing amounts of personal genetic information will be available. The biggest barrier to accessing it is not technological, but rather a social licence issue.

B.C. has one of the richest repositories of medical and pharmaceutical data in North America – a 20-year databank of

patient and pharmacy data that could be interrogated by researchers, if only they had timely access.

But Population Data BC keeps tight reins on the information. Researchers can access it, but a lengthy application process is involved. So while the data is available, it's not accessible for the kind of real-time analysis that PHEMI is designed for.

"The type of data that we're talking about is very privacy-sensitive, and it's not something for which we have the appetite to just allow anybody to access in an unfettered fashion," says Population Data BC executive director

Nancy Meagher.

A person's genome can reveal genetic dispositions to certain diseases, so there are also concerns that health insurance companies could use that information to deny coverage to people.

Brad Popovich, chief scientific officer for Genome BC, is one of only a few hundred people to have his whole genome sequenced, and even he is uneasy with the idea of sharing it.

"Until we have people very comfortable allowing their genomic information to populate these databases, it's going to be difficult to have the true number of what you need to infer things at a clinically meaningful level," he says.

"We need protections in place where people feel there is no chance that their information can be used against them."

Protecting patient privacy is central to PHEMI's "privacy by design" approach. The system was built so it can be set according to the privacy laws and guidelines of a particular country or health authority.

"We can create a view on data that conforms to whatever standards you want, and we can organize and analyze data any way you want," says PHEMI CEO Paul Terry.

DUE SOUTH AND BACK AGAIN

As B.C. biotechs move to California to find funding, U.S. venture capital firm Versant Ventures opens Vancouver office to help fill the city's VC hole

SEAN KOLENKO

Money invested by corporate venture capitalists

January 1, 2012–June 30, 2013 (in USS millions)

\$1.012.49 m

Software

\$644**.**95 m

Biotechnology

\$422.03 m

Industrial /energy

\$340,73 m

Medical devices and equipment

\$299**.**81 m

IT services

\$929.22 m

All other industries

SOURCE: PWC "TOP HEALTH INDUSTRY ISSUES OF 2014: A NEW HEALTH ECONOMY TAKES SHAPE" hen veteran biotechnology investor Punit Dhillon founded his company OncoSec Medical in March 2011, the native Vancouverite was forced to make a tough choice: establish the business in his hometown, or relocate to the United States where it's easier to access the critical venture capital needed to grow an early-stage biotechnology company.

He went south to San Diego.

"For me, in order to make this company a success, I literally had to situate this company in the middle of having access to great institutions, being able to generate the data that could entice venture capital and fund the company to continue," says Dhillon, whose company is developing a skin-cancer treatment.

"It has worked really well for us. Being in the U.S. has allowed us to leverage those opportunities."

And Dhillon isn't alone. Other British Columbia-formed biotechnology companies have also moved to California to be closer to larger pools of venture capital. San Francisco and Cambridge, Massachusetts, remain the world's most active hubs for biotech investment.

But then late last year the opposite happened – venture capital travelled north from California to Vancouver.

In December, U.S. venture capital firm Versant Ventures, a life-sciences-focused venture capital organization with more than \$1.6 billion under management, established Inception Sciences Canada.

The new organization, a branch of Versant's successful Inception Sciences division, which has spawned a

handful of biotech companies in San Diego, will manage a company called Inception 4. Versant has invested \$10 million in Inception 4, a company developing a treatment for macular degeneration. Bayer HealthCare is a partner in the company as well.

Despite the relative novelty of Versant's move to Vancouver, some say it highlights long-standing qualities of the city's biotech sector: Vancouver has top-notch academic institutions, renowned researchers and innovative companies worth investing in.

Gordon McCauley, a biotechnology executive and partner at NDI Capital, says there "is an interesting bit of symbolism" to Versant's choice to open an office in Vancouver.

"It really tells you that a major-league VC is seeing what is happening here and making sure they are on the ground to identify those opportunities early," says McCauley.

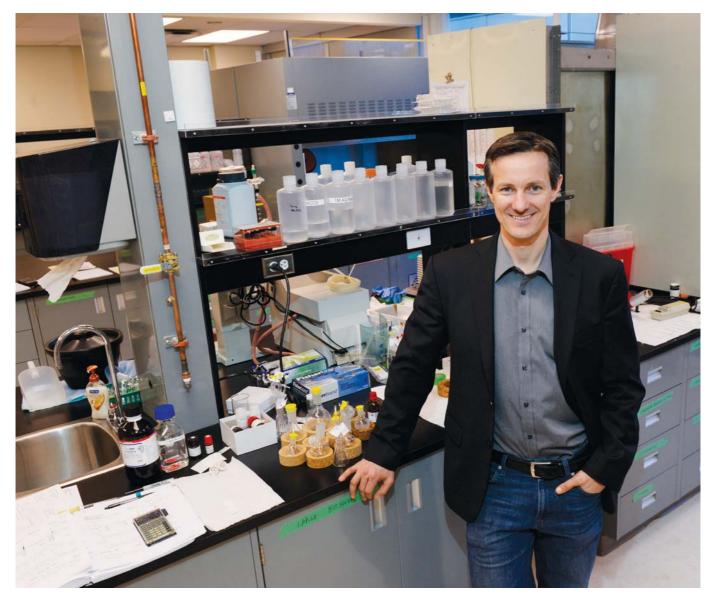
"If you have a strong business, good management and good data in Vancouver, you can access capital."

Jerel Davis, a principal with Versant Ventures, also lauds Vancouver institutions such as the University of British Columbia and the BC Cancer Agency as "great places for

GORDON MCCAULEY | PARTNER, NDI CAPITAL

If you have a strong business, good management and good data in Vancouver, you can access capital





us to pick and find great opportunities."

But Davis, echoing Dhillon's sentiments on the relative scarcity of venture capital in Vancouver, adds that Versant's decision was buoyed by the fact that it wouldn't have to compete with many other venture capital firms to invest in promising local companies.

"That is a real plus for us. Because there are very few other VC investors in Vancouver and other parts of Canada, we see real opportunity," says Davis.

The global biotech sector has performed well in the past two years with 44 initial public offerings and 66 approvals for new drugs by the U.S. Food and Drug Administration in 2012 and 2013.

One way to increase the capital available to Vancouverbased biotech companies is to expose high school students to a life of entrepreneurship, says Dhillon. Recently, Dhillon and two partners started the Young Entrepreneur Leadership Launchpad, a small-scale incubator that teaches students in grades 11 and 12 how to draft business plans and pitch to investors, among other skills.

The desired result is graduating classes eager to one day embark on careers in startups, ideally in the biotech sphere.

"When I was in Canada, in my 20s, the only place I knew that biotech was based in was Canada. I realized there were other pockets like Cambridge and San Francisco, but I thought that biotech in Vancouver was very robust," says Dhillon.

"Since then, I think it has retracted. The tech sector has done well and good companies have opened offices in Vancouver. I would love to have that environment recreated for the biotech community."

Jerel Davis, principal at Versant Ventures, in the lab of a company in which Versant Ventures has invested | DOMINIC SCHAEFER

HOWI DID IT



What does one go through to take a company public?

DAVID MAIN | Co-founder and CEO of Aquinox Pharmaceuticals Inc.

Q&A

Q: What is your main drug candidate and what is it for?

A: It is called AQX-1125 and we're currently studying it for serious inflammatory diseases including chronic obstructive pulmonary disease and bladder inflammation.

Q: What are the company's immediate plans for the money [approx. \$47 million, after discounts, commissions and expenses] raised in the IPO?

A: Our plans are for three critical areas: the first one is to be more Phase-3 ready, which is the final stage of testing before you seek market approval; the second category is to expand clinical development of AQX-1125; and the third will be to advance one additional new compound into the clinic.

Business in Vancouver's "How I Did It" feature asks business leaders to explain in their own words how they achieved a business goal in the face of significant entrepreneurial challenges. In this week's issue, biotechnology executive David Main, co founder and CEO of Aquinox Pharmaceuticals Inc. (Nasdaq:AQPX), explains the road the company followed to going public on the Nasdaq stock exchange.

"As you'd expect, going public was a success story on March 12 for us that took more than five years. It really is a culminating event, rather than a single point in time.

"But I would say the actual process of taking the company public started a year before that March date. It took a lot of work transitioning the company both from an accounting perspective and a legal perspective to be ready to go public. It also means starting to build rapport with investors that may want to participate in your IPO and, ultimately, requiring that you have investment bankers and analysts interested enough they want to sponsor you to take you public.

"That takes time. You must allow them time to do the due diligence and ensure you are the kind of company they want to be associated with.

"It's a thorough process and a process that requires that you are well on top of what your science can and cannot do and what the attributes of your company are that would make it an attractive investment.

"But there is a big range of investment bankers out there. So selecting your banker is an important part of your due diligence on them.

"President [Barack] Obama put in place something called the Jobs Act, also known as the Jumpstart Our Business Startups Act, and this allowed something very different from what was allowed before in financings. Before, going public was you showed up one day and said 'We're going public.' Now, you're allowed to do what's called test-thewaters meetings, where you go out on a confidential basis and meet with investors to read their level of interest.

"So we spent the better part of three or four months meeting with prospective investors to educate them about Aquinox. At this point we're not selling shares and we are not talking about the value of the company. All we're saying, in general, is: 'Here is our science, here is our track record and here is where we are going. Is this the kind of company you'd be interested in?'

"That was a tremendously valuable experience in going public. In biotechnology, these tend to be very sophisticated and complicated investment stories, so [it's important to give] investors time to make a rational decision rather than the rush of a two-week IPO road show. By the time we kicked off our public offering we already had feedback from a number of professional investors with a high degree of experience in investing in biotechnology to know whether or not they would be interested in participating in our IPO.

