

Biotechnology Focus

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**A GENOMIC
WORLD**



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Companies bring their A-game to BioFinance 2012

It was a chance to make connections, to pitch ideas and to form partnerships. Held on May 29th and 30th at the St. Andrew's Club in downtown Toronto, BioFinance 2012 brought together the who's who of Canadian biotech companies with the promise of putting them in the same room as potential investors. The event most certainly delivered on this promise.

As for the presentation schedule, MaRS Innovation filled the schedule on day one showcasing promising breakthroughs and technologies from 17 of Toronto's top universities and research institutes. Day two featured corporate presentations from more than 62 public and private life science companies. In addition, BioFinance also ran a series of 13 panels comprised of industry experts and leaders discussing everything from investment landscape and financing, to forecasts of what to expect in and around the industry in the coming months. In all, there were 520 participants over the two days with 72 expert panelists, 20 sponsors and two large networking receptions.

While much of the buzz leading into the event centred on the recent acquisition of Enobia Pharma by Alexion Pharmaceuticals, Inc. for \$610 million (the largest transaction in recent Canadian history), there was also lots of speculation and evidence at the event that the VC community both locally and internationally is falling in love with biotech once more.

As proof, one only had to look around the room to see potential investors out in full force at BioFinance, often huddled with companies discussing opportunities. Some of these investors even gave us the chance to speak with them one-on-one about their activities (to see video coverage of Investors at BioFinance 2012 visit: www.youtube.com/user/BiotechnologyFocus).

This positive showing was echoed by event organizer Michael Stinson, who stated, "With the possibility of increased venture capital now available to fund Canadian biotech companies, as well as the continued interest from U.S. venture capital, 2012 could mean a very promising year for many Canadian life science companies."

As for the event as a whole, Stinson was pleased with both the turnout and the high level of activity. It will be exciting to see what transpires in the coming months as a result of the meetings and discussions that took place at the event. This year marked the 15th anniversary for BioFinance, and according to Stinson, next year's event will take place on May 28th and 29th, 2013.

Biotechnology Focus

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Biotechnology Focus is published 10 times per year by Promotive Communications Inc. 24-4 Vata Court, Aurora, Ontario L4G 4B6 Phone 905-727-3875 Fax 905-727-4428 www.bioscienceworld.ca

E-mail: biotechnology_focus@promotive.net
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■ OmniActive Health Technologies opens R&D centre in PEI



(From left to right) Dr. Jayant Deshpande, President, OmniActive Health Technologies, the Honourable Allen Roach, Minister of Innovation and Advanced Learning, the Honourable Gail Shea, Minister of National Revenue, and Mr. Rajesh Udhoji, OmniActive Health Technologies, recently participated in the official opening of a new bioscience research and development company, OmniActive Health Technologies, at the new PEI BioCommons Research Park.

India-based ingredient supplier company, OmniActive Health Technologies is opening a new research and development facility in Charlottetown, Prince Edward Island, contributing to the province's growing bioscience cluster.

PEI's Minister of Innovation and Advanced Learning Allen Roach said the new facility provides OmniActive with a base of operations for development, expansion and growth in North America.

"OmniActive has been an important partner in our plans for development of the Island's bioscience sector," said Roach. "The Government of Prince Edward Island has worked with this company as they establish an Island research presence at the

National Research Council Charlottetown and now move to expand that presence into space within the Biocommons Manufacturing Centre."

Currently, the company employs a senior research scientist, a nutritional biochemist and three undergrad students from University of PEI's science faculty. In the coming three years, the company hopes to increase the number of student researchers to five.

The new facility will be a centre for innovation and discovery-based platforms. Its aim is to find new dietary ingredients that can provide therapies for preventative health solutions. The problem areas targeted are eye health, obesity and joint and brain health.

■ BIOTECCanada appoints new president and CEO

BIOTECCanada announces the appointment of Andrew Casey as the association's new president and CEO starting July 30, 2012.

Casey joins the biotech industry after spending almost 20 years in senior roles

in the national trade association business. Currently, Casey is the vice president of public affairs and international trade with the Forest Products Association of Canada (FPAC). Prior to joining the FPAC, Casey was assistant vice president, government relations, for the Canadian Life and Health Insurance Association.

The announcement was made by Brad Thompson, chairman of BIOTECCanada.

Correction notice

An article which appeared in the June, 2012 issue of *Biotechnology Focus* titled 'Determining Patentable Subject Matter in the United States and Canada' failed to properly identify the authors and the company they represent. We regret the error. The author's bylines are as follows:

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Clinical Trials & Patents

■ **Aeterna Zentaris** (Québec, QC) and its partner **Yakult Honsha** have commenced a Phase 1 trial for blood cancer treatment with Aeterna Zentaris Inc.'s cancer treating drug perifosine. The orally-taken drug works by inhibiting Akt activation in the phosphoinositide 3-kinase (PI3K) pathway. Yakult Honsha is sponsoring and carrying out the initial trial in Japan. The two step Phase 1 trial is an open-label test, where perifosine is mixed with (Velcade®) and dexamethasone in patients with refractory multiple myeloma who had been treated before with bortezomib. The primary goal is safety, secondary goals comprise of response rate, progression-free survival and time to tumour progression.

■ Clinical stage vaccine development company, **Immunovaccine Inc.** (Halifax, NS), announces positive results from a Phase 1 clinical trial. The trial targeted multi-functional immunotherapeutic responses induced by the DPX-0907 vaccine. The Phase 1 trial was conducted at five U.S. centres. Patients received three injections (0.25 mL or 1 mL doses) of the active immune therapy DPX-0907, three weeks apart. Sixty-one per cent of the study's evaluable cancer patients, and 89 per cent of evaluable breast or ovarian cancer patients, experienced targeted T cell responses against one or more of DPX-0907's seven key cancer-specific antigens. The trial included observed immune responses in advanced stage ovarian, breast and prostate cancer patients. Seventy-three per cent of immune responders generated a response after the first vaccination. Responses were detected at two or more time points after vaccination in 83 per cent of responders. Sixty-four per cent maintained a lasting response one month after a third vaccination.

■ The **NCIC Clinical Trials Group** at Queen's University will sponsor and conduct an open-label, randomized, non-blinded Phase 2 clinical study of **Oncolytics Biotech Inc.'s** (Calgary, AB) REOLYSIN®. Study participants will be patients with advanced or metastatic non-small cell lung cancer. NCIC CTG and Oncolytics' collaborative work also includes colorectal and prostate studies. Dr. Brad Thompson, president and CEO of Oncolytics commented that the study builds on the company's existing NSCLC clinical studies and on clinical research combining REOLYSIN with docetaxel. In this study, patients with squamous cell histology will be treated either with REOLYSIN in combination with docetaxel or with docetaxel alone. Patients with non-squamous cell histology will be treated either with REOLYSIN in combination with pemetrexed or with pemetrexed alone.

■ Blood test for pregnant women predicts underweight infants



Researchers at the Ottawa Hospital Research Institute (OHRI) and the University of Ottawa announce a new study that finds women with high levels of a certain protein are 22 times more likely to give birth to tiny infants than women with normal levels of the protein.

In their report, Dr. Andrée Gruslin, a high risk obstetrician at The Ottawa Hospital and a University of Ottawa professor in the faculty of medicine, along with her team of researchers analyzed a protein in the blood of pregnant women. This protein, called the Insulin Growth Factor Binding Protein-4 (IGFBP-4), determines whether or not there is a risk of Fetal Growth Restriction, also known as Intrauterine Growth Restriction, a condition thought to have an effect on three to five per cent of all pregnancies and cause almost half of all stillbirths. Infants born with the condition have a larger threat of developing serious health problems in infancy and childhood, along with chronic diseases such as hypertension and diabetes when they are adults.

Dr. Gruslin's research could potentially lead to a widely available blood test that could help improve the outcomes of those diagnosed with the condition, which is estimated to be as many as one in every 20 pregnancies.

"Usually, we don't find out until later in a pregnancy that a fetus isn't growing properly, but this test can tell us in the first trimester if there's likely to be a problem," said Dr. Gruslin, in a release. "By identifying these high-risk pregnancies early on, we will be able to monitor these women more closely and hopefully help them deliver a healthier baby."

The IGFBP-4 is a protein that has been linked to pregnancy before, but this study was the first to show its part in pregnancy complications. IGFBP-4 levels were examined in first trimester blood samples from women who participated in a large study of pregnancies and newborns, the Ottawa and Kingston (Oak) birth cohort.

While the protein blood test is still at the experimental stage, Dr. Gruslin hopes to create a more refined version within the next few years that could be made

available to all pregnant women. She also hopes her studies on IGFBP-4 could lead to improvements to fetal growth in high-risk pregnancies.

The study was published in the *Journal of Clinical Endocrinology and Metabolism* and funded by the Canadian Institutes of Health Research and the National Key Basic Research Program of China. It was carried out by researchers at OHRI, University of Ottawa, the Chinese Academy of Science and the Third Hospital of Hebei Medical University in China.

