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GenomeCanada

BACKGROUNDER

Genomic Applications Partnership Program
Funded Projects – Round 2

The Genomic Applications Partnership Program (GAPP) funds research projects that address real world challenges and opportunities as identified by industry, government, not-for-profits and other users of genomics research. The following seven projects have been selected for funding in the second round of funding under the Program.

Better Feed for Better Fish: Biomarker Platform for Commercial Aquaculture Feed Development

Project Leaders: Matthew Rise, Memorial University; Richard Taylor, EWOS Innovation
Lead Genome Centre: Genome Atlantic

The health of farmed salmon in Canada is threatened by infectious diseases including those caused by pathogenic viruses and bacteria. The quality of feed can affect salmon health, but currently there is no way to measure how effective it is apart from growth rates – if fish grow bigger, faster, then presumably the feed is effective.

This project seeks to develop tools to better assess salmon health from their genes. Scientists at Memorial University and EWOS Innovation will jointly develop a platform to quantify the expression of multiple genes related to health and performance, using a single biological sample. This will allow EWOS, one of the world's largest producers of aquafeeds, to develop novel, high-quality feeds, thus increasing its market share and profitability. New feeds will be commercialized within the life of the project and continue for three to five years following the project's completion. Some of these feeds will focus on growth, while others – clinical feeds – will focus on combatting the infections that are currently reducing salmon numbers.

The research will strengthen salmon aquaculture in Canada, in particular by reducing disease among farmed salmon. In addition, some project results will be shared as intellectual property, supporting growth in the sector. Finally, a focus on the use of Canadian raw materials in developing the feeds will also strengthen the feed supply industry.

Making Feed Go Further: Development and Commercialization of Next Generation Enzymes Supplement for Pork and Poultry

Project Leaders: Adrian Tsang, Concordia University; Paul Matzat, Elanco Animal Health, a division of Eli Lilly & Co
Lead Genome Centre: Génome Québec

Feeding swine and poultry doesn't come cheap; in fact, feed costs eat up some 70 per cent of costs for producing the pork and poultry consumed in Canada. Yet up to one-quarter of that feed doesn't actually do much, because the animals lack the enzymes that would allow them to digest it. Delivering those enzymes to animals is big business, amounting to $800 million a year globally, and expected to grow steadily, up to 7-8 percent each year.

Elanco, a major global animal health company, is partnering with Concordia University in its first large-scale product development collaboration in Canada in its 60-year history, to develop new enzyme combinations for pork and poultry producers. The project, which will begin by screening proprietary enzymes for digestibility of common ingredients found in Canadian pork and poultry feed, will result in commercial products suited for the diverse Canadian feed market, that are expected to result in significant improvements in feed conversion and thus improve producer profit margins.

The project, if successful, will benefit the company, the university and Canada. Elanco is committed to investing in this exciting area of research and development with the objective of improving customer profits and providing an attractive return on this research investment. Concordia would receive royalty income, and likely continue to partner with Elanco to develop genomics-derived technology for Canadian agriculture. Canada will see lower production costs and increased international competitiveness for swine and poultry producers and more competitively priced meat and eggs for domestic consumption; increased use of Canadian grains such as canola in feed production; reduced land use for feed production; and training of highly qualified personnel. This joint effort will provide a new road map for sustainable and innovative partnerships to improve global food supplies.

Matching the Drug to the Patient: Safer and More Effective Drug Therapy for Mental Health Patients

Project Leaders: James Kennedy, Centre for Addiction and Mental Health; C. Anthony Altar, Assurex Health.
Lead Genome Centre: Ontario Genomics Institute

One in five Canadians will experience some form of mental illness in their lifetime. Treatments are available but each person responds differently to them, in part because of their genes. A clinically proven genetic test, called GeneSight, analyzes an individual's genes and recommends the optimal drugs for that person along with dose adjustments among the 33 most commonly prescribed antidepressant and antipsychotic drugs. Clinical testing in the United States has shown that GeneSight doubles the odds of a patient responding to antidepressant medication. More than 100,000 patients have received GeneSight tests in the United States.

