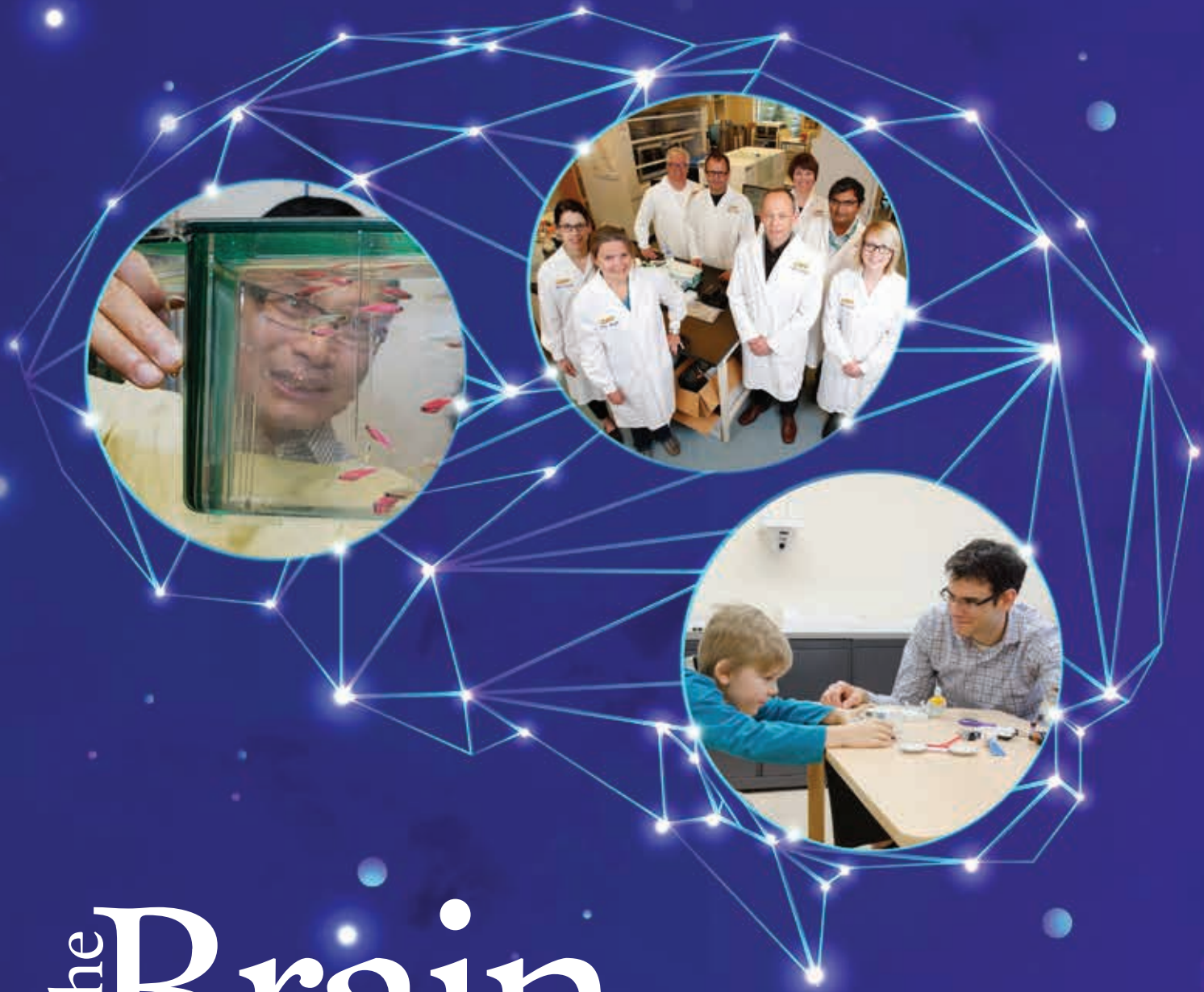
Brain Canada Foundation



the Brain
a space of discovery

Annual Report
2016

VISION

To understand the brain, in health and illness, to improve lives and achieve societal impact.

MISSION

Brain Canada is achieving its vision by:

- Increasing the scale and scope of funding to accelerate the pace of Canadian brain research;
- Creating a collective commitment to brain research across the public, private and voluntary sectors;
- Delivering transformative, original and outstanding research programs.

VALUES

- Connecting with purpose.
  - "One brain". Seeking to understand different brain functions and dysfunctions as part of a single interconnected system.
  - Partnerships. Building mutually beneficial and transparent relationships with every partner.
  - Diverse perspectives and approaches. Fostering original insights and outcomes.
- Outcome focused. Delivering value and benefits with efficiency and effectiveness.
- Professional integrity. Ensuring the highest standards of ethical behaviour and good governance.

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The Brain Canada Foundation (referred to throughout as "Brain Canada") is a registered charity. Registration number: 89105 2094 RR0001.

Production of this Annual Report has been made possible with the financial support of Health Canada through the Canada Brain Research Fund. The views expressed herein do not necessarily represent the views of the Minister of Health or the Government of Canada.

Canada

Message from the Chair and President

Naomi Azrieli
Chair

Inez Jabalpurwala
President and CEO

The theme of this year's Annual Report—"the brain, a space of discovery"—reflects the size of the challenge to explore the brain as one interconnected system, and the excitement and promise of brain research in the context of advances in science and technology. It also captures our role as a convenor – Brain Canada is creating a space which enables collaborations involving a constellation of partners across sectors; and collaborations involving researchers from different disciplines who are charting new territory and changing paradigms. The result is a brain community that is better coordinated to achieve common goals – and achieving these goals more rapidly.

Brain exploration is the way to solve one of the greatest mysteries of all time: what makes us human and what is human consciousness. But first and foremost, brain exploration aims to improve health outcomes. There are more than 1,000 disorders of the brain and they impact 1 in 3 Canadians directly – 1 in 5 in mental illness alone – and millions more as family, friends, work colleagues and caregivers. Research will lead to reducing the stigma of diseases as we understand their biological basis; it will lead to prevention strategies, new and better diagnostics and treatments; and ultimately, it will lead to cures.

For nearly 20 years, Brain Canada has been transforming brain research in Canada. In 2011, the Government of Canada recognized our track record and results, and through Health Canada, established a partnership with Brain Canada called the Canada Brain Research Fund (CBRF). With a commitment of $100 million in matched funding in 2011, and a subsequent additional $20 million in 2016, the CBRF has the potential to reach $240 million.

By March 2017, Brain Canada and Health Canada had allocated $184 million in new funding to support 188 projects across Canada involving more than 800 researchers at 112 institutions. The 2016-17 grants are listed on pages 28-29.

The research funded through the Canada Brain Research Fund touches all Canadians. We are very proud to provide some examples on pages 10 to 19. The selected projects showcase our three grant types– teams (our signature grants), platform support, and capacity building; more detail is provided on page 8. Our support has enabled researchers to work together to pursue new thinking and new approaches, and has given many scientists access to equipment and expertise that would not have otherwise been available to them.

All of our projects are selected through open and partnered competitions, and rigorous international peer review. Once awarded, the grants are monitored against agreed-upon milestones. This has been the case since we first launched our signature team grants, the Brain Repair Program, in 2003. On pages 30-31 you will find a description of our review process, and the list of 24 countries from which we have recruited the 325 researchers and clinicians who have been involved with our process over the last 10 years.

Brain Canada's successes of the past few years were made possible thanks to the partnership between Brain Canada and the Government of Canada, and especially Health Canada and our Minister of Health. We were delighted when the Hon. Jane Philpott joined Brain Canada for a meeting of thought leaders in mental health to discuss how best to invest in this area, where the needs meet our capacity. This was one important demonstration of our convening role; two other meetings were focused on developing a strategy to coordinate brain research in Canada, and a meeting to develop a consensus on the need and the opportunity for a national open science/data sharing platform. You can read more on page 35.

The challenge of the Government leveraged fund was met by an ever-expanding list of more than 100 donors and partners, including research institutes, provincial agencies and voluntary health organizations. To all of these valued supporters, we extend a heartfelt thank you. We thank also the dedicated researchers and clinicians who are keeping Canada at the forefront of brain research.

We thank our committed Board and volunteers from across the country, and recognize in particular our outgoing Chair, Rupert Duchesne, who served in this capacity from 2010 to January 2017. We thank the dedicated and hardworking Brain Canada team. Brain Canada has always been and will always be a collective effort.

We close by sharing that a new Brain Canada website will be launched in the fall and, in addition to up-to-date information about Brain Canada and the Canada Brain Research Fund, this website will include a directory of all funded projects, and an ability to search by theme, investigator, institution or province.

This will be our platform to celebrate Canada's world-class researchers, and to showcase the range of research that is happening at all stages—from basic science to programs aimed at improving health outcomes—all of which will benefit Canada and the world.

Naomi Azrieli
Chair, Brain Canada

Inez Jabalpurwala
President and CEO, Brain Canada

Introducing Brain Canada's new Chair

The Brain Canada Foundation is delighted to announce the election of Dr. Naomi Azrieli as Chair of the Foundation's Board of Directors, effective January 24th, 2017.

Dr. Azrieli has been a member of the Brain Canada Board of Directors since 2015 and she brings a unique track-record of accomplishment and leadership to the role of Chair at an important moment for brain research in Canada. She has a history of creating successful partnerships in business and philanthropy, and a long-standing involvement in brain-related initiatives.

Dr. Azrieli is the Chair and CEO of the Azrieli Foundation, and has been the strategic driver behind the Foundation's philanthropic initiatives, as well as its growth and development into the largest public foundation in Canada.

She is President of Canpro Investments Ltd., a Canadian commercial real estate company. She serves as a Director on the Board of the Azrieli Group Ltd., a publicly-traded real estate company (TASE: AZRG), as well as serving on the Board of the Weizmann Institute of Science, and several other scientific, academic and cultural institutions. In 2013, Dr. Azrieli was awarded France's Legion of Honor (rank: Chevalier).

Brain Canada is privileged to benefit from both Dr. Azrieli's business acumen and extensive experience in the non-profit sector, as well as her commitment to encouraging a view of brain research that is focused on the interconnectedness of the system instead of segmented by specific disease or dysfunction.

Epilepsy
Brain tumours
Schizophrenia
Alzheimer's disease
Autism
Post traumatic stress disorder
Huntington's
Addiction
Depression
Spinal cord injury

There are more than 1000 brain disorders

Parkinson's
Concussion
Fragile X
Fetal alcohol syndrome
Multiple sclerosis
ADHD
Chronic pain
ALS
Migraine
Stroke
Sleep disorder
Tourette's syndrome
and many more...

Disorders of the brain are an enormous public health burden; 1 in 3 Canadians are directly impacted, as well their families, friends, coworkers, caregivers, society and the economy

Brain disorders are the leading cause of disability

The $60 billion burden of brain disorders on the Canadian economy every year is more than the cost of cancer and cardiovascular disease combined

20% of Canadians will experience a mental illness in their lifetime

Today, the medical and indirect (lost earnings) costs of dementia total $33 billion per year. If nothing changes, these costs will rise to $293 billion by 2040

There has been no new class of drugs in the last 20 years for autism, schizophrenia or depression

Why support brain research?

The brain is the most critical organ in the body but the least understood. As researchers continue their exploration of the brain and delve deeper into our understanding of brain disorders, the complexity of the challenge increases, and so too does our need to join different disciplines and to pursue new thinking and new approaches.

Brain research is a process - every discovery carries the potential to improve lives by:

Brain Facts

- The brain contains about 86 billion nerve cells (neurons) — the "gray matter"
- It contains billions of nerve fibers, made up of axons and dendrites — the "white matter"
- These neurons are connected by trillions of connections, or synapses
- The diameter of an individual neuron is just 4 microns, meaning 30,000 could fit on the head of a pin
- The average adult's brain weighs about 1.5 kg but consumes 20% of the body's supply of oxygen
- The brain requires 20% of the entire body's blood flow
- The brain generates up to 25 watts of power while a person is awake — enough to illuminate a light bulb

Brain Canada

BRAIN CANADA FACTS

- Brain Canada is a registered, charitable organization that funds innovative, paradigm-changing brain research across Canada
- Founded: 1998
- Over $194 million in funds has been disbursed to research since the founding of Brain Canada
- Over 200 grants have been awarded
- Over 90% of funds goes directly to research

Brain Canada Foundation

Established in 1998, the Brain Canada Foundation supports and advances transformative, original and outstanding brain research focused on outcomes that will benefit Canadians impacted by brain disorders and their families.

Brain Canada seeks to accelerate research advances at all stages in the process: from basic science through population health. We bring together researchers from different disciplines and institutions to form new collaborations and new networks.

- **Brain Canada plays a unique and invaluable role as the national convenor of the community of those who support and advance brain research**
- **Brain Canada's main areas of focus are fundraising, granting and strengthening the brain research community**
- **A greater understanding of how the brain works will contribute to the prevention, diagnosis, treatment and cure of disorders of the brain, thereby improving the health outcomes of Canadians**

Brain Canada funds all types of research:


Basic science


Preclinical research


Clinical research


Translational research


Population health


Public health

And funds across all brain science:


Neurodegenerative diseases


Brain and spinal cord injury


Neurodevelopment disorders


Brain cancer


Mental illness


Pain

among others

One Brain One Community

For nearly 20 years, Brain Canada has made the case for the brain as a single, complex system underscoring the need for increased collaboration across disciplines and institutions.

One Brain

Thanks to advances in research and technology, we now know that the brain is a single, complex and integrated system with common mechanisms across disorders

The One Brain approach means that every discovery has the potential to have an impact across the full spectrum of brain disorders, as well as on our understanding of brain functioning

With Brain Canada's support, researchers broaden their perspective, widen their scope of inquiry, and connect with scientists across disciplines, leading to insights into specific mechanisms and disorders, as well as their interconnections

Along with increased potential to address disorders, brain research is driving innovations in artificial intelligence, brain plasticity and normal brain functioning

One Community

Brain Canada convenes and strengthens Canada's brain community, which encompasses researchers and clinicians (and their institutions), governments, voluntary health organizations, philanthropists, business and community leaders, patients and caregivers

Brain Canada facilitates linkages with the global brain science community: the exceptional quality of Canadian research contributes to broad technological, data-driven initiatives, as well as to bottom-up initiatives in labs from multiple countries

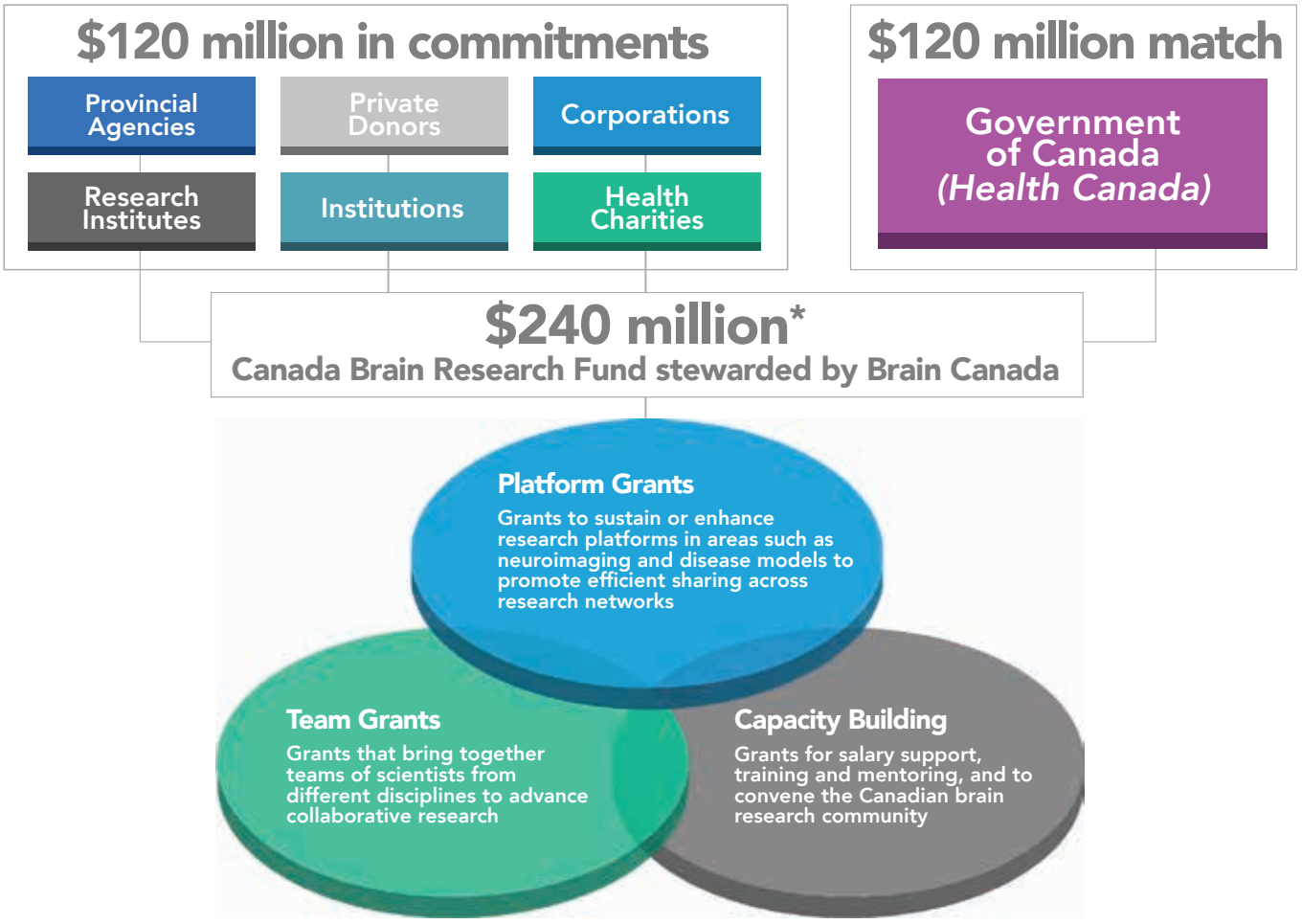
Brain research extends beyond neuroscience, including genetics, chemistry, engineering, mathematics, computer science and the social sciences

Canada Brain Research Fund

The Canada Brain Research Fund (CBRF), established in 2011, is a partnership between Brain Canada and Health Canada designed to encourage Canadians to increase their support of brain research, and maximize the impact and efficiency of those investments.