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■ CQDM, MaRS Innovation, Ontario Brain Institute and Ontario Centres of Excellence partner to launch Life Sciences Funding Program



From Left to Right: Consul General of Canada to New England Patrick Binns; Québec Minister of Economic Development, Innovation and Export Trade Sam Hamad; Ontario Minister of Economic Development and Innovation Brad Duguid; Québec Minister of Health and Social Services Yves Bolduc

Together with key partners from Ontario, the Québec Consortium for Drug Discovery (CQDM) is creating a new initiative to fund collaborative life sciences research projects between Ontario and Québec.

CQDM is partnering with three leading Ontario organizations: MaRS Innovation (MI), Ontario Brain Institute (OBI) and Ontario Centres of Excellence (OCE) to launch the Québec/Ontario CQDM Funding Program, which will support collaborative research projects that seek to develop new

tools for biopharmaceutical research.

"This initiative will help deliver on the potential of the Ontario-Québec Life Sciences Corridor, and build on the reputation of the life sciences industries in Canada's two largest provinces," said Ontario Minister of Economic Development and Innovation Brad Duguid. "That means new opportunities for innovation, investment and job creation that will benefit all Canadians."

"Québec and Ontario are lead actors in the life sciences sector, a field with much

promise. We have put in place measures to respond to the needs of our businesses and our researchers in that field. The projects announced today fully accord with this vision and contribute to our efforts to bring together the advantages of our two provinces," commented the Québec Minister of Economic Development, Innovation and Export Trade Sam Hamad.

The new program is open to all researchers in Québec and Ontario from academic institutions or small- to medium-sized enterprises (SMEs). Selected projects will be eligible for up to \$750,000 in funding for three years. CQDM will fund the Québec arm of the project. While the research being performed in Ontario may be funded by many different sources, OBI, OCE or MaRS Innovation will work with Ontario-based partners to secure funding and will also provide support in preparing projects.

The initiative is the first notable and concrete realization of the Ontario-Québec Life Sciences Corridor, announced at the 2011 BIO International Convention. It will build upon two previous pilot projects and existing strengths within the two provinces to increase innovation, productivity, investment and job creation.

Detailed information about the Québec-Ontario CQDM funding program is available on the OCE website, <http://www.oce-ontario.org/news-events/news/news-archives/2012/06/19/cqdm>.

■ Pfizer Canada injects \$4.5 million into Alzheimer's research



Pfizer Canada and the Fonds de recherche du Québec – Santé announce the establishment of a joint fund for Al-

zheimer's disease and related disorders, created with \$4.5 million in funding from Pfizer Canada.

The new research grant program, the Pfizer-FRQS Innovation Fund, will be administered by the FRQS, and will be open to Québec's research community. The new program will give researchers a chance to better understand the disease. The fund will be divided into two parts: one focuses on creating a home base for Québec researchers, while the other will fund high-risk, high-spinoff-potential projects that allow researchers to explore new research opportunities.

"The purpose of creating this fund is to mobilize Québec researchers, to provide them with an infrastructure that will enable them, among other things, to set up an Alzheimer's patient data registry," says Claude Lazure, FRQS's acting scientific director, in a prepared statement. "It will also make it

possible to conduct innovative research for better understanding the mechanisms underlying this disease by exploring research hypotheses that have so far never been investigated. Pfizer Canada's financial support is extremely valuable because it provides a unique opportunity to further our knowledge of this disease, which is having a considerable impact on Québec society."

"Setting up this fund for Alzheimer's disease is part of a broader Pfizer strategy for partnering with the FRQS to meet health needs identified in the Québec population and is therefore enabling Québec's life sciences sector to bolster its presence and global leadership," said Allen Van der Wee, general manager of Pfizer's Primary Business Unit Canada, in a release.

Further details on the Pfizer-FRQS Innovation Fund will be announced on the FRQS's website at www.frqs.gouv.qc.ca.

■ GSK, CDRD and CVI collaborate to commercialize health research in Canada



The Centre for Drug Research and Development, its commercial arm, CDRD Ventures Inc., and GlaxoSmithKline in Canada are collaborating to provide financial resources and drug development expertise to develop and commercialize health research conducted in Canadian research institutions.

A GSK-CDRD Innovation Fund will support early stage projects. CDRD in collaboration with academic researchers at hospital-based

research centres or institutions that are affiliated with CDRD will carry out the projects. Projects to receive support from the fund will be selected by a joint Innovation Committee consisting of GSK and CDRD representatives as well as external reviewers.

A joint venture between GSK and CVI will invest additional funds to advance projects further toward commercialization. CVI will manage conduct of selected research projects to be partially funded by GSK.

■ Teralys Capital and Eli Lilly and Company invest in new \$150 million life science fund

Teralys Capital has announced an investment of \$65 million in TVM Life Science Ventures VII, which now stands at \$150 million. Teralys Capital and Eli Lilly and Company are joined in the fund by leading institutional investors including BDC Venture Capital, Fondation and Advantus Capital Management, a subsidiary of the Minnesota Life Insurance Company.

The fund will focus primarily on early stage drug development and life sciences company opportunities. The investment by Teralys Capital, together with invest-

ments by Lilly and other partners, will enable a new investment model in Québec, which includes the formation by the fund of single therapeutic asset companies. It is expected the fund will benefit the entire local life sciences ecosystem of researchers, entrepreneurs, business partners and service providers.

As part of the arrangement, Lilly will establish a Canadian division of Chorus in Montréal. Chorus, an autonomous unit of Lilly, is a global-early-phase drug development network that focuses on

designing and executing lean and highly-focused development plans that cost-effectively progress potential medicines from candidate selection to clinical proof-of-concept.

Chorus draws on internal Lilly assets, contract research organizations, and external consultants with very specific areas of expertise. Chorus Canada will work with development service providers across the province and elsewhere to offer development services to project-focused companies based primarily in Québec.

Julia was diagnosed at **four months old** with a virus in her heart.

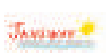
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■ Ernst & Young report says 53 per cent increase in financing a positive sign for Canadian biotechs

The Canadian biotech industry's financial performance was down again in 2011, but a surge in positive clinical news stimulated the sector nonetheless, generating a 53 per cent increase in financing according to Ernst & Young's 2012 *Beyond Borders* report.

"The Canadian biotech sector responded with cost-cutting measures and improved their overall business practices in the wake of the 2008 crisis," said Paul Karamanoukian, national life sciences leader and partner at Ernst & Young. "As a result, the stronger companies were able to weather the storm and do more with less, as efficiency is the name of the game in the life science world of today!"

In 2011, the Canadian biotechnology industry raised slightly more than US\$740 million, an increase of US\$257 million compared to 2010. Public companies raised US\$574 million, a US\$178 million increase over 2010.

In 2011, 15 public companies raised 80 per cent of the total public financings, which is a clear improvement over 2010, when most of the public company financings went to only eight companies.

"There are more successful companies



this year than last, and this is sending a positive signal to new potential investors," commented Karamanoukian.

As for private companies, they raised just under US\$166 million, which represents a 91 per cent increase over 2010.

According to Karamanoukian, preliminary reviews of the first quarter of 2012 show an upward trend. With the Canadian government and some provinces announcing stimulus programs, the sector could see a real turnaround.

"We're also seeing some of the major pharmaceutical companies partnering with the public sector to create investment funds that should result in further increases in investments, which demonstrates the industries trust in our science."

The province of Quebec is now leading the pack in both total public company financings and venture capital financings, surpassing the 2010 leader, British Columbia. Manitoba and Nova Scotia are also emerging as players in the sector. The total public and private financing breakdown by province was as follows:

- **Quebec:** 50% of total financing, with US\$372.6 million
- **Ontario:** 24% of total financing, with US\$177.3 million
- **BC:** 15% of total financing, with US\$112.2 million
- **Alberta:** 9% of total financing, with US\$62.9 million
- **Manitoba:** 1% of total financing, with US\$8.6 million
- **Nova Scotia:** 1% of total financing, with US\$6.4 million

Other highlights of the report included the following: Once again in 2011 there were no IPOs, the number of public companies remained virtually flat in Canada at 71 companies, while overall revenues decreased 21 per cent from 2010 to US\$998 million. The overall employment in the sector also fell in 2011.

Dealmakers

■ **EnWave Corporation** (Vancouver, BC) has signed a collaboration agreement with **Cherry Central Cooperative Inc.**, a U.S. company specializing in production and processing of red tart cherries, along with other fruits and vegetables. After a successful initial evaluation of EnWave's Radiant Energy Vacuum (REV) technology, Cherry Central is planning to expand its usage of the REV technology. The company, under the terms of the contract, can license its REV technology for production of red tart cherries and apple and cherry powders for commercial distribution.

■ Biopharmaceutical company **ProMetic Life Sciences, Inc.** (Laval, QC) has received a \$4.6 million purchase order from its continuing supply agreement with **Octapharma**, a Swiss-based plasma fractionation company specializing in human proteins. The shipments for the order are expected to be over \$2 million during 2012's second half of the year. Octapharma's latest order relates to its purchase of PrioClear™, a proprietary prion capture resin incorporated into the company's manufacturing process for its solvent/detergent treated plasma product Octaplas®LG. Currently, Octaplas®LG is approved for marketing in several European coun-

tries, and is the object of ongoing procedures for regulatory approval in the North American market.