"In parallel to all of this you are making your submissions to the [U.S.] Securities and Exchange Commission called your S1 or prospectus. It is a 250-page legal document outlining your business, your financial affairs, how people are compensated, what your risk factors are and what your business plans are.

It's a very rigorous legal process to ensure you are disclosing all material information so investors can make an informed decision about investing in your company. Then, finally, you can put that document on the public record and launch your IPO."

► FROM UNIVERSITY LAB TO STOCK EXCHANGE

AN 2006

The founding of the company, together with professors from the University of British Columbia, and putting in place the licences for the founding technology.

JUZ 70

Declaring AQX-1125 as the company's lead candidate giving the company a strong product to focus on and marking a transition from research to product development.

MAD 201

Aquinox Pharmaceuticals goes public on the Nasdaq stock exchange.

JUNE 2007

The closing of the Series A financing of approximately \$15 million bringing in names like Johnson & Johnson (NYSE:JNJ).

UNE 2010

The closing of the company's Series B financing for \$25 million, which was led by Pfizer Inc. (NYSE:PFE).

JAN 2012

The release of the company's clinical data which showed the drug was working exactly as predicted.

2013
Private-sector investments into British
Columbia's life sciences sector

JANUARY 25 DelMar Pharmaceuticals announces acquisition and \$5.4 million private placement to advance novel cancer therapies

JANUARY 31 DelMar Pharmaceuticals announces \$1.5 million second closing in private placement

FEBRUARY 22 U.S. life sciences investor Moody Capital leads Sirona Biochem's US\$2.7 million placement

FEBRUARY 25 DelMar Pharmaceuticals announces \$1.6 million closing in private placement

MARCH 6 Sirona Biochem completes first-tranche private placement of US\$1.4 million, welcoming participation of Pathfinder Asset Management

APRIL 3 Aquinox Pharmaceuticals completes US\$18 million series C financing

APRIL10 RepliCel announces closing of \$500,000 private placement

APRIL 24 viDA Therapeutics' milestone completion triggers release of second-tranche funds of \$3.6 million

APRIL 25 Neovasc reports exercise of 1.8 million warrants for net proceeds of \$2.3 million

APRIL 30 Celator Pharmaceuticals raises US\$32.5 million, completing a \$39.3 million private-placement financing MAY 3 Sirona Biochem raises \$2.4 million to date, extends warrants

MAY 17 Verisante completes \$900,000 private placement
MAY 21 iCo Therapeutics closes \$3.4 million financing

MAY 21 RepliCel Life Sciences announces closing of \$100,000 private placement

JULY 10 viDA Therapeutics completes financing of \$1.8 million, led by BDC Venture Capital

JULY 19 RepliCel Life Sciences announces closing of \$500,000 private placement

SEPTEMBER 11 Sirona Biochem announces \$1 million private placement

SEPTEMBER 20 Aequus Pharmaceuticals closes on \$1.2 million in equity financing and in-licenses global rights to intellectual property enabling the transdermal delivery of aripiprazole OCTOBER 4 Boreal Genomics secures US\$18 million series C financing

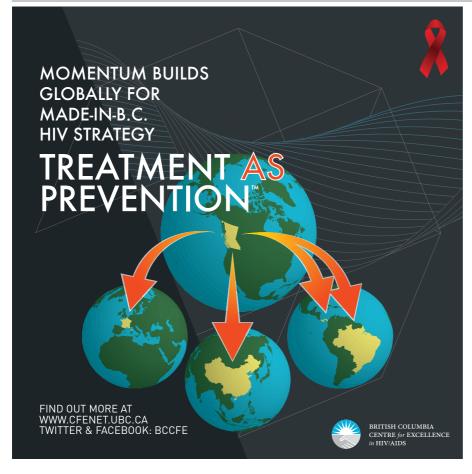
OCTOBER 22 Tekmira announces completion of US\$30 million public offering of common stock

NOVEMBER7 Response Biomedical Corp. announces conversion of subscription receipts for proceeds of \$3.1 million

NOVEMBER 8 Verisante Technology closes prospectus offering raising \$1.1 million

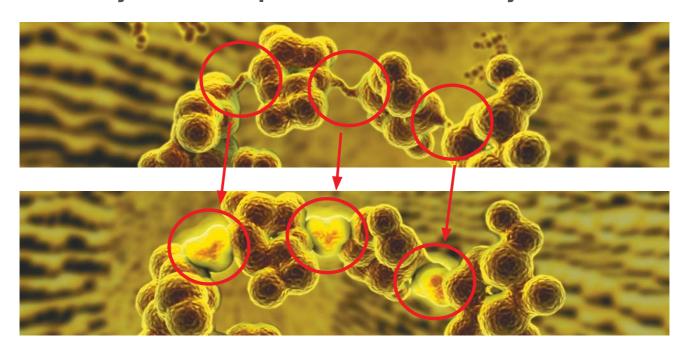
DECEMBER 16 Tekmira Pharmaceuticals receives \$5 million milestone payment for phase 3 initiation of LNP-enabled patisiran (ALN-TTR02)

DECEMBER 20 EnWave closes \$7.75 million private placement





Carbohydrate compounds are naturally unstable...



Sirona Biochem strengthens their bonds

Sirona Biochem is a cosmetic ingredient and drug discovery company with a proprietary platform technology developed at its laboratory facility in France. Sirona specializes in stabilizing carbohydrates; improving their efficacy and safety.

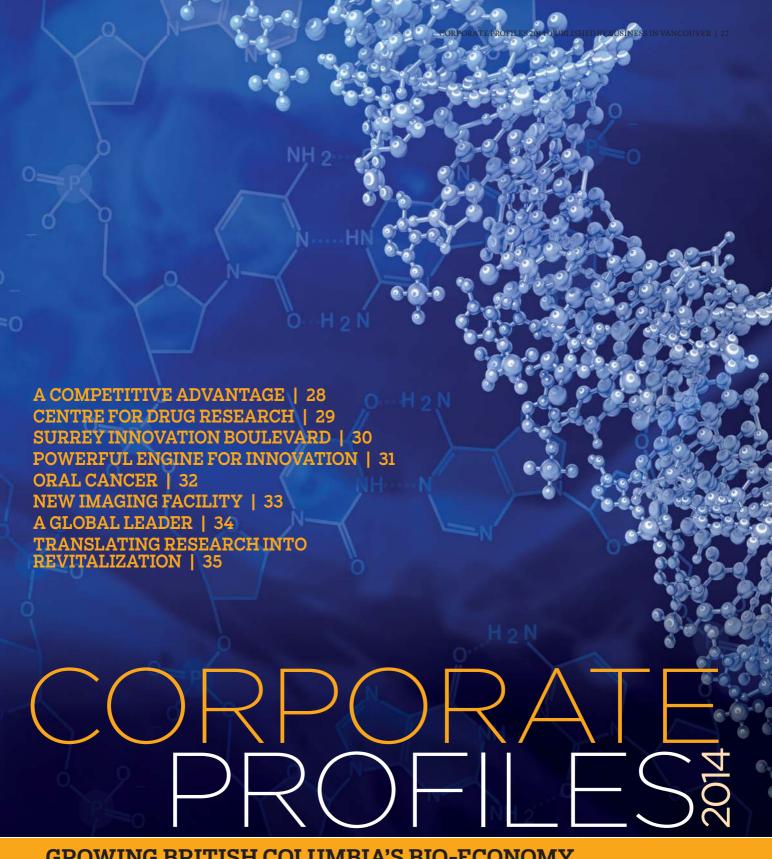
Sirona Biochem's innovative compounds are patented as new chemical entities for maximum commercial protection and revenue potential. Newly developed compounds are licensed to category-leading global companies in return for licensing and milestone fees and ongoing royalty payments.

Recent Licensing and Joint Venture Agreements Include:

Obagi Medical Products / Valeant Pharmaceuticals — Global Exclusive Skin Lightening License Wanbang BioPharma / Fosun Pharma — Anti-Diabetic Drug for China Cincinnati Children's Hospital Medical Center — Joint Venture for an Anti-Aging Compound Bloom Burton — Joint Venture to Create Multiple New Therapeutic Compounds Jean-Michel Cousteau and Fabien Cousteau — Brand Ambassadors and Shareholders

For more information www.sironabiochem.com





GROWING BRITISH COLUMBIA'S BIO-ECONOMY

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Michael Smith Foundation for Health Research

www.msfhr.org

MSFHR: A competitive advantage for BC's health research community

British Columbia is home to a vibrant health research community with an international reputation for excellence. A central pillar of support for BC's health researchers is the Michael Smith Foundation for Health Research (MSFHR), considered a "competitive advantage" in the current BC Jobs Plan. Inspired by the memory and passion of Nobel Laureate Dr. Michael Smith, we work province-wide to empower BC's best and brightest to pursue world-class innovation and stretch the bounds of what health research can achieve.

MSFHR was founded in 2001 by the provincial government to revitalize BC's health research enterprise and to attract substantial investment from a range of funding sources. Over the past 13 years, the provincial government has invested more than \$380 million in MSFHR to:

- Bolster BC's capacity to develop new treatments and cures.
- Help our health system be more effective and responsive to emerging health threats.
- Keep BC's health research sector globally competitive.

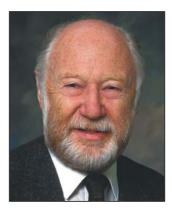
In response to changes in the health research sector over the past decade, MSFHR has evolved into an agile organization valued for our leadership and our ability to mobilize action on key provincial priorities. In the context of increasingly scarce resources, we recognize the demand for greater accountability and the need for new approaches to solve the complex problems facing our health system. Our new strategic plan positions MSFHR to continue to support discovery, connect knowledge with its use, and engage our partners to address health priorities.

Discover solutions to our greatest health challenges

MSFHR programs advance BC's ability to generate world-class health innovation. Our awards provide vital early-career support to new investigators and up-and-coming research stars. This support enables our province's research institutes to retain top talent and attract high-quality researchers from abroad. Since 2001, we have granted more than 1,500 individual awards that have directly supported the career development of a generation of BC researchers.