Now, Assurex Health, the company that developed GeneSight, is partnering with scientists at Toronto's Centre for Addiction and Mental Health (CAMH) to develop the Enhanced GeneSight (E-GeneSight) genomic test. E-GeneSight will incorporate new genomic markers that scientists

at CAMH have identified and characterized for their association with patient responses to psychiatric medications. Assurex Canada and CAMH will together validate these markers for their ability to predict efficacy and side effects of psychiatric medications; the most predictive markers will be integrated into E-GeneSight. E-GeneSight, when launched in 2017, is anticipated to reduce the need for "trial-and-error" approaches to prescribing and increase the likelihood that people will respond optimally to the medications prescribed for them, while reducing side effects.

This will increase the proportion of patients who stay on their medications and improve their quality of life. It will also save the Canadian healthcare system $4,000 per year per treatment-resistant patient and will generate royalty revenues for CAMH as E-GeneSight is marketed internationally.

Healthy Veins, Healthy Kidneys: Developing Vasculotide, a Genomic/Proteomic-Derived Treatment to Target Vascular Inflammation and Destabilization

Project Leaders: Dan Dumont, Sunnybrook Research Institute; Parimal Nathwani & Paul Van Slyke, Vasomune Therapeutics
Lead Genome Centre: Ontario Genomics Institute

More than one million cardiac surgeries are carried out each year, usually successful. Nearly one-third of high-risk patients, however, will experience a rapid loss of kidney function after surgery, known as Acute Kidney Injury, or AKI. AKI is the result of short-term interruptions in blood flow during surgery; 11 percent of patients who develop AKI after bypass surgery will die, compared to 2 percent of those who do not. Those who survive AKI are at risk of developing longer term kidney complications such as chronic kidney disease or End Stage Renal Disease. There is, therefore, a pressing need for better ways to prevent or treat AKI.

DRS Dumont and Van Slyke conceptualized and designed a drug called Vasculotide (VT) that binds to the Tie2 receptor, which is responsible for maintaining vascular health (and thus blood flow). Vasomune Therapeutics, the company developing and commercializing the drug, is partnering with these researchers to develop VT to the point where it is ready for human clinical trials. AT that point, Vasomune will be positioned to seek venture capital for further development.

Within three-to-five years of the end of the project, Vasomune will be a venture-backed Ontario biotech company with a Phase II clinical program in renal disease. Being able to prevent or reverse AKI will save the healthcare system as much as $1 billion each year, in part because fewer patients will develop chronic kidney disease. Canadians will also have earlier access to VT. Commercializing VT will also bring financial returns to Canada and provide training and create jobs for highly qualified personnel.

Fighting Heart Failure: Cardiovascular Biomarker Translation Program

Project Leaders: Peter Liu, University of Ottawa Heart Institute; Gabriela Bucklar-Suchankova, Roche Diagnostics International Ltd.
Lead Genome Centre: Ontario Genomics Institute

Heart failure (HF) is the most costly chronic disease in developed and developing countries. More than 26 million people worldwide are suffering from HF, placing great stresses on patients, caregivers and health care systems. The number of patients will be increasing in the next decades due to ageing populations, therefore improved diagnosis and therapy of HF are important goals of major healthcare organizations.

In keeping with its mission to identify areas of unmet medical needs and develop innovative health care solutions, Roche Diagnostics is partnering with the University of Ottawa Heart Institute (UOHI) to develop a better way to identify and classify HF, based on testing novel biomarkers for the disease. To date, with previous Genome Canada funding, UHOI, University of Toronto and Roche Diagnostics have identified eight novel biomarker candidates for HF characterization and have filed for global patents for these candidates. Now, the partners will conduct further clinical evaluation of the biomarkers, with the intent of developing a HF biomarker panel and an accompanying clinical development program to translate the findings from basic research to clinical benefit of patients. Partnering with Roche has the strategic advantage that their diagnostic test might run on more than 40,000 Roche Diagnostic instruments worldwide.