■ **Amorfix Life Sciences Ltd.** (Mississauga, ON) has signed an agreement granting an exclusive worldwide license for its preclinical Alzheimer's disease diagnostic test, the Amorfix Aggregated Abeta Assay (the A4) to **JSW Lifesciences GmbH**. The A4 is an ultra-sensitive assay that measures the levels of aggregated Abeta (beta amyloid) in brain, spinal fluid (CSF) and plasma from preclinical animal models used for Alzheimer's disease research and drug development. The A4 enables the detection and quantitative measurement of aggregated Abeta, the building block of brain plaques and a hallmark of Alzheimer's disease, up to a year earlier than conventional methods. Under the terms of the agreement, JSW will market and perform the A4 assay as a service in the area of preclinical Alzheimer's disease studies.

■ **Valeant Pharmaceuticals International, Inc.** (Montréal, QC) has agreed to acquire OraPharma, a specialty oral health company that develops and commercializes products

for improving and maintaining oral health. The dental hygiene company, currently owned by Water Street Healthcare Partners, is a private equity firm specializing in the health care industry. The total consideration for the deal is approximately \$312 million, with up to \$114 million in potential contingent payments based on OraPharma achieving specific milestones, including revenue targets.

■ **Lyonbiopole** has joined the already existing consortium between **Alsace BioValley** and **Québec Consortium for Drug Discovery** (CQDM). A first agreement, signed in November 2010 between the two partners had already helped to initiate several research collaboration between actors in Alsace and Quebec. With these early successes and the special relationship established between Alsace BioValley and Lyonbiopole, a new bilateral agreement has been recently signed between CQDM and Lyonbiopole. This new agreement aims to develop a joint program to enhance biomedical research in Québec, Alsace and Rhone-Alpes by the alignment of international resources. This collaborative program aims to co-finance research projects between the three regions Québec, Alsace and Rhone-Alpes.



By: Dr. Brad Popovich,
Chief Scientific
Officer at Genome BC

GENOMICS

From Mendel to Molecular:

Photo: Dominic Schaefer Photography.



WE ARE LIVING IN A GENOMIC WORLD

The history of genetics can be traced back to an Augustinian monk by the name of Gregor Mendel. In the 1860s Mendel began studying pea plants and the characteristics that were passed on from one generation to the next and then published his findings. Prior to this, many theories had existed about hereditary characteristics of living organisms. Despite his meticulous work and documentation, it was not until the early 1900s that the tenets of Mendelian genetics began to be more widely accepted. In concert with scientists working within the teachings of Mendel's principles, mathematicians in the early half of the 20th century also began to develop models to explain population genetics and ultimately applied them to evolution. In 1953 the double-helix DNA structure was

revealed when James Watson and Francis Crick cracked the nucleus of the cell and the era of molecular biology was born.

While much has changed since 1953, including polymerase chain reaction (PCR) a technique in molecular genetics that allows detection and manipulation of even the tiniest amounts of DNA sequences, the most significant and profound changes in genomics have occurred in just the last decade, arguably since the sequence of the human genome was completed in 2003. Today, we refer to genomics as a discipline that studies the structure, function and inheritance of the genome. It allows us to study molecular mechanisms and the interplay of genetic and environmental factors in health and disease. The knowledge and innovations emerging from the field of genomics are providing

solutions to complex biological challenges, many of which are then raising questions of societal and economic importance.

Although the human genome gets the bulk of the attention, all living organisms have a genome: animals, plants, viruses and even fungi. The development of technologies to sequence the DNA of whole genomes on a routine basis – essentially to map an organism's 'blueprint' – has enabled thousands of genome sequencing projects in labs around the world. Along with the human genome sequence, we now have blueprints containing structural information for all kinds of organisms, such as soil microbes, trees, bees and salmon.

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. The remarkable discoveries and advances in cancer research are leading to vaccines and therapies to fight many forms of the disease. Even though Canada is a world leader in overall survival

The impact of technology reaches into all sectors. Canadian watersheds may soon be benefiting from improved testing for contaminants thanks to the application of genomics.

rates and cancer care, it is estimated that there will be 186,400 new cases of cancer diagnosed in Canada this year (excluding about 81,300 non-melanoma skin cancers) and 75,700 cancer-related deaths (Canadian Cancer Society – www.cancer.ca). These figures equate to an enormous burden on healthcare systems. The applications and technologies resulting from genomics research could play a significant function in helping to reduce these costs.

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 in the genome, including variations in genes, 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. If we can measure and test for the expression of multiple genes, detect genetic variations and quantify proteins and other molecules in the body, we can gain substantially more information about a specific patient's condition, allowing us to tailor the treatment plan. If a cancer is found to be resistant to an existing therapy, a patient can avoid the ineffective treatment and the accompanying side-effects and focus on other more effective therapies.

Such 'therapeutic stratification' is currently being utilized in cancer research projects across Canada involving pediatric medulloblastomas (brain cancer), acute myeloid leukemia (AML), breast and prostate cancers. Major innovation hubs across our country are burgeoning with clinicians, researchers and bioinformaticians joining together under the genomic umbrella to work towards the goal

of better outcomes for patients and their families.

Cancer is not the only area of human health that is being affected by genomics research. A dramatic change in how we approach numerous health-related concerns is on the horizon as genomics provides a more powerful magnifying glass with which we can examine our health in both well and diseased states. With our genetic blueprint in hand scientists are working towards identifying patients' underlying genetic susceptibility to adverse drug reactions. Tests are being developed to predict if a patient will experience known adverse effects, such as deafness or heart failure, enabling clinicians to tailor an individual's drug therapy. If a drug response can be predicted, incidents of adverse reactions can be lessened, lives can be saved and our healthcare system can realize economic savings. Researchers are currently working on moving these tests into the clinic.

The development of personalized vaccines and individual gene therapy may sound like science fiction. However, we hope to see today's results moving from clinical trials to clinical management within the decade.

To ensure this can happen there must be numerous factors at play not the least of which is collaboration between research and regulatory bodies. The continued development of cutting-edge technology to make things more efficient and effective will also help further our understanding of the human genomic code.

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.

Aquaculture is a timely example: many of British Columbia's wild salmon runs have been steadily declining for the past two decades. Researchers are using genomics to investigate the stressors that might be under-



We now know there is a better tool to sooner identify pathogens and contaminants in our water, which will allow us to set thresholds to determine levels where water pollutants become dangerous.

mining salmon performance and survival. They have identified biomarkers for growth and feeding, high water temperature stress, response to low oxygen and numerous signatures that contain differential immune stimulation. These signatures reflect conditional differences among migrating salmon.

By studying these signatures and patterns of immune stimulation, researchers are now investigating their hypothesis that a large proportion of salmon dying prematurely may be linked to the presence of a new virus. These breakthrough findings were published in *Science* and led to researcher participation in the recent Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River (the Cohen Commission), and raised numerous questions about the impacts of environmental issues and farm-raised species on wild fish. Ongoing research aims to understand the cause-effect relationship between specific genomic signatures, new pathogens and salmon mortality. Researchers will use this knowledge to predict and, if possible, mitigate the causes of diminishing runs.

The impact of technology reaches into all sectors. Canadian watersheds may soon be

benefiting from improved testing for contaminants thanks to the application of genomics. We now know there is a better tool to sooner identify pathogens and contaminants in our water, which will allow us to set thresholds to determine levels where water pollutants become dangerous. The issue of climate change is also being addressed using genomics. Research is underway to help address the climate-change-induced mismatch between the inherent genetics of trees and the locations where they grow. Using genomic analysis coupled with cutting-edge geospatial analysis and climate modeling, research teams are looking at the impact of climate change, and how to help manage adaptation processes through breeding and geographic placement for two of BC's most important trees – lodgepole pine and spruce.

The future of Canada's forest industry is looking brighter these days: the forest pathologist's arsenal includes molecular tools in addition to traditional testing methods to help determine tree health. Additionally, an entirely new realm of possibilities has been uncovered with an increased understanding of the genetic and molecular underpinnings of practical and selective tree breeding. Time

and outlay invested into genomics has positioned BC as a leader in the transformation of how tree breeders, forestry disease experts and others approach their work. Looking back at the changes in forestry practices in the last decade we expect to see even more positive change over the coming years as a result of investments in genomics. This outlay will continue to spin off benefits in healthier and better-adapted tree varieties for the future benefit of Canada's forest economy.

From Research to Reality

Today anybody and everybody who is studying a living population can ask better and more refined questions thanks to genomics technology. All living things contain genomes and by understanding them, they become more accessible to the relevant communities around them.

Genome BC has played a catalytic role in identifying opportunities where genomics can make a difference to B.C., the rest of Canada and the world. A critical step in this has been ensuring that research answers timely questions. Knowledge can no longer remain in silos — and Genome BC is helping break down these silos and move ideas from the lab to everyday applications. Innovative solutions to real world problems are imminent. This means current, relevant problems are being addressed. By examining sector opportunities and matching research with those needs, we can deliver value to end-users by offering genomic solutions.