The return on this investment has been remarkable. During and after our awards, 304 funded scholars attracted more than \$1.1 billion from other sources to drive made-in-BC research. Provincial investments have been multiplied 10-fold as researchers secure additional funding from national, international, non-profit, and private-sector sources.

Thousands of knowledge-economy jobs – trainees, lab technicians, and support staff – have been created and sustained by enabling the establishment of these research programs. BC has become a hub of innovation, generating discoveries with global



impact in diverse fields, including cancer, HIV/AIDS, and genomics. At the federal level, BC's share of funding from the Canadian Institutes of Health Research has grown from less than nine percent in 2000 to more than 15 percent in 2013.

Connect knowledge and action

Research is important for improving health outcomes, yet a significant percentage of patients do not receive the recommended types of care because of gaps in moving discoveries into practice. As a provincial leader in the science and practice of knowledge translation, MSFHR

works to bridge the gap between what is known to improve health and what is done to improve health at the point-of-care.

The complex health system also needs help to coordinate efforts to address emerging and urgent priorities. We are driving province-wide initiatives to help create a learning health system and ensure that research knowledge is used effectively to deliver better health and lower costs. For example, a research support unit for BC, which is being developed as part of a national strategy to encourage more patient-oriented research, will bring together policy-makers, researchers, care providers and patients to answer questions that directly impact patient care.

Engage partners to address provincial priorities

Health research in BC is a complex enterprise with many stakeholders. Harnessing its innate power for innovation and change requires coordination and strategic vision. As a trusted, non-partisan voice for BC's health research community, MSFHR is uniquely placed to provide leadership and unite diverse stakeholders for province-wide planning and action.

In this role, we spearheaded development and will drive implementation of a provincial health research strategy that will leverage BC's strengths and encourage integration across sectors and disciplines. The strategy provides a road map to sustaining and enhancing BC's health research excellence.

A dynamic health research sector enables BC to address the challenges of the present while building towards a healthier future. Through our continued work to promote coordination and coherence province-wide, MSFHR plays a vital role in maximizing BC's health research investment for the benefit of all British Columbians.

To learn more, visit www.msfhr.org

Contact: Lori Last Director, Communications Email: llast@msfhr.org

Email: llast@msfhr.org Phone: 604.714.2788



Discover. Connect. Engage.

Centre for Drug Research and Development

www.cdrd.ca

principal investigators from

more than 40 affiliated

research institutions across

Canada and international-

ly to identify commercially

promising discoveries, and

then providing the state-

of-the-art specialized drug

development facilities, sci-

entific and business exper-

tise, and professional proj-

ect management needed to

advance the technologies to

a stage where they are suffi-

ciently de-risked for private

The Centre for Drug Research and Development (CDRD) and CDRD Ventures Inc. (CVI)

he Centre for Drug Research and Development (CDRD) together with its commercialization vehicle, CDRD Ventures Inc. (CVI) addresses one of the biggest challenges facing the global life sciences sector today: how to translate commercially promising health research conducted at the university level into new therapies that improve and save lives. Canada, as well as other countries around the world, invests bil-



sector consideration.

lions of dollars in medical research each year, and our universities and research institutes have achieved impressive results in terms of scientific discoveries. Yet it is extremely difficult to translate these discoveries into commercial products. The main reason is

That's where CDRD/CVI comes in. CDRD is Canada's national, not-for-profit drug development and commercialization centre. Our mandate is to de-risk discoveries stemming from publicly funded research to create viable investment opportunities for the private sector— thereby bridging the commercialization gap between early-stage academic research and industry. CDRD is the only fully-integrated centre of its kind in the country — and one of a handful in the world — with the full expertise and infrastructure to source, evaluate, develop and commercialize both small molecule and biologic innovative technologies in virtually any therapeutic area.

CDRD was born of a shared vision between government, industry and academia. We were founded in 2007 as an independent, not-for-profit organization by a group of renowned academic investigators and business people with proven track records in creating new medicines. Just one year later, we were recognized by the Government of Canada as a national Centre of Excellence in Commercialization and Research (CECR). Since then, CDRD has leveraged public and private sector funding to create a state-of-the-art drug development and commercialization platform with the infrastructure, scientific and business expertise and professional project management skills to develop innovative health technologies in virtually any therapeutic area through the pre-clinical stage.

We do this by collaborating with our network of over 10,000

CDRD Ventures Inc. (CVI) then acts as the interface between CDRD and industry to drive drug development and technology commercialization further. CVI in-licenses selected intellectual property generated from CDRD projects directly from the affiliated institution or inventor, and forms strategic partnerships with pharmaceutical and biotechnology companies and third-party investors to transform promising drug research into much-needed medical therapeutics through out-licensing, new company creation or joint ventures. Profits from CVI flow back to CDRD to support future drug development projects.

To date, CDRD/CVI has established partnerships with some of the world's top pharmaceutical companies including Pfizer, Johnson & Johnson, and GlaxoSmithKline (GSK), and Roche; undertaken over 125 technology development projects, out-licensed three novel therapies, and launched four new start-up companies. We have also led the formation of the Global Alliance of Leading Drug Discovery and Development Centre, bringing together the world's top translational centres to strengthen the international academic and/or not-for-profit drug development and commercialization network to ultimately improve the rate at which academic research is translated into new medicines.

Ultimately through the work of CDRD/CVI, health research discoveries have a much greater prospect of being developed into new medicines; the life sciences industry is fuelled with a robust pipeline of new pre-validated technologies; and the societal returns on public research investment are maximized.

For more information on The Centre for Drug Research and Development and CDRD Ventures Inc. (CVI), please visit www. cdrd.ca and www.cdrdventures.com.



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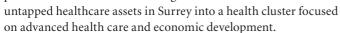
Surrey Innovation Boulevard

www.surrey.ca/innovationboulevard

Surrey Innovation Boulevard

Co-location. Partnerships. Access.

Innovation Boulevard is a network of health institutions, universities, companies and talented people located within one square mile in Surrey's City Centre between Simon Fraser University and the Surrey Memorial Hospital (SMH) campus. Innovation Boulevard integrates the





Surrey Memorial Hospital is home to the busiest ER in BC, a UBC teaching hospital, and its current half-billion dollar expansion represents the largest health infrastructure investment in BC's history. SFU Surrey's science, engineering and business faculties produce leading health technology innovations.

Surrey Mayor Dianne Watts and SFU's Dr. Ryan D'Arcy have been building partnerships to capitalize on the assets located in Surrey and the region. Dr. D'Arcy is the SMHF BC Leadership Chair in Multimodal Technology for Healthcare Innovation at SFU and the Head of Health Sciences and Innovation for SMH. These complementary roles have created significant new connections between the two institutions specifically in the areas of medical, independent living and digital health technologies.

Access to the Clinical Environment

Innovation Boulevard provides access to the clinical environment to advance technologies that will ultimately improve care and touch patients' lives. This access benefits both health technology companies and researchers. Health technology companies connect clinicians to technology innovation, perform research spanning from discovery to commercialization of health technology products, and are then able to better understand the challenges to refine prototypes and business plans. Researchers are able to access clinical research opportunities and find partners to commercialize technologies.

Accelerate Company Growth

Innovation Boulevard provides the support needed to help companies grow. For example, the City of Surrey provides a valuable single point of contact service to connect companies, researchers and clinicians. The new NeuroTech Lab at SMH, Digital Health Hub incubator, and Health Tech Connexx incubator represent some of the recent additions within Surrey's Innovation Boulevard that concentrate academic expertise, clinical expertise, and industry connections. These efforts complement existing entrepreneur support delivered by the BC Technology Industry



Association (BCTIA) Centre4Growth and SFU's Innovation Office along with industry liaison support from LifeSciences BC and BCTIA.

Partnerships and 2013 Accomplishments

Innovation Boulevard is partnership-driv-

en and has established relationships with four universities, the Fraser Health Authority, the City of Surrey, Surrey Memorial Hospital, industry associations, developers and a large number of health technology based companies. Its inaugural year produced a number of early successes, including:

- **1. Mayor's Health Tech Working Group** A group of 20 experts and thought leaders from across the region was created, and held quarterly meetings to provide strategic advice to help guide growth of Innovation Boulevard.
- 2. Surrey Memorial Hospital half-billion dollar expansion The largest health care facility investment in BC's history opened the new ER, and the Critical Care tower will open in spring 2014.
- **3. New ER** Surrey Memorial Hospital's ER is the 2nd largest in Canada, and is the busiest in BC with over 100,000 patient visits per year.
- **4. Neurotech Lab** –The neuroscience and medical imaging lab opened, which embeds SFU researchers and companies within Surrey Memorial Hospital.
- 5. Digital Health Hub— The SFU Surrey digital-health-focused incubator opened, which links companies to a wide array of computer science expertise for health authority guided applications.
- **6. Health Tech Connexx** A new facility connecting innovators, clinicians, and businesses within Surrey Memorial Hospital campus was announced.
- **7. Innovation Boulevard Launch Event** Over 280 executives from the health technology and innovation sector spent the day in Surrey networking and learning from a line-up of industry thought leaders from Canada and the US.
- 8. Trade Mission to Israel Mayor Watts and key Innovation Boulevard partners conducted a trade mission to Israel focused on health technology and innovation. During the mission partnerships with the Israel Centre for Medical Simulation and Israel Brain Technologies were established. Advancement of many other collaborative projects initiated while in Israel are now underway.

Donna Jones dljones@surrey.ca 604.591.4128



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Genome British Columbia

www.genomebc.ca

Genomics... a powerful engine for innovation and technology

genome is an organism's complete set of DNA – basically a blueprint for an organism's structure and function. Genomics is the science that aims to decipher and understand the entire genetic information of an organism (i.e. plants, animals, humans, viruses and microorganisms) encoded in DNA and corresponding complements such as RNA, proteins and metabolites.