Brain Canada initially committed to raising $100 million over six years from private and non-governmental sources which is being matched by the Government of Canada on a 1:1 basis, creating a $200-million fund. Brain Canada met its fundraising objective of $100 million by the fall of 2015 – more than one year ahead of schedule. To maintain the positive momentum achieved with donors, partners and the research community, in Budget 2016, the Government of Canada provided $20 million in additional matching funds, administered through Health Canada, to the CBRF, bringing the total fund to $240 million.

This visionary commitment by the federal government will ensure that Canada continues to be among the leaders in the global challenge to understand brain function and brain diseases. More than simply contributing public money to this vital cause, the matching nature of the fund is stimulating and rallying private donations and other non-governmental funders to support transformative brain research in areas of importance to the various donors on a scale never before achieved in Canada.



* Beginning in April 2016, up to 10 percent of government funding was reserved for stewardship of the fund

LARGEST PUBLIC-PRIVATE FUND in Canadian history devoted to supporting brain research across Canada

Up to **$240M** of new funding directed to brain research

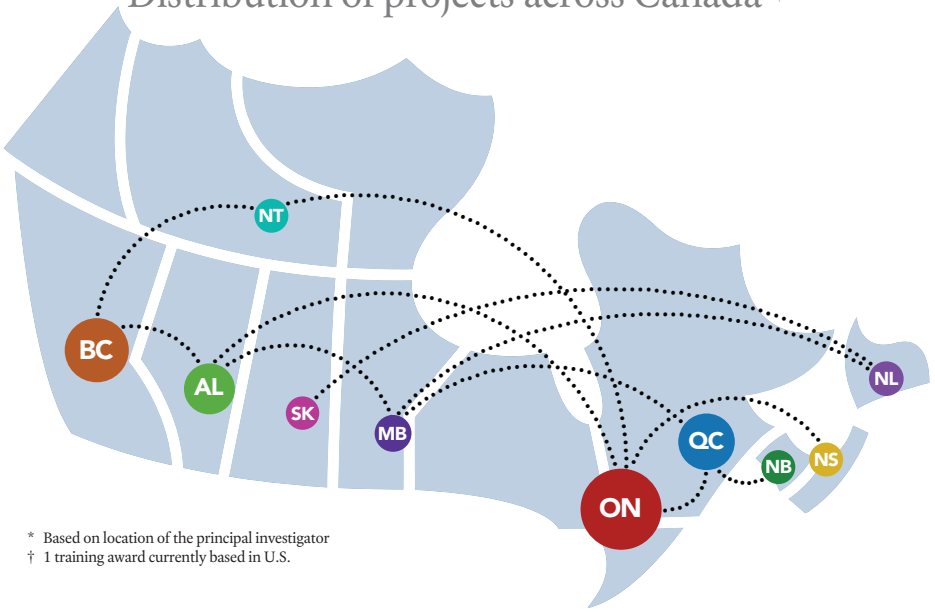
$184M awarded as of March 2017

188 projects

More than **800** researchers across Canada

CONNECTING **75+** DISCIPLINES AND **112** INSTITUTIONS

Distribution of projects across Canada*†



* Based on location of the principal investigator
† 1 training award currently based in U.S.

BC British Columbia
29.5 projects
112 researchers/ trainees

AL Alberta
18 projects
103 researchers/ trainees

NT Northwest Territories
-
1 researcher/ trainee

SK Saskatchewan
1 project
4 researchers/ trainees

MB Manitoba
2 projects
29 researchers/ trainees

ON Ontario
80.5 projects
385 researchers/ trainees

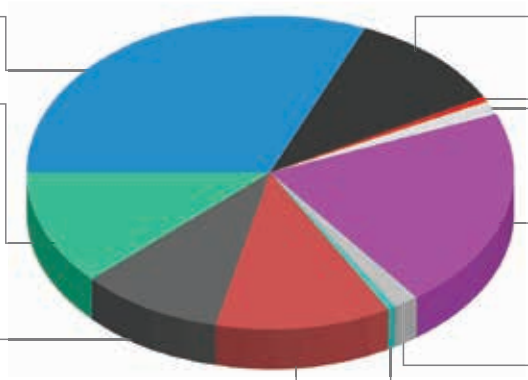
QC Quebec
51 projects
192 researchers/ trainees

NB New Brunswick
2 projects
3 researchers/ trainees

NS Nova Scotia
2 projects
20 researchers/ trainees

NL Newfoundland
1 project
3 researchers/ trainees

Distribution of funding across brain disorders



Neurodegenerative diseases **31.4%**

Brain and spinal cord injury **11.7%**

Mental illness **9.6%**

Neurodevelopmental disorders **11.7%**

Migraine and pain **0.5%**

Brain cancer **10.6%**

Seizure **0.5%**

Sensory system disorders **1.6%**

Multiple disorders **20.7%**

Knowledge translation **1.6%**

Brain Canada's 800+ funded researchers are conducting research along the continuum from basic high-impact discovery to translational work of direct relevance to the clinic. Their research covers the full range of brain disorders including neurodegenerative disorders, neurodevelopmental disorders, mental illness, and brain and spinal cord injuries. We are very proud of the progress made by our researchers and in the following pages we have selected a few examples from among the 188 projects we are funding to showcase our different programs and partnerships.

How cell shape can affect brain function

FACTS ON DEMENTIA

- Dementia is the most common type of neurodegenerative condition.
- In 2010, it was estimated that well over 30 million people worldwide were living with dementia, and that figure is expected to double in the next 20 years.
- 65% of people diagnosed with dementia over the age of 65 are women.
- There are over 25,000 new cases of dementia diagnosed in Canada every year and there are currently over half a million Canadians living with dementia.
- It costs over $10 billion a year in Canada alone to care for those living with dementia.

References: Statistics Canada and Alzheimer Society of Canada

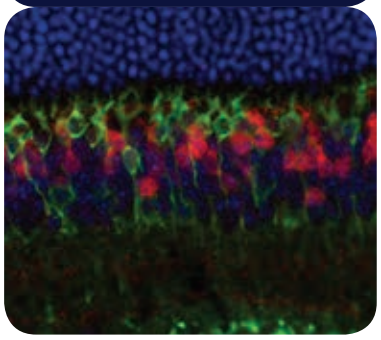


Image of a retinal section viewed under the microscope showing retinal cells essential for vision labelled in different colours. Amacrine neurons are labelled in red and bipolar neurons are labelled in green. The blue staining marks all nuclei, highlighting the tri-layered structure of the neural retina with the light-sensing photoreceptor cells at the top of the image.

Neuronal polarity defects as an underlying cause of neurological diseases

Grant Program: The W. Garfield Weston Foundation – Brain Canada Team Grant

Grant Amount: $1,500,000

Principal Investigator:
Michel Cayouette, Institut de Recherches Cliniques de Montréal

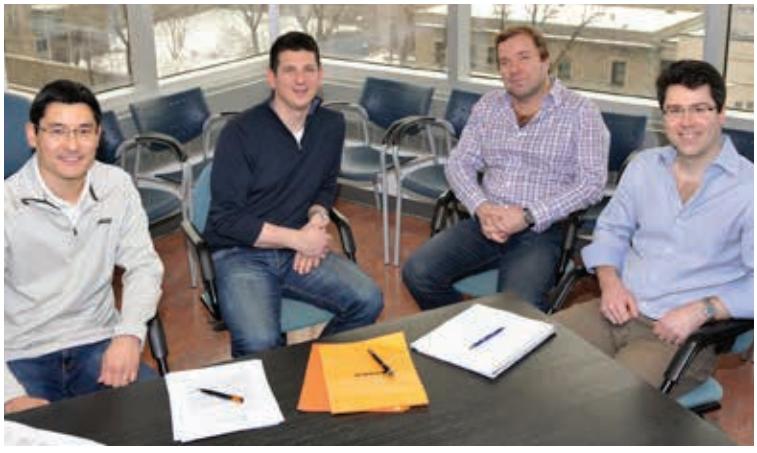
Co-investigators:
Fred Charron, Institut de Recherches Cliniques de Montréal, Université de Montréal
Artur Kania, Institut de Recherches Cliniques de Montréal, Université de Montréal,
Keith Murai, Research Institute of the McGill University Health Centre

Michel Cayouette and his team are looking at whether the loss of cellular polarity could be a mechanism underlying multiple brain diseases, such as neurodegenerative diseases (like Alzheimer's disease, stroke, and retinal degeneration), neuronal connectivity diseases (such as autism and schizophrenia), and brain cancer. Cell polarity is what gives neuronal cells their unique shape (cell morphology) that is essential to perform their function. Just like there are hundreds of different shapes of leafs in nature, there are hundreds of different neuronal cell morphologies. Dr. Cayouette's team is trying to figure out how each cell is shaped, as this is essential information not only to understand how the shape of each cell affects brain function, but also because it is one of the first features that goes wrong in disease. They know that the key to cell polarity processes are PAR proteins, a family of proteins responsible for correctly segregating cellular components.

In their project, they propose to use innovative molecular and cellular approaches to investigate the role of these proteins in four critical neuronal events underlying multiple brain diseases. These studies are having a major impact on the fundamental understanding of cell polarity and have the potential to determine a common underlying cause of neuronal disruption and discover new treatments for a wide spectrum of neurological diseases.

Over the past three years of the grant, the team has made important advances in their understanding of neurodevelopmental and neurodegenerative disorders. They have uncovered genetic pathways essential for neuronal development, the formation of neuronal circuits, and the survival of neurons, paving the way to identification of new therapeutic targets for neurodegenerative diseases. They have also identified a novel regulator controlling the levels of toxic proteins that accumulate in Alzheimer's disease, offering a novel avenue for therapeutic intervention. This work has major implications for understanding how local neural circuit environments are altered in brain diseases such as epilepsy, Alzheimer's disease, Huntington's disease, and amyotrophic lateral sclerosis.

The next steps will be to use the fundamental knowledge that they have generated to develop novel therapeutic interventions. The team is eager to test whether the new protein they identified can be used to stimulate the removal of toxic proteins in neurons in pre-clinical models of Alzheimer's disease, which will be a first step towards developing drug targets in humans. Additionally, their studies have identified potential biomarkers for brain cancers, and uncovered new mechanisms by which neuronal activity can be altered during disease, which could be exploited to treat various neurological disorders.



From left to right: Keith Murai; Michel Cayouette; Artur Kania; Fred Charron

> "This grant allowed us to establish strong ties between our different research teams that are continuing to this day to develop new projects and collaborations."
>
> — Michel Cayouette, Ph.D.
> Institut de Recherches Cliniques de Montréal

Using tropical fish to find treatments for brain disorders

Z-BRAIN: A zebrafish drug screening platform targeting brain disorders

Grant Program: 2014 Platform Grant

Grant Amount: $2,423,500

Principal Investigator:
Xiao-Yan Wen, St. Michael's Hospital

Co-investigators:
Pierre Drapeau, CRCHUM (Montreal)
Raymond Andersen, Cheryl Gregory-Evans, University of British Columbia
Robert Gerlai, Vince Tropepe, Henry Klause, University of Toronto
Jonathan Brotchie, Toronto Western Research Institute
Georg Zoidl, York University
Loch Macdonald, Andrew Baker, Tom Schweizer, David Munoz, Corinne Fischer, Thomas Steeve, Claudia dos Santos, St. Michael's Hospital
Albert Wang, Centre for Addiction and Mental Health
Marc Ekker, University of Ottawa
Sidney Kennedy, Canadian Biomarker Integration Network in Depression
Alan Fin, Dalhousie University, Halifax
Janice Robertson, Centre for Research in Neurodegenerative Disease
Terry Van Raay, University of Guelph
Ted Allison, University of Alberta

The traditional target-based drug development strategy (in vitro screening) has had poor success in developing new drugs. The vast majority of Investigational New Drugs (INDs) fail in clinical trials due to toxicity or lack of efficacy. On the other hand, mammalian models are excellent tools to study disease mechanisms and test therapies but are difficult to use for large scale drug screening.

Zebrafish have proven to be an ideal preclinical model due to the high number of genes shared with humans and the high percentage of genes associated with human disorders that have a zebrafish equivalent (see sidebar on Why Zebrafish).

With support from the Brain Canada platform grant, Xiao-Yan Wen and his multidisciplinary team from across Canada have built Z-BRAIN, a national high-throughput drug screening platform to target brain disorders, using zebrafish central nervous system (CNS) disease models for direct *in vivo* drug discovery on zebrafish embryos. Their team brings together specialists in drug development, robotic technologies, medicinal chemistry, bioinformatics, disease mechanisms and zebrafish modelling. The brain disorders targeted include, but are not limited to, Alzheimer's disease, Parkinson's disease, ALS, epilepsy, schizophrenia, depression/stress, stroke and traumatic brain injury. Six industrial partners (Eli Lilly, Treventis Corporation, Atuka Inc., Edge Therapeutics Inc., Janssen Pharmaceutical, and Life Chemicals) and multiple international collaborators have joined this initiative.

This CNS drug discovery platform is centered on existing CFI-funded drug screening infrastructure recently installed at St. Michael's Hospital in Toronto, which allows robotic screening of zebrafish embryos carrying gene mutations or human transgenes. The platform is a state-of-the-art system that can perform fully automated screens from fish embryo sorting and drug dosing to efficacy readouts. The Brain Canada platform funding has greatly improved the platform's performance. The funds have been used to hire new research staff to conduct computer and mechanical engineering work associated with the platform, as well as to hire staff for disease modelling, compound screening, drug database development and chemical informatics.

Since the beginning of the grant, the team has made significant progress in developing zebrafish disease models for Alzheimer's disease, Parkinson's disease, ALS, epilepsy, schizophrenia, vascular leakage/brain hemorrhage, fear/anxiety/stress and traumatic brain injury. Their research has also led to a Phase 2b clinical trial for one compound (Pimozide) identified from ALS zebrafish models. Several others are in the preclinical phase including screens for stroke and Alzheimer's disease. They have also launched two spin-off companies, ZebraPeutics Inc. and DanioDesign Inc., for preclinical drug development and services in generating transgenic and mutant zebrafish lines.

Additionally, they have organized regular Z-BRAIN platform retreats and international zebrafish precision medicine conferences attracting over 200 researchers from Canada and around the world. These events bring together scientists from both biological and medical research fields to accelerate the translational process of zebrafish-based knowledge to clinical applications.

