10 YEARS and STILL GROWING

Synergie

No. 6 • Spring 2011

Message from the Vice President

Dear colleagues,

To begin, I would like to mark the arrival in Québec of a leading authority in genomics, Mark Lathrop. Professor Lathrop was appointed as the Scientific Director of the McGill University and Génome Québec Innovation Centre last February as part of our *Recruitment Program*. A native of Alberta, he lived in Europe for some thirty years, where he distinguished himself for his outstanding scientific contribution to applied genomics in human health. He also founded and managed three major research facilities: the *Centre national de génotypage* and the *Fondation Jean Dausset-Centre d'Etude du Polymorphisme Humain* in France, along with the Wellcome Trust Centre for Human Genetics in the United Kingdom. The presence of this leading researcher here at home will most certainly help Québec remain a front-runner in genomics both in Canada and abroad. I am convinced that through his leadership, the Innovation Centre will climb to new heights.

I am also pleased to present two new competitions launched in the spring. The first is the *Support for International Collaboration in Genomics* program. It aims at promoting networking between Québec and foreign researchers to facilitate Québec's participation in innovative international research initiatives. The purpose of the second competition – *Québec Vert* – is to finance pilot projects that use genomics to solve issues related to ecosystem health. It will give Québec researchers the opportunity to gather important data needed for the development of large-scale environmental genomics projects in order to secure funding from provincial, federal and international competitions, in particular those of Genome Canada.

Finally, I would like to focus for a moment on personalized medicine, an area that is especially important to us here at Génome Québec and one where genomics serves as an essential pillar. In the past, I have mentioned our enthusiasm for playing a key role in the expansion of this new approach to health care. In keeping with this vision, we have elected to concentrate our efforts on its predictive and preventive aspects and will soon be implementing initiatives in this respect.

For more details on our two new competitions and to stay abreast of coming initiatives, please visit our Website at **www.genomequebec.com**. •

Catalina Lopez Correa
Vice President, Scientific Affairs

What's new

New Genome Canada *Entrepreneurship Education in Genomics* (EEG) program

Launched on February 1st, 2011 by Genome Canada, the EEG pilot program aims at providing Canadian genomics scientists with assistance to facilitate the translation of their discoveries into successful business ventures.

The competition associated with the program called on experts in scientific and technological commercialization to recommend innovative approaches that could help Genome Canada–funded researchers enhance their entrepreneurial skills. Canadian business schools were asked to submit proposals, preferably jointly with one or more organizations or businesses working in a relevant field. Candidates had to register their projects by February 14th. Once their eligibility was confirmed, they were invited to present a full request no later than May 2nd.

Results of the competition will be announced in mid-July. Genome Canada plans on allocating the $1 million available to at least two projects, perhaps more. If the selected projects produce the results expected, they will form the basis of a recurring national program. •

Good luck to the two teams from Québec who qualified!

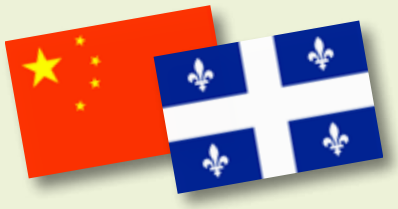
First project funded by the Québec-China *Research on Genomics and Diseases* program

The *Fonds de la recherche en santé du Québec* (FRSQ), Génome Québec and the National Natural Science Foundation of China (NSFC) are funding a first project under the joint program *Research on Genomics and Diseases*, launched in July 2010.

Aimed at better understanding the causes of male infertility, the project involves a research team from Québec and another from China. The first is led by Simon Wing of McGill University, while Wenming Xu of the West China Second University Hospital (an affiliate of Sichuan University) is spearheading the second.

The FRSQ and Génome Québec are providing $150,000 over three years in support of the research work conducted here, and the NSFC is granting 450,000 yuan for the same period for work carried out on its soil.

The *Research on Genomics and Diseases* program is a direct result of the Québec-China Workshop on Genomics held in Beijing in October 2009.