As every living organism has a genome, genomics is the heart of life sciences in British Columbia. It cuts across energy and mining, agri-food, fisheries and aquaculture, forestry and human health. Genomics is at the core of cutting-edge science and technologies that are driving growth, productivity, commercialization and global competitiveness. Since 2000, Genome BC has invested over \$625 million in 180 research projects and science and technology platforms to establish a world-class genome sciences infrastructure. These investments are generating jobs, creating and advancing new companies and attracting national and international investments to help address challenges facing BC's key economic sectors.

By the numbers, Genome BC has:

- Fostered 300+ international collaborators
- Enabled 139 non-provisional patent applications
- Created 5,930 direct research & development jobs & training opportunities
- Attracted \$440 million in co-investments from international, industry & federal sources
- Advanced 17 local companies

From cancer to cardiovascular disease

The field of cancer research is proving to be where some of the most exciting examples of genomics applications are making a difference in human health. Genomics is playing a leading role in the pursuit of personalized medicine as the implementation of molecular medicine provides a deeper understanding of the contents of the genome, including variations in genes, as well as gene expression, proteins and metabolites. Scientists and clinicians are using genomics to sequence certain cancer tumours to identify the most effective treatment and moving us away from a one-size-fits-all approach.

From fish to forests

Human health often dominates discussions of genomics research. But a wide cross section of other sectors exists where genomics research is making significant impacts. Forestry, fisheries, agriculture, bioenergy, mining and the environment are all sectors benefiting from advances in genome science research. Increasing understanding of living organisms at a molecular level is laying the

groundwork for developing effective solutions to international challenges such as climate change, sustainable food networks and energy sources.

Necessity is the mother of invention

As genomics technology matures and is translated into applications there is reason to be optimistic about the future. A few

examples of real-world utility include:

Tests to identify patients who are likely to have adverse reactions to certain drugs, making treatments safer for patients and reducing the significant healthcare burden associated with adverse drug effects.

A genomics-based test has dramatically increased the speed of testing for mutations in BRCA1 and BRCA2 genes linked to breast cancer.

The development of tools for fish, trees and crops that are now being used to examine responses to environmental factors, pathogens and pollutants, and for brood stock development, improving harvests and yields and improving the health of fish stocks.

Novel technologies to identify the source of water contaminants in order to ensure clean drinking water and mitigate outbreaks of water-borne disease.

Ongoing engagement

Genome BC is working with industry experts to identify the sector challenges that genomics can help mitigate. Instead of developing technologies with the hope that they may one day provide assistance, we are identifying challenges at the outset and aligning researchers to develop solutions in partnership with industry. Through dialogue and engagement with industry stakeholders, Genome BC has developed funding programs to support the application and translation of genomic technologies. These programs have mobilized a combined investment of more than \$85.6 million. Genome BC recently launched the User Partnership Program to support research with industry co-funding.

Together with support from the Province of British Columbia, the Government of Canada through Genome Canada and Western Economic Diversification Canada and more than 300 international public and private co-funding partners, we are fueling genomics in BC: a powerful engine for innovation and technology and driving future economic growth in BC's expanding bio-economy. To get involved or to learn more about genomics-related activities contact:

Rachael Ritchie,
Director, Business Development
rritchie@genomebc.ca
604.637.4379



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LED Medical Diagnostics Inc.

www.ledmd.com

Oral cancer: better outcomes through earlier discovery

t is estimated that there are 640,000 people diagnosed with oral cancer annually on a worldwide basis. In the United States alone, oral and pharyngeal cancers will claim one person every hour of every day.

LED Medical Diagnostics is a global leader in tissue fluorescence visualization, and developed its VELscope® adjunctive technology to help clinicians detect oral cancer and other oral mucosal disease in early stages.

Partners in Innovation

Core research on the tissue fluorescence visualization technology was conducted

by several universities and cancer research organizations with support provided in part by the National Institutes of Health. LED Medical Diagnostics and the British Columbia Cancer Agency co-developed and patented the VELscope technology, which in 2006 received FDA and Health Canada approval for use in detecting pre-cancerous and cancerous lesions in oral mucosal tissues.

VELscope technology has been recognized by the World Health Organization, twice been named "Best of Class" by the prestigious Pride Institute, and named to the 2013 "Top 100 Products" list by *Dentistry Today* magazine.

Tissue Fluorescence Visualization

The basic premise of tissue fluorescence visualization is that it allows clinicians to see cellular, structural, and/or metabolic activity changes in oral mucosal tissues by observing the fluorescence response of oral tissues in response to light excitation.

Abnormal fluorescence patterns aid the clinician in detecting unhealthy mucosal tissue that sometimes cannot be seen with the naked eye, such as viral, fungal and bacterial infections, inflammation from a variety of causes (including lichen planus and other lichenoid reactions), squamous papillomas and salivary gland tumours.

Changing Demographics

New research confirms that the risk factors for oral cancer have been expanded to include the Human Papilloma Virus (HPV16), in addition to tobacco use, frequent and/or excessive alcohol consumption, a compromised immune system, and past history of cancer. This changing demographic presents an unprecedented call to action for oral cancer awareness and regular screenings. In response, LED Medical has implemented a comprehensive training program and provides expert clinician support for dental professionals.



Why Early Discovery Matters?

The VELscope device is an imaging modality which is extremely sensitive to tissue changes. Its use in everyday practice can provide timely information to dentists and hygienists to enable earlier detection of abnormal tissues and provide better outcomes for patients. The statistics are highly favourable: when discovered early the 5-year survival rate for oral cancer patients is about 83%. Unfortunately, most cases of oral cancer are discovered in late stages, when the five-year survival rate drops to around 50 percent.

The best chances for early discovery of oral cancer occur when patients receive an annual conventional clinical exam plus visual and tactile inspection of the oral cavity, followed by an examination of the oral cavity with an adjunctive device. With this growth of awareness the VELscope has rapidly become entrenched in the examination protocols of thousands of dental practices worldwide.

Going Forward

New management, under the leadership of CEO, Dr. David Gane, is expanding the company's sales footprint, creating opportunities for collaborative research partnerships, and evaluating new technology opportunities in the global marketplace.

LED Medical is pursuing market expansion opportunities to evolve into a high value dental imaging company by growing its VELscope foundational product line while adding a full portfolio of complementary diagnostic dental imaging solutions that leverage its market brand and market penetration.

In addition, LED Medical recently announced a collaborative agreement with Genome BC to create and commercialize a progression-risk assessment test for oral cancer based on a quantifiable genetic phenomenon known as "Loss of Heterozygosity". This test has the potential to lower oral cancer morbidity and mortality rates by helping clinicians distinguish between highrisk and low-risk oral pre-cancers. This will be another first-ofits-kind innovation from the company.

Mark Komonoski, Investor Relations LED Medical Diagnostics Inc. 877.255.8483 investors@ledmd.com

TSX.V: LMD | OTCQX: LEDIF | FSE: LME



Centre for High-Throughput Phenogenomics www.phenogenomics.dentistry.ubc.ca

Introducing Your New Imaging Facility Supporting R&D

he Centre for High-Throughput Phenogenomics officially opened February 2013 with generous support from the Canada Foundation for Innovation (CFI), the BC Knowledge Development Fund and UBC's Faculty of Dentistry. Collectively \$10.1 million has been invested in the Centre. This core facility supports a wide variety of research projects from across universities, research organizations, and is equally committed to supporting the R&D needs of corporate users in the Province of British Columbia and Canada. The Centre provides two- and three-dimensional sample imaging and data analysis. Hard and soft biological tissue and non-biological specimens are imaged using the following modalities:

Scanning Electron Microscopy

- Extreme high resolution (1 nm) characterization in 2D & 3D
- · Quantitative elemental analysis
- · Crystal structure characterization
- · Micromachining and nanomanipulation
- · Cold stage available
- · Sample preparation for SEM, STEM, EDX, EBSD

Optical Imaging

Confocal Microscopy

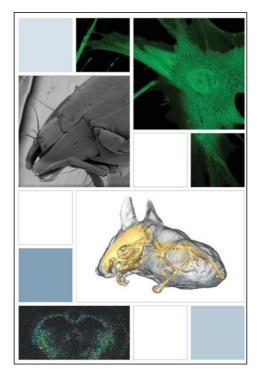
- Temperature and CO₂ controlled environmental chamber for extended live-cell imaging
- Tunable white light laser can support simultaneous imaging with up to 7 fluorophores and managing autofluorescence
- · High-sensitivity detector
- FRET and FRAP imaging capabilities

Laser Capture Microdissection

- · High-throughput microdissection of cells from frozen or
- Recovery of viable living cells from cell and tissue cultures
- Supports cell-specific genomic (DNA, RNA) and proteomic analysis

Optical Projection Tomography

• High-resolution 3D imaging of both fluorescent and non-fluorescent biological specimens



- 3D surface mapping of wholemount embryos
- 3D gene and protein expression

X-ray Imaging

- High-resolution (5-100 μm) specimen imaging for intact samples or excised organs/tissues
- In vivo imaging of preclinical rodent
- Respiratory- and cardiac-gated image acquisitions
- Pre-approved protocols for imaging soft tissue, bone and gated acquisitions
- Integrated state-of-the-art vivarium supporting long-term in vivo micro-CT imaging with housing and procedure
- · Customized imaging protocols to suit different sample types

MALDI Mass Spectrometry

- · Qualitative 2D mapping of peptides, proteins, lipids, drugs/metabolites in tissue sections
- Measurement of hundreds of molecular targets in parallel in each tissue section
- Label-free; antibodies, probes, fluorescent dyes or radiolabels typically not required
- Quantitative analysis of individual compounds with external standards
- Customized protocols available for different compound classes
- · Valuable for biomarker discovery and diagnostics; drug and metabolite distribution studies, etc.