WHY ZEBRAFISH?

Zebrafish are small tropical fish native to southeast Asia. They have become an ideal model for scientific research:

- They are more economical to maintain than other preclinical models.
- They develop at an extremely fast rate and are transparent at the embryo stage, allowing for easy analysis of internal structures.
- They share 70% of genes with humans.
- There is a zebrafish equivalent for over 80% of genes known to be associated with human disease.

References: yourgenome.org

Xiao-Yan Wen and Anju Philip, Postdoctoral fellow, holding a tank of zebrafish

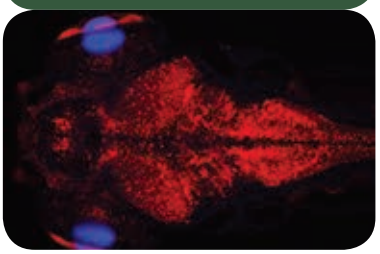


Image of a zebrafish brain

> "No such platform currently exists anywhere in the world, and our novel initiative draws from Canadian as well as international expertise in neuroscience."
>
> — Xiao-Yan Wen, M.D., Ph.D.
> St. Michael's Hospital

Sneaking therapeutics into the brain

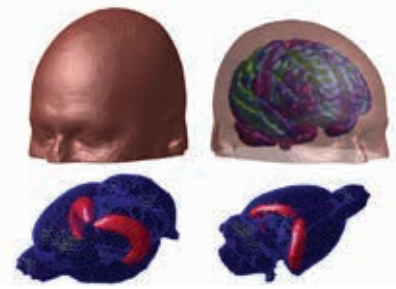
FACTS ON THE BLOOD-BRAIN BARRIER

- The blood-brain barrier (BBB) is a semi-permeable boundary that separates the central nervous system from the circulating blood in the rest of the body. It allows some materials, such as essential nutrients, to cross into the brain, but prevents most other materials from reaching the brain.

The existence of this barrier is very important:

- It prevents foreign and toxic substances that may cause harm from reaching the brain.
- It helps the brain maintain a constant environment.
- However, at the same time, it prevents possibly life-saving substances from reaching the brain.
- Scientists are working on ways to "trick" the BBB into allowing life-saving drugs to reach the brain.

References: Brainfacts.org



These images were created by Dr. Rosa-Neto's Lab at Douglas Hospital, McGill University and show the fusion between brain anatomy and amyloid deposition in the living human brain (top row) and rat (bottom row).

Drug Delivery across the Human Blood-Brain Barrier

Grant Program: CQDM - Brain Canada - OBI Focus on Brain

Grant Amount: $1,496,800

Principal Investigator:
Nathan Yoganathan, Kalgene Pharmaceuticals

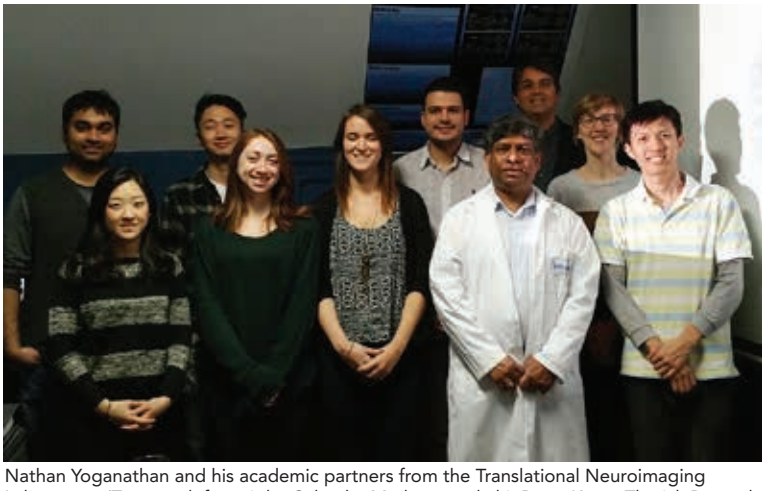
Co-Investigators:
Louis Collins, McGill University Biomedical Engineering
Danica Stanimirovic, National Research Council of Canada
Balu Chakravarthy, National Research Council of Canada
Jean-Paul Soucy, McConnell Brain Imaging Centre, Montreal Neurological Institute, McGill University
Pedro Rosa-Neto, Douglas Hospital Research Centre
Michael Waterston, Centre for Imaging Technology Commercialization (CIMTEC)
John Gillard, KalGene Pharmaceuticals

There is no disease modifying molecule for Alzheimer's disease currently on the market or in use. This is one the largest unmet medical needs in neuroscience. If no cure has be found by 2038, the total cost of care is expected to rise to $153 billion in Canada alone. Delivering drugs to targets in the brain is significantly impeded by a special protective layer, called the blood-brain barrier, which is designed to prevent toxins and anything potentially harmful from reaching the brain, but also prevents potentially lifesaving drugs from reaching the brain.

Nathan Yoganathan and his team are working on a way to solve this problem. Their goal is to take a disease-modifying molecule for Alzheimer's disease that binds toxic amyloid proteins and sneak it across the blood-brain barrier by attaching it to another molecule that is able to cross. This is known as the Trojan horse method, and if the team is successful, it would represent the first time this has been achieved in humans. The project involves a collaboration between academia, non-profits, and small and medium-sized enterprises. The multidisciplinary, multi-institutional team from across the country is testing the efficacy of an Alzheimer's disease modifying molecule from Kalgene coupled with a carrier molecule, both of which were developed by the National Research Council and licensed to Kalgene. The Montreal Neurological Institute and CIMTEC are also involved and their imaging and diagnostic expertise will measure if the conjugated molecule was able to cross the blood-brain barrier in humans and also effectively bind to toxic amyloid.

The objectives of the project are twofold: To successfully demonstrate that this Trojan horse method, proven in preclinical models, will also work to deliver the peptide to the human brain, and that the medicine is safe in Phase 1 clinical trials. Both of these objectives have already been accomplished in preclinical studies, which also demonstrated the efficacy of the peptide in clearing amyloid beta. The team has already made significant progress. In close collaboration with Kalgene, the Translational Neuroimaging Laboratory (McGill Research Centre for Studies in Aging, McGill University) demonstrated blood-brain barrier permeability, target engagement and drug efficacy in vivo using imaging methods in transgenic models. These exciting results will be announced at the Alzheimer's Association International Conference, to be held in London in July 2017. In early 2018, KalGene will be initiating the first human clinical trial which will be led by Pedro Rosa-Neto, Serge Gauthier and Angela Genge from McGill University. Additionally, this project allows for the training of a large number of highly qualified professionals in the areas of advanced drug development and clinical trials.

If the team can successfully demonstrate safely delivering this Alzheimer's disease modifying drug to the brain, this can also accelerate the development of therapies for other brain conditions.



Nathan Yoganathan and his academic partners from the Translational Neuroimaging Laboratory (Top row, left to right: Sulantha Mathotaarachchi; Peter Kang; Tharick Pascoal; Pedro Rosa-Neto; Hanne Struyfs. Bottom row left to right: Monica Shin; Kayla Horowitz; Laurie-Anne Dion; Nathan Yoganathan and Kok Pin Ng).

> "This grant was a catalyst to bring Canadian academics, clinicians, and companies together to use Canadian assets and Canadian intellectual property and Canadian expertise at every level, including the clinicians, to advance the project."
>
> — Nathan Yoganathan, Ph.D.
> CEO, Kalgene Pharmaceuticals

Advancing towards treatment for Huntington's Disease

Gangliosides in Huntington's disease: from bench to clinics and back

Grant Program: Huntington Society of Canada - Brain Canada - Creating HD Clinician-Scientist-to-Patient Virtual Networks

Grant Amount: $950,000

Principal Investigator:
Simonetta Sipione, University of Alberta

Co-Investigators:
Jonathan Curtis, University of Alberta
Sylvain Chouinard, Centre de Recherche du Centre hospitalier de l'Université de Montréal
Oksana Suchowersky, University of Alberta
Justyna Sarna, Hotchkiss Brain Institute, University of Calgary
Richard Fahlman, University of Alberta

Huntington disease (HD) is an inherited disorder that causes progressive malfunctioning and death of parts of the brain that control movement, reasoning and emotions. HD patients also suffer from depression and personality changes. Symptoms progress steadily until patients can no longer lead a normal life and eventually die. There is no cure for HD. To date, while treatments for symptom control are available, there are no therapies that delay or stop disease progression. Disease-modifying therapies are urgently needed.

The cause of HD is known - people with HD have a mutated protein called huntingtin which becomes toxic. One of the reasons why mutated huntingtin is toxic is that it causes the brain to produce insufficient amounts of a molecule called GM1 (a type of ganglioside) that is important for healthy brain function. Supplementation of GM1 to mouse models of HD dramatically improves the symptoms of the disease and slows down the underlying neurodegenerative process. This suggests that GM1 could be a potential treatment for HD. Previous research by Simonetta Sipione has shown that administration of GM1 to animal models of HD improves symptoms and slows down neurodegeneration, but the underlying mechanisms are still unclear.

In this project, Dr. Sipione and her team will continue their work on gangliosides, advancing their knowledge towards a potential treatment for Huntington's disease. Their objective is to identify the mechanisms of action of therapeutically administered gangliosides and also to measure gangliosides in human samples and determine their potential role as biomarkers of HD progression. Altogether, this work will significantly advance the understanding of the mechanisms of action of GM1 in HD and will accelerate the development of ganglioside-based therapies for HD.

The multidisciplinary team assembled for this project includes three biomedical scientists and three clinicians from Alberta and Quebec with experience in the neurobiology of HD, clinical neurology, ganglioside and lipid biology and biochemistry and quantitative proteomics. HD patients and their families are crucial partners in this project as volunteering participants who will provide samples and data for both objectives. This exciting research will pave the way towards a clinical trial in HD patients.

WHAT ARE GANGLIOSIDES?

Gangliosides are part of the family of lipids (fat cells). They were so named because they were isolated from cells called ganglion cells in the brain. Gangliosides appear in the highest concentration in the nervous system. While their function is still not totally understood, they are thought to have important effects in cell signaling and neuroprotection.

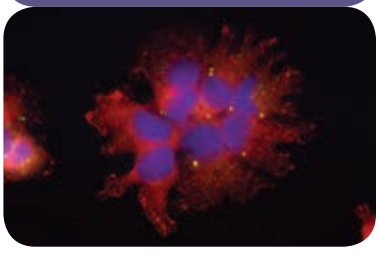
Reference: HOPES, Huntington's Outreach Project for Education, at Standford.

From left to right: Richard Fahman; Simonetta Sipione; Oksana Suchowersky

FACTS ON HUNTINGTON'S DISEASE (HD)

- HD is an inherited brain disorder that causes cells in parts of the brain to die. It is a fatal disorder that causes progressively worsening physical and psychological symptoms.
- Children of a parent with HD have a 50% chance of inheriting the disease. Huntington's occurs in all races and both females and males have the same risk of inheriting the disease.
- HD symptoms generally appear between the ages of 30 and 50.
- 1 in 7000 people in Canada has HD.
- 1 in 5500 is at-risk of inheriting the disease.
- Approximately 1 in 1000 is affected by HD through a spouse, friend or relative living with the disease.

References: Huntington Society of Canada



Group of cells expressing mutant huntingtin (in red) in vitro. Yellow puncta are aggregates of mutant huntingtin and p62, a protein involved in the clearance of protein aggregates.

> "We think that our research will have important implications not only for HD but also for other brain diseases where gangliosides have been involved, including Parkinson's disease."
>
> — Simonetta Sipione, Ph.D.
> Associate Professor, University of Alberta

Creating computers that work like the human brain

WHAT IS ARTIFICIAL INTELLIGENCE (AI)?

- Artificial Intelligence (AI): computer systems that can think like we do (or, the sub-discipline of computer science focused on trying to engineer these systems).
- Neural networks: simulated brains designed to mimic information processing and learning in the real brain (used to create AI).
- Deep learning: a technique for training neural networks that can take advantage of multiple layers of simulated brain cells to achieve human, or super-human, levels of performance.

Reference: Blake Richards, Ph.D. Associate Fellow, Learning in Machines and Brains

Learning in Machines and Brains Senior Fellow, Joëlle Pineau, presents at the December 2015 meeting of CIFAR's program Learning in Machines and Brains

Learning in machines and brains

Grant Program: CIFAR (Canadian Institute for Advanced Research) Global Call for Ideas

Grant Amount: $6,482,885

Co-Directors:
Yoshua Bengio and **Yann LeCun**
For a list of the 38 fellows involved in this project, visit www.braincanada.ca.

Learning in Machines and Brains is one of the 14 global research programs at CIFAR (Canadian Institute For Advanced Research). The CIFAR research programs were created to connect many of the world's best minds – across borders and between disciplines – to shape new perspectives and spark groundbreaking ideas.

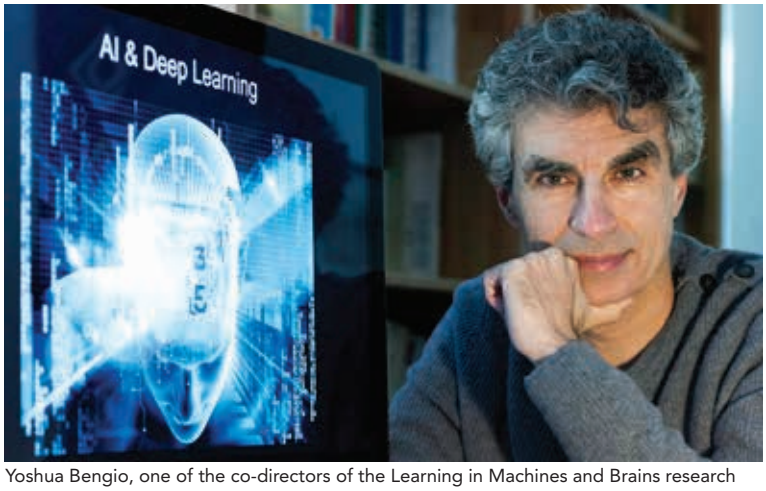
The Learning in Machines & Brains research program (formerly known as Neural Computation & Adaptive Perception) was founded in 2004 and is revolutionizing the field of artificial intelligence, and creating computers that think more like us – that can recognize faces, understand what is happening in a picture or video, and comprehend the actual meaning of language. The result will be computers that are not only powerful but intelligent, and that will be able to do everything from conduct a casual conversation to extract meaning from massive databases of information. The CIFAR program has shaken up the field of artificial intelligence by pioneering a technique called "deep learning". A decade ago, CIFAR took a risk on researchers who wanted to revive interest in neural networks, a computer technique inspired by the human brain. This program brings together computer scientists, biologists, neuroscientists, psychologists and others, and the result was rich collaborations that have propelled artificial intelligence research forward.

The current co-directors of the program are Yoshua Bengio and Yann LeCun and there are currently 38 members (fellows) from around the globe in the program.

The program has produced several research outputs over the past year including several articles in prestigious science journals. A new research direction has emerged that looks at the application of deep learning in medicine. A group in Montreal is looking at biomedical image analysis and prediction of medical outcomes for personalized medicine and another group is looking at predicting complications after surgery. They have also organized program activities throughout the year. In May 2016, CIFAR partnered with RBC to present a moderated panel discussion in Toronto featuring Senior Fellow Brendan Frey (University of Toronto) and other participants from the investment and technology sectors to explore how artificial intelligence may disrupt the financial industry in future years. Over 500 individuals attended, in addition to a global audience reached by WebEx broadcast.

The program also convenes an annual summer school for its fellows' graduate and postdoctoral trainees. Student organizers invite CIFAR fellows and other distinguished researchers to lecture on cutting-edge topics not yet covered in the regular university curricula. In 2015/2016, the program opened its doors to host the largest ever summer school in deep learning, attracting participants from around the world, coming from both academia and industry.

The program advanced one of its core research directions, deep learning, by making it the central theme of its annual program meeting in December 2016. This choice reflected a strong surge of interest within the program and the machine learning community at large, driven by a rapid series of outstanding successes in recent years that have seen deep learning embraced by global information companies like Google and Facebook, and the placement of CIFAR fellows at their research helms. The program meeting took place in Montreal during the two days preceding the annual Neural Information Processing Systems (NIPS) conference, the premier venue for the presentation of research in machine learning and neural networks.



