

# 10 YEARS and STILL GROWING

## Message from the Vice President

Dear colleagues,

I am pleased to announce the coming launch of a new Genome Canada competition focused on the application of genomics research to the area of personalized medicine.

With a budget of a minimum of \$40 million, the competition will finance translational research projects with outcomes expected, on the one hand, to advance the development of the predictive, preventive, diagnostic or therapeutic applications of personalized medicine and, on the other, generate significant socio-economic benefits in the short and medium term, leading to improvements in the quality of patient care and greater cost-effectiveness of the Canadian health care system.

To reach these objectives, project teams should include at least one representative from an "end-user" organization, either as a collaborating researcher or as a member of the administrative team. Examples of end-users that fall under this category include organizations that determine health care practices, policies and programs and corporations that produce new health products and services.

The analysis of key ethical, environmental, economic, legal and social aspects of genomics (GE<sup>3</sup>LS) is another important part of the competition. As such, all scientific projects submitted will be required to incorporate a GE<sup>3</sup>LS component intended to determine the anticipated impact of scientific

developments on society. Stand-alone GE<sup>3</sup>LS research initiatives will also be eligible for funding.

I would like to acknowledge the timeliness and relevance of this Genome Canada initiative, which falls in line with Génomique Québec's priorities and the objectives of the 2010-2013 MDEIE Québec Research and Innovation Strategy.

I am convinced that this competition will position Québec globally as a leader in the application of genomics to personalized medicine. By encouraging innovation in this area, it will help foster an approach to medicine that will pave the way for improving health care, while limiting its costs.

I invite all Québec researchers interested in this competition to consult the Website for more information and submit their research proposals. Further details will soon be posted on the Genome Canada Website [www.genomecanada.ca](http://www.genomecanada.ca). •



**Catalina Lopez Correa**  
*Vice President,  
Scientific Affairs*



# What's new

## Genome Canada's EEG Competition: Québec Project Takes Top Spot



Spearheaded by Professor Denis J. Garand of the Department of Management at Université Laval, the project *Boosting Entrepreneurial Skills & Training in Genomics: BEST in Genomics!* was awarded, in September, \$1.2 million over three years as part of the Entrepreneurship Education in Genomics (EEG) pilot program. The funds were provided by Genome Canada (50%), Génome Québec (25%) and other sources (25%).

The EEG program was implemented in February 2011 in an effort to support initiatives aimed at developing the entrepreneurial skills of Genome Canada-funded researchers and help them convert their discoveries into marketable successes. Another goal of the program is to increase the economic benefits for Canada from genomics research.

More specifically, *BEST in Genomics!* will offer genomics researchers in Québec and the Maritime provinces, including graduates and research staff, four levels of entrepreneurship training and support. The first two levels will involve awareness and education activities to help them master the basics of entrepreneurship (level 1) and learn to recognize business opportunities inherent in their scientific projects (level 2). Most of these activities will be delivered online through the Université Laval ENA digital teaching environment, allowing participants to learn at their own pace in the comfort of their own workplaces. For subsequent levels, researchers will receive personalized support to maximize the marketable value

of an innovation stemming from their research (level 3) and develop a business plan to market that innovation (level 4).

From November to February, before the project is launched, members of the *BEST in Genomics!* team will be visiting the genomics scientific community in their own provinces. There they will meet the researchers in their labs and research centres to present the various steps of the program and invite them to complete online tests aimed at evaluating their entrepreneurial potential. The test results will be used to better identify the needs of participants and determine which of the four levels represents the best starting

point for each of them. Activities from levels one to three are expected to be ready by 2012, while those of level four will be completed by 2013, at the latest.

Génome Québec is proud to support *BEST in Genomics!* and calls on all researchers to take full advantage of the resources it will make available to them. To learn more, go to [www.bestingenomics.ca](http://www.bestingenomics.ca).

### The *BEST in Genomics!* Team

To carry out the *BEST in Genomics!* program, Professor Garand has brought together a multidisciplinary team of skilled professionals, including nine researchers and two representatives from the life sciences industry.