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INNOVATORS

WINNING IMMUNITY

Halifax company leads the way in vaccine development

Halifax-based clinical stage vaccine development company, Immunovaccine, is forging new paths in cancer and infectious disease management, earning much evidence-based accolade. CEO John Trizzino and chief science officer Marc Mansour are steering the company as a team from the business and science sides respectively. A seasoned health care business professional, Trizzino has over 17 years of experience dealing with infectious disease vaccines. With a PhD in molecular and cellular biology specializing in immune cells, Mansour has guided the company's scientific foundation from the beginning over 10 years ago. Trizzino and Mansour share the story of Immunovaccine, making it clear that the company values ambition, versatility and the highest quality research.

Immunovaccine grew around technology developed at Dalhousie University for the purpose of immunocontraception in animal populations. It has since been tailored to human immunotherapy and infectious disease applications. The DepoVax™ is a vaccine delivery system that combines antigens and adjuvant, carried via liposomes, in a depot – an oil-based solution that retains them at the site of vaccination. The DepoVax platform is unique in that it emulates a real bug. Upon injection, immune cells are attracted in large numbers to the depot, actively clearing it over a prolonged period of time. The attraction and long term exposure of antigen presenting cells to the depot generates a robust immune response.

Early on, the technology was licensed out to Pfizer Animal Health. While Immunovaccine continues to pursue animal health applications (now exploring the potential to target infectious disease in companion animals), its early vision was far broader in scope. As the DepoVax technology is effective on multiple platforms, the company wanted to leverage it wherever possible. "After a long evaluation we made a strategic decision to start focusing on human health applications for the platform. It was a huge challenge and I'm all about taking challenges so it was great," says Mansour.

In 2005, Immunovaccine began to delve into tests with known cancer models of the time. Mansour describes the light bulb moment reviewing the results of the first study demonstrating the platform could enhance a cancer vaccine: "I still remember that meeting when the immunologist came into the room and showed us the results... I was looking at the results and we were all

antigen at Merck KGA, Survivin, was a biomarker for cancer that had been the subject of much scientific literature. Immunovaccine very quickly developed DPX-Survivac, completing necessary safety studies and preclinical work and getting clearance in the US and Canada to run clinical trials in less than a year. Since December 2011, the product has been in the Phase 1 trial stage of a Phase 1-2 pro-



"When you're talking about vaccines for addiction you want to get the body's immune system to respond as robustly and as efficiently as possible so what we're trying to do here is to enhance the benefit of their antigen candidate to get as quick and durable a response as possible."

— John Trizzino

looking at each other thinking 'how can you not be jumping up and down?'" A series of further studies and published papers quickly followed.

Licensing some antigens from a company in the U.S., Immunovaccine very quickly developed DPX-0907. At the same time, the company was working on its manufacturing process and making DepoVax scalable and thus possible to commercialize. Things came together in 2008/2009 when the company started making DPX-0907 in the U.S. and filed its first IND with the FDA. DPX-0907 went through a Phase 1 trial in a record 9 months targeting patients with breast, ovarian and prostate cancer.

"It was the first time DepoVax made it into the clinic so we demonstrated a good safety profile and showed that it is generating immunity in humans," says Mansour. Presently, Immunovaccine is looking to take DPX-0907 into a Phase 2 trial.

During the DPX-0907 Phase 1 trial, the company struck a deal with Merck KGA to take an early stage clinical product from their pipeline, put it in DepoVax to enhance it and take it into the clinic in a better format. The





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tol. It is being tested at several sites across North America, targeting patients with ovarian cancer. Final data is expected before the end of the year. The company is currently looking into partnering opportunities and grant opportunities in the U.S. and Canada to move things forward for the Phase 2 stage. Mansour cites DPX-Survivac as a huge opportunity in immunotherapy, noting that the company is very excited about it.



"In this industry, it's about getting out there telling your story, showing the data. All your successes, everything is data driven - it's your success and your failure." — Marc Mansour

Planning to advance their work with infectious disease applications as well, Immunovaccine is in the midst of a non-human primate challenge study funded by the National Institutes of Health. The study employs DepoVax as a component of several bio-defense vaccine candidates. The company is very optimistic that the study will result in not only protection but protection in fewer doses, which would further validate the advantage of the DepoVax platform. Trizzino clarifies that protection in fewer doses is critically important in regard to pandemics or bio-terror events when protective levels of immunity are needed as quickly as possible. The company is also currently working with Weill Cornell Medical College to develop an anti-cocaine vaccine. The aim of the vaccine would be to prevent relapse in people who have overcome addiction. "When you're talking about vaccines for addiction you want to get the body's immune system to respond as robustly and as efficiently as possible so what we're trying to do here is to enhance the benefit of their antigen candidate to get as quick and durable a response as possible," says Trizzino.

Immunovaccine's business development strategy to maximize the potential of its broadly applicable patents by working with as many organizations as possible has been yielding dividends. The company was recently named best early stage vaccine biotech at the fifth Vaccine Industry Excellence Awards. Trizzino comments that it was a pleasant and exciting surprise for the company, noting it also is a confirmation that the company's strategy is working. "You have to be very diligent in making sure that you are talking to the right people – the right



scientists, the right key opinion leaders, the right government agencies, the right non-government organizations - so that people are aware of the technology." A compelling case, he says, must be made and repeated several times to get people to pay attention. Immunovaccine has been aggressively making its case over the past six months and Trizzino attributes the ViE Awards recognition in large part to these efforts.

He also stresses the importance of sound technology to achieve success in the field. "The increasing value of a company comes from solid clinical data so you're only able to move a good biotechnology company along if you continue to generate good data and generating good data gives you an opportunity to invest further in advanced clinical development." Immunovaccine aims to utilize its foundational platform in as many areas as possible, collecting stores of strong data to support its efficacy. Mansour confirms the need for solid data. "In this industry, it's about getting out there telling your story, showing the data. All your successes, everything is data driven - it's your success and your failure."

Future plans see the company advancing various programs into clinical trials and continuing pre-clinical studies that support innovative clinical trial designs. Mansour expounds on the opportunities for Survivin, as it can be applied to many types of cancer and there are many research avenues to explore with it before proposing anything for clinical use. Specifically within the coming year, Immunovaccine's goals are plentiful. They plan to advance the development of DPX-0907, announce final data from the DPX-Survivac Phase 1 trial, and identify partners and funding opportunities to take DPX-Survivac into

a Phase 2 clinical trial. The company also plans to expand its animal health business into new indications, announce data from the bio-defense vaccine study, expand its infectious diseases vaccine pipeline, and develop a Phase 1 clinical trial for one of its infectious diseases candidates. Over the next 12 to 18 months, the focus will likely be to bring an infectious disease antigen candidate into the clinic. Immunovaccine is currently looking at several opportunities including some of the emerging market tropical diseases that do not currently have an effective vaccine to test with DepoVax.

To advance their technology and perpetuate success, Trizzino stresses the importance of building the best and brightest team possible, including a dynamic and diverse board of directors. "You've got to have the right science minds supporting you both inside and outside of the company, having a strong scientific advisory board, bringing people that are really capable, key opinion leaders to discuss the direction that the company is going in." Since Trizzino came on board in September 2011, his vision of a cohesive, ambitious and experienced team to leverage the company's resources has taken shape. The board of directors has seen three new additions in biotech investment banker Stephanie Léouzon, CEO of Oncolytics Biotech Inc., Brad Thompson, and former Sanofi-Pasteur CEO Wayne Pisano.

There may be some expansion into new locations on the horizon as well. While the roots of Immunovaccine remain in Halifax, Trizzino stresses the need to view the company as a global entity, leveraging whatever they can out of Halifax and Dalhousie but also looking to the U.S., Asia and Europe in order to build capability and facilitate greater success. He envisions the company having more of a physical presence in the U.S. and likely in Asia as well. For a company whose core culture champions response and reaction to opportunity, expansion is part of a natural evolution.

Assured that Immunovaccine will maximize every opportunity that presents itself, embracing diversity and solidifying its reputation, it's likely they will be making a lot of news in the near future. "I think there is a lot more to come from Immunovaccine over the next 12 months," Trizzino says. We are excited to see it unfold.



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PROGRESS AND PROMISE

*at the Samuel Lunenfeld Research
Institute of Mount Sinai Hospital*

Millions of Canadians and their families are affected by cancer—an illness that is not a single disease, but an enigmatic one comprised of well over 100 subtypes. The complexity of cancer and its impact on so many people has researchers worldwide scouring for better tools to use against it.

Researchers at the Samuel Lunenfeld Research Institute of Mount Sinai Hospital are at the forefront of efforts to understand the genetic and molecular events underlying many types of cancer, as well as identifying targets for early detection, understanding the process of metastasis, and developing new, personalized therapies.

Understanding the genetic bases of cancer

Surgeon-scientist Dr. Steve Gallinger, senior investigator and co-director of the Fred A. Litwin Centre for Cancer Genetics, and his team are working to identify the gene(s) conferring risk for familial pancreatic cancer. “The identification of these genes would be a major breakthrough in understanding the biologic basis for individuals at increased risk of pancreatic cancer, facilitate earlier diagnosis and would help lead to newer, more sophisticated and personalized therapies,” says Dr. Gallinger.