Yoshua Bengio, one of the co-directors of the Learning in Machines and Brains research program

Diagnosing autism in the youngest of patients

Novel approaches to early detection and treatment of ASD

Grant Program: Azrieli Neurodevelopmental Research Program

Grant Amount: $2,086,742

Principal Investigator:
Lonnie Zwaigenbaum,
University of Alberta

Co-investigators:
Ofer Golan, Bar-Ilan University (Israel)
Jessica Brian, Holland Bloorview Research Institute
Sam Wass, MRC Cognition and Brain Sciences Unit (UK)
Mark Johnson, CBCD, Birkbeck, University of London (UK)
Susan Bryson, IWK Health Centre
Isabel Smith, IWK Health Centre
Azadeh Kushki, Holland Bloorview Research Institute

More than 1 in 100 individuals are diagnosed with Autism Spectrum Disorder (ASD), with profound impacts on the quality of life of those who are affected and their families. Many parents of children with ASD identify concerns as early at 12-18 months of age, yet the average age of diagnosis remains around four years. Children who receive an early diagnosis of ASD can benefit from a growing array of evidence-based interventions. There is also evidence that diagnosing and treating autism earlier leads to better long-term outcomes for children and families, and reduces ultimate societal costs related to treatment.

Over the past decade, studies of high-risk infants - younger siblings of children with ASD - have revolutionized the field, bringing us to the threshold of earlier diagnosis and treatment.

The members of this international team are made up of researchers from Canada, UK and Israel who have been at the forefront of research on this high-risk cohort of "baby sibs" and for this particular project they are expanding on previous research on the early development of ASD. They are looking at how at-risk infants direct their attention and regulate their emotions, and how this relates to their ability to communicate and interact with others. They believe these relationships may help in understanding the earliest expression of ASD. Their research project consists of two related projects. In the first project (involving the Canadian and Israeli teams) they will examine how flexibly infants shift their attention from one interesting object to another, and how this influences their responses to situations that elicit positive or negative emotion. Infants who have difficulty shifting their visual attention may also get 'stuck' on intense emotions, and that may impair both their ability to interact and communicate with others, leading to increased risk of ASD. In the second project, they will test whether teaching infants to become more flexible in shifting their attention (using computer games developed by their UK team) helps them benefit further from other interventions developed by the Canadian and UK teams. The team has just completed the first year of their grant. Progress has mainly focused on preparing the research team trialing new technologies for the home-based intervention trial, working with international partners to learn the novel intervention approaches that they believe will further optimize benefits to infants with early signs of ASD, and engaging with community partners to begin the process of ensuring that findings from their research will ultimately be incorporated into clinical practice. They have also begun data collection activities for their early detection study, as well as the intervention trial.

The next steps involve accelerating recruitment into both studies to achieve their ultimate goal of mapping early developmental pathways of ASD risk and understanding how these pathways can be targeted to improve on interventions for children with early signs of ASD.

Based on findings from this research, they will train health professionals to better identify the earliest signs of ASD, and work with community partners to implement new interventions to help these children reach their potential.

Lonnie Zwaigenbaum conducting a study with a young patient

FACTS ON AUTISM

- Autism and autism spectrum disorder (ASD) are a group of complex disorders of brain development, characterized by difficulties in social interaction and verbal and nonverbal communication, and also by repetitive behaviours.
- ASD is caused by a mix of environmental and genetic factors.
- The prevalence of ASD has increased dramatically over the past 10 years.
- 1 in 68 children are currently diagnosed with autism spectrum disorder.
- Autism is the most commonly diagnosed neurological disorder in Canada.

Reference: Autism Speaks Canada

> "Collaboration with our international partners has been essential to the innovative aspects of this research program."
>
> — Lonnie Zwaigenbaum, M.D
> University of Alberta

Can stress affect a child's development?

WHAT IS SELF-REGULATION?

Self-regulation is the ability to monitor and control one's own behaviour, emotions, and thoughts, and to adapt to the task at hand.

- Self-regulation includes the ability to:
  - filter out irrelevant stimuli
  - calm one's self down
  - work towards one's long-term self-interest
  - cope with challenges.
- The ability to self-regulate is extremely important for social, emotional, and academic success during childhood and beyond.
- Research is showing that the better a child can self-regulate, the better he/she will be able to master increasingly more complex skills and concepts.

Reference: Canadian Education Association

Adolescent participating in intervention research focused on classical conditioning – a key element underlying the placebo effect – of thermal perception in youth. Differences in thermal ratings in response to conditioned cues are being assessed, and this indicates either attenuated or amplified thermal perception.

Developmental origins of stress and self-regulation and implications for interventions to improve childhood behaviour.

Grant Program: Brain Canada-Kids Brain Health Network Training Awards, Developmental Neurosciences Research

Grant Amount: $100,000

Principal Investigator:
Regula Neuenschwander,
University of British Columbia

Self-regulation is the ability to monitor and control one's own behaviour, emotions, and thoughts, and to adapt to the task at hand. Double checking work is an illustration of good self-regulation; losing your temper is a reflection of poor self-regulation. It involves control mechanisms functioning at the biological and behavioural level that enable an individual to manage arousal, attention, emotion, behaviour, and cognition in an adaptive way, facilitating goal-directed actions. (See sidebar on Self Regulation). Research has shown that the brain pathways and neurobiological processes associated with self-regulation, such as stress reactivity and attentional capacity, are affected by the *in utero* environment.

Regula Neuenschwander's research examines how early stress affects children's development. She is looking specifically at 6 year-olds whose mothers have been depressed or non-depressed during pregnancy, and how well the children develop in terms of their self-regulation. Regula and her colleagues have found that a mother's depressed mood during pregnancy can change how a child manages stress arousal (i.e., stress regulation) and how she/he performs on challenging thinking tasks. Importantly, not all changes are negative, but may be adaptive for the world the child is living in. Examining developmental effects of fetal exposure to maternal depression will allow her to better understand why some, but not all, children are affected by early life stressors. This will help in understanding susceptibility, plasticity, and resiliency in children's development.

The second component of her research involves designing and testing interventions (such as mindfulness and coping strategies) to help in self-regulation. She is studying how to best intervene in children who show early disruptions in stress-response systems, such as children who have been exposed to prenatal maternal depression. This would help in discovering novel opportunities for targeting children's self-regulation through interventions in early educational and clinical contexts.

Her Developmental Neurosciences Research Training Award includes a $5000 annual career development supplement which she used in 2016 to present her work at the annual meeting of the International Society of Developmental Psychobiology (ISDP) in San Diego, USA, the first conference of the Society for Interdisciplinary Placebo Studies (SIPS) in Leiden, Netherlands, and the biennial meeting of the Society of Research in Child Development (SRCD) in Austin, USA.

Regula Neuenschwander leading an informal workshop at BC Children's Hospital Research Institute

> "Our findings will hopefully contribute to optimizing developmental pathways that support best outcomes for children exposed to early life adversity such as maternal depression – which is one of the earliest and most common risk factors in modern Western societies."
>
> — Regula Neuenschwander, Ph.D.
> University of British Columbia

Creating viruses that can shrink brain tumours

Oncolytic rhabdovirus immunotherapy for brain cancer

Grant Program: Canadian Cancer Society Impact Grants

Grant Amount: $1,238,500

Principal Investigator:
David Stojdl, Children's Hospital of Eastern Ontario

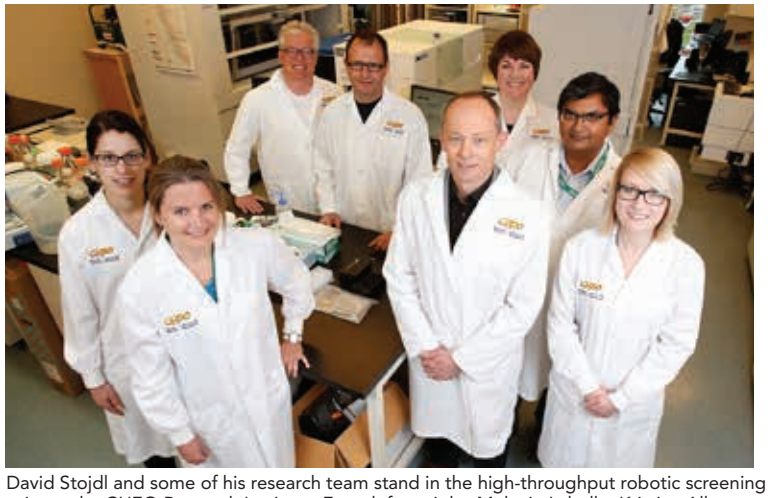
Co-investigators:
Yonghong Wan, McMaster University
Ian Lorimer, Ottawa Hospital Research Institute
Garth Nicholas, The Ottawa Hospital
Vasco Ferreira Da Silva, The Ottawa Hospital
J. Andrea McCart, The Toronto Hospital (General Division) – UHN

David Stojdl and his team are trying a different way to treat brain tumours. Their lab has custom-built an oncolytic virus biotherapy specifically for the treatment of the devastating brain cancer Glioblastoma multiforme (GBM). The Farmington virus kills brain cancer cells but leaves normal healthy tissue intact, and is one of the only oncolytic viruses in the world that can be safely injected at high doses into the brain. For their Brain Canada-funded project, they have re-designed the Farmington virus with an immunotherapeutic payload that triggers a patient's own immune system to fight their brain tumour.

Dr. Stojdl has assembled a team of both basic and clinician scientists who are world leaders in the field of oncolytic virotherapy and brain cancer and they have already been successful in bringing other oncolytic viruses to clinical trials. This new project is uniquely positioned to succeed in its goal of bringing this technology to Phase I/IIa trials, and ultimately vastly improve the outlook of GBM patients in Canada.

Since their project started, they have shown that the new Farmington virus immunotherapy attacks brain tumours on multiple levels: first, it engages and boosts pre-existing immune cells to unprecendented levels against cancer cell targets. This also establishes long-lived immune cells that can perform immune surveillance to prevent future tumour recurrence. Secondly, the Farmington virus acts as a beacon to guide immune cells to the tumour site. Thirdly, Farmington virus supports these T cells as they kill cancer cells by releasing the brake that restricts their activity. By placing treated mice into an MRI machine, researchers can actually watch the virus shrinking large, aggressive brain tumours. This tumour-fighting ability is directly linked to the way they have engineered the virus.

The next steps are to move this promising virus immunotherapy into patients. The team is already at the forefront of designing and producing rhabdovirus vectors for clinical trial: they currently have two ongoing virus clinical trials for other cancer indications in Ottawa and across Canada. The size of the immune response that they have seen with their new Farmington virus platform is bigger than anything previously described in the cancer vaccine field. Consequently, this technology holds great promise for improving the outlook of Canadians with aggressive, devastating brain tumours.

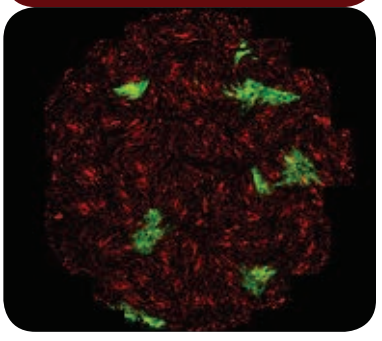


David Stojdl and some of his research team stand in the high-throughput robotic screening suite at the CHEO Research Institute. From left to right: Melanie Labelle; Kristina Allan; Stephen Baird; Charles Lefebvre; David Stojdl; Stephanie Swift; Ananda Mookerjee and Katelynn Rowe.

FACTS ON BRAIN CANCER

- Almost 3,000 Canadians are diagnosed with brain cancer each year.
- Currently, there are no effective long-term treatments for brain tumours.
- Treatment usually consists of surgery, chemotherapy and radiation.
- Glioblastoma multiforme (GBM) is the most common and most lethal type of malignant primary brain tumour. These types of tumours are very resistant to conventional therapies and treatment.
- GBM patients currently face a grim outlook, with an expected survival rate of just 18 months.

References: Canadian Cancer Society, Brain Tumour Foundation of Canada



Bright flashes of green and yellow mark the spots where Farmington virus is killing susceptible target cells (red)

> "The support our lab has received from Brain Canada, together with the Canadian Cancer Society and BioCanRx, has allowed us to expand our Farmington virus project to incorporate multiple research streams focused on designing a single robust, multi-modal virus platform to treat brain cancer. This includes bringing new research collaborators on board to create new ways of testing and validating our immunotherapy within the research setting. Ultimately, this support has put us in a very strong position to bring our immune-stimulating virus technology to the point of clinical testing."
>
> — David Stojdl, Ph.D.
> Children's Hospital of Eastern Ontario

Predicting serious mental illness in youth

FACTS ON YOUTH AND MENTAL HEALTH

- Most mental disorders begin in adolescence.
- Young people in the 15 to 24 age category are more likely to experience a mental illness and/or substance use disorders than other age ranges.
- Over one million children and youth in Canada are affected by a mental illness—yet, less than one in five will receive appropriate treatment.
- By the age of 25, it is estimated that 20 per cent of Canadians will have developed a mental illness.

References: Mental Health Commission of Canada, Statistics Canada

Jean Addington's students demonstrating neuropsychological testing

Adolescent Mental Health

Grant Program: 2014 Team grants

Grant Amount: $1,387,285

Principal Investigator:
Jean Addington, Hotchkiss Brain Institute, University of Calgary

Co-Investigators:
Glenda MacQueen, Hotchkiss Brain Institute, University of Calgary
Signe Bray, University of Calgary
Jonathan Downar, Toronto Western Research Institute, University of Toronto
Sidney H. Kennedy, University Health Network
Benjamin Goldstein, Sunnybrook Research Institute
JianLi Wang, University of Calgary
Catherine Lebel, University of Calgary

Serious mental illnesses (SMIs) such as recurrent unipolar depression, psychotic or bipolar disorder have multi-factorial causes, resulting from interactions among biological, clinical and psychosocial factors, including, but not limited to, stress, early trauma, and the use of psychoactive drugs.

Currently, if a young adult experiences mild behavioural disturbances, there is no way to determine if they will go on to develop an illness, what that illness will be, and what can be done to change its course and prevent its worsening to an SMI. Understanding the interplay of risk factors that determine the onset of SMI therefore relies on learning about the effects that key risk factors exert on the neurobiology of the developing brain.

For this project, Jean Addington and her team of researchers at the University of Calgary and the University of Toronto are aiming to identify youth at risk before they develop a SMI so that intervention can begin as soon as possible. At the same time, they are trying to understand the triggers of SMI. To do this work, they have brought together researchers who study psychotic and mood disorders, along with imaging specialists and basic scientists.

Their project involves following a large group of youth in both Calgary and Toronto, aged 14-25, who are at different stages of risk for developing SMI. They assess a wide range of clinical and psychosocial factors in order to determine the ones that can be used to predict key outcomes. Risk factors being looked at include increasing disability, secondary substance misuse, not participating in education or employment, new self-harm and worsening physical health, as well as SMI development.

They perform brain scans of each study participant to investigate whether neuroimaging can distinguish youth who will develop SMI from those who will not. They also collect and analyze blood in order to cast light on the biological factors that may contribute to SMI development in youth.

At the end of the project they will have a comprehensive database of demographic, clinical, imaging, genetic and biochemical data that will be combined to create prediction models that categorize youth across a range of risk severity for developing SMI. This information will eventually feed into national and provincial programs to optimize prevention and early intervention services.

Having just finished the second year of the grant, the team has recruited over 80% of participants at the Calgary site and just over 50% at the Toronto site. They expect to have full recruitment by the end of the summer of 2017.

Jean Addington, Ph.D., Principal Investigator of the Adolescent Mental Health project

> "This project will generate fundamental knowledge about the impact of key risk factors, such as stress and substance use, on the developing adolescent brain."
>
> — Jean Addington, Ph.D.
> University of Calgary

Moving discoveries from the lab towards real-world applications

BIOTIC: The BIOmedical Translational Imaging Centre

Grant Program:
2015 Platform grants

Grant Amount: $449,846

Principal Investigator:
Steven Beyea, IWK Health Centre, Halifax

Co-Investigators:
Tim Bardouille, **Chris Bowen**, **Kim Brewer**, **Steve Patterson**, **Lauren Petley**, IWK Health Centre
James Rioux, QEII Health Sciences

Canada has world-class neuroscience talent, leading to high-impact discovery research in brain science. However, turning leading science into the products that will affect the course of a patient's health requires, in part, the existence of platforms capable of leveraging the impact of Canada's world-class talent through commercialization of new therapeutic and diagnostic technologies.