#### RESEARCHERS

Jacques Baronet: Université de Sherbrooke Entrepreneurship Institute

Catherine Beaudry: École polytechnique de Montréal, Department of Mathematics and Industrial Engineering

Michel G. Bergeron: Université Laval, Centre de recherche du Centre hospitalier universitaire de Québec (CRCHUQ)

Roger C. Lévesque: Université Laval, Institut de Biologie intégrative et des systèmes (IBIS)

Diane Poulin: Université Laval, Department of Management

Johanne Queenton: Université de Sherbrooke, Équipe de recherche en management de l'innovation (ERMI)

Marc-André Sirard: Université Laval, Centre de recherche en biologie de la reproduction

Maripier Tremblay: Université Laval, Department of Management

Sophie Veilleux: UQAM, Department of Marketing

#### INDUSTRY PARTNERS

Francis Beaulieu : Montréal InVivo

Richard Cloutier: Centre québécois de valorisation des biotechnologies (CQVB)

# What's new

## First Canadian Genomics Summit

### Message from Marie-Kim Brisson, Vice President, Public Affairs and Communications

The first Canadian Genomics Summit—a Génomique Québec initiative organized in partnership with Genome Canada and the genomics centres of British Columbia, Alberta, Ontario, the Prairies and the Maritimes—was held on October 11, 2011 in Montreal. Bringing together genomics experts and influential actors in the health sector from all parts of Canada, the event focused on how to best apply genomics research findings to the country's health care systems.

The meeting was an opportunity to both highlight the benefits of genomics for health care and discuss the challenges of passing on genomics knowledge and tools to health care professionals, managers and decision makers. Two major observations

came out of the event. The first is that genomics is already producing tangible results and positive change, the pace of which will only accelerate in the future. Second, Canada's health care systems and stakeholders at every level must be better prepared to meet this major shift that will bring about change in terms of medical technology and our approach to medicine.

In light of the above observations, suggestions for future action were recommended. For example, participants underscored the importance of fostering dialogue between genomics researchers and health care professionals to ensure that both groups understand the respective needs and realities facing the other. They also pointed out that the successful

implementation of genomics-based health care will require a step-by-step approach, such as recourse to pilot projects.

A white paper to be released in early 2012 will present a summary of the Summit's key messages and establish the priorities that will continue to guide the discussion and reflection on the topic.

The Summit was the first of a series of initiatives aimed at strengthening the ties that bind genomics researchers and the key decision makers in charge of transferring genomics knowledge to the various health sectors. Genome Canada and the genomics centres are planning similar events that will address other relevant themes. •



# Faces of research

## B. Franz Lang



### Professor Lang

Professor, Biochemistry Department,  
Université de Montréal

Chairholder, Canada Research Chair  
on Comparative and Evolutionary  
Genomics

Director, Robert Cedergren Centre

*Synergie* is proud to present the two co-directors of the project, *Improving Bioremediation of Polluted Soils through Environmental Genomics*, selected as part of Genome Canada's 2010 Large-Scale Applied Research Project Competition.

### B. Franz Lang: Understanding the origin and evolution of eukaryotes

For nearly 25 years, B. Franz Lang has been exploring the DNA of organisms belonging to the earliest branches of the tree of life. He is attempting to discover how the first eukaryotes came into existence more than a billion years ago and how they subsequently evolved into the plethora of animals, plants and fungi we know today.

To do so, Professor Lang led large-scale sequencing projects aimed at decoding the mitochondrial, plastidial and nuclear DNA of several protists (ancestral unicellular eukaryotes), as well as the mitochondrial DNA of the main strains of fungi. Using bio-informatics tools he helped develop, Professor Lang then analyzed these genomics data and compared them to those of other organisms, with the goal of establishing the kinship among various species.

Professor Lang was the first to decipher the *Reclinomonas americana* protist, the most primitive mitochondrial genome known to date, and identify its resemblance to bacterial DNA. This major discovery was featured in *Nature* in 1997 and provided an additional argument in support of the endosymbiotic theory, which postulates, among other things, that mitochondria developed as the result of bacteria being incorporated by primitive eukaryotic cells.

Professor Lang's work has also shed light on some of the relations among the biological kingdoms. For instance, his research revealed that, contrary to what was commonly held, animals are more closely related to fungi than to plants. His work also retraced the closest unicellular relative of animals, namely protists of the *Choanoflagellata* and *Ichthyosporea* groups.

Thanks to the research work of Professor Lang, ancient evolutionary events have become clearer, previously unknown genomics data have been published and new bio-informatic approaches for genome analysis have been developed.

### Eukaryotes

The eukaryote domain consists of organisms composed of cells containing a nucleus and, in most cases, mitochondria and other organelles. It includes plants, animals, fungi and protists. It differs from the prokaryote domain, which features organisms from the two oldest categories of living things: bacteria and archaeobacteria, unicellular organisms that lack a nucleus and mitochondria.

# Faces of research

## Mohamed Hijri

### Mohamed Hijri: Unlocking the secrets of arbuscular micorrhizal fungi

For 10 years or so, Mohamed Hijri has been studying arbuscular micorrhizal fungi (AMF). Using techniques from molecular biology, cell imagery and genomics, he is attempting to understand their genetic structure, evolution, reproduction and the role they play in the environment.