Through Dr. Gallinger’s research, a new technology called exome sequencing allows researchers to develop a detailed map for the genomes of patients at high risk of pancreatic cancer. Dr. Gallinger and his team are currently examining several promising genes that may lead to exciting breakthroughs in generating a genetic road map of familial pancreatic cancer.

Dr. Irene Andrulis, a molecular biologist, senior investigator and co-director of the Fred A. Litwin Centre for Cancer Genetics at the Lunenfeld, is world-renowned for her pioneering work in hereditary breast cancer. She is collaborating with researchers internationally who are conducting genome-wide analyses of genes that impact the risk of breast cancer.

For example, Dr. Andrulis’ team is involved in a study as part of the CIMBA group (Consortium of Investigators of Modifiers of BRCA1/2), a collaborative group of researchers assessing genetic abnormalities and cancer risk—including environmental factors—in women who carry the BRCA1/BRCA2 genetic mutation.

“We are studying women who carry genes that increase the risk of breast cancer, to better understand the factors triggering onset of the disease and, ultimately, finding ways to prevent these triggers,” says Dr. Andrulis.

While cancers of the breast and pancreas have a more fully characterized genetic signature, lung cancer is often associated with environmental risks, including the known link to tobacco smoking. But Dr. Rayjean Hung, Lunenfeld Principal Investigator and leading cancer epidemiologist, believes that understanding the epidemiology and genes underlying lung cancer is becoming increasingly important, as cumulative evidence has suggested the disease is not exclusively linked to smoking but may involve hereditary risk factors.

In 2008, Dr. Hung and her team uncovered, for the first time, an important genetic region associated with lung cancer risk. Since this pivotal paper, her research group and others have identified additional genetic regions linked to an increased susceptibility to lung cancer, including two loci on chromosome 5, as well as genetic variations in chromosome 15.

Meanwhile, Dr. Hung’s group is also leading an effort to apply new statistical modeling to investigate the genetic factors that may affect lung cancer survival.

The International Lung Cancer Consortium, of which Dr. Hung is scientific coordinator, continues to search for additional lung cancer genetic variants. The Consortium is currently conducting combined analyses of all lung cancer genome-wide data, which would be the largest study of its kind for lung cancer genetics.

Uncovering the role of DNA damage and repair

Lunenfeld Senior Investigator Dr. Daniel Du-rocher is one of only a handful of researchers

The Samuel Lunenfeld Research Institute of Mount Sinai Hospital >



Dr. Steve Gallinger

“The identification of these genes would be a major breakthrough in understanding the biologic basis for individuals at increased risk of pancreatic cancer.”



Dr. Irene Andrulis

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in Canada studying DNA repair mechanisms in the cell. He is investigating how cells effectively protect the integrity of our genetic material and how these systems are inactivated in cancer.

Dr. Durocher and his team discovered that a gene known as RNF8 helps guide BRCA1, a protein that assists in repairing DNA damage and, when mutated, is known to cause breast cancer. By guiding BRCA1 to the sites of damaged DNA, RNF8 helps ensure that the necessary repairs can be orchestrated.

More recently, Dr. Durocher and Lunenfeld colleagues Drs. Anne-Claude Gingras and Frank Sicheri uncovered pivotal new information on how cells regulate their genetic material through their research into a protein called OTUB1, a discovery that may lead to the development of strategies to improve cancer therapies.

"In recent years, we have been very good at finding proteins that are necessary for DNA repair," says Dr. Durocher. "What we did not appreciate was that gatekeepers existed to inhibit the capacity of the cell to repair DNA."

After exposing cells to radiation, Dr. Durocher and his team used RNA interference to discover that OTUB1 inhibits a cell's DNA repair mechanisms, through its role in the process of ubiquitination.

"Perhaps the biggest surprise was that OTUB1 works by an entirely new and elegant mechanism," says Dr. Durocher. "Mutations in genes that repair our DNA can lead to cancer, infertility and immune deficiency. Therefore, inhibiting the proteins that block DNA repair could lead to new types of therapeutics for these diseases."

Identifying protein networks and the mechanisms of cellular communication

Lunenfeld senior investigator and internationally renowned cancer researcher Dr. Jeff Wrana's explorations of the interactions of human proteins, and the complex network of pathways that lead to illness, has given scientists and clinicians new opportunities for the diagnoses and treatment of cancer.

Dr. Wrana and post-doctoral researcher Dr. Ian Taylor developed a new software analysis tool called 'DyNeMo' that analyzes breast cancer tumours and helps physicians provide more accurate and individualized diagnoses and treatments.

"Cancers aren't diseases of single genes, but a network," says Dr. Wrana. "Differences in the way these networks are organized in cancers allow us to predict the prognosis of a newly diagnosed breast cancer patient."

Now Dr. Wrana is working with Mount Sinai surgeon Dr. Alex Zlotta to apply the DyNeMo software to uro-oncologic cancers such as those of the bladder and prostate.

"These types of technologies are the future of cancer diagnostics and prognostics, allowing us to grasp the true nature of a patient's cancer — and ultimately empowering clinicians with new knowledge about how best to treat their patients," says Dr. Wrana.

Exploring the role of insulin in the development of cancer

Several years ago, studies showed that diabetics taking metformin — a drug commonly used to treat type 2 diabetes — were less likely to develop cancer or succumb to the illness than diabetics who do not take metformin. Other results of studies in

women with breast cancer who are waiting for surgery have shown that the drug may slow tumour proliferation rates.

Dr. Pamela Goodwin, a clinician-scientist at Mount Sinai Hospital and Director of the Marvelle Koffler Breast Centre, is leading the largest clinical trial worldwide to explore the potential of metformin to reduce recurrence and improve survival in women with early-stage breast cancer.

Her earlier research showed that high levels of insulin associated with obesity encourage tumour growth and make breast cancer recurrence more likely. Metformin lowers insulin levels, which is one possible explanation for its anti-cancer effects.

"Tumours don't exist in isolation. Changing the patient's physiology by lowering her natural insulin level may make her body more inhospitable to tumour growth and can potentially change the outcome of the cancer," says Dr. Goodwin.

In the Phase 3 trial, 3,582 non-diabetic patients under the age of 75 with early-stage breast cancer and who have undergone surgery to remove their tumour, are being randomized to receive metformin or placebo. The trial began in 2010, and at interim and final endpoints patients will be assessed to determine the effect of metformin versus placebo on disease-free survival and overall survival.

"Metformin may exert its effects on breast cancer via insulin-mediated or insulin-independent mechanisms of action, or both," says Dr. Goodwin. "It may lower insulin levels and hence reduce signaling through a key proliferation pathway in breast cancer cells. Secondly, independent of insulin, metformin may alter metabolism in mitochondria and

> The Samuel Lunenfeld Research Institute of Mount Sinai Hospital >The Samuel Lunenfeld Research Institute of Mount Sinai Hospital



Dr. Rayjean Hung

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Dr. Jeff Wrana

"Differences in the way these networks are organized in cancers allow us to predict the prognosis of a newly diagnosed breast cancer patient."

activate the enzyme AMP kinase, which disrupts normal cell proliferation and survival.”

Targeting sub-types of cancerous tumours

New, less toxic cancer treatments targeted to specific tumour sub-types in sarcoma are on the horizon, and clinician-scientists in Mount Sinai's Sarcoma Program are breaking new ground in this area.

A team led by Dr. Rebecca Gladdy, a Mount Sinai Hospital scientist and surgical oncologist specializing in soft-tissue sarcomas (cancer of the connective tissue), has developed novel cell lines from operative specimens at the hospital that can be used to assess the molecular changes characteristic of different sarcoma subtypes, which will help provide a basis to design better drug therapies.

For example, her team found that combining doxorubicin, a standard yet toxic sarcoma chemotherapy regimen, with more selective drugs (found by screening several hundred compounds) improves the ability to kill tumour cells.

“In creating a biorepository of sarcoma cell lines from operative specimens, we now have a more reliable model to better understand what genes are driving sarcoma, which will help lead us to the development of more effective, less toxic therapies,” says Dr. Gladdy.

New insights into the process of metastasis

Metastasis is a complex process whereby cancer cells disengage from the original tumour, enter the bloodstream, and infiltrate healthy tissue in a new part of the body, in conditions that are initially ‘hostile’ to the tumour cell's makeup.

Mount Sinai surgeon-scientist Dr. Carol Swallow is collaborating with Senior Investigator Dr. Jim Dennis, whose lab has been studying metastasis for over 20 years.

Dr. Dennis' lab isolated a gene called Plk4, which is implicated in liver cancer and promotes genome instability, a precursor to cancer progression and metastasis. His team is using mouse models to study the effects of Plk4 mutations and the resulting changes in cell metabolism and thus propensity for cancerous growth.