Imaging is, in many ways, a bridge between the diagnostic and therapeutic worlds. The creation of new neuroimaging technologies can advance our understanding of the brain and improve the diagnosis of brain disorders, while the application of imaging to the study of novel therapeutics can provide critical information on the efficacy, mechanism of action, dosage and safety.

Whether the company is a large multinational or a small university-based start-up, obtaining access to leading-edge multimodal imaging technology and expertise is vital to advancing their technology down the regulatory pathway. For the small start-ups that dominate the neurotechnology space in Canada, this access must be cost-effective, since access to capital is a significant challenge. This represents a hurdle, however, since imaging platforms and expertise are expensive to operate, yet full recovery of the costs of this research is a limiting factor for these small Canadian companies.

BIOTIC is a hospital-based medical imaging research facility, explicitly mandated and structured to focus on the clinical and commercial translation of new neuroscience technologies. BIOTIC's platform achieves its goals by taking research-dedicated imaging equipment, locating it directly within academic health centres, and surrounding it with an integrated team of technical, scientific and business expertise that understands what it takes to partner with industry and launch a product to market. BIOTIC is uniquely placed in Canada to play a catalytic role in helping companies and academics advance their technology. They can help companies get a foothold in the hospitals and try out their technology in a cost effective way within a rigorous scientific and ethical framework.

Although demand for additional partnerships with Canadian neuroscience companies exists, BIOTIC's ability to further grow its capacity, and hence accelerate the commercialization of neuroscience, is currently limited by a lack of on-the-ground staff performing research coordination, and assistance. This platform grant allowed the funding of an Industry Research Assistant, Industry Research Coordinator, and Industry Research Associate and provides BIOTIC with the capacity for growth in the number of companies that they are able to work with, while equally accelerating the rate at which they can complete industry partnered research, through dedicated research coordination and assistance. It allows companies to work with a partner who understands commercial timelines, milestones and deliverables that are needed and exist within a healthcare setting.

Dr. Tim Bardouille and Santosh Murthy analyze functional MEG data in the MEG lab located in the IWK Health Centre

FACTS ON NEUROIMAGING

Neuroimaging plays a critical role in brain research by allowing researchers a non-invasive look into the brain.

Neuroimaging:
- advances researchers' understanding of the brain
- provides information on the efficacy of therapeutics
- helps improve diagnosis of brain disorders

NEUROIMAGING TECHNIQUES

MRI - Generates images of the brain through the use of magnetic fields and radio waves.

fMRI – Measures brain activity by depicting changes in blood flow and oxygen levels.

DTI - Measures thickness and density of the brain's connections by tracking how water molecules move around the brain.

CT – Creates images of the structures of the brain by combining a series of x-ray images taken from different angles.

EEG – Detects changes in electrical activity in the brain through electrodes attached to the scalp.

References: American Psychological Association

MRI technician prepares a participant for an MRI scan

> "This platform support grant will really help us deliver on what is frankly the core mandate of our platform – to help companies in getting cost-effective access to expertise and technology that they need to move the technology forward."
>
> — Steven Beyea, Ph.D.
> Scientific Lead, BIOTIC

Research programs overview 2016

Grants awarded

2015 Team grants
(formerly Multi-Investigator Research Initiative (MIRI))

Team grants support multi-disciplinary teams that are conducting novel and transformative research that will fundamentally change our understanding of nervous system function and dysfunction and their impact on health. The grants are for three years and normally provide up to $500,000 a year for a total of $1.5 million. In 2016, four new team grants were awarded as part of the 2015 Team Grant Competition, representing over $5,000,000 in funding over three years.

2015 Platform grants
(formerly Platform Support Grants)

Platform grants are designed to sustain and enhance the capabilities and accessibility of research platforms essential for tomorrow's brain research. The grants are intended to fill a funding gap for operations and maintenance of major research platforms that provide national or regional technical capability to multiple neuroscience investigators from a number of institutions. In 2016, four new platform grants were announced as part of the 2015 competition, representing $6,000,000 of new funding.

New Targeted Programs

Improving Health Outcomes and Quality of Life team grants

On December 9th, 2016, Brain Canada launched a new team grant competition called the Improving Health Outcomes and Quality of Life Team grant. This initiative will support three-year team research projects that address improving health outcomes, including quality of life, over a reasonably short period of time. This competition is intended to provide opportunities for unorthodox collaborations between multidisciplinary teams of researchers (including social sciences), clinicians, allied-health workers, carers and patients. The deadline for Letters of Intent was February 8th, 2017 and the deadline for Full Applications is July 31st 2017. Funding is expected to begin in November 2017.

Open Neuroscience Data Sharing Platform grant

On December 16th, 2016, Brain Canada launched the Open Neuroscience/ Data Sharing Platform Grant competition. This initiative will help support the development and maintenance of a large-scale neuroscience network as well as its operating costs for a period of three years. The competition is intended to bring together existing Canadian neuroscience platforms, initiatives and networks, in order to "hardwire" Canadian neuroscience and position Canada as a world leader in this area. Neuroscience research generates large amounts of complex data. Understanding the significance of this data requires critical infrastructure in the form of large, integrated databases with associated neuroinformatics and computational tools for analyzing and modelling brain function. To facilitate collaboration, data must be shared between qualified investigators, with strict adherence to the highest standards of ethics, privacy and data security. The platform grant will help bring together existing Canadian neuroscience platforms, initiatives and networks, and will allow them to link, leverage, enhance and expand to form an integrated network. One project will be funded and funding is expected to begin in August of 2017.

Partnered grants

ALS Society of Canada

In November of 2014, a partnership between the ALS Society of Canada and Brain Canada resulted in the largest one-time investment in research in the history of the ALS Society of Canada: a $20-million investment in a national research program. To date, 33 projects have been funded through this partnership over the past three years, representing $18,054,690 in funding. The Brain Canada and ALS Society of Canada partnership encompasses three jointly- funded programs; Arthur J. Hudson Grants for Translational Research; Career Transition Grant; and the Discovery Awards. The 2016 programs were officially launched on March 17th, 2016 and following a rigorous review process, two Hudson, three career transition and seven discovery grants were awarded. The 2017 Hudson grant competition was launched on March 9th, 2017.

Alzheimer's Society of Canada

Brain Canada has partnered with the Alzheimer's Society of Canada for the Alzheimer Society Research Program (ASRP)/Brain Canada New Investigator & Career Change Grant program. This program is providing salary support to new investigators and investigators wishing to make a career change from other areas to Alzheimer's disease and related dementias. The 2016 competition was launched on September 4th, 2015, and the full application deadline was November 6th, 2015. Following a rigorous review process, three projects were recommended for funding.

Canadian Cancer Society (CCS)

Brain Canada is collaborating with the Canadian Cancer Society to support research focused on brain and nervous system cancer. In 2016, one project was recommended for funding, through the CCS's Impact Grant program. This program contributes to "pipeline" research by supporting significant progress along the research continuum from basic high-impact discovery to translational work of direct relevance to the clinic. The 2017 competition was launched in August of 2016. On February 28th, 2017, six new multi-disciplinary and multi-institutional research projects were funded under the CCS' Innovation, Innovation to Impact and Impact grant competitions, representing 2.4 million in funding. For details on one of the CCS Impact Grants projects, please see page 17.

> "There is a critical need for more research in brain cancer. We are very grateful for our partnership with Brain Canada, as well as our generous donors, to enable Canadian scientists to make significant contributions to improving diagnosis and treatment of brain cancer."
>
> — Michael Wortzman, Ph.D.
> Assistant Director, Research Programs,
> Canadian Cancer Society

Partnered grants cont'd

From left to right: Learning in Machines and Brains co-directors Yann LeCun and Yoshua Bengio and Associate Fellow Richard Sutton

CIFAR

In April of 2015, Brain Canada and CIFAR signed a joint collaboration agreement to increase research capacity in Canada by co-funding three brain-related programs totalling up to $20 million. Each of the three research programs consists of 10-40 leading researchers from around the globe who are answering fundamental questions about the brain and what it means to be human. The three programs are the Learning in Machines and Brains program; the Brain, Mind and Consciousness program; and the Humans and the Microbiome program. All three programs have advanced in their research directions and have held several meetings in the form of symposia, panel discussions and summer schools over the past year resulting in new collaborations and new research projects. For details on one of the CIFAR programs, please see page 14.

> "The CQDM and Brain Canada Focus on Brain program has funded eight outstanding Canadian teams whose projects are addressing unmet needs in Alzheimer's and Parkinson's diseases, as well as in drug delivery to the brain."
>
> — Diane Gosselin, Ph.D.
> President and CEO, CQDM

> "My colleagues and I are grateful to CQDM and Brain Canada for this outstanding opportunity to pursue innovative work that could lead to treatments for patients dealing with the devastating consequences of Parkinson's disease and ALS. The next three years could prove to be ground-breaking in our understanding of these diseases."
>
> — Edward Fon, M.D.
> Professor, McGill University
> Scientific Director, Montreal Neurological Institute;
> Recipient of a 2015 Focus on Brain grant

Consortium Québécois sur la Découverte du Médicament (CQDM)

Brain Canada partnered with CQDM to create the Focus on Brain program. The goals of the program are to link academia with industry to support pre-competitive research that enhances bio-pharmaceutical R&D productivity, and to accelerate the development of new, safe, and effective drugs in neuroscience.

The second Focus on Brain competition was launched on September 15th, 2015, and the letter-of-intent submission deadline was December 15th, 2015. The applications were reviewed by a CQDM-Brain Canada Joint Selection Committee. Seven applications were invited to submit a full application by the April 28th, 2016, deadline and two applications were approved for funding, totaling almost $3 million.

A third project was funded through CQDM's Quantum Leap program for a total of $1 million. The Quantum Leap program is intended to support outstanding translational research projects implementing state-of-the art technologies with very high potential impact in key areas of unmet needs within the biopharmaceutical industry. It is expected that the funded technologies should provide valuable opportunities for future collaborations and/or investment from key partners on a global scale. For details on one of the Focus on Brain projects, please see page 12.

Dr. Hubert van Tol Travel Fellowship

The Dr. Hubert van Tol Travel Fellowship was established in 2006 to honour the memory of neuroscientist Dr. Hubert van Tol who died suddenly in a bicycle accident on April 20th, 2006. Dr. van Tol greatly valued mentoring young researchers and recognized the importance and value of international experiences early in the training of young scientists. The fellowship is open to all PhD students and postdoctoral fellows undertaking research on a Brain Canada-funded grant. The award enables young researchers to attend a major international conference, symposium, or training course. The recipient is selected on a competitive basis by an expert selection committee.

In honour of the 10-year anniversary of the Dr. Hubert van Tol Travel Fellowship, Brain Canada organized an event, with the generous support of the Seger-van Tol family, to highlight the impact of the award, to announce this year's award recipients and to showcase past recipients. The event took place on November 7th, 2016, at Biff's Bistro in Toronto. Twenty guests attended, including past and new award recipients and their supervisors at the time of their award, Dr. Monica Seger-van Tol and Mrs. Marianne Seger, and Brain Canada staff and Directors.

The event was chaired by Ms. Inez Jabalpurwala, President and CEO, Brain Canada. For this event, four of the previous recipients were able to attend and provided speeches describing the opportunities that the award afforded them.

The 2017 Dr. Hubert van Tol Travel Fellowship was launched on March 1st, 2017, and the applications were due on April 30, 2017. The award recipients will be announced in the summer of 2017.

Monica Seger-van Tol with past and current award recipients (Left to right: Long-Jun Wu, Maria Morena, Haley Vecchiarelli, Nancy Butcher, Monica Seger-van Tol, Anastassia Voronova, Mike Hildebrand).

> "Being in my third year of my postdoctoral training, attending and presenting research results at international conferences is of crucial importance, in order to network with important scientists, exchange ideas and establish international collaborations, all of which are critical to achieve my career goals."
>
> — Maria Morena, Ph.D.
> Hotchkiss Brain Institute,
> University of Calgary
> Recipient of 2016
> van Tol Travel Fellowship
> Post Doctoral Award

> "I was extremely grateful to receive the Dr. Hubert van Tol Travel Fellowship from Brain Canada. This fellowship facilitated my attendance at two major international conferences and one training course. Attendance at conferences is vital for all researchers, but especially young researchers, as it allows them to build up their confidence in their work."
>
> — Haley Vecchiarelli
> Hotchkiss Brain Institute, University of Calgary
> Recipient of 2016 van Tol Travel Fellowship Doctoral Award
> University of Toronto

Kids Brain Health Network (KBHN)

(Formerly NeuroDevNet)

Brain Canada partnered with the Kids Brain Health Network in April of 2015 on the Developmental Neurosciences Research Training Awards program. The training award funds doctoral candidates and post-doctoral fellows performing research aimed at the origins, early detection, and effective treatment of brain development disorders. In addition to the award, the recipients will take part in the Kids Brain Health Network Training program, which endeavors to develop cross-disciplinary and collaborative skill sets for the next generation of scientists, clinicians, and health-service professionals. Brain Canada's financial commitment was up to $1 million per competition. The program was launched May 15th, 2015, and 64 applications were received. Seventeen applications were approved for co-funding (eight graduate studentships and nine postdoctoral fellowships), totaling $1.5 million in funding. With the generous support of The Azrieli Foundation, $120,000 was provided to fund three of these trainees. A new competition was launched in April of 2017. For details on one of the Developmental Neurosciences Research Training Award projects, please see page 16.

Huntington Society of Canada

On November 20th, 2015, Brain Canada and Huntington Society of Canada launched the Creating HD (Huntington Disease) Clinician-Scientist-to Patient Virtual Networks Multi-Investigator Research Initiative (MIRI). This joint initiative supports research projects that connect clinicians with scientists, and scientists with the HD community, in a manner that can be demonstrated to create a collaborative HD Clinician-to-Scientist-to-Patient Virtual Network. The multi-disciplinary and multi-investigator approach emphasized in this initiative is expected to maximize the opportunity for discovery and translational research that will expedite the discovery-to-effective-treatment cycle, while expanding the overall understanding of HD therapy in humans. Five applications were submitted by the March 4th 2016 deadline. One application was approved for funding, totaling $950,000. A second "Creating HD Clinician-Scientist-to-Patient Virtual Networks" competition was launched on December 1st, 2016 and successful projects were announced in April of 2017, with funding commencing in July of 2017. For details on one of these projects, please see page 13.

> "As we advance towards treatments addressing the root cause of Huntington disease. This innovative research initiative and partnership with Brain Canada has the potential to transform HD research and provide the mechanisms to expedite discovery to treatments."
>
> — Bev Heim-Myers
> Chief Executive Officer, Huntington Society of Canada

Multiple Sclerosis Society of Canada (MS Society) and Biogen

The MS Society of Canada, Biogen, and Brain Canada announced a partnership on December 6th, 2016, at the endMS Conference in Toronto. Brain Canada will provide $2.5 million towards this $7+ million research initiative to support an MS Progression Cohort that will provide a platform to address research questions related to the mechanisms of progression, treatments and the impact of MS. (More details on the partnership can be found on page 24 of the report.)

National Institutes of Health (NIH)

The Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative is part of a US Presidential focus aimed at revolutionizing our understanding of the human brain. In 2015, the 10 NIH Institutes that are part of the NIH BRAIN Initiative announced a new partnership with Brain Canada to support the involvement of Canadian researchers in the NIH BRAIN Initiative. Both the NIH and Brain Canada believe that the ambitious goals of the BRAIN Initiative can best be attained by collaboration across disciplinary geographic boundaries. Two Canadian researchers are currently being supported through this partnership.

Les Grands Ballets Canadiens

Brain Canada has partnered with Les Grands Ballets Canadiens de Montréal to support a collaborative research study that evaluates the effects of dance therapy on mental health. Funds for this award are provided by Brain Canada through the financial support of Health Canada and Les Grands Ballets Canadiens de Montréal's National Centre for Dance Therapy. $23,000 was awarded to this project led by Dr. Isabel Fortier of McGill University.