Professor Hijri has helped bring to light a surprising feature of AMF, namely that they contain not one, but several nuclear genomes. Published in *Nature* in 2001, this discovery sent a shockwave through the scientific community, since it called into question the theories of evolution and heredity grounded in the idea of “one individual = one genotype.”

The work of Professor Hijri also identified little-known genetic characteristics of AMF, for example that they possess only one member of each pair of chromosomes (haploidy) and present a high degree of polymorphism at the species, individual and cellular levels. More recently, he has been leading research projects that show how AMF are able to fight off a parasite of the potato plant and other initiatives that identify which AMF species are better able to survive in soil contaminated with heavy metals.

By tackling AMF from all these different angles, Professor Hijri has successfully unlocked many of their secrets, shedding light on several fundamental aspects of their functioning and structure.

### Genomics improving bioremediation

Through their project, *Improving Bioremediation of Polluted Soils through Environmental Genomics*, professors Lang and Hijri are using their expertise to achieve new objectives. Backed by a team of 14 researchers, they now plan on developing an innovative process using willows and the microorganisms that live in their root systems (bacteria, AMF and other fungi) to rehabilitate polluted soils.

With an approach that combines molecular biology, genomics and other “omic” sciences, the research team will carry out a detailed analysis of the biological processes that enable the willow to naturally decontaminate polluted soils using their bacterial and fungal counterparts. From these data, the researchers will then develop technologies and protocols aimed at promoting the growth and efficiency of this living purifying system.

The knowledge and applications generated by this research will make it possible to optimize the bioremediation of polluted soils. This could lead to the development of ecological and economical alternatives to traditional decontamination methods, which are often extremely costly and less effective. •



### Professor Hijri

Professor, Department of Biological Sciences, Université de Montréal  
Researcher, Institut de recherche en biologie végétale

### Arbuscular micorrhizal fungi (AMF)

AMF are microscopic organisms that live in the roots of 80 percent of all plant life, promoting their growth and their resistance to disease. As a result, they play a fundamental ecological role. There are some 200 species of AMF.

# New technologies

## Focus on the Human Proteome Project

Launched in September 2010 by the Human Proteome Organisation (HUPO), the Human Proteome Project (HPP) had been percolating in the minds of scientists for more than a decade. During that period, the project was defined, then fine-tuned and finally tested through a pilot phase. At the same time, the technology on which it relies reached the level of maturity required for a comprehensive understanding of the human proteome. For an update on this international initiative, *Synergie* interviewed K.W. Michael Siu and John J.M. Bergeron, two prominent Canadian scientists working on the development and implementation of the HPP.

According to Professor Siu, the transition from the genome to the proteome represented a major technological challenge. While the genome of an individual is present in every cell and remains constant throughout a person's life, the proteome—the set of proteins expressed by a genome—varies based on the location of the cells, their physiological state and their stage of development. Individual genes can also generate several versions of a protein. As a result, an organism's proteome changes over time and space, with each protein also featuring more than one facet. Highly accurate technology is therefore needed to map and characterize the full set of proteins coded by our DNA. And that is exactly what the HPP intends to do.

Thanks to major advancement in mass spectrometry and its related techniques, added Professor Siu, it is now possible to detect, quantify and locate proteins with a high degree of accuracy—including low-abundance proteins, the most significant from a functional standpoint. Professor Bergeron, for his part, explained that, in recent years, mass-spectrometry proteomics has adopted standardized protocols and bio-informatics tools, allowing the highest standards in scientific excellence to be met.

Now that the HPP is underway and technically feasible, the HUPO is

coordinating international efforts to ensure its achievement. To that end, proteomics researchers have been asked to form consortia in individual countries to “adopt” a chromosome and analyze the proteins coded by its genes. And so, in September 2011, the Canadian National Proteomics Network (CNPN) launched the Canadian Human Proteome Project (CHPP). After four workshops that involved a wide spectrum of Canadian as well as international scientists, HUPO, and potential industrial partners, two initiatives have crystallized around chromosomes 6 and 21. Work on chromosome 6 will be spearheaded by Paul A. Keown of the University of British Columbia, while research on chromosome 21 will be led by Professor Bergeron of McGill University. A position paper has been sent to Genome Canada and other funding agencies. With the exception of funding that still needs to be consolidated, everything is now set for the research work to begin, explained Professor Siu.

Both professors Siu and Bergeron agree that countries that choose to invest in the HPP will reap significant benefits. The project will help identify and locate proteins in the various tissues, organs and fluids of the human body and measure their quantity, define their functions and determine how they interact. By comparing these data in healthy and unhealthy subjects, researchers will then be able to detect protein patterns of many diseases and discover new targets for treatment—two preliminary steps in the development of new drugs and diagnostic tools.