But while the basic research in Dr. Dennis' lab is critical to understanding metastasis, it is incomplete without clues from patient samples and clinical data. That's where Dr. Swallow's clinical work and her access to the Familial Gastrointestinal Cancer Registry, a vast database of patient tumour samples from people with inherited colorectal cancers, comes into play.

“We're able to identify and analyze genes from a patient's primary tumour, and compare them to those from metastatic tissue,” says Dr. Swallow. “Few other centres in North America have access to such a rich source of research data. What we ascertain from the samples will help us give patients more individualized treatments, customized to their specific tumour type.”

Dr. Swallow points to successes made to date through this model of research, and says that her team has already identified a number of patients for whom they have clinical data and tumour samples from the primary lesion and from the metastases that emerged years later. “With this information, I can work with Dr. Dennis and others at the Lunenfeld to sequence and analyze gene expression, finding clues that will help us understand how and

why some of the initial cancer cells spread.”

The theory underlying Dr. Swallow's research into Plk4 is that blocking the invasive behaviour of cancer cells will have more specific, targeted effects on stopping cancerous growth than merely stopping cells from dividing. Elevated levels of Plk4 (and, conversely, abnormally low levels) are a marker of aggressive tumour behaviour, and the gene is on the cusp of being clinically tested at some centres in Toronto.

Dr. Swallow's team is examining the role of Plk4 in tumour cell invasion in several cancer cell lines. Previous data has shown that the gene promotes the migration and invasion of fibroblasts, and is present in the tips of cancer cell protrusions. Her group is working to define the cell signaling cascade of Plk4 to understand the hierarchies of the pathway and its cellular effects.

In collaboration with researchers in the labs of Lunenfeld scientists Drs. Tony Pawson and Anne-Claude Gingras, she is also using mass spectrometry data to determine other proteins that Plk4 interacts with during cell motility.

“We are now working to determine the up- and down-stream targets of Plk4 to better define the signaling cascade, and to determine its interacting proteins,” says Dr. Swallow.

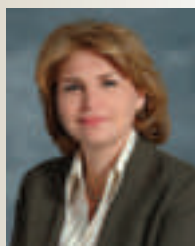
Karin Fleming is a Communications Specialist for research at the Samuel Lunenfeld Research Institute of Mount Sinai Hospital

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Dr. Pamela Goodwin

“Changing the patient's physiology by lowering her natural insulin level may make her body more inhospitable to tumour growth and can potentially change the outcome of the cancer.”



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ACROSS CANADA

Canadian Trends IN GENOMICS

From research to innovation

A shift has recently begun to unfold in genomics. After a decade of basic research and discoveries, emphasis is now being placed on innovation in applied research, a phenomenon that is evident throughout the Western world. Two factors explain this shift. First, genomics has attained a critical mass of knowledge and technologies that make the transformation of knowledge into applications possible. Second, public investors now expect genomics to produce tangible social and economic benefits, which translates into support programs increasingly focused on applied research.

Canada is not immune to this trend. Since 2008, Genome Canada, the organization responsible for developing and implementing Canada's funding strategy for large-scale genomics projects, has been proposing primarily applied research competitions. This trend has also been observed in regional genomics centres and in major national and provincial funding agencies. The priority targets for investments in genomics are strategic sectors that offer significant benefits for human health, agriculture, environment, forestry, fisheries and the development of new technologies. The underlying strategy is to focus efforts in these promising sectors in order to increase economic and trade returns from research and to facilitate the transfer of technologies to companies.

Such conditions lead to a swift rise in the potential of genomics innovation in Canada, a movement expected to gain even more momentum in the coming years. What are the trends and issues associated with this innovation potential? Here is a brief overview.

A potential that grows stronger with every day

In human health, the development of genomics-based predictive tests and diagnoses will multiply. Using the patient's genetic profile,

some tests will target the best preventive measures and treatments for personalized medicine. Others will identify the genetic characteristics of cancerous cells, bacteria or viruses that cause disease in order to determine the most appropriate treatment. These tests will become increasingly easy to use, be it in a doctor's office or possibly even in the hands of patients themselves. These different tools will help practitioners and patients make informed decisions to determine the best treatments and measure their effectiveness.



Research carried out by **Dr. Michel G. Bergeron**, full professor and director and founder of the Infectious Disease Research Center (IDRC) at Université Laval, readily exemplifies the potential of

health care applications. Dr. Bergeron's team has created a diagnostic tool in the form of a compact disk, a kind of miniature lab that uses DNA-based tests to perform diagnoses. This groundbreaking device allows a physician to identify a variety of microbes, such as *C. difficile*, in less than an hour and pinpoint their antibiotic resistance genes. This application stems from research conducted as part of the PRIVAC program, a major competition funded by Génome Québec. It was owing to a successful collaboration with Dr. Bergeron that BD Diagnostic GeneOhm, a molecular diagnostics company that ranks among the leading developers of rapid assays in detecting and identifying a range of infectious agents and genetic variants, moved to the

Québec Metro High Tech Park. BD Diagnostic GeneOhm invested \$60 million in a manufacturing plant and research centre, and now employs 325 people in Québec City.

The alliance between Dr. Bergeron's research and the entrepreneurship of BD Diagnostic GeneOhm led to the development of a series of tests that is sold today in over 200 hospitals across the United States, Canada, Europe and Asia; this international outreach positions Québec as a world leader in this sector.



In forestry, examples of promising applications are similarly compelling. For instance, support is being provided to develop tools that will help better manage the sustainable development

of our forests. Professor **John MacKay**, researcher in forest genomics at Université Laval, has embarked on one of the most important Canadian initiatives ever undertaken in forest genomics in the country, SMarTForest, which he heads jointly with Jörg Bohlmann from the University of British Columbia.

The goal of SMarTForest is to develop genomics tools that will be used to select, from populations of white, black, Sitka and Norway spruce, the specific seedlings whose genetic characteristics are associated with superior phenotypes in terms of rapid growth, better wood quality and greater insect resistance. These tools will allow for the rapid identification of the highest performing



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seedlings for reforestation, while respecting both the requirements of the forest industry and the need to protect the genetic diversity of the species. In short, the work Professor MacKay and his collaborators are doing will be contributing to the sustainable development of our forests and the vitality of this key sector of the Canadian economy.

Genomics has given rise to many emerging biological solutions in the environmental sector. These green solutions give governments and businesses the opportunity to make more cost-effective choices for the industry, while ensuring the sustainability of natural resources.



The work of **Dr. Adrian Tsang**, professor of biology at Concordia University, and his team is aimed in this direction, as it involves the study of genes of certain fungi that could

pave the way for a solution to the shortage of fossil fuel. The team sequences and analyzes fungal DNA to understand its structure and how it works in order to develop innovative technology. The acquired knowledge would enable them to create processes that reduce the use of chemical products derived from oil in the industry, but above all, to convert wood waste into bioethanol, a clean fuel. The applications of this work have the advantage of significantly reducing the cost of energy production and making it more environmentally friendly.

In agriculture and fisheries, genomics can also be used to improve stock management. The selection of genetic traits that, for instance, make certain males better breeders or certain females better carriers would lead to more efficient animal reproduction.

As far as aquaculture is concerned, take the formation of delimited natural pools in the ocean, which can cause density problems among fish populations. In such cases, the various parasites or bacteria specific to these species should be identified; this is where genomics comes in. It can be used to select certain species or sub-species that will reproduce faster and whose meat is more tender and less fatty. These different characteristics in fish populations, including lobster, are not only of great economic interest, but also come into play in the health of these populations, the environment and the quality of our fish consumption.

Many researchers and producers have learned from these experiences in aquaculture; this is why they now want to use genomics to identify various species and individuals in order to target good spawners. Although some fishing areas are very well characterized, scientists who are using genomics tools more and more are now able to characterize populations and see how they migrate. This knowledge could be used to avoid overfishing in certain regions where the reproductive potential of fish is lower.

Barriers to overcome

There are, however, some barriers to applied research. They are generally two-fold: regulations and social acceptance.

Regulations in the health genomics sector are designed to regulate innovative medical and technological practices. The need for these regulations emerged in the past decade in light of the social and legal consequences of changing medical practices. Canada is not trailing in this area, quite the opposite in fact. It is important to bear in mind that regulations relating to human health are generally more stringent than those on animal health, agriculture or fisheries. Although it is not an obstacle to the development of genomic applications in health, it is a greater challenge than in other sectors, hence the importance of working with this type of oversight.

Another barrier to consider is social acceptance, which arises from the integration of new applications within society. When we consider the development potential of consumer products, for instance, the public interest must be preserved and remain a constant concern. The goal is to maximize the benefits genomics has to offer and minimize the risks associated with the introduction of certain products and services. Public opinion is always a key criterion where application in society is concerned.

Social acceptance is as much an issue among the general public as it is in the industry and among practitioners; all these categories of users must be considered when adopting innovation-driven applications so that they can be integrated into daily life.

The health sector is of particular significance. Today's doctors are not always able to read a genetic profile or a DNA sequence to interpret the results so they can prescribe medication or propose treatment. There is currently a sizeable gap between the massive amount of data being produced in health genomics and the clinicians' ability to interpret it accurately. If the clinician does not have the required qualifications, it will

take special tools, from bioinformatics to visualization, for a faster and more effective decision to be made. The percentage of trial-and-error will no doubt drop as soon as the level of knowledge about these applications and their adoption by users increases. The ability to be able to prescribe the right medication at the right dose for the right patient remains one of the main challenges of personalized medicine.