Through the presence of this broad range of imaging equipment with resolutions ranging from the millimeter to micrometer to nanometer scale together in one Centre, the exciting opportunity to do correlative cross-platform imaging has emerged. Operator training for all equipment is provided and staff are available for image acquisition and data analysis. High-end graphic workstations for 2D and 3D data analysis are available.

Director: Dr. Nancy Ford Email: nlford@dentistry.ubc.ca

Director Phone: 604-822-6641

Centre for High-Throughput **PHFNOGFNOMICS**

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Tekmira Pharmaceuticals

www.tekmira.com

BC's Tekmira – A Global Leader in an Emerging New Class of Medicine

Tekmira is a Burnaby-based biotechnology company focused on advancing novel RNA interference (RNAi) therapeutics. With a diverse pipeline of product candidates in development to treat serious diseases, such as cancer and viral infections like Hepatitis B and Ebola, the company is advancing the development of drugs in areas where there is a significant unmet medical need and commercial opportunity.

The biological mechanism behind Tekmira's platform, RNAi, is consid-

ered to be one of the most important discoveries in the field of biomedical science in the last decade. In a 2008 New York Times article titled *The Power and Promise of RNA*, John S. Mattick, a professor of molecular biology at the University of Queensland in Australia, states: "This is potentially the biggest change in our understanding of biology since the discovery of the double helix." RNAi uses the human body's own natural processes to silence or "turn off" genes and, by extension, treat serious human diseases that often rely on the production of certain proteins at the genetic level.

Effective delivery of an RNAi trigger to a target tissue is critical to the success of this new class of drugs. Tekmira's proprietary lipid nanoparticle (LNP) delivery technology is recognized as one of the best in the world and, through various license agreements, the most widely adopted in the RNAi field. To date, eight LNP products have entered clinical development and more than 200 patients have been administered RNAi therapeutics using Tekmira's LNP technology.

A deeper look into some of Tekmira's leading drug development candidates:

TKM-PLK1, Tekmira's Lead Oncology Product Candidate

Tekmira's oncology product candidate, TKM-PLK1, targets pololike kinase 1 (PLK1), a protein involved in tumor cell proliferation and a validated oncology target. Inhibition of PLK1 expression prevents the tumor cell from completing cell division, resulting in cell cycle arrest and death of the cancer cell. Based on the encouraging results from Tekmira's Phase I TKM-PLK1 clinical trial, the company has expanded into a Phase I/II clinical trial, which is enrolling patients with advanced Gastrointestinal Neuroendocrine Tumors and Adrenocortical Carcinoma. Tekmira also plans to initiate another Phase I/II clinical trial with TKM-PLK1, enrolling patients with Hepatocellular Carcinoma in the first half of 2014.



TKM-Ebola, Tekmira's Product Candidate to Treat Ebola

For many years, the Zaire species of Ebola virus, a highly contagious and lethal human infectious disease, has been associated with periodic outbreaks of hemorrhagic fever in human populations with mortality rates reaching 90 percent. TKM-Ebola, an anti-Ebola viral therapeutic, is being developed under a \$140-million contract with the U.S. Department of Defense. In January 2014, Tekmira commenced its TKM-Ebola Phase I human clinical

trial. The study is assessing the safety, tolerability and pharmacokinetics of administering TKM-Ebola to healthy adult subjects.

TKM-HBV, Tekmira's Product Candidate to Treat the Hepatitis B Virus

Tekmira's extensive experience in the anti-viral arena has been applied to its TKM-HBV program and the development of an RNAi therapeutic for the treatment of chronic Hepatitis B infection. Researchers at Tekmira are focused on eliminating HBV surface antigen expression in chronically infected patients. Blocking surface antigen – and reducing much of the pathology associated with its expression – may also allow these patients a potential to raise their own antibodies against the virus, and affect a functional cure of the infection. Tekmira anticipates completing the necessary preclinical work and expects to file an Investigational New Drug application in the second half of 2014 in order to advance TKM-HBV into a Phase I clinical trial.

In addition, Tekmira is currently evaluating several preclinical candidates with potential in diverse therapeutic areas, including those addressing rare and orphan indications. The company intends to identify another development candidate in 2014.

A Robust Company Positioned for Success

Tekmira has developed a broad portfolio of patents and patent applications specific to LNP and RNAi drugs. Additionally, Tekmira has partnered with several leading pharmaceutical biotechnology companies to license its LNP technology to enable its partners' product candidates. Add to this, Tekmira has also developed a manufacturing process that is rapid, scalable, and highly reproducible – which enables the commercialization of LNP-based products.

For more information on Tekmira, visit www.tekmira.com.



SLIPPLIED BY

Vancouver Coastal Health Research Institute

www.vchri.ca

Translating research into revitalization of personal health and public health systems in B.C.

he term "translational health research" may not mean much to most British Columbians but health research discoveries that improve quality of life affects us all. At the Vancouver Coastal Health Research Institute (VCHRI), we move research into action. As a world leader in translational health research, VCHRI is affecting British Columbians' lives in significant ways. "Our research community continues to answer very complex questions and the impact to public health -- in terms of improving quali-



Partnership

VCHRI supports collaborative projects that incorporate basic and clinical science research. For example, the Djavad Mowafaghian Centre for Brain Health is a leading centre at VCHRI and is a partnership between the UBC and VCH. The Centre opened in February 2014 and is regarded as one of Canada's largest integrated brain centres bringing together research and clinical expertise in neuroscience, psychiatry and neurology.

ty of life, extending lives, and contributing to a robust research industry in B.C. -- is substantial," says Dr. Robert McMaster, VCHRI Executive Director.

VCHRI is the research body of Vancouver Coastal Health (VCH) and a major health partner of the University of British Columbia (UBC). VCHRI is engaged in interdisciplinary research focused on various aspects of health care and delivery in B.C.

We lead and excel in the generation of health knowledge through discovery, education, and evaluation. VCHRI includes three of B.C.'s largest academic and teaching health sciences centres -- Vancouver General Hospital, UBC Hospital, and GF Strong Rehabilitation Centre -- as well as other hospitals and public health agencies across Vancouver Coastal Health.

Impact

VCHRI is dedicated to moving research into practice. Research plays a valuable role in examining how people get access to health care, what health services they use, and ultimately how efficiencies can be created in the delivery of care that benefits both the patient and our public system.

Health research also has economic benefits. It is estimated that for every 100 health research jobs that are directly funded there are another 46 to 80 additional jobs created. Millions of dollars are also generated annually for the provincial and local economies through our clinical trials and programs.

Discovery

Researchers at VCHRI are internationally recognized and have published numerous pioneering discoveries.

A recent study led by VCHRI and UBC researchers revealed how the fatal neurodegenerative disease called amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, is transmitted from cell to cell and suggests how the spread of the disease could be blocked.

Similarly, the development of novel prostate cancer models at the Vancouver Prostate Centre is opening doors to precision oncology and giving scientists unprecedented levels of accuracy in seeing how prostate tumors respond to drug therapies or develop drug resistance.

"Our work speaks for itself," says Dr. McMaster. "Our vision for the future of VCHRI is strong: we will continue to attract top researchers, create more economic opportunities within B.C., and continue to integrate research and patient care to create healthier communities."

Visit www.vchri.ca to learn more about health research and how it changes lives.





Life sciences companies at a glance

Biopharmaceutical companies Stage of development Fields of study Tools Diseases																											
	Stage of development							Fi	elds c	of stu	dy									Diseases							
	Drug discovery	Pre-clinical studies	Phase 1 clinical studies	Phase 2 clinical studies	Phase 3 clinical studies	On market	Bio-products	Bioinformatics	Diagnostics	Environmental	Therapeutics	Vaccines	Bio-processing	Drug delivery	Gene therapy	Genomics	High-throughput screening	Lab reagents	Proteomics	Autoimmune diseases	Cancer	Cardiovascular diseases	Infectious diseases	Inflammatory diseases	Metabolic diseases	Neurological diseases	
AbCellera	•										•	_					•			Ť							
Alectos Therapeutics Inc.	•	•																			•					•	
Amgen British Columbia Inc.	•	•	•	•	•	•					•															•	
Aquinox Pharmaceuticals Inc.	•	•																									
Aspect Biosystems Ltd.							•				•										•	•		•			
Augurex Life Sciences Corp.									•		•								•								
Biocidium Biopharmaceuticals Inc.	•	•	•								•	•									•		•				
BioMark Technologies Inc.	•	•							•												•						
Boreal Genomics	_								•							•					•						
Bovicor Pharmatech Inc.				•					·		•					·					•		•				
Cardiome Pharma Corp.		•	•	•	•						•											•	•				
Celator Pharmaceuticals Corp.				•	•						•											·					
DelMar Pharmaceuticals				•							•										•						
				•							•										•						
ESSA Pharma Inc.	•																										
Eupraxia Pharmaceuticals Inc.		•	•											•													
iCo Therapeutics Inc.		•		•							•			•									•	•			
ImStar Therapeutics Inc.	•	•									•															•	
Inception Sciences Canada	•	•									•			•		•	•			•			•	•		•	
Innovative Targeting Solutions Inc.	•	•									•									•	•		•	•	•		
iProgen Biotech	•										•			•						•	•	•	•	•	•	•	
MedGenesis Therapeutix Inc.				•							•			•												•	
Medicenna Therapeutics, Inc.		•									•										•					•	
MRM Proteomics	•	•					•		•		•						•	•	•	•	•	•	•	•	•	•	
MSI Methylation Sciences Inc.	•			•							•															•	
Network Immunology Inc.		•									•	•							•	•	•		•	•			
Neurodyn Inc.	•	•							•		•															•	
OncoGenex Pharmaceuticals, Inc.	•	•	•	•	•						•			•		•					•						
Ondine Biomedical Inc.		•	•	•	•	•					•										•		•	•			
Phyton Biotech						•															•						
Precision NanoSystems, Inc.	•										•			•	•	•		•		•	•	•	•	•	•	•	
QLT Inc.		•	•	•		•					•			•													
Qu Biologics Inc.	•	•	•	•							•	•								•	•			•			
Renaissance BioScience Corp.							•						•														
rep-L Antimicrobials Inc.	•	•				•	•																•				
RepliCel Life Sciences Inc.			•	•							•				•					•				•			
Sirona Biochem Corp.	•	•									•	•						•			•				•		
STEMSOFT Software Inc.								•																			
Symvivo Incorporated	•	•									•			•	•												
Tekmira Pharmaceuticals Corporation	•	•	•								•			•							•		•	•	•		
viDA Therapeutics		•																									
Vifor Pharma					•						•									•							
Xenon Pharmaceuticals Inc.	•	•																									
Zymeworks Inc.	•	•					•				•									•	•			•			
Zymeworks mc.																											