Partnerships

Partnerships are a central component of the Canada Brain Research Fund (CBRF). Brain Canada is working with funding partners with interests across the entire range of neurological diseases and injuries, mental illnesses and addictions, with a view of ensuring that the CBRF broadly serves the brain research community. We are proud to count 94 research institutions, provincial agencies and health charities as strategic, intellectual and financial partners—resulting in a more coordinated, collaborative brain community. Together we will have an impact on the lives of all Canadians. We have provided an overview of our partnered grants programs in the previous pages and below we provide a more in-depth look at one of these partnerships, as well as some profiles of our knowledge translation partnerships and activities which are described in the following pages.

FACTS ON MULTIPLE SCLEROSIS (MS)

- MS is as an autoimmune disease of the central nervous system. Symptoms of MS include fatigue, lack of coordination, weakness, tingling, vision problems, bladder problems, cognitive impairment and mood changes. there are treatments that can help prevent relapses and slow progress but there is currently no cure.
- Canada has the highest rate of multiple sclerosis (MS) in the world. It is estimated that there are currently 100,000 Canadians living with the disease.
- While it is most often diagnosed in those aged 15 to 40, children and older adults are also diagnosed with the disease.
- Rates of MS are higher farther from the equator.
- Approximately 2.5 million people around the world have MS.
- The ratio of women to men having the disease is 2:1

References: MS Society of Canada, National Multiple Sclerosis Society

MS Partnership

The Multiple Sclerosis Society of Canada, Biogen Canada, and Brain Canada have formed a partnership to fund a $7+ million innovative research initiative to study disease progression in people living with MS in Canada. Officially launched on March 28th, 2017, the MS Progression Cohort is a unique pan-Canadian opportunity to answer the critical question of why some people with MS progress and others do not, and to pinpoint the exact triggers of progression and establish tools that can detect and monitor those triggers. In addition, the impact of the disease and treatments on individuals as well as the impacts on the Canadian healthcare system will be researched. Progression – or the steady worsening of disease and increase in disability – is a challenging reality faced by all people affected by MS, and despite major advances in MS research, the mechanism of progression and the ways in which researchers and clinicians can track progression are still not fully understood. The Canadian MS Progression Cohort will have significant implications on how those living with MS manage and understand their illness from diagnosis and throughout the various stages of the disease. This study will look at progression from the biological, physical, and socioeconomic perspectives, and will meaningfully engage people living with MS so that their individual experiences are captured. Ultimately, the goal of the cohort is to connect biological findings with real world and clinical findings to create a comprehensive picture of progression in MS, with the hope that researchers will better understand the unpredictable nature of MS and find a cure.

Each funding partner is contributing more than $2 million to the project. The deadline for the LOI submission was May 8th, 2017. The full application deadline is November 1st, 2017 and funding for the successful project is expected to begin in 2018.

Inez Jabalpurwala, President and CEO, Brain Canada; Yves Savoie, President and CEO, MS Society of Canada; Lisa Hickey, Vice President, Managing Director, Biogen Canada signing the MS Partnership agreement at the EndMS gala on December 7th, 2016

> “Biogen Canada is thrilled to partner with both the MS Society of Canada and Brain Canada on such an innovative and unique pan-Canadian research study for Canadians and MS. We recognize that this novel multistakeholder partnership demonstrates our collective commitment to the MS community here in Canada. A study of this magnitude will dramatically change the landscape about what we know about MS and MS progression.”
>
> — Lisa Hickey
> Vice President, Managing Director, Biogen Canada

Knowledge Translation

Brain Canada believes that by better connecting research findings and practice, every discovery along the pathway carries the potential to improve lives. This is seen through Brain Canada's commitment to funding projects across the entire spectrum of research including knowledge translation and exchange. Such programs are instrumental in taking the knowledge generated by research and translating it into applications that can deliver benefits to all Canadians. Here we highlight some of the knowledge translation partnerships and activities that took place in 2016/2017.

RBC Parlour Events

Brain Canada, with the generous support from RBC Foundation, organized three parlour breakfasts in different cities across Canada. These intimate events were designed to showcase excellent research across the country, and the impact of the Canada Brain Research Fund. Events were held in Edmonton on November 3rd, 2016, Winnipeg on December 7th, 2016 and Ottawa on February 9th, 2017. Mr. Wayne E. Bossert, Deputy Chairman and Global Head of Ultra High Net Worth Clients and Canadian Private Banking, RBC Wealth Management and Brain Canada director, co-chaired all three events along with a senior executive from the region: Ms. Tasha Giroux, Regional Vice President, RBC Royal Bank (Edmonton), Ms. Kim Ulmer, Regional President, RBC Royal Bank (Winnipeg), and Ms. Tina Sarellas, Regional President for Ontario North-East, RBC Royal Bank (Ottawa). Each event featured a keynote presentation from a Brain Canada-funded researcher. All three events received great feedback from guests and have initiated follow-up discussion about Brain Canada and brain research funding.

> "Thank you very much for the opportunity to co-host the Edmonton breakfast. It was a truly inspiring event. It presented a unique opportunity to showcase the depth and breadth of research and talent in Edmonton, while educating many influential community members and thought leaders on the important work of the Brain Canada Foundation."
>
> — Tasha Giroux
> Regional Vice President, Commercial Financial Services, Alberta & Territories, Royal Bank of Canada

Edmonton
November 3rd, 2016

In Edmonton, Dr. Lonnie Zwaigenbaum of the University of Alberta addressed early detection, diagnosis and treatment of autism spectrum disorders (ASD) in children and youth. Dr. Zwaigenbaum is a clinician scientist with first-hand experience of working with children with ASD.

Winnipeg
December 7th, 2016

In Winnipeg, Dr. Marco Essig of the University of Manitoba discussed the Manitoba Neuroimaging Platform housed at the University of Manitoba. Dr. Essig is a leading expert in the field of radiology whose research has helped advance the use of neuroimaging to better diagnose and treat various cancers.

Ottawa
February 9th, 2017

In Ottawa, Dr. Ruth Slack, University of Ottawa, discussed novel approaches to treating Parkinson's disease. Dr. Slack specializes in neural regeneration and her research includes the identification of strategies for the treatment of acute brain injury and neurodegenerative diseases.

Women's Brain Health Initiative Partnership

FACTS ON SEX AND GENDER IN RESEARCH

- Unipolar depression, stroke and dementia are twice as common in women than men.
- 70% of new Alzheimer's patients will be women.
- There is an over-reliance on male animals and cells in research which can obscure key sex differences.
- Women experience higher rates of adverse drug reactions than men do.
- 69% of the recipients of Brain Canada's capacity building awards – which are awarded to graduate students, postdoctoral fellows and early career researchers – are women.

References: World Health Organization, Alzheimer's Association, National Institutes of Health, WBHI

The Women's Brain Health Initiative (WBHI) and Brain Canada have partnered to help translate and communicate the outcomes of brain research by engaging and educating Canadians on the importance of brain health. WBHI is a Canadian charitable organization inspired to combat women's brain health disorders through investment in focused, innovative research at leading institutions across Canada. WBHI supports urgently-needed, leading-edge, peer-reviewed research on women's health and brain aging, to improve diagnostic and treatment methods.

As part of the partnership, Brain Canada has sponsored two editions of the WBHI publication *Mind Over Matter*, focused on sex and gender and prevention. Inez Jabalpurwala, Brain Canada's President and CEO authored the tribute page for each of them. Also as part of the partnership, Brain Canada and WBHI have co-organized six Millennial Minds events in Toronto designed to educate young Canadians on the importance of brain health and gender-based brain-aging disease research. These very successful events have focused on topics including yoga and meditation to calm the mind, the benefits of sleep, healthy eating and more.

Based on the overwhelming success of the Millennial Minds events, Brain Canada and WBHI will be organizing another series of events in 2017.

> "Ensuring that women's voices are heard and celebrated in research is not only about equity; it is about excellence."
>
> — Inez Jabalpurwala
> President and CEO, Brain Canada

Participant asking a question at the "How to eat healthy over the holidays" Engaging Millennial Minds event on November 15th, 2016, in Toronto, Ontario

Audience practicing some meditation techniques at the "Calm Your Mind" Engaging Millennial Minds event on December 6th, 2016, Toronto Ontario

2016 and 2017 editions of WBHI's *Mind over Matter* magazine, sponsored by Brain Canada

Mental Health Commission Partnership

Brain Canada has partnered with the Mental Health Commission of Canada to develop a *Road To Mental Readiness (R2MR)* training package for the families of first responders. First responders, whose jobs commit them to persistent, repeated exposure to potentially triggering incidents, are at ongoing risk of developing mental health problems. Work stress, workloads, and work-life issues have a negative impact on the physical and mental health of a substantive portion of Canada's first responder personnel. Stigma is a major barrier preventing people from seeking help for mental health problems or mental illness and it is the fear of stigma that often delays diagnosis and treatment. The R2MR program for families of first responders is based on a program initially developed by the Department of National Defence and adapted for the special needs of a law enforcement/first responder audience. The main objectives of R2MR are to reduce the stigma of mental illnesses, increase awareness of mental health, and offer resources to maintain positive mental health and increase resiliency. The program teaches family members about the 'Big 4': a set of evidenced-based cognitive behavioural theory techniques that can help individuals cope with stress and improve their mental health and resiliency. The Big 4 are positive self-talk, visualization, tactical breathing, and SMART goal setting. This new adaptation of the R2MR program is set to launch in December of 2017.

> "It is clear that improving mental health is a priority in paramedicine and other first responders. But we often forget about the family members and the important role they can play in supporting their loved ones. By supporting first responders and their families through R2MR, we aim to increase literacy and reduce the stigma associated with mental illness, helping to create a healthy work and home life environment. It says a lot about Medavie and Brain Canada that they have recognized this and have decided to contribute to the development of this important project."
>
> — Ed Mantler
> Vice President, Programs and Priorities,
> Mental Health Commission of Canada

FACTS ON MENTAL HEALTH IN FIRST RESPONDERS

- 194 Canadian military and public safety personnel have died by suicide since 2014.
- The prevalence of post traumatic stress disorder (PTSD) within Canadian general population is estimated to be 8%.
- The prevalence of PTSD within Emergency Services is estimated to be much higher at 16 – 24%.
- First responders experience PTSD at double the rate of the average population.
- It is estimated 22% of all paramedics will develop PTSD.

References: The Tema Conter Memorial Trust, Centre for Suicide Prevention

From left to right: Paul LeBlanc, Paramedic, Ambulance New Brunswick; Ed Mantler, VP of Programs and Priorities, Mental Health Commission of Canada; Bernard Lord, CEO, Medavie; Michel Gravel, Senior Manager, Deployment & Medical Communications Management Centre, NB EMS; Eric Arsenault, Fire Chief, City of Moncton; at the launch of the *Road to Mental Readiness for Families and other Supportive Relationships* at the Ambulance New Brunswick Fleet Centre in Moncton, New Brunswick.

First responder attending the launch of the *Road to Mental Readiness for Families and other Supportive Relationships* program

Canada Brain Research Fund grant recipients*

January 1st, 2016 – March 31st, 2017

2016

Team Grants (formerly MIRIs)

Cognitive Outcomes and Response/ Remission Efficacy of Convulsive Therapies in Treatment Resistant Depression: The CORRECT-TRD Trial
Principal Investigator:
Daniel Blumberger, Centre for Addiction and Mental Health
AMOUNT: $1,387,424

Novel approaches to understand the role of cAMP and co-signaling cascades in synaptic plasticity and brain disorders
Principal Investigator:
Graham L. Collingridge, LTRI Sinai Health System
AMOUNT: $1,850,000

Testing therapeutic approaches to improve cognitive dysfunction in a primate model of Alzheimer's Disease
Principal Investigator:
Douglas P. Munoz, Queen's University
AMOUNT: $857,062

The Aging Brain: Circadian, Transcriptomic, and Epigenomic Dimensions
Principal Investigator:
Art Petronis, Centre for Addiction and Mental Health
AMOUNT: $1,213,292

Platform Grants (formerly PSGs)

BIOTIC: The BIOmedical Translational Imaging Centre
Principal Investigator:
Steven Beyea, IWK Health Centre
AMOUNT: $416,107

Brain Tumour Registry of Canada
Principal Investigator:
Faith Davis, University of Alberta
AMOUNT: $303,359

Canadian Paediatric Stroke Imaging Research Platform: Harnessing an International Focus
Principal Investigator:
Gabrielle deVeber, The Hospital for Sick Children
AMOUNT: $1,433,750

The McConnell Brain Imaging Centre: a Hub of Scientific Excellence for Translational Neuroimaging
Principal Investigator:
Sylvain Baillet, Montreal Neurological Institute, McGill University
AMOUNT: $3,885,000

Canadian Cancer Society Impact Grants

Synergistic combination of IAP antagonism and immunotherapy to treat brain cancers
Principal Investigator:
Robert Korneluk, CHEO Research Institute
AMOUNT: $1,200,000

CQDM - Brain Canada - Focus on Brain

A patient-derived hiPSC neuronal platform for drug discovery in Parkinson's Disease and Amyotrophic Lateral Sclerosis
Principal Investigator:
Edward Fon, McGill University
AMOUNT:$1,500,000

ShARP: Screenable assays for RNA-binding proteins involved in brain disorders and diseases
Principal Investigator:
Martin Beaulieu, University of Toronto
AMOUNT: $1,477,008

CQDM - Brain Canada - Quantum Leap

Development of a disruptive mammalian membrane two-hybrids (MaMTH) platform for high-throughput screening of small molecules against PPI targets
Principal Investigator:
Igor Stagljar, University of Toronto
AMOUNT: $1,041,136

Alzheimer's Society Research Program/Brain Canada New Investigator & Career Change Grants

Novel mechanisms regulating intraneuronal Tau clearance as potential targets for Alzheimer's disease
Principal Investigator:
Michel Cayouette, IRCM Université de Montreal
AMOUNT: $225,000

Role of mitochondrial c-Src kinase in Alzheimer's disease
Principal Investigator:
Etienne Hébert-Châtelain, Université de Moncton
AMOUNT: $ 225,000

Tracking Alzheimer's disease progression at the earliest stages: a multimodal project
Principal Investigator:
Sylvia Villeneuve, Douglas Hospital Research Institute, McGill University
AMOUNT: $223,407

ALS Canada - Brain Canada Career Transition Awards

Characterization of MATR3 mutations associated with ALS
Principal Investigator:
Jeehye Park, The Hospital for Sick Children
AMOUNT: $315,000

Discovery of transcriptomic biomarkers and epigenetic therapeutic targets for c9ALS and sALS
Principal Investigator:
Veronique Belzil, Mayo Clinic
AMOUNT: $425,000

Pathogenic mechanisms of C9ORF72 repeat expansion in ALS and development of therapeutics
Principal Investigator:
Kessen Patten, INRS-Institut Armand-Frappier
AMOUNT: $315,000

*For a full list of team members for each project, please visit www.braincanada.ca

CANADA BRAIN RESEARCH FUND GRANT RECIPIENTS 2016/2017

ALS Canada - Brain Canada Discovery Grants

Decoding motor cortex circuit abnormalities at ALS onset through combined two-photon imaging in vivo and pharmacogenetics
Principal Investigator:
Lisa Topolnik,
CHUL, Université de Laval
AMOUNT: $100,000

Defining conserved functions of RNA binding proteins in stress-granule biogenesis
Principal Investigator:
Eric Lecuyer,
IRCM, Université de Montréal
AMOUNT: $100,000

Generating expanded repeats in the C9ORF72 ortholog in zebrafish
Principal Investigator:
Gary Armstrong,
CRCHUM, Université de Montréal
AMOUNT: $100,000

Impaired neuromuscular junction connectivity in Amyotrophic Lateral Sclerosis
Principal Investigator:
Charles Krieger, Simon Fraser University
AMOUNT: $100,000

Investigation of microbiota mediated suppression of motor neuron degeneration in genetic models of ALS
Principal Investigator:
Alex Parker,
CRCHUM, Université de Montréal
AMOUNT: $100,000

Mechanisms of in vitro synaptic transmission of mis-folded human SOD1
Principal Investigator:
Neil Cashman,
University of British Columbia
AMOUNT: $100,000

Proteomic and transcriptomic profiling of paraspeckle function in healthy and ALS model neuronal cells
Principal Investigator:
Marlene Oeffinger,
IRCM, Université de Montréal
AMOUNT: $100,000