The FRSQ and NSFC are both thrilled at the prospects of hosting a second joint workshop next fall in Montréal, this time on aging. •

Génome Québec scientific café

On March 29th, Génome Québec organized a scientific café on the environment at McKibbins Irish Pub in Montréal. Hosted by Patrick Masbourian, the event attracted some fifty guests who came out to converse with Mohamed Hijri (Université de Montréal), Adrian Tsang (Concordia) and Anwar Naseem (McGill), three researchers working on various aspects of environmental genomics. Up for discussion were the new opportunities provided by genomics for the decontamination of polluted soils and the production of bioproducts to replace fossil fuels, petroleum-based plastics and other pollutants. The economic and social impact of biotechnologies resulting from genomics research was also addressed. "Do genomes hold the key to our environmental problems?" asked the host. To that question, the experts answered a resounding "yes!" And judging by the participants' level of interest throughout the evening, that question was certainly worth asking! •

Watch the clip on YouTube: Génome Québec scientific café

The face of research

Unravelling the secrets of tree DNA for developing sustainable forests

The projects of three Québec researchers were selected as part of Genome Canada's 2010 Large-Scale Applied Research Project Competition.

Today, *Synergie* is pleased to present one of those researchers, John MacKay, Co-Leader of *SMarTForest*. Our next issue will feature the work of the remaining two researchers, B. Franz Lang and Mohamed Hijri, who are co-managing the project *Improving Bioremediation of Polluted Soils Through Environmental Genomics*.

John MacKay, a professor at Université Laval, has spent more than 20 years exploring the genetic and molecular basis of wood formation and wood characteristics of forest trees. Relying heavily on functional genomics, his research has led, among other things, to the identification of many of the genes that control tree growth and wood properties, as well as to a better understanding of their function and regulation. For instance, his research has shed light on the mechanisms governing the development of cell walls responsible for wood's strength and solidity, especially in the formation of lignin, one of their major and unique components. It has also revealed a high level of metabolic plasticity in the formation of lignin in forest trees–a previously little-known fact that has had significant scientific repercussions.

Professor MacKay also launched and co-directs Arborea, a major forest genomics project, which ran from 2002 to 2011 and rapidly became a world reference in the area. As part of the Arborea project, he sequenced and analyzed the expressed genes of white spruce. The data resulting from this massive undertaking, combined with those of Treenomix, another Canadian tree genomics initiative, led to the creation of the most comprehensive gene catalogues, among forest trees, an inventory of some 28,000 spruce genes, in other words, 85 percent of the anticipated total number of genes. The data was also used to develop the first DNA microarrays for the species. In addition, using the gene sequences from Professor MacKay's work, Arborea researchers were able to continue their investigation into the genes of the white spruce, allowing them to gain greater insight into their natural variability and correlate specific alleles with their phenotypic effects.

In July of this year, Professor MacKay, in conjunction with Jörg Bohlmann of the University of British Columbia, will launch *SMarTForest*, the largest pan-Canadian initiative in forest genomics ever conducted. 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 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, *SMarTForest* will be contributing to the sustainable development of our forests and the vitality of this key sector of the Canadian economy. For Professor MacKay, *SMarTForest* is the culmination of an approach he has emphasized throughout his scientific career: using knowledge gained through the study of tree genes in order to generate socio-economic benefits for society as a whole. •

John MacKay

New technologies

New high-throughput platform to study gene expression

A new tool to study gene expression has recently been developed at the McGill University and Génome Québec Innovation Centre. Dubbed the "Living Microarray Platform," it can measure, with high temporal resolution, the parallel expression of promoters in thousands of individual living cells, for as long as seven days. Robert Sladek, a professor at McGill University, a researcher at the Innovation Centre and the project's co-director, presents this innovative platform and its potential applications.

The array, he explains, is produced on an 8.6 cm^2 coverglass slide using reverse transfection, a method that was designed to introduce foreign genetic material into living cells. The genetic material is specially made for the platform and features a reporter plasmid, which includes the promoters under study and fluorescent constructs. When introduced into living cells, it triggers the activity of the promoters, leading to the synthesis of fluorescent proteins (Venus and ECFP). The resulting fluorescence can then be detected, traced back to the cells emitting it and subsequently measured in order to quantify the level of promoter expression.

Once completed, a microarray contains 600 to 1000 spots, each including an average of 75 transfected cells. Using automated microscopy, imaging then begins. Every 20 minutes, the system scans each spot of the microarray, capturing the images of the cells and recording their fluorescence, position and morphology. They are then segmented into independent images. This allows researchers to see the variation in expression levels of the promoters under observation.