Contract research orga	niz	zati	ion	S				Plea	ise refe	r to ww	w.lifes	ciences	bc.ca f	or furth	erinfor	mation	on thes	e comp	anies
		Preclinical Services					Clinical Services						General Services						
	Drug discovery	Bioinformatics	Bioanalytical services	Analytical services	Pathology services	Toxicology	Phase I clinical studies	Phase II clinical studies	Phase III clinical studies	Phase IV 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
Aurora Biomed Inc.	•		•	•		•									•				
BC Cancer Agency's Investigational Drug Program (IDP)				•		•							•		•	•	•	•	
BC Preclinical Research Consortium (BC PRC)						•													
BRI Biopharmaceutical Research Inc.	•		•	•			•	•	•	•							•	•	
Healthmetrx (CEQAL)	•			•			•	•	•	•									
Covance	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
inVentiv Health Clinique	•		•			•	•	•	•	•	•	•	•	•		•	•	•	
IonsGate Preclinical Services Inc.	•					•													
MPI Research, Inc.	•		•	•	•	•					•							•	
Northern Lipids Inc.	•			•									•		•	•	•		
PharmEng Technology													•	•	•	•	•	•	•
Wax-it Histology Services	•				•	•							•				•		

Medical devices Please refer to www.lifesciencesbc.ca for further information on these companies													
	Fields of Study							Company type					
	Dental Device	Medical Equipment	Medical Supplies	Testing Instruments	Imaging	Device design	Other(s)	Manufacturer	Distributor	Developer			
Biolux Research Ltd.	•							•		•			
bioLytical Laboratories, Inc.							Rapid diagnostic device	•	•	•			
Critical Systems Labs Inc.						•	Risk management, software V&V		•				
Conquer Mobile					•		3D Apps for Training and Marketing		•				
Farabloc Development Corp.			•					•	•	•			
Innovatek Medical Inc.				•				•					
Kardium		•				•		•		•			
LED Medical Diagnostics	•							•	•				
LifeScan Canada Ltd.		•	•				Diabetes		•				
LightIntegra Technology				•		•	Transfusion			•			
Lungpacer Medical, Inc.		•	•			•	Implantable, Transvascular, Stimulation			•			
Neovasc Inc.		•	•			•	Contract Manufacturing	•		•			
Novadaq					•			•		•			
ReFleX Wireless Inc.		•	•			•	Health Data Hosting Service	•	•	•			
Response Biomedical Corp.		•		•			Cardiac, Infectious disease, Biodefense, Environmental	•	•	•			
Sorin Group Canada Inc., Mitroflow Division		•		•	•	•	Contract manufacturing	•		•			
StarFish Medical	•	•	•	•		•	Airway management	•		•			
Traumis Surgical Systems		•				•	Computer assisted surgery			•			
Verathon Medical (Canada) ULC		•				•	Airway management	•		•			
Verisante		•					Cancer	•		•			
Views IQ		•			•			•	•	•			



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Biggest life sciences companies in B.C.

RANKED BY | Number of R&D employees in 2013

Rank '14	Company	Top local executives	Areas of research	Ownership	Year founded	Revenue '13/'12	R&D expenditures '13/'12	No. B.C. staff '13/ '12	No. staff globally '13/ '12	No. R&D staff '13, '12
1	Stemcell Technologies Inc 570 West 7th Ave Suite 400, Vancouver V5Z1B3 P: 604-877-0713 F: 604-675-7830 www.stemcell.com	Allen Eaves , president and CEO	Stem cell biology focused on hematology, immunology, neurobiology, breast, prostate, pancreas, regenerative medicine and tissue engineering	Privately held Allen Eaves	1993	\$70 million \$64 million	\$8.4 million \$7.1 million	380 411	485 521	141 137
2	Kardium Inc 12851 Rowan Pl Suite 100, Richmond V6V 2K5 P: 604-248-8891 F: 604-304-3478 www.kardium.com	Doug Goertzen, CEO	Cardiovascular	Privately held	2007	NP	NP	86 60	86 60	75 55
3	Tekmira Pharmaceuticals Corp 8900 Glenlyon Pkwy Suite 100, Burnaby V5J 5J8 P: 604-419-3200 F: 604-419-3201 www.tekmirapharm.com	Mark Murray, president and CEO	RNA interference (RNAi) therapeutics	TSX:TKM	1992	NP \$10.2 million ¹	NP \$10.8 million ¹	78 63	83 63	65 40²
4	Amgen British Columbia Inc 7990 Enterprise St, Burnaby V5A 1V7 P: 604-676-8300 F: 604-676-8349 www.amgen.com	John Delaney , director of research	Antibody therapeutics for the treatment of oncology, inflammation and infectious diseases	Nasdaq:AMGN Amgen Inc	1980	NP \$17.3 billion	NP	63 65	18,000 17,000	50 ³ 50
4	Xenon Pharmaceuticals Inc 3650 Gilmore Way Suite 200, Burnaby V5G 4W8 P: 604-484-3300 F: 604-484-3450 www.xenon-pharma.com	Simon Pimstone , president and CEO	Metabolic, neurological and cardiovascular	Privately held	1996	NP	NP	NP NP	NP NP	50 ² 47 ⁴
6	Zymeworks Inc 1385 West 8th Ave Suite 540, Vancouver V6H 3V9 P: 604-678-1388 F: 604-737-7077 www.zymeworks.com	Ali Tehrani , president and CEO	Antibody and protein therapeutics development for oncology, autoimmunity and anti-inflammation applications	Privately held	2003	NP \$0	NP	43 42	43 42	34 34
7	ABM Applied Biological Materials Inc 13520 Crestwood Pl Suite 8, Richmond V6V 2G2 P: 604-247-2416 F: 604-247-2414 www.abmgood.com	Peter Li , CEO, Lisa Young , CFO, Jun Li , chief scientific officer	Expression libraries for ORF, siRNA and miRNA; lentivirus and adenovirus systems; cell immortalization; stem cells; next generation sequencing	Privately held Peter Li	2004	\$2.5 million \$2.1 million	\$1.5 million \$1.1 million		63 57	30 27
8	Neovasc Inc 13700 Mayfield PI Suite 2135, Richmond V6V 2E4 P: 604-270-4344 F: 604-270-4384 www.neovasc.com	Alexei Marko, CEO	Comprehensive R&D laboratory and team that develop pericardial tissue-based devices, catheter-based devices and engineered heart valves	TSX-V:NVC	2000	\$11.8 million \$7.8 million	\$6.3 million \$3 million ¹	117 71	118 72	28 11 ⁴
9	Response Biomedical Corp 1781 West 75th Ave, Vancouver V6P 6P2 P: 604-456-6010 F: 604-456-6066 www.responsebio.com	Peter Thompson , board chair, Jeffrey Purvin , president and CEO	Rapid immunoassay diagnostics for clinical cardiovascular applications, environmental infectious disease testing and biothreat identification	TSX:RBM	1991	NP \$11.8 million	\$3 million	63 66 ⁴	67 67	15 NP
10	Kinexus Bioinformatics Corp 8755 Ash St Suite 1, Vancouver V6P 6T3 P: 604-323-2547 F: 604-323-2548 www.kinexus.ca	Steven Pelech , president and CSO	Proteomics and bioinformatics products and services	Privately held Steven Pelech	1999	NP		15 16	15 16	11 13
11	Alectos Therapeutics 8999 Nelson Way, Burnaby V5A 4B5 P: 604-628-7129 F: 604-628-0137 www.alectos.com	Ernest McEachern , president and CEO	Neuroscience, oncology	Privately held	2007	NP	NP	NP NP	NP NP	7 8
11	Aquinox Pharmaceuticals Inc 887 Great Northern Way Suite 450, Vancouver V5T 4T5 P: 604-629-9223 F: 778-331-4486 www.aqxpharma.com	David Main , president and CEO	Novel targeted small molecule therapeutics for the treatment of inflammatory disease	Privately held	2006	\$0 \$0	\$7.5 million \$8 million	12 20	12 20	7 12
11	MSI Methylation Sciences Inc 4475 Wayburne Dr Unit 108, Burnaby V56 4X4 P: 604-435-5155 F: 604-435-5110 www.methylationsciences.com	Barry Guld, CEO	Depression	Privately held	2007	NP	NP	10 NP	11 NP	7 7
11	Qu Biologics Inc 887 Great Northern Way Suite 138, Vancouver V5T 4T5 P: 604-734-1450 F: 604-676-2235 www.qubiologics.com	Hal Gunn, CEO	Treatment of chronic inflammatory conditions including cancer, inflammatory bowel disease (i.e., Crohn's disease and ulcerative colitis) and arthritis	Privately held Hal Gunn	2007	\$0 \$0	NP	9 8	9 8	7 8
15	CICTAN Health Group Corp 4238 Lozells Ave Suite 109, Burnaby V5A 0C4 P: 604-420-4999 F: 604-420-7072 www.cictanhealth.com	Fuchang He, president	Natural health products, personal skin care products, water devices, and food and drink sciences	Privately held	NP	\$900,000 \$480,000	\$600,000 \$300,000		20 15	6
16	Celator Pharmaceuticals 1140 West Pender St Suite 810 , Vancouver V6E 4G1 P: 604-708-5858 F: 604-708-5883 www.celatorpharma.com	Lawrence Mayer , president and head of research	Advanced cancer therapies	Privately held	2000	NP	NP	NP NP	NP NP	5 ² 5⁴
17	iCo Therapeutics Inc 777 Hornby St Suite 760, Vancouver V6Z 1S4 P: 604-602-9414 F: 604-602-9699 www.icotherapeutics.com	Andrew Rae, CEO	Ophthalmology, infectious diseases	TSX-V:ICO	2006	NP	NP	6 NP	6 NP	2 NP
18	Neurodyn Life Sciences Inc 439 Helmcken St, Vancouver V6B 2E6 P: 604-619-0990 F: 604-684-3350 www.neurodyn.ca	Kenneth Cawkell, CEO	Early-stage neurodegeneration	Privately held	NP	NP	NP	1 NP	10 NP	O NP
18	Sirona Blochem Corp 889 West Pender St Suite 605, Vancouver V6C 382 P: 604-641-4466 P: 604-608-5471 www.sironabiochem.com	Howard Verrico, chair, Neil Belenkie, CEO, Christopher Hopton, CFO	Diabetes and obesity therapeutics, cosmeceuticals, biological ingredients	TSX-V:SBM Geraldine Deliencourt- Godefroy	2006	\$0 \$5.1 million⁵	\$400,000 \$441,304	4 6	12 14	0 8