ALS Canada - Brain Canada Arthur J. Hudson Translational Team Grants

A patient-derived iPSC platform of disease relevant cell models for biological studies
Principal Investigator:
Guy Rouleau, McGill University,
Montreal Neurological Institute
AMOUNT: $2,203,120

Pathogenic mechanism of C9orf72 haploinsufficiency in ALS/FTLD: a road to therapeutic discovery
Principal Investigator:
Janice Robertson,
University of Toronto
AMOUNT: $1,647,800

NIH BRAIN Initiative

Prototype NIR Ca2+ indicators into refined tools that can be applied for neuronal activity imaging in model organisms
Principal Investigator:
Robert Campbell,
University of Alberta
AMOUNT: $246,995

Summer school in Computational Sensory Motor Neuroscience (CoSMo)
Principal Investigator:
Gunnar Blohm, Queen's University
AMOUNT: $194,000

Huntington Society of Canada - Brain Canada Creating HD Clinician-Scientist-to-Patient Virtual Networks Team Grants

Gangliosides in Huntington's disease: from bench to clinics and back
Principal Investigator:
Simonetta Sipione,
University of Alberta
AMOUNT: $950,000

Les Grands Ballets - Brain Canada Team Grants

A mixed-methods evaluation of a dance therapy intervention for students seeking on-campus mental health services
Principal Investigator:
Isabel Fortier, McGill University
AMOUNT: $23,000

Dr. Hubert van Tol Travel Fellowships

Hayley Vecchiarelli,
University of Calgary
AMOUNT: $5,000

Maria Morena, University of Calgary
AMOUNT: $5,000

Women's Brain Health Initiative
(Knowledge Translation)

Mind Over Matter magazines
Millennial Minds events
AMOUNT: $406,000

2017

Canadian Cancer Society Impact Grants

Advancing biology based therapies for rhabdoid brain tumours
Principal Investigator:
Annie Huang,
The Hospital for Sick Children
AMOUNT: $1,214,047

Canadian Cancer Society Innovation to Impact Grants

Quantitative MRI as a biomarker of tumour resistance to radiation treatment in brain metastasis
Principal Investigator:
Greg Stanisz, Sunnybrook Health Sciences Centre,
University of Toronto
AMOUNT: $441,000

Canadian Cancer Society Innovation Grants

Integrative discovery of ion channels as drug targets in glioblastoma
Principal Investigator:
Jüri Remaind, Ontario Institute for Cancer Research
AMOUNT: $196,000

Molecular characterization of transcriptional repressor capicua in GBM
Principal Investigator:
Kenneth Aldape, UHN Princess Margaret, University of Toronto
AMOUNT: $196,000

Using synthetic antibody parts to construct antibody-based imaging devices – anti-EGFR molecular targeted imaging probes for diagnosing and monitoring glioblastoma
Principal Investigator:
Clarence Geyer,
University of Saskatchewan
AMOUNT: $195,968

The feasibility of hyperpolarized 13C-Pyruvate MRI for monitoring patients with intracranial metastasis
Principal Investigator:
Charles Cunningham,
Sunnybrook Health Sciences Centre,
University of Toronto
AMOUNT: $187,915

Mental Health Commission of Canada
(Knowledge Translation)

Road to Mental Readiness for Families and other Supportive Relationships
AMOUNT: $149,200

International review process

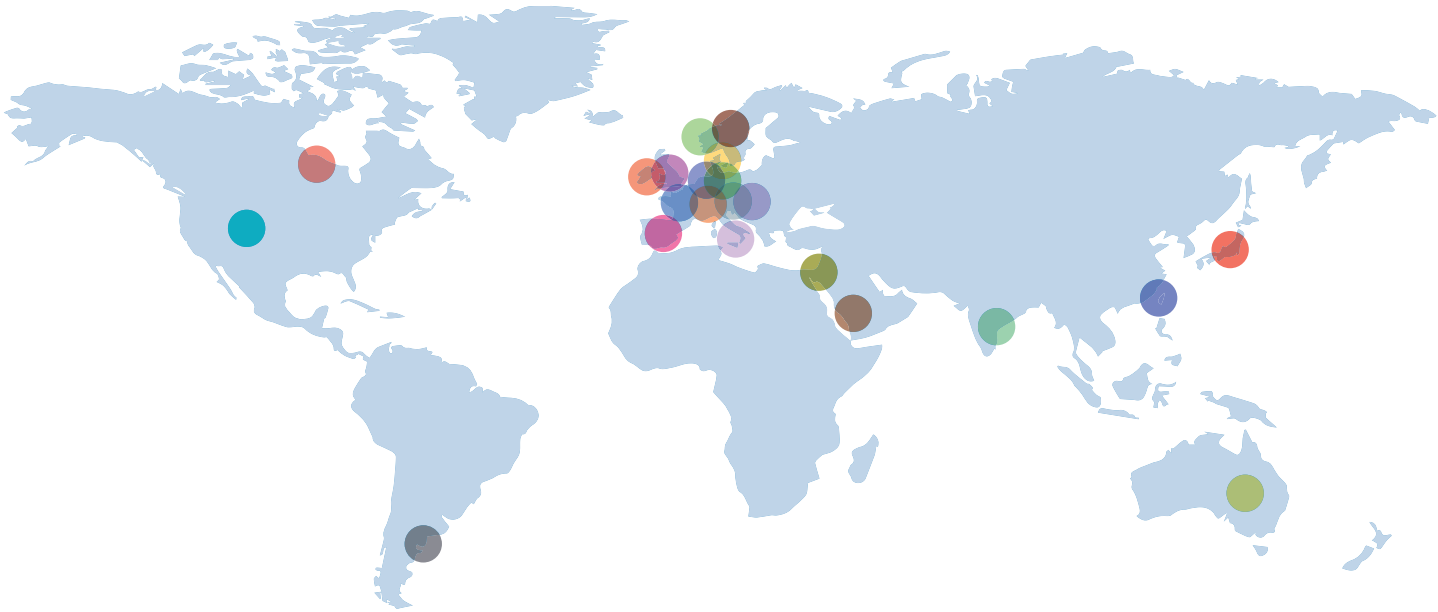
Brain Canada funding is allocated, first and foremost, on merit. We reward excellence and innovation and are able to take risks to fund high-potential ideas. Funding recipients are selected through open and partnered competitions and rigorous international peer review. In some cases, where an understanding of the Canadian context is required, one or more Canadian reviewers can take part in the peer review. Only applications judged to be at or above the high standard of excellence set by the relevant selection committees are funded.

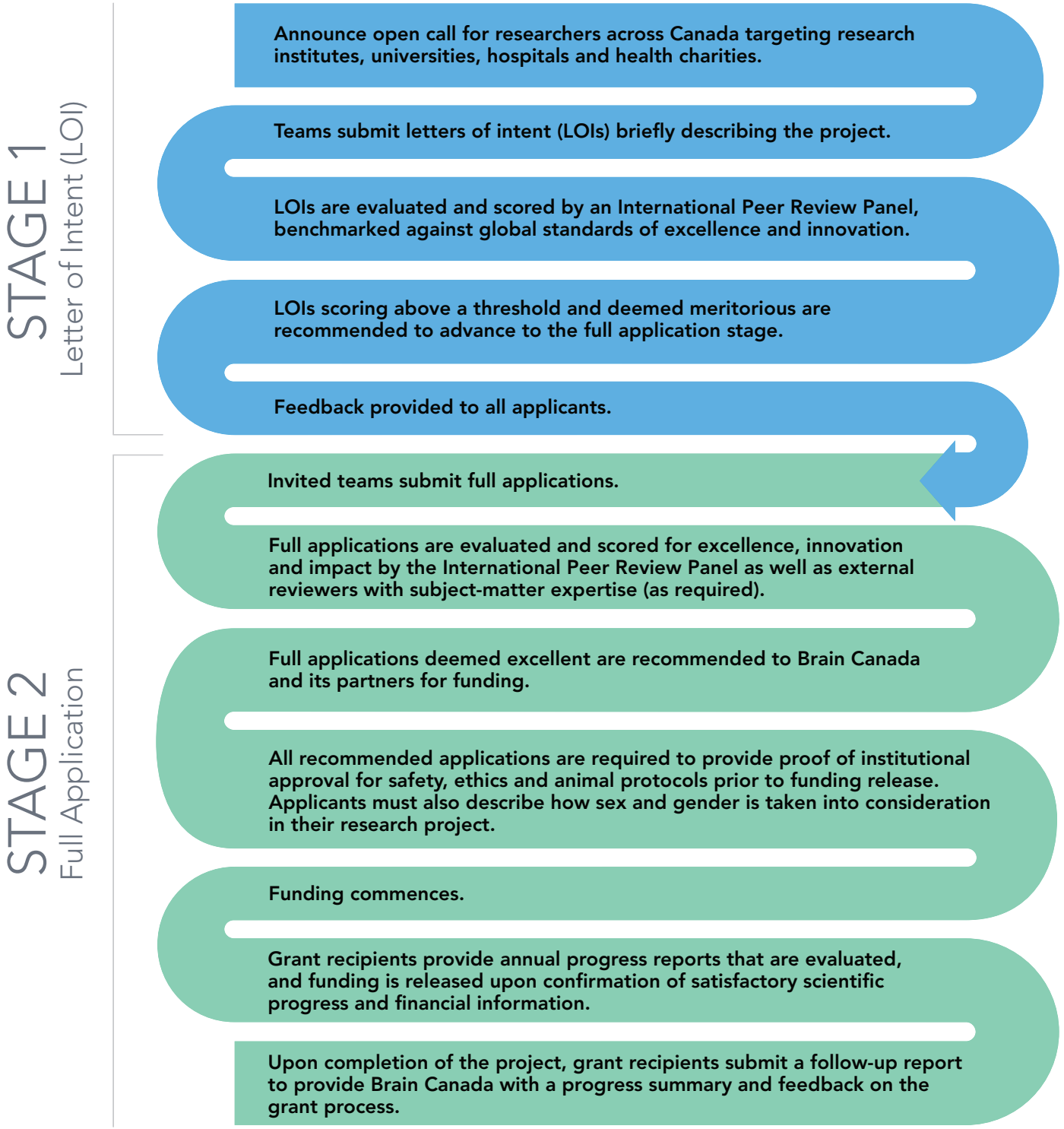
325 leading scientists from Canada and **23** other countries have served as reviewers.

> “Brain Canada’s high-quality peer review process ensures that the precious funds raised through the Ice Bucket Challenge are being used to fund only the absolute best ALS research. Additionally, our exposure to Brain Canada’s practices has greatly improved how we perform our own peer review.”
>
> — David Taylor, Ph.D.
> Vice President, Research, ALS Society of Canada

> “The complementarity of our expertise has made the collaboration with Brain Canada a real pleasure. Indeed their ability to recruit some of the best scientists and international neuroscience leaders as members of our review panel has allowed us to fund outstanding Canadian teams whose projects are addressing important unmet needs not only in devastating diseases such as in Alzheimer’s and Parkinson’s, but that are also paving the way to deliver one day drugs to the brain.”
>
> — Mario Chevrette, Ph. D.
> Vice President, Scientific Affairs, CQDM

Brain Canada reviewers from around the world




STAGE 1
Letter of Intent (LOI)
Announce open call for researchers across Canada targeting research institutes, universities, hospitals and health charities.
Teams submit letters of intent (LOIs) briefly describing the project.
LOIs are evaluated and scored by an International Peer Review Panel, benchmarked against global standards of excellence and innovation.
LOIs scoring above a threshold and deemed meritorious are recommended to advance to the full application stage.
Feedback provided to all applicants.
STAGE 2
Full Application
Invited teams submit full applications.
Full applications are evaluated and scored for excellence, innovation and impact by the International Peer Review Panel as well as external reviewers with subject-matter expertise (as required).
Full applications deemed excellent are recommended to Brain Canada and its partners for funding.
All recommended applications are required to provide proof of institutional approval for safety, ethics and animal protocols prior to funding release. Applicants must also describe how sex and gender is taken into consideration in their research project.
Funding commences.
Grant recipients provide annual progress reports that are evaluated, and funding is released upon confirmation of satisfactory scientific progress and financial information.
Upon completion of the project, grant recipients submit a follow-up report to provide Brain Canada with a progress summary and feedback on the grant process.

Communications and outreach

Brain Canada is proud to add our voice to Canadian and global forums, where we have the opportunity to connect with other country initiatives, to highlight Canada's contributions to brain research, to showcase our funding model, to seek opportunities to further leverage funds and ideas, and to ensure that Canadian researchers continue to make important contributions to advancing brain initiatives around the world.

Brain Canada had a presence at the following events:

May 28-31, 2016

10th Annual Canadian Association for Neuroscience

Toronto, Ontario

This year's conference had a strong focus on circuit structure and function, learning, memory, and behaviour, sex and gender differences, neurotechnology, and neuroimmunology.

July 20, 2016

Canadian Cancer Society Awards for Excellence in Cancer Research

Toronto, Ontario

The Canadian Cancer Society (CCS) held an event on July 20th, 2016 that celebrated the recipients of the CCS Awards for Excellence in Cancer Research. During the event, the CCS took the opportunity to showcase its partnership with Brain Canada to fund research in brain and nervous system cancer, by presenting a video highlighting the impact of the partnership and the matched funding model.

Canadian Cancer Society showcasing their partnership with Brain Canada at the Canadian Cancer Society Awards for Excellence in Cancer Research

June 9, 2016

CIFAR's "Our Musical Brain"

Toronto, Ontario

Brain Canada attended an event hosted by CIFAR to showcase the Azrieli Program in Brain, Mind, and Consciousness and to honour the generous support of the Azrieli Foundation. The event demonstrated the science behind music; pairing the music performance of the Gryphon Trio with scientific explanations from various CIFAR Senior Fellows. This sold-out event took place at the TELUS Centre for Performance and Learning in Toronto.

July 24-28, 2016

The Alzheimer's Association International Conference

Toronto, Ontario

The Alzheimer's Association International Conference (AAIC) is the world's largest forum on dementia research. Brain Canada participated in the 2016 AAIC as an exhibitor in the Canadian Pavilion – a Canadian-themed section of the Exhibit Hall made up of 19 Canadian organizations.

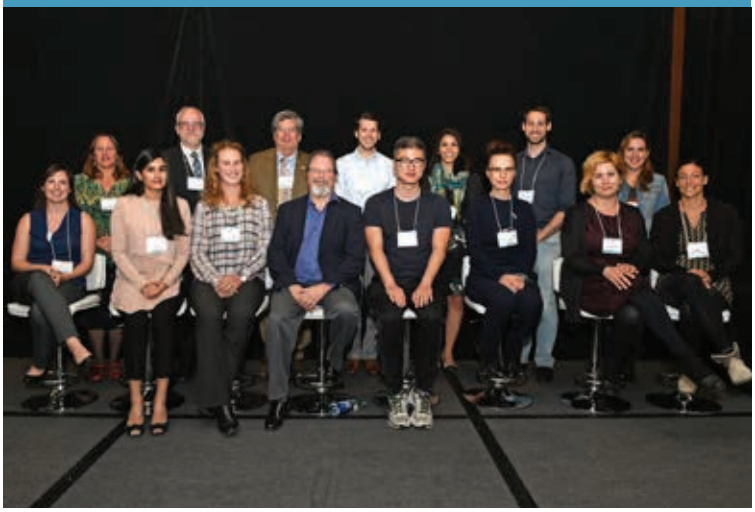
The Brain Canada booth at the 2016 AAIC

September 28-October 1, 2016

NeuroDevNet's 7th Annual Brain Development Conference

Calgary, Alberta

Brain Canada sponsored and attended NeuroDevNet's 2016 Brain Development Conference and co-hosted two conference events: a ceremony to welcome this year's Brain Canada-NeuroDevNet trainees and a "Meet the Experts" lunch



Participants at the 2016 NeuroDevNet Brain Development Conference

October 4-5, 2016

Canadian Alzheimer's Disease Basic Research Symposium (CANAD)

Vancouver, British Columbia

As part of knowledge translation and exchange events of the British Columbia Alzheimer's Disease Consortia, of which Brain Canada is a member and partner, Brain Canada co-hosted a public forum in Vancouver during CANAD called "Towards a cure: A public forum on Alzheimer's disease and dementia research." The event featured Brain Canada-funded researcher Dr. David Vocadlo, Simon Fraser University, among other panelists. The panel was moderated by Dr. Diane Finegood, President & CEO, Michael Smith Foundation for Health Research. In addition to a panel discussion, the event featured round-table discussions between researchers and community members, and a moderated audience discussion.