Both Canadian initiatives are especially promising, professors Siu and Bergeron mentioned. In fact, the two chromosomes under study here in Canada are involved in over 150 diseases, including Alzheimer's, several cardiovascular diseases, type 1 diabetes, arthritis and various types of cancer. The Canadian HPP has the potential of making major strides in our understanding of a broad range of incapacitating illnesses. These breakthroughs will lead the way to the



**K.W. Michael Siu – PhD, FCIC, FRSC**

Distinguished Research Professor and NSERC / AB SCIEX Senior Industrial Research Chair • Department of Chemistry, York University • Director, Centre for Research in Mass Spectrometry • Member of the HUPO Board of Directors • Chairman, Board of Directors, Canadian National Proteomics Network, spearheading the Canadian HPP



**John J. M. Bergeron – PhD**

Professor, Department of Anatomy and Cell Biology, McGill University • Member of the HUPO Board of Directors • President of the HUPO Board of Directors from 2003 to 2005 • Lead investigator of the Québec initiative on chromosome 21

development of marketable applications that will subsequently be used in clinical research and medical practice. In other words, the Canadian project holds great potential, both in terms of improving the health and welfare of the population here and abroad and increasing our collective wealth.

Professors Siu and Bergeron are inviting private and public funders to invest in the Canadian HPP, pointing out that countries such as France, Sweden, China and South Korea have already secured financing for their adopted chromosomes. •

# News Flash

## COMMUNICATING LIFE SCIENCES TO THE PUBLIC

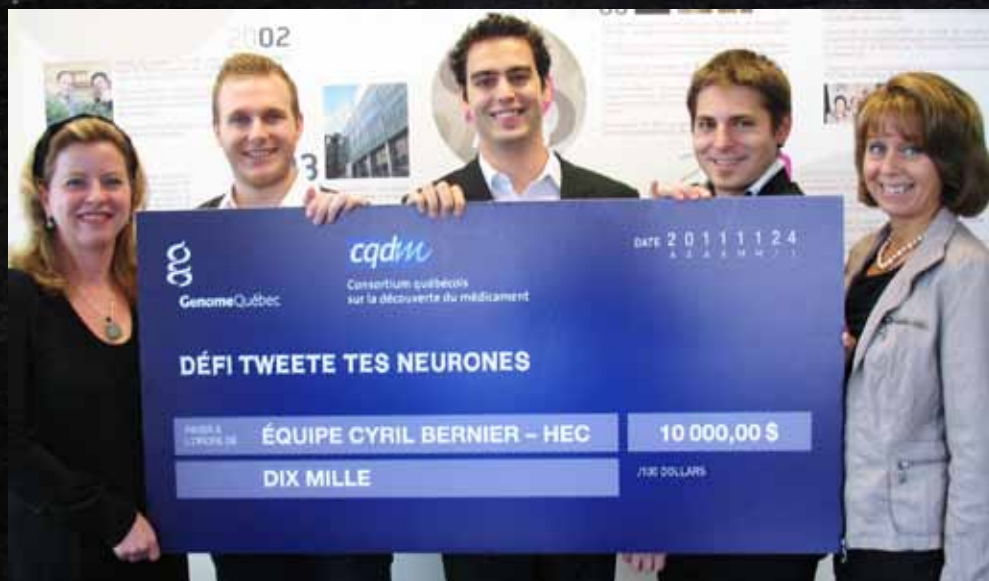
### WINNERS OF “TWEETE TES NEURONES!” CHALLENGE PITCH IN

Génomique Québec and the Québec Consortium for Drug Discovery (CQDM) are happy to announce the winners of the “Défi Tweete tes neurones!,” a contest organized to promote the life sciences sector, in particular medical and biopharmaceutical research.

The winning team, which included **Anthony Hachez, Cyril Bernier and David Pontbriand**, marketing students at École des Hautes études commerciales de Montréal,

was awarded a \$10,000 cheque for its top-notch promotional campaign entitled, “Parlons-en de vive voix.” The project’s goal was to create an original approach to raising awareness and connecting with individuals 18-34 regarding the importance of technological breakthroughs in Québec’s life sciences sector. •

To learn more:  
[www.tweetetesneurones.com](http://www.tweetetesneurones.com)



From left to right: Marie-Kym Brisson, Vice President for Public Affairs and Communications for Genome Québec, the winners of the HEC Montréal Anthony Hachez, David Pontbriand and Cyril Bernier, Diane Gosselin, Vice President for Research and Business Development at CQDM.

