GenomeCanada

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BACKGROUNDER

Genomic Applications Partnership Program
Funded Projects – Round 8

The Genomic Applications Partnership Program (GAPP) funds translational research and development projects that address real-world challenges and opportunities as identified by industry, government, not-for-profits, and other "receptors" of genomics knowledge and technology. The following five projects have been selected for funding in Round 8 of GAPP, for a total investment of $24.5 million ($8.1 million from Genome Canada and $16.4 million from co-funding partners including provincial governments, private sector and not-for-profit organizations).

Device for the rapid detection of seven common bloodstream infections and assessment of antibiotic susceptibility

Project leaders: Deirdre Church, Calgary Lab Services (receptor); Ian Lewis, University of Calgary (academic)
Genome Centre: Genome Alberta
Total funding: $6 million

Testing for bloodstream infections (BSIs) is a costly and time-consuming process. Currently, two to four days are needed to identify the pathogen causing an infection and measure its susceptibility to antibiotics. These time delays contribute to preventable deaths. For example, a 24 hour delay in detecting ESBL producing *E. coli* (an emerging threat in Canada) increases mortality rates by five per cent. Detecting these pathogens faster will allow dangerous infections to be controlled before they progress into life-threatening conditions.

Calgary Laboratory Services (CLS), which serves more than 2.1 million people in Calgary and the surrounding area, is partnering with Dr. Ian Lewis of the University of Calgary to accelerate the development of a testing device that can identify BSI pathogens and determine their drug sensitivity in less than six hours. This new device uses an emerging "metabolomics" technology to identify and characterize pathogens. The UofC/CLS partnership has developed a prototype that can perform standardized testing in less than 24 hours and future devices will complete this process in a fraction of that time. The project has financial backing from, among others, Thermo Scientific, a leading instrument manufacturer with a global distribution network. The Genome Canada funding will be a bridge to refine the existing prototype and move the product into clinical service.

Once in use, the device will reduce the costs of BSI analysis by more than 70 per cent and simplify the testing procedure. Once implemented this device could capture a significant portion of the $12 billion global market for clinical microbiology testing, lower deaths and long-term consequences from BSIs, and deliver significant savings to health-care systems.

Validation of TAC receptors for use against liquid and solid tumours

Project leaders: Christopher Helsen, Triumvira Immunologics, Inc. (receptor); Jonathan Bramson, McMaster University (academic)
Genome Centre: Ontario Genomics
Total funding: $2.3 million

Immunotherapies show tremendous potential to unleash the immune system to attack cancers. However, while some patients benefit, others do not respond and, even when it is successful, immunotherapy treatments can carry with them severe, and sometimes fatal, toxicities. The most promising of these immunotherapies are based on T-cells, cells of the immune system, particularly CAR-T cells, which are showing significant efficacy in treating terminal cancers, but which can also often result in significant life-threatening toxicities.

Dr. Jonathan Bramson, of McMaster University, is working with Triumvira, a young Canadian biotech company, to further develop the company's platform for engineering T cells, the T-Cell Antigen Coupler (TAC). The platform has already demonstrated equivalent or superior efficacy and much greater safety compared to other CAR-T cell platforms. Currently, however, the TAC platform is limited primarily by access to novel binding domains. Genome Canada funding will be used to validate TAC receptors carrying novel binding domains developed in the Bramson lab and at the Centre for Commercialization of Antibodies and Biologics. Triumvira will then commercialize those domains that are successful by working with commercial pharmaceutical companies.

The primary economic benefit to Canada in the short term will be new jobs and the attraction of investment capital. Within three-to-five years of the project's completion, human clinical trials will be underway, providing hope to patients with cancer who otherwise have no treatment options.

Leveraging Leukocytes as Endogenous Biosensors to Create Novel Diagnostics for Preterm Birth

Project leaders: Liu Xin, BGI-Research (receptor); Stephen Lye, Lunenfeld-Tanenbaum Research Institute (academic)
Genome Centre: Ontario Genomics
Total funding: $4.6 million

Two hundred million women around the world become pregnant each year. Of those, 13 million will give birth preterm, one million of their babies will die and millions more will experience serious, life-long medical and developmental disorders as a result. In Canada, the annual cost associated with preterm births is estimated to be $600 million.