The Panel aims to assist physicians in earlier identification and classification of HF and support personalized HF treatment that might result in more effective therapies and better outcomes for HF patients. These are important aspects in view of patient burden and costs associated with HF, with particular focus on minimizing length of hospitalization, re-admissions, unnecessary treatments and adverse events. The project aims at promoting Canadian leadership in medical innovation and attracts additional partnerships and investments from major leaders in the global biotech industry.

Delving into Mouse Proteins: Development of Disease Biomarker Assessment Assays and Kits for Targeted Quantitative Proteomics of Mouse Plasma by Mass Spectrometry

Project Leaders: Christoph Borchers, University of Victoria; Gary Kruppa, MRM Proteomics, Inc.
Lead Genome Centre: Genome British Columbia

Proteomics – the study of proteins found in human cells and how they regulate their actions – is one of the most promising areas for developing new therapies for human diseases. It is currently extremely difficult, however, to carry out proteomic research on mouse models, the mainstay of most other forms of biomedical research, due to the small volumes of blood that can be sampled from live animals.

MRM Proteomics, Inc., and the University of Victoria – Genome BC Proteomics Centre are together developing new tools that will enable researchers to use mouse models for proteomics research. The tools are based on multiple reaction monitoring mass spectrometry (MRM-MS) and consist of assays (or tests) that allow researchers to measure the concentration of individual

proteins in mouse plasma. The MRM-MS technique is highly sensitive, making it compatible with very low sample volumes such as those obtained from individual mice. Three new products will be developed: a complete assay to quantify the 500 most abundant proteins in mouse plasma as a service offering; three kits for disease biomarker proteins, one each for discovery research, oncology and cardiovascular diseases; and two kits for quality control of mouse plasma proteomics experiments. All three will be delivered to customers ready to use, and adapted for use with instruments from different manufacturers.

Currently, there are no assay kits for mice that companies can use in their own facilities and few organizations offer mouse proteomics assay services. With its new tools, MRM Proteomics, which is already known for its human proteomics MRM-MS assays and kits, will strengthen Canada's leading position and competitiveness in biomedical research and proteomics. The mouse kits could generate $8.4 million within five years after completing the project, with increasing sales thereafter, leading to increased staffing for both MRM and the Proteomics Centre.

Getting at Pests Early: Protecting Canada's Forests against Invasive Alien Species by Next Generation Biosurveillance

Project Leaders: Richard Hamelin, University of British Columbia; Cameron Duff, Canadian Food Inspection Agency
Lead Genome Centres: Genome British Columbia and Génome Québec

Invasive alien species like emerald ash borer are in the news, causing irreversible damage to the environment and costing hundreds of millions of dollars to the Canadian economy, affecting agriculture, forestry and international trade.

The Canadian Food Inspection Agency (CFIA) protects Canada's forests and agricultural resources by intercepting alien forest pests and intervening before they establish themselves. The Agency is partnering with scientists at the University of British Columbia and a network of academics from Université Laval in Québec and Natural Resources Canada to develop, validate and deploy genome-based biosurveillance tools aimed at two species – the Asian gypsy moth (AGM), which feeds on a wide range of economically important tree species, and *Phytophthora ramorum* (PR), which attacks dozens of plants and tree species including oak trees. The tools will use DNA detection arrays that target unique genome regions in the pests, improving CFIA's ability to better detect and identify these two species. The project will take approximately three years, after which CFIA laboratories will use the tools to enhance and complement their current procedures.

The benefits will be significant. Knowing more about the sources of infestations will decrease the resources needed for inspection and surveillance and reduce treatment costs. By preventing the introduction and establishment of these pests in the first place, the costs of dealing with them will be avoided, while Canada's pest-free status, important to maintaining expert markets, will be maintained. Adoption of these tools is forecast to save an estimated $374-$625 million over three-to-five years.