Sources: Interviews with representatives of the above biotech firms and BIV research. NR Not ranked NP Not provided 1-Nine months 2-BIV estimate 3-2012 figure 4-2011 figure 5-Other income

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BC Institute of Technology

3700 Willingdon Avenue, Burnaby, BC V5G 3H2

BC Preclinical Research Consortium

4145 Wesbrook Mall, Vancouver, BC V6T 1W5

British Columbia Centre for Excellence in HIV/AIDS

608-1081 Burrard Street, Vancouver, BC V6Z 1Y6

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Infrastructure Network

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400-575 West 8th Avenue, Vancouver, BC V5Z 0C4 %604-738-8072 **g** www.genomebc.ca

Blusson Spinal Cord Centre, 818 West 10th Avenue, Vancouver, BC V5Z 1M9



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%604-682-2344 ext. 66795 ■ www.proofcentre.ca

Providence Health Care Research Institute

St. Paul's Hospital, 1081 Burrard Street, Vancouver. BC V6Z 1Y6

Research Universities' Council of British Columbia

400-880 Douglas Street, Victoria, BC V8W 2B7

Rick Hansen Institute

6th Floor 818 West 10th Avenue Vancouver, BC V5Z 1M9 %604-707-2100 g www.rickhanseninstitute.org

Simon Fraser University

8888 University Drive, Burnaby, BC V5A 1S6 \$778-782-3111 gf www.sfu.ca

The Jackson Laboratory

600 Main Street, Bar Harbor, Maine 04609 USA

Thompson Rivers University

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Trinity Western University

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University of British Columbia

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University of British Columbia UILO

103-6190 Ågronomy Road, Vancouver, BC V6T 1Z3

University of Northern BC

3333 University Way, Prince George, BC V2N 4Z9

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Aa-West Bio Inc.

101-111 Research Drive, Saskatoon, SK S7N 3R2

BC Technology Industries Association (BCTIA)

900-1188 West Georgia Street, Vancouver BC V6F 4A2

BioAlberta

314 Capital Place, 9707-110 Street, Edmonton AB T5K 2L9

BioTalent Canada

1100-85 Albert Street, Ottawa, ON K1P 6A4 %613-235-1402 ext 229 ■ www.biotalent.ca

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Vancouver Board of Trade

400-999 Canada Place, Vancouver, BC V6C 3E1 **604-640-5484** € 604-640-5484

g www.vancouverboardoftrade.com

Vancouver Economic Commission

2480-1055 West Georgia Street, Box 11102, Vancouver, BC V6E 3P3

VANTEC Vancouver, BC grantec.ca

Washington Biotechnology & Biomedical Association

300-1551 Eastlake Avenue E, Seattle, WA 98102 USA

Wavefront Wireless Innovation Society of British Columbia

1400-1055 West Hastings Street, Vancouver, BC V6F 2F9 %778-331-7500 ■ www.wavefrontac.com

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Oneworld Accucracy Inc., (previously HealthMetrx Inc.)

306-2083 Alma Street, Vancouver, BC V6R 4N6 \$800-665-7436 of www.oneworldaccuracy.com

STEMSOFT Software Inc.

400-570 West 7th Avenue, Vancouver, BC V5Z 1B3 %604-668-0843 gf www.stemsoft.com/Home

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AbCellera

317-2125 East Mall, Vancouver, BC V6T 1Z4 AbCellera is a Canadian biotechnology company focused on accelerating the discovery of monoclonal antibody (mAhs) theraneutics

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1500-888 Dusmuir Street, Vancouver, BC V6C 3K4 %604-428-4641 **■** www.aequuspharma.ca Aeguus Pharmaceuticals Inc. is a life sciences company specializing in transdermal reformulations of existing and approved drugs that address the difficult clinical problems of side-effects and patient compliance.

Alectos Therapeutics Inc.

8999 Nelson Way, Burnaby, BC V5A 4B5 %604-628-7129 **g** www.alectos.com Alectos Therapeutics is dedicated to the discovery and development of novel small-molecule therapeutics for the treatment of serious human diseases

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450-887 Great Northern Way. Vancouver, BC V5T 4T5 %604-629-9223 **g** www.aquinox.com Aquinox Pharmaceuticals is committed to the discovery, development, and commercialization of novel and targeted small molecule therapeutics for the treatment of cancer and inflammatory disease.

Augurex Life Sciences Corp.

1423 Dempsey Road, North Vancouver, BC V7K 1S7 %778-839-3319 **■** www.augurex.com/ Augurex Life Sciences Corn, develops biomarker technologies such as 14-3-3_ which is a novel biomarker and arthritis drug target.

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%778-321-9195 ■ biocidium.com Biocidium™ Biopharmaceuticals Inc. is an emerging privately-held company focused on the discovery, development and commercialization of novel antibiotics and antimicrobials

bioLytical Laboratories

1108-13351 Commerce Parkway, Richmond, BC V6V 2X7 bioLytical™ Laboratories is a leading developer and manufacturer in rapid HIV diagnostic testing.

BioMark Technologies Inc.

165-10551 Shellbridge Way, Richmond, BC V6X 2W8 %604-282-6567 ■ biomarktech.com BioMark is focused on the research, development and commercialization of its novel Acetylated Biomarker Assay (ABA) Red Alert technology nlatform

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302-2386 East Mall, Vancouver, BC V6T 1Z3 %604-822-8268 ■ www.borealgenomics.com Boreal Genomics develops and commercializes high performance methods and instruments for biomolecule purification, enrichment, and detection.

Bovicor Pharmatech Inc.

2000-1066 West Hastings Street, Vancouver, BC V6E 3X2 Bovicor Pharmatech Inc. is developing a nonantibiotic anti-infective for Bovine Respiratory Disease (BRD), the most costly disease in cattle production, responsible for approximately \$1 billion in economic loss in North America alone.

Cardiome Pharma Corp.

405-6190 Agronomy Road, Vancouver, BC V6T 1Z3 % 604-677-6905 **g** www.cardiome.com Cardiome is a research-based biopharmaceutical company. Our lead clinical programs target the treatment of atrial fibrillation through cardiac ionchannel modulation

Celator Pharmaceuticals

810-1140 West Pender Street, Vancouver, BC V6E 4G1 %604-708-5858 ■ www.celator.ca Celator Pharmaceuticals Inc. is developing new carrier technology for targeting combinations of rationally selected chemotherapeutic agents to sites of disease

DelMar Pharmaceuticals

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MedGenesis Therapeutix Inc.

730-730 View Street, Victoria, BC V8W 3Y7 \$250-386-3000 www.med-genesis.com MedGenesis Therapeutix Inc. is a company developing and commercializing innovative treatments for patients with serious neurologic diseases

Medicenna Therapeutics Inc.

220-1075 West Georgia Street,
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Medicenna is focused on developing receptor
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MSI Methylation Sciences Inc.

108-4475 Wayburne, Burnaby, BC V5G 4X4 %-604-435-515 gf www.methylationsciences.com Methylation Sciences, Inc.(MSI) has patented a new formulation of a naturally occurring human molecule called S-Adenosyl Methionine (SAMe).

Network Immunology Inc.

3311 Quesnel Drive, Vancouver, BC V6S 1Z7 \$778-847-7521

www.networkimmunologyinc.com
Network Immunology is developing an HIV vaccine,
an organ transplant facilitation technology, and a
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1 diabetes and lupus.

Neurodyn Inc.

1260-1188 West Georgia Street, Vancouver, BC V6E 4A2 %604-619-0990 " www.neurodyn.ca Neurodyn Inc. is developing and marketing early stage, pre-clinical, diagnostic and theraputic products to treat neurodegeneration.

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Ondine Biomedical Inc.

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Mwww.sironabiochem.com
Sirona Biochem is developing diabetes therapeutics,
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Symvivo Incorporated is a privately held
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%604-822-6499 gf www.renaissanceyeast.com

TerraBioGen Technologies Inc

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310-938 Howe Street, Vancouver, BC V6Z 1N9 %604-659-1300 ■ www.fifthoption.com

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%604-638-7392 ■ www.criticalsystemslabs.com

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%450-510-3249 g www.inventivhealthclinical.com IonsGate Preclinical Services Inc.