BGI and Dr. Stephen Lye of the Lunenfeld-Tanenbaum Research Institute, part of Sinai Health System, have agreed to collaborate in the development of preterm birth diagnostics and screening solutions.

BGI is the largest genomic organization in the world and is committed to reducing the rate of major disease by offering accurate and affordable genetic tests and molecular diagnostics services. Dr. Lye has identified gene expression signatures in maternal white blood cells that can predict which women who experience too-early symptoms of labor will go on to experience preterm birth of their infants.

BGI and Dr. Lye will work together to enhance the diagnostic capability of these gene expression signatures and aim to develop a simple genomic test to identify risks and prevent preterm births. The test aims to reduce rates of preterm birth by enabling intervention with women at risk, potentially saving the healthcare system $200 million per year and reducing the burden on neonatal ICUs.

BGI intends to continue its research collaboration with the Sinai Health System and expand its R&D activities in Canada, which will generate downstream investment and create jobs for highly qualified personnel.

Genomics Driven Engineering of Hosts for Bio-Nylon

Project leaders: Kit Lau, BioAmber (receptor); Radhakrishnan Mahadevan, University of Toronto (academic)
Genome Centre: Ontario Genomics
Total funding: $5.7 million

Currently, nylon is made from petroleum. While the process works well, it is not as environmentally friendly as many would like. There is strong demand for nylon produced using man-made chemicals derived from sugar, which requires less energy and results in fewer greenhouse gas emissions.

BioAmber, an industrial biotechnology company located in Sarnia, Ontario, is successfully manufacturing succinic acid (used in producing polymers, resins and solvents) from sugar streams, which materially decreases the carbon footprint. These same principles could be used to develop a process for the manufacture of adipic acid, used in producing nylon.

A genomics-driven bioengineering approach has been developed by the University of Toronto's team at BioZone led by Dr. Radhakrishnan Mahadevan to convert sugars into value-added industrial chemicals such as adipic acid. Adipic acid alone has a market of 2.2 million tonnes; chemicals that can be derived from it have similarly large markets. As an industrial biotechnology company, BioAmber is positioned to apply the results from this research program to the development of next generation chemicals.

The results of its work will benefit Canada's economy by growing the biorefining industry and creating new manufacturing jobs, while protecting the environment through reduced greenhouse gas emissions and pollution.

Lysozyme feed additives to improve gut health and productivity of food animals

Project leaders: Paul D. Matzat, Elanco Animal Health, Eli Lilly and Company (receptor); Adrian Tsang, Concordia University (academic)
Genome Centre: Génome Québec
Total funding: $6 million

In 2012, some 1,450 tonnes of antibiotics were used, through feed, water and as injectable products, to prevent disease and improve performance in all livestock species across Canada. Globally, more than 63,000 tonnes were used that year, ten times more than those used in human medicine. The use of antibiotics for productivity enhancement has come under pressure from both the scientific community as well as consumer groups. Scaling back the use of antibiotics in farm animals could reduce the development of drug-resistant microbes.

Dr. Adrian Tsang and his colleagues at Concordia University have developed infrastructure and knowledge to support the development of genomics-enabled technologies that provide this alternative. Now he is partnering with Elanco, the third-largest animal health company in the world and the current market leader in antibiotic feed additives, to develop lysozymes (part of the innate immune system of animals) to be used as feed additives. These naturally occurring proteins, when fed to food animals, can help improve gut health and productivity. Dr. Tsang will use genomics to develop lysozymes, which Elanco will then evaluate in various food animal species for gut health and economic response. Elanco will also manage the registration and manufacturing processes required to bring the lysozyme-enriched feed to market.

The developed lysozyme formulations are expected to displace the use of antibiotics in food animal production. The resulting improvements in health and productivity would reduce production costs, leading to lower food costs for consumers, while reducing risks to public health.