Even if the coming years are spent developing tools to help clinicians in their decision-making, it will not be without the introduction of genomics in medical schools. This is an inevitable adaptation in medical training that can only be contemplated in the long-term.

Working in synergy for a competitive future

No matter the scope of application, end-users are key to developing the full potential of applied research in genomics. Businesses, industry and foundations must all gear their actions towards commercialization because that is where their strength lies. This is not usually the case with researchers, whose focus is on discovery. But a new synergy seems to be taking shape in this regard, as much within the research community as within the economic sector and among policymakers.

Only with such synergy will genomics be able to start emerging as a true force capable of stimulating major business sectors. It is there to provide the tools and solutions to real issues for improving practices and strengthening the competitiveness of our economy, now and in the future.

Daniel Tessier has worked for the National Research Council (NRC) Biotechnology Research Institute for 19 years. His work in genetics, protein engineering, new technology implementation, including the NRC's pan-Canadian microarray platform and biosensors for the private sector, has resulted in over 40 published articles. Mr. Tessier holds a Master's in Microbiology and Immunology from McGill University. He has worked as Senior Director, Operations and Business Development for the McGill University and Génome Québec Innovation Centre since 2005, where he oversees a team of 65 employees.



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McMaster University

researchers discover drug destroys human cancer stem cells but not healthy ones

Imagine having access to a cancer-fighting treatment that doesn't come with the toxic side effects of conventional treatments, like chemotherapy or radiation. Thanks to Mick Bhatia and a team of researchers at the McMaster Stem Cell and Cancer Research Institute, we're on the brink of exactly that.

Bhatia, alongside his team of scientists, has discovered that the drug known as thioridazine can successfully kill cancer stem cells while leaving the normal, healthy cells relatively unscathed. However, for Bhatia, that's not even the most intriguing part of the discovery.

"The unusual aspect of our finding is the way this human-ready drug actually kills cancer stem cells by inducing differentiation," he says. "It changes them into cells that are non-cancerous."

The research was published in the May 24, 2012 issue of the science journal *CELL*.

The innovation is the next step in Ontario's role in the discovery of the link between cancer and stem cells. It was back in 1997

that researchers at the University of Toronto first discovered cancer stem cells in certain types of leukemia. Today, they've been identified in blood, breast, brain, lung, gastrointestinal, prostate, and ovarian cancers.

Bhatia, as the principal investigator for the study and the scientific director of the McMaster Stem Cell and Cancer Research Institute of the Michael G. DeGroote School of Medicine, believes the new finding holds the promise of bringing to life a new strategy and discovery pipeline for the development of anti-cancer drugs in the treatment of various cancers. In fact, the team has identified another dozen drugs that have good potential for a similar response.

To flesh out the promise, McMaster researchers have already pioneered a fully automated robotic system to identify several drugs, including thioridazine, and their effects not only on cancerous stem cells, but on normal ones as well.

"Now we can test thousands of compounds," Bhatia says. "Eventually, we'll be

New business venture to commercialize stem cell technologies

McMaster University and Actium Research Inc. have signed an agreement that will allow Actium to address the need for better drugs targeting cancer stem cells and regenerative medicine.



Scientific director of the McMaster Stem Cell and Cancer Research Institute (SCCRI) **Mick Bhatia** says the agreement, which covers McMaster's proprietary human stem cell lines, cancer stem cells and platforms developed by SCCRI researchers, is exactly what's needed to accelerate the movement of his team's research discoveries into the marketplace.

Actium Research Inc. is a drug discovery and development company targeting both cancer stem cells to improve survival and health outcomes, and normal tissue stem cells to promote healing and help discover cures in chronic disease. It was founded by David Young and Helen Findlay – the same duo who founded ARIUS Research Inc. – one of Canada's most successful biotech companies. Bhatia has been named Actium's founding scientific director.

More at: actiumresearch.com



↑ Mick Bhatia and Jennifer Russell talk while running an assay with the CGD (Cell Growth and Discovery) WorkCell.



← Postdoctoral Fellow, Eva Szabo and Research Technician, Monica Graham of the Bhatia Lab in the McMaster Stem Cell and Cancer Research Institute, visually analyzing the protein expression pattern observed on a Western Blot film

McMaster University is home to a world-class stem cell and cancer research institute

The McMaster Stem Cell and Cancer Research Institute (SCCRI), established in 2006, is now home to 70 scientists studying stem cell biology with a unique focus on human stem cells which is core to its translational research efforts.

Housed in the Michael G. DeGroote Centre for Learning and Discovery on McMaster University's campus, the 15,000 square-foot suite of laboratories includes the Braley Centre for Automated Stem Cell Screening and Drug Discovery, which is a centre focused on the exploitation of unique stem cell properties and cutting edge proprietary technology to propel drug discovery and the advancement of regenerative medicine.

SCCRI researchers continue to make discoveries that pave the way for medical advances. A few examples of that work include:

- In 2010, SCCRI's scientific director Mick Bhatia took the world's medical and scientific communities by storm when he and his team discovered how to make human blood out of human skin. The findings, published in the prestigious science journal *Nature*, mean that, in the very near future, people needing blood for surgery, cancer treatment, or other blood conditions will be able to have blood created exclusively for them, from them. Clinical trials are expected to begin this year.
- In 2011, Brad Doble and his team found that a protein called beta-catenin controls the ability of mouse embryonic stem cells to differentiate into various new types of specialized cells such as neurons. Featured on the cover of *Cell Stem Cell*, the researchers believe the newly discovered properties of beta-catenin will have important implications for cancer, because it is frequently found mutated in several types of human cancer.
- In 2011, Bhatia and his team confirmed that human stem cells have the ability to become any cell type in the human body, but when it comes to their destination, they know exactly where they want to go. Published in the scientific journal *Cell Stem Cell*, the researchers shed new light on how these regenerative cells turn into more specialized cell types, such as neural or blood cells. Until then, the thought was stem cells kept all their options open when it came to becoming more specialized. The results opened the door to tailoring stem cells and improving their ability for tissue and organ regeneration.

Check out sccri.mcmaster.ca for more discoveries

able to define a candidate drug that has little effect on normal stem cells but kills the cells that start the tumour."

Once that's been established, Bhatia says the next step is to test thioridazine in clinical trials, focusing on patients with acute myeloid leukemia whose symptoms have relapsed after chemotherapy. He wants to determine whether or not, by targeting cancer stem cells – the root of the problem – the drug can prevent the cancer from coming back.

The wheels are already in motion. Bhatia's team at McMaster has found that thioridazine works through the dopamine receptor on the surface of the cancer cells in both leukemia and breast cancer patients. This means that it may be possible to use it as a biomarker that would allow early detection and treatment of breast cancer and early signs of leukemia progression too.

The team's next steps will be to investigate the effectiveness of the drug in other cancers; explore several other drugs identified along with thioridazine; and begin to analyze thousands of other compounds using McMaster's robotic stem cell screening system – the latter, in partnership with academic groups as well as industry.

"The goal for all of the partners is the same," Bhatia says. "We all want to find unique drugs that will change the way we tackle and treat cancer."

The research was funded by the Ontario Consortium of Regenerating inducing Therapeutics (OCRiT), which is an arm of Ontario's Ministry of Economic Development and Innovation, the Canadian Institutes of Health Research, the Canadian Cancer Research Institute, and private donors. Bhatia says such a large scale research endeavour would have been impossible without their support and vision.



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Maurice and the snow storm

Maurice, our Front Desk Agent, isn't exactly a huge fan of the snow. And driving in the stuff? He dislikes that even more. But one cold, grey December evening, our intrepid Maurice ventured out into one of the biggest storms of the season. What could have driven him to drive into this tempest? His sense of duty. You see, one of our guests had left an important item behind.

Knowing that a cab wouldn't make it to the airport in time to reunite our guest with his property, Maurice took matters, as well as a frigid steering wheel, into his own hands. Arriving at the airport with mere minutes to spare, Maurice personally handed the item to our surprised, and extremely relieved, traveller. Proof once again that, even after you've left our hotel, you're still a VIP.