Room 2340, Life Sciences Institute. 2350 Health Sciences Mall, Vancouver, BC V6T173 %604-827-1733 gf www.ionsgate.com

MPI Research

54943 North Main Street Mattawan, MI 49071 USA %269-668-3336 ■ www.mpiresearch.com

MRM Proteomics

MRM Proteomics

2108-4464 Markham Street, Victoria, BC V8Z 7X8

Northern Lipids Inc.

8855 Northbrook Court, Burnaby, BC V5J 5J1 %604-222-2548

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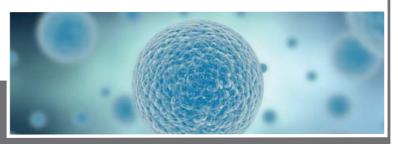
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INNOVATION & ACHIEVEMENT AWARD

Dr. John Webb, director, Centre for Heart Valve Innovation, St. Paul's Hospital





science and ending up in marine biology. This was followed by medical school and specialty training at the University of British Columbia, the University of Toronto and the University of California, San Francisco.

Developing and evaluating new and novel minimally invasive procedures for heart disease has been a long-standing interest. Among a number of first-in-human procedures was the development of non-surgical transcatheter valve replacement of diseased heart valves. This new alternative to open-heart surgery has had a dramatic and rapid uptake with more than 100,000 procedures performed to date. It has been referred to as one of the most important advances in heart disease over the last 25 years. Dr. Webb is among a group that has been a leader in training thousands of physicians in this new procedure, supervising new centres in over 25 countries, and has been widely published.

He is currently director of interventional cardiology at St. Paul's Hospital, provincial director of the Transcatheter Heart Valve Program for British Columbia and the McLeod professor of transcatheter heart valve therapy at UBC.

MILTON WONG AWARD FOR LEADERSHIP

Hector MacKay-Dunn, J.D. Q.C., senior partner, Farris, Vaughan, Wills & Murphy LLP

The joy MacKay-Dunn receives from helping others succeed fuels his own. He believes that British Columbia and



He has served as officer or director and adviser to a number of leading life sciences companies, including QLT, Aspreva Pharmaceuticals, AnorMed, Tekmira Pharmaceuticals, Cantest, MedGenesis Therapeutix and XBiotech.

MacKay-Dunn is an effective industry advocate and an active member of the community. Currently a LifeSciences BC board member, he is immediate past chair of BCIC, B.C.'s crown agency with the mandate to advance science and technology into investment-ready companies, past director of BC's Leading Edge Endowment Fund, the \$60 million program to attract top researchers to B.C., and Genome British Columbia. He serves on the board and executive committee of Tennis Canada, the national governing body for tennis in Canada, and he is past president of both the United Way of the Lower Mainland and the Red Cross.

MacKay-Dunn is a frequent speaker on finance, business and the future of securities regulations for the American Bar Association and the National Centre for Business Law and, most recently, a contributor to Canadian Model of Corporate Governance: Insights from Canada's Leading Legal Practitioners. He has been recognized by Lexpert, the most respected legal publication in Canada, as among the top 100 leading U.S./Canada crossborder corporate lawyers in Canada; a national leader in mergers and acquisitions, securities, technology and biotechnology and was named Vancouver 2014 Biotechnology Lawyer of the Year by Best Lawyers in Canada.

GENOME BRITISH COLUMBIA AWARD FOR SCIENTIFIC EXCELLENCE

Dr. Elizabeth M.
Simpson, PhD, senior
scientist, Centre for
Molecular Medicine and
Therapeutics, Child
and Family Research
Institute; professor,
Department of Medical
Genetics, University of
British Columbia



Dr. Elizabeth M. Simpson joined the University of British Columbia in 1999 and held a Canada Research Chair, Tier II, in genetics and behaviour, from 2001 to 2010. She is a senior scientist at the Centre for Molecular Medicine and Therapeutics (CMMT), a professor in the Department of Medical Genetics and an associate member in the Department of Psychiatry. Dr. Simpson is also an investigator of the Brain Research Centre and a founding fellow of the Institute of Mental Health. She currently serves as director of the CMMT Mouse Animal Production Service.

Dr. Simpson received her BSc from the University of Toronto. She earned her MSc and PhD in the laboratory of Dr. Victor Ling at the Ontario Cancer Institute, University of Toronto. Dr. Simpson was a post-doctoral fellow in the laboratory of Dr. David Page at the Whitehead Institute (MIT). She joined the faculty of The Jackson Laboratory (1992-1999) and was founding director of its gene targeting service.

Dr. Simpson is a leading scientist in mammalian genetics and genomics. She was project leader for the Genome Canada Pleiades Promoter Project: Genomic Resources Advancing Therapies for Brain Disorders. Dr. Simpson is currently project leader for the Genome British Columbia CanEuCre: Pleiades Promoters for Brain Research and Therapy. She is the author of 67 peer-reviewed publications.



2014 LifeSciences British Columbia award recipients

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PHEMI Health Systems Inc.

PHEMI Health Systems is a process automation and big data platform company that unlocks patient data to improve clinic productivity, patient outcomes and medical research.

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Tekmira Pharmaceuticals Corp.

Tekmira Pharmaceuticals Corp. is a biopharmaceutical company focused on advancing novel RNA interference (RNAi) therapeutics. This emerging class of medicine aims to treat human diseases by taking advantage of the body's own natural processes to silence genes or more precisely, eliminate specific gene products or proteins in the cell. With a diverse pipeline of product candidates addressing therapeutic areas such as cancer as well as viral infections like hepatitis B and Ebola, Tekmira is advancing its drug development efforts in areas where there is a significant unmet medical need and commercial opportunity. Tekmira also licenses its leading lipid nanoparticle (LNP) delivery technology to partners including pharmaceutical, biotechnology and agricultural companies.

DR. DON RIX AWARD FOR LIFETIME ACHIEVEMENT

Dr. Robert C. Brunham, head, Vaccine Research Laboratory; Professor, Department of Medicine, University of British Columbia

Dr. Robert C. Brunham is the head of the Vaccine Research Laboratory at



the University of British Columbia Centre for Disease Control. Until 2014, he was the executive and scientific director of the British Columbia Centre for Disease Control (BCCDC). He is also a professor of medicine at UBC.

Dr. Brunham was born in Creston, and grew up in B.C. and became a medical doctor after studying at UBC. He trained under King Holmes at the University of Washington, before becoming a physician scientist at the University of Manitoba. Dr. Brunham returned to the province he calls home in 1999 to play a leading role at the BCCDC.

At the BCCDC, Dr. Brunham used the provincial databases to track the impact of chlamydia control efforts on transmission dynamics and chronic infection sequelae, such as pelvic inflammatory disease, ectopic pregnancy and infertility. He found several significant unexpected consequences of public-health chlamydia control efforts. The most important being early antibiotic treatment interrupts the acquisition of natural immunity; therefore, "seek and treat" control approaches result in even higher cases numbers. Termed the "arrested immunity hypothesis," these findings have received widespread attention, with the Centres for Disease Control and Prevention convening an international symposium to consider the importance for the hypothesis and a dedicated issue of the Journal of Infectious Diseases summarizing the proceedings.

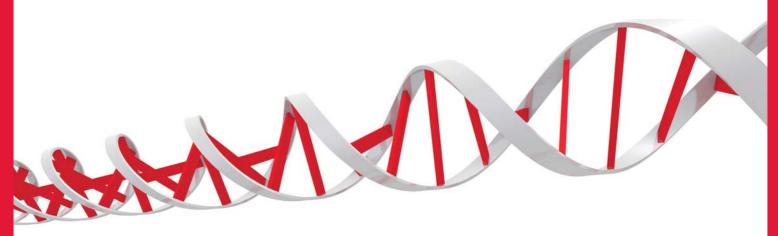
Robert, in collaboration with UBC researcher Leonard Foster, successfully attempted a world's first – identifying the chlamydia peptides through immunoproteomics, resulting in a first-generation molecular vaccine to prevent C. trachomatis infection. This patented vaccine breakthrough was met with support and funding from the U.S. National Institutes of Health and has caught the interest of several biotech and pharmaceutical companies. The technology has been successfully licensed out for commercial development. Moreover, the method creates a platform technology that holds promise for vaccine target discovery for other intracellular infectious diseases.

At BCCDC, Dr. Brunham's research extends

beyond chlamydia to a range of other pathogens, where it is continuing to produce novel and impactful insights. He was among the first adopters of genomics technologies in public health and leveraged rapid improvements in genome sequencing technologies to routinely survey both bacterial and viral populations. He and a group of BCCDC researchers demonstrated the utility of whole genome sequencing in tracing the dynamics of a local tuberculosis outbreak. He also led an effort to sequence several hundred pandemic H1N1 genomes to explore viral evolutionary dynamics in the context of a pandemic at the Vancouver 2010 Olympic Games.

Under Dr. Brunham's leadership, the BCCDC has transitioned from a provincial agency dedicated to public health service to an internationally recognized centre of excellence in communicable disease research and control. Through promoting an inquisitive research culture within the community of BCCDC's public health professionals and by hiring promising young investigators, he has created an international reputation for the centre as an expert in multiple diseases, including emerging infectious diseases, STDs/HIV, tuberculosis and influenza.

Dr. Brunham has received awards from the Rh Institute at the University of Manitoba for outstanding achievements in health research, from Astra Pharmaceuticals for research excellence, from the Canadian Institutes of Health Research for excellence in research partnerships and from UBC for research excellence. He has received the prestigious Thomas Parran Award for lifetime achievement in STD research and was elected member of the American Society for Clinical Investigations. In 1989, he entered the list as one of America's best doctors, and in 2010, he was awarded the Order of British Columbia. His vision that genomic research advances public health has benefited by major funding support from Genome Canada and Genome British Columbia.



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