According to Professor Sladek, one of the main advantages of the Living Microarray Platform is its ability to measure, with speed and accuracy, the dynamic changes in transcriptional activity associated with a given promoter. This makes it a powerful tool for the study of the temporal regulation of gene expression, particularly in complex processes, such as cellular division and differentiation. Professor Sladek also notes that the platform will be able to detect anomalies in the gene expression "clock"– for example when gene transcription occurs too soon or too late. This, he adds, could help us discover any existing correlations between these anomalies and the onset of diseases.

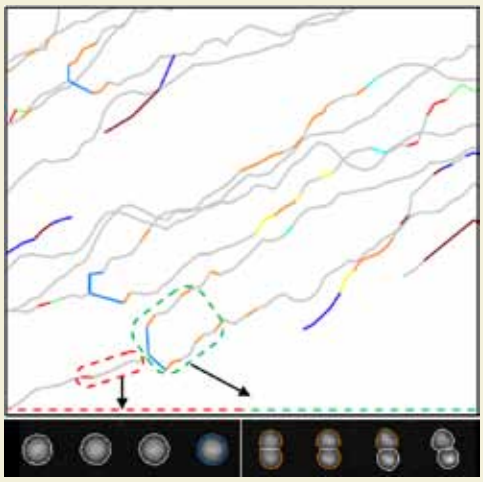
Another noteworthy asset of this platform, according to Professor Sladek, is its capacity for studying, in parallel, a large number of individual cells. This facilitates experimentation on numerous promoters using a small number of cells, a significant advantage when analyzing the interaction among several genes in multigenic diseases, such as diabetes. It also simplifies the study of rare cellular events in heterogeneous samples (from tumours, for instance), potentially leading to a better understanding of cancer.

The Living Microarray Platform is currently being fine-tuned, explains Professor Sladek. A year from now, it is expected to be part of the Innovation Centre's inventory of tools used for the analysis of gene expression. •

Many researchers have worked to develop this platform:

- Robert Sladek, Co-director of Development (McGill University and Génome Québec Innovation Centre)
- Thomas J. Hudson, Co-director of the Project (University of Toronto)
- Saravanan Rajan (University of Toronto)
- Haig Djambazian (McGill University and Génome Québec Innovation Centre)
- Huan Chu Pham Dang (McGill University)
- Hans De Sterck (University of Waterloo)
- Justin Wan (University of Waterloo)
- Bernhard Bodmann (University of Houston)

Robert Sladek, professor at McGill University.



Each tracked cell trajectory is represented by a graph where cell divisions branches are shown in blue, the cell contours are shown in the bottom strip. After a cell has divided, the tracking algorithm continues to follow the daughter cells as shown in the image sequence in the bottom strip. The transition marked with the vertical white line marks the start of the telophase in the mitotic phase of the cell division.

News flash

Génome Québec funds two Canadian projects on childhood diseases

Two Canadian research projects on childhood diseases were undertaken in 2011. Financed by Genome Canada, the Canadian Institutes of Health Research, Génome Québec and Genome BC, the aim of the research is to identify the genes involved in the most challenging types of cancer and rare diseases affecting children in order to develop new diagnostic tests and treatment for these serious illnesses.

Two Québec researchers are participating: Dr. Jacques Michaud of the *Centre hospitalier universitaire Sainte-Justine* is working on the FORGE Canada project (Finding of rare disease genes in Canada), and Dr. Nada Jabado of the McGill University Health Centre is associated with the Canadian Pediatric Cancer Genome Consortium. •

Genomics on the Hill

Two Québec researchers took part in Genomics on the Hill, an event hosted by Genome Canada on November 22nd, 2010. **Maryam Tabrizian** of McGill University discussed the new high-throughput proteomics platforms developed under her leadership, while **Vincent Martin** of Concordia University reported on his research pertaining to the synthesis of high-value plant metabolites.

Held on Parliament Hill in Ottawa, the gathering provides Genome Canada-funded researchers the opportunity to present their projects to Members of Parliament, Senators, government officials, ambassadors and other key stakeholders. •

THE DÉFI TWEETE TES NEURONES !

Twenty student teams from universities McGill, Laval, Montréal, UQAM, UQTR and HEC Montréal signed up for the *Défi Tweete tes neurones!*, a competition launched by Génome Québec and the CQDM (Québec Consortium for Drug Discovery). The teams were asked to develop a campaign promoting medical and biopharmaceutical research in Québec and submit their proposals by May 25th. Five finalists will be selected by a jury on June 13th. The winning team, to be announced in September, will be awarded a grant of $10,000. For more details on the competition, visit **www.tweetetesneurones.com**. •