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Web: www.rheosense.com

■ **Pumps** The Harvard Apparatus PHD ULTRA 4400 Syringe Pump delivers more than 200 lbs linear pumping force with accurate and smooth flow from 3.06 pl/min to 215.8 ml/min. It is offered in stand alone, remote, satellite and OEM models. The PHD Ultra 4400 includes colour LCD touch screen with icon interface. Users can Easily create, save and run simple to complex methods without a PC. It also offers flexibility in connectivity with a footswitch input, USB serial port, RS-485 ports for daisy chaining and a digital I/O. Optional RS-232 (RJ-11) ports available



Web: www.HarvardApparatus.com

■ **Sensors** The Mettler Toledo FlowIRTM High Pressure (HP) sensors for use with FlowIRTM. FlowIRTM is a small, dedicated



Fourier Transform Infrared Spectroscopy (FTIR) instrument that offers real-time flow chemistry monitoring nearly anywhere within a continuous reactor setup. Its HP Sensors expand the use of flow chemistry by allowing users to gain the enhanced control of critical process parameters provided by FlowIRTM in high-pressure experiments. Benefits include faster experiment optimization, easier lab-to-plant scaling, reduced costs, and shorter time-to-market. Interchangeable FlowIRTM HP Sensors, available in both Di-Comp and SiComp models, allow chemists working with high pressure experiments to quickly and easily swap sensor types to meet the needs of the current application. The new models can be trusted under pressures up to 50bar (725psi) and temperatures up to 120°C. No extra equipment or setup is required to use the new sensors. Users simply substitute the high-pressure version for the standard FlowIRTM sensor, gaining the same performance, optical window, chemical compatibility, and flow characteristics they enjoy with the standard sensor.

Web: www.mt.com/flowir

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Web: www.btxonline.com

■ **Pumps** Supercritical Fluid Technologies, Inc. introduces the completely self-contained SFT-10 Liquid Carbon Dioxide Pump. The SFT-10 pump can pressurize carbon dioxide up to 10,000 psi (69 MPa) at flow rates from 0.01 to 24.0 ml/min.



These characteristics make the SFT-10 an ideal pump for use in supercritical fluid extraction as well as a variety of other high pressure applications, including supercritical fluid reaction chemistry and chromatography. The SFT-10 utilizes reliable, dual sapphire syringe pump technology to achieve high pressures rapidly while its Peltier chiller has superior cooling capability. It maintains the temperature at the pump heads low enough to ensure the carbon dioxide remains liquid. The SFT-10 may be acquired as a stand alone CO2 pump or used as part of Supercritical Fluid Technologies' SFT-100 / SFT-100XW Supercritical Fluid Extractors.

Web: www.supercriticalfluids.com

■ **Columns** Phenomenex Inc introduces Yarra, a new family of aqueous size exclusion chromatography (SEC) columns for biomolecule analysis. Yarra columns are offered in three phases with 3-micron particles, and are ideal for the separation of small to large proteins and peptides, as well as biological therapeutics and biosimilars. Its proprietary hydrophilic surface chemistry ensures high resolution and minimal absorption of proteins for accurate quantitation. They are also highly reproducible, column-to-column and batch-to-batch. The lifetime of Yarra columns can be further extended with the SecurityGuard column protection system. Phenomenex offers complete online application and method development and optimization support for the new product.

Web: www.phenomenex.com

NEW PRODUCTS

■ **Chambers** Sheldon Manufacturing, Inc. introduces the SHEL LAB Bactrox Chamber, the latest addition to its line of anaerobic chambers. The Bactrox is ideal for stem cell research, mammalian cancer research and clinical and research microbiology. It offers precise oxygen and carbon dioxide control from 1 to 20 per cent. Removal of cultures from the incubator does not require exposure of cells to undesirable oxygen or carbon dioxide levels. The unit's advanced atmospheric controller allows for the use of a highly accurate and long-lasting zirconium dioxide oxygen sensor, with independent oxygen and carbon dioxide control and logging.



The Bactrox also has a standalone 300 plate incubator so users can comfortably work without gloves in ambient room conditions. To minimize set-up time, the Bactrox includes an extra-large vacuum-less sample pass box that takes only sixty seconds to purge. The new design provides a vacuum-less sleeve entry into the chamber. Other features of this unit include temperature control and logging, superior condensation control, and ultra bright LED examination lights inside the chamber.

Web: www.shellab.com

■ **High Throughput** Developed by Union Biometrika, Inc., the Copas Plus is suitable for high-throughput analysis and sorting of human induced pluripotent stem cell (hiPS) clusters using large particle flow cytometry. Union Biomet-



rica's large particle flow cytometers allow the analysis and sorting of intact hiPS cell clusters from a complex mixture of varying sizes based on size, optical density and fluorescent parameters. This process is gentle and does not influence the morphology or viability compared to manually sorted cell clusters.

Web: www.unionbio.com

■ **Probes** Omega introduces its new pH and ORP differential probes that stay in service and provide accurate measure-

ments under conditions that often render conventional pH probes inoperable. These probes feature integral 2-wire 4 to 20 mA transmitter, a built-in pre-amp that supports up to 914mm (3000') sensor-to-analyzer distance, 4.6 m (15') standard cable length and automatic temperature compensation on pH versions. Applications include: process control, industrial and municipal water treatment, food and beverage, chemical processing, and mining and power generation.

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August 5-9

Protein Society 26th Annual Symposium
Venue: San Diego, CA
Tel: 301-634-7277
Fax: 301-634-7271
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Web: www.proteinsociety.org

August 7-9

ICNFA 2012: 3rd International Conference on Nanotechnology: Fundamentals and Applications
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Web: www.international-aset.com/index.html

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ICMEM 2012: International Conference on

Mechanical Engineering and Mechatronics
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IFBLS 30th World Congress
Venue: Potsdam-Berlin, Germany
Tel: 905-528-8642 Ext. 31
Fax: 905-528-4968
Email: communications@ifbils.org
Web: www.ifbils.org

August 19-23

244th ACS National Meeting & Exposition
Venue: Philadelphia, PA
Tel: 202-872-6061
Email: nationalmeetings@acs.org
Web: www.acs.org

August 27-30

World Cancer Congress 2012
Venue: Montreal, Quebec
Tel: +41 22 809 1811
Email: congress@uicc.org
Web: www.worldcancercongress.org

August 28-30

ICEPR 2012: 2nd International Conference on Environmental Pollution and Remediation

Venue: Montreal, Quebec
Tel: 613-695-3040
Email: administrator@international-aset.com
Web: www.international-aset.com/index.html

SEPTEMBER

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ABIC 2012 in New Zealand: Adapting to a Changing World
Venue: Rotorua, New Zealand
Tel: 306-955-5059
Email: abicfoundation@abic.ca
Web: <http://www.abic2012.com/abic2012/index.cfm>

September 10-11

13th International Conference on Alzheimer's Drug Discovery
Venue: Jersey City, NJ
Web: www.worldeventsforum.com/addf/addrugdiscovery

September 10-13

Innovations in Biomedical Materials
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Tel: 614-794-5829
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THE FOSTERING OF A CLUSTER

Creating an Innovative Region



**Dr. Murray
McLaughlin,**
President & CEO,
Sustainable
Chemistry Alliance

Sarnia has been a cluster in the area of petrochemicals for well over 100 years and has benefited exceptionally from that cluster and the collaboration between the public and private sector.

However, as the petroleum industry has consolidated, reduced its research efforts locally, and centralized globally, Sarnia is now production focused for petroleum.

Recognizing this change, the Sarnia-Lambton community designed a bold plan to get the cluster on track for the 21st century. They brought together all the key people from the public, private, non-profit organizations and academic areas to assess the situation and ensure the cluster is continued with the right focus on creativity and innovation.

Approximately 10 years ago, Sarnia-Lambton ran a series of meetings with the purpose of looking at the future of a successful cluster. The outcome of these sessions was that in order to maintain the cluster there was a need to shift the focus. An emphasis on green and sustainable technologies that could benefit from partnering with the chemical/petroleum industry was the direction of the plan with the decision to build an innovative cluster. The community came together to ensure a focus on innovation and commercialization of technologies that could possibly enhance the local petroleum industry - be it new technologies, new partners or innovation that enhances sustainability.

In addition the local industry, the Sarnia-Lambton community created increased relations with Western University and Lambton College. They established a Research Park in Sarnia with research and pilot capabilities for green technologies at the Bioindustrial Innovation Centre (BIC). BIC as a non-profit was supported with a \$15 million grant from the Centre of Excellence for Com-

mercialization and Research (CECR), a federal government program managed by the NSERC program, BIC was organized into two support entities - The Research/Pilot facility (BIC) and Sustainable Chemistry Alliance (SCA). SCA was established as a standalone non-profit focused on investments in green and sustainable technologies that are moving to demonstration phase. To date SCA has 11 investments in its portfolio that generate jobs, collaboration and build on cluster development. Three of these investments have located in the Sarnia cluster.

A key driver is the cross-sector network activity in Sarnia-Lambton with government, university/college, non-profit organizations and businesses. This has lead to a true collaboration effort that restarts and reinforces the cluster and is a key part of the Michael Porter cluster prescription. (Michael Porter developed the original cluster concept.)

What drives the cluster? First of all, businesses need to provide the economic engine. They provide a large portion of the capital and drive innovation to maintain success. Sarnia-Lambton is seeing businesses step up, and new ones are being established. Why? Over the past few years Sarnia-Lambton has formed a common culture that welcomes innovation.

The whole shift to a new cluster focus has resulted in establishing an engine of sustainable innovation and economic growth for Sarnia-Lambton.



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- **Discover.** Experience innovation and groundbreaking technologies from around the globe.
- **Observe.** Learn about the goals and interests of world-wide regional bio-clusters.
- **Network.** Take advantage of this global platform and meet with international executives and thought leaders face-to-face.



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