November 12-16, 2016

46th Annual Society for Neuroscience Conference

San Diego, California

Society for Neuroscience (SfN) is the largest neuroscience meeting in the world, with over 30,000 annual attendees who present and discuss cutting-edge research on the brain and nervous system.

November 15, December 6, 2016, and January 20, February 7, March 2, March 30, 2017

Women's Brain Health Initiative's (WBHI) Engaging Millennial Minds

Toronto, Ontario

As part of Brain Canada's partnership with WBHI, Brain Canada is co-organizing events that are both unique and engaging to educate Canadians on the importance of brain health and gender-based brain-aging disease research. This event was the kickoff event of a series geared towards millennials to engage them in thinking about what they can do to stay cognitively healthy throughout their lives. Proceeds raised from these events support the research and education programs of WBHI. Several Brain Canada-funded researchers, collaborators, and partners were invited and attended as our guests. The events have sold-out and received great feedback. See page 31 for more information on this partnership.

Alix Dudley, Senior Science Officer, Brain Canada; Inez Jabalpurwala, President and CEO, Brain Canada; Lynn Posluns, Founder, President and Board Chair, Women's Brain Health Initiative at a Millennial Minds event

November 13-15, 2016

Partnering for Cures

New York, New York

The Partnering for Cures Conference was a two-day conference hosted by FasterCures, a Center of the Milken Institute. The goal of this conference was to learn about creating a culture of patient engagement through panels, plenaries, workshops and breakfast roundtable discussions. The panels focused on understanding the challenges facing the Research & Development ecosystem and discussed actionable ideas to accelerate the development of treatments so that they can reach patients faster.

Speaking engagements

Inez Jabalpurwala, President and CEO, Brain Canada, had the following speaking engagements in 2016.

May 11, 2016

Corporate State Summit

Toronto, Ontario

The Corporate State Summit is a conference for women senior executives influencing business growth and leadership across the country and continent. This annual summit attracts a prestigious and accomplished group of women who engage in private debate about the trends shaking the corporate landscape and creating unprecedented business opportunity. During the 2016 summit, Inez Jabalpurwala, President and CEO, Brain Canada, participated in the panel discussion "Unraveling the Brain". Speakers included Fang Liu, M.D., Ph.D., Senior Scientist, Centre for Addiction and Mental Health; Gillian Hawker M.D., Sir John and Lady Eaton Professor and Chair, University of Toronto; Lynn Posluns, Founder, President and Board Chair, Women's Brain Health Initiative; and Catherine Zahn, M.D., President and CEO, Centre for Addiction and Mental Health and Brain Canada director. The panel was moderated by Beth Wilson, Toronto Managing Partner and Canadian Managing Partner of Community Leadership, for KPMG LLP.

From left to right: Catherine Zahn, M.D., President and CEO, Centre for Addiction and Mental Health and Brain Canada director; Inez Jabalpurwala, President and CEO, Brain Canada; Gillian Hawker M.D., Sir John and Lady Eaton Professor and Chair, University of Toronto; Fang Liu, M.D., Ph.D., Senior Scientist, Centre for Addiction and Mental Health; Lynn Posluns, Founder, President and Board Chair, Women's Brain Health Initiative

June 10, 2016

The Hospital for Sick Children, Centre for Brain and Mental Health Advocacy Day

Toronto, Ontario

Inez Jabalpurwala participated in a panel about working with federal and provincial partners to effect change and in particular, advocating for research. The theme for this inaugural event was "Building Connections, Accelerating Impact" and included educational workshops and networking events. Inez talked about the story of Brain Canada and key success factors and lessons learned working with Government. The panel included Cindy Blackstock, Executive Director, First Nation Child and Family Caring Society, and Carter Snead, M.D., Staff Neurologist and Senior Scientist, SickKids. Keynote speakers included Mark Del Monte, Director, Federal Affairs for the American Academy of Pediatrics and The Honourable Kirsty Duncan, Member of Parliament, Minister of Science.

September 15-16, 2016

OECD Workshop "Neurotechnology and Society: Strengthening Responsible Innovation in Brain Science"

Washington D.C.

Inez Jabalpurwala was invited to participate in a panel discussion about the "Role of Funders and Investors" in shaping trajectories of neurotechnology research and development, and to place scientific work within social, ethical, and regulatory contexts. The purpose of the workshop was to pool ideas and approaches, and promote coordinated efforts aimed at understanding and addressing the interplay of science and society in brain research and the development of neurotechnologies.

September 19, 2016

Coordinating Brain Projects Across the Globe Conference

New York, New York

Inez Jabalpurwala was invited to participate in the first global brain projects conference co-hosted by the Kavli Foundation, Rockefeller University, and Columbia University, which was funded by the National Science Foundation in support of the U.S. BRAIN Initiative. The goal of the event was to bring together government representatives, leading neuroscience researchers, and leaders of non-profit institutions from countries collaborating with the US. Inez shared part of Canada's planned and ongoing activities in brain research funding through explanations of Brain Canada and the Canada Brain Research Fund.

Inez Jabalpurwala speaking at the Coordinating Brain Projects Across the Globe Conference

Brain Canada as a convenor

September 28-29, 2016

Open Science/Data Sharing Workshop

Montreal, Quebec

Brain Canada organized an open science workshop in Montreal on September 28th and 29th of 2016 with the goal of developing a strategy for making Canada a leader in open neuroscience and data sharing. The event included a discussion about Open Science and data sharing with Guy Rouleau, M.D., Ph.D., Director of the Montreal Neurological Institute and Hospital and Anthony Phillips, Ph.D., then Scientific Director of the Institute of Neuroscience, Mental Health and Addiction. The key players in brain research and open science across Canada were invited to participate in this workshop and their discussion formed the basis for drafting a Request for Applications for a $10 million grant towards the creation of a Canadian open neuroscience and data sharing network.

November 7-8, 2016

Workshop on Canadian Brain Research Strategy

Toronto, Ontario

A workshop was organized by Brain Canada, CIFAR and Canadian Institutes of Health Research (CIHR) on November 7th and 8th, 2016. The purpose of the workshop was to discuss the development of a brain research strategy for Canada, by bringing together members of Brain Canada's Research Policy Committee and Science Advisory Council, together with co-leaders of each of the brain-related CIFAR and Canada First Research Excellence Fund (CFREF) research programs. The workshop was built upon previous discussions around the importance of developing a pan-Canadian strategy in brain research, initiated by Anthony Phillips, Ph.D., then Scientific Director of CIHR's Institute of Neuroscience, Mental Health and Addiction. The workshop participants were from key organizations that are well positioned to lead to a consensus on a Canadian brain research strategy. Through this effort, a more substantial and, ideally, co-ordinated federal investment in Canadian brain research may become possible. The workshop led to the creation of a working group that will work on a first draft strategy over the next months, prior to the commencement of broader consultation around the country.

April 25, 2017

Mental Health Initiative Workshop

Toronto, Ontario

A workshop was organized by Brain Canada on April 25th, 2017 at the Fairmount Royal York in Toronto to convene thought leaders in mental health research to advance a major national mental health initiative. The workshop, chaired by Sam Weiss, Ph.D., Vice Chair, Brain Canada and Chair of the Research Policy Committee, was divided into three main sections focused on research needs, governmental priorities and fundraising. The session on governmental priorities was attended by the Hon. Jane Philpott, Minister of Health. The workshop was attended by 30 participants and received excellent feedback.

A press release was issued by Health Canada to coincide with this workshop, announcing the $29 million in funding that was awarded by Brain Canada to 18 research teams in 2015. The release generated a lot of interest and resulted in more than a dozen news stories.

Top row, from left to right: Marco Leyton; James Kennedy; Paul Shay; Doug Earle; John Howland; William Honer; Bernard Le Foll; Gustavo Turecki; Nicholas Watters. Middle row, from left to right: Katarina Stojkovic; Mary Deacon; Paul Links; Bruce Pollock; Martin Alda; Stephanie Borgland; Rebecca Jesseman; Patricia Conrod; Marc Cuesta; Harriet MacMillan. Front row, from left to right: Rosemary Bagot; Ashok Malla; Sam Weiss; Inez Jabalpurwala, President and CEO, Brain Canada; The Honourable Jane Philpott; Minister of Health; Naomi Azrieli, Chair, Brain Canada; The Honourable Michael H. Wilson; Louise Bradley; Mary Anne Chambers.

In the news

Neuron, NeuroView

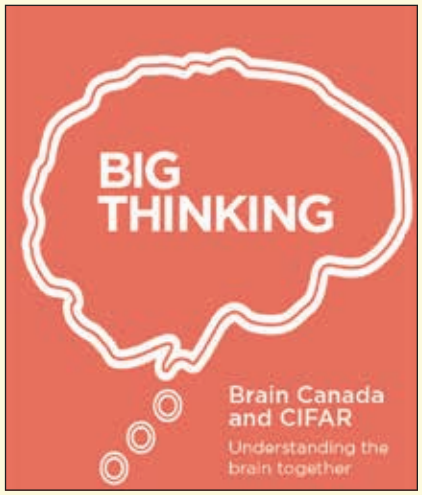
November 2nd, 2016

Inez Jabalpurwala, Brain Canada's President and CEO authored the NeuroView article of the November 2nd, 2016 edition of scientific journal *Neuron*. The article describes Brain Canada's "One Brain One Community" approach and its views on international collaboration and the future of brain research.

The Globe and Mail

May 31st, 2017

The May 31st edition of the *Globe and Mail* featured an advertisement highlighting the partnership between CIFAR and Brain Canada. Through this partnership, CIFAR is providing $10 million for brain research through the generosity of partners and donors, which is being matched by Brain Canada through the Canada Brain Research Fund, with the financial support of Health Canada. The funding is directed to ground-breaking research conducted by fellows in three CIFAR programs, the Learning in Machines and Brains; the Azrieli Program in Brain, Mind and Consciousness; and Humans and the Microbiome.



Society for Neuroscience

Spring 2016 newsletter

Inez Jabalpurwala, President and CEO of the Brain Canada Foundation, and Doug Munoz, Ph.D., President of the Canadian Association for Neuroscience were featured in the Society for Neuroscience's Q&A on Brain Canada and Canadian Neuroscience Funding. The column had previously featured the European Brain Project and Japan's Brain/MINDS Project. The Society for Neuroscience is the world's largest organization of scientists and physicians devoted to understanding the brain and nervous system. The nonprofit organization, founded in 1969, now has nearly 38,000 members in more than 90 countries and over 130 chapters worldwide. Their newsletter, Neuroscience Quarterly (NQ) provides coverage of SfN news, efforts, and events, as well as other issues important to the neuroscience community.

National Post Neurological Conditions Campaign

March 17th, 2016, May 17th, 2017

For 2016 and 2017, Brain Canada has once again authored the foreword on the *National Post*'s Neurological Conditions campaign. In the 2016 edition, Inez Jabalpurwala, President and CEO of Brain Canada discussed the enormous burden brain disorders place on our society and how increased funding and new collaborations in brain research are key to reducing this burden. The 2017 edition discussed how research is leading to improved patient outcomes through our increased understanding of brain function, which leads to advances in prevention, diagnosis, and treatment options.

Social Media Stats as of March 1st 2017

4,384 followers on Twitter

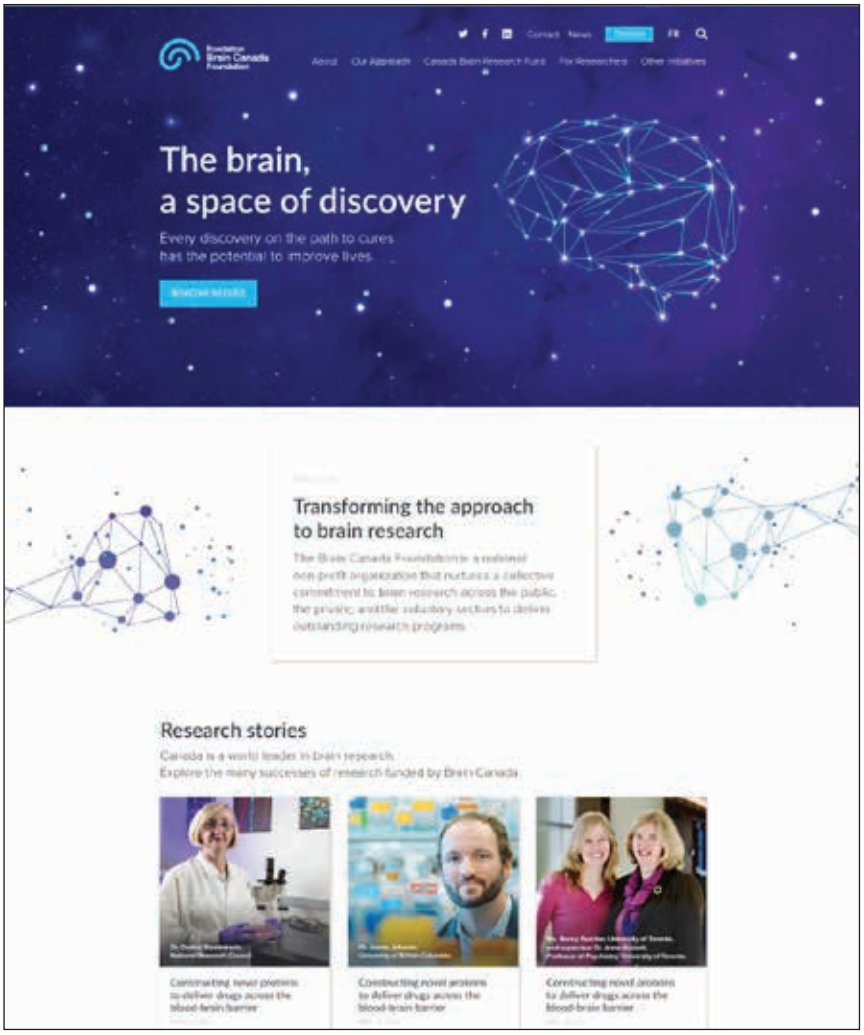
436 Facebook likes

Canada's Most Powerful Women: Top 100 Awards

November 24th, 2016

Inez Jabalpurwala, President and CEO, Brain Canada was named one of Canada's Top 100 Most Powerful Women by the Women's Executive Network. She was awarded in the "Trailblazers and Trendsetters" category—a recognition of her leadership of Brain Canada since 2001, and her role as a pioneer in advocating for brain research. The awards were officially presented at a gala of more than 1,000 in Toronto on November 24th.

The 2016 Canada's Most Powerful Women award winners



Brain Canada will be launching a new website in September 2017!

Check out www.braincanada.ca for information on Brain Canada, the Canada Brain Research Fund as well, as profiles of our funded researchers and a searchable directory of funded projects.

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University of Calgary
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The Science Advisory Council is comprised of 21 renowned Canadian and international scientists who represent a broad range of brain science fields and who provide timely insights into developments in the field well as a means to effectively assess our research program.

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Senior Scientist,
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Hospital for Sick Children Research Institute;
Canada Research Chair in Molecular and Cellular Cognition;
Associate Professor, Department of Physiology
Institute of Medical Science
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Area of expertise: Cognition and Behaviour

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Scientific Director, Quebec Pain Research Network
Area of expertise: Neural Excitability, Synapses, and Glia: Cellular Mechanisms

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Director, Molecular Genetics research unit,
IRCM Full Researcher Professor, Department of Biochemistry, Université de Montréal,
Adjunct Professor, Department of Anatomy and Cell Biology and Department of Biochemistry, McGill University
Area of expertise: Integrative Systems: Neuroendocrinology, Neuroimmunology and Homeostatic Challenge

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Area of expertise: Disorders of the Nervous System

Lesley K. Fellows, M.D., DPhil
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Area of expertise: Neurologist

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Area of expertise: Model organisms and systems

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Area of expertise: Cognition and behaviour

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University of British Columbia
Area of expertise: Neural Excitability, Synapses and Glia, Cellular Mechanisms

Doug P. Munoz, Ph.D.
Professor of Physiology, Psychology and Medicine
Queen's University;
Director, Queen's Centre for Neuroscience Studies;
Canada Research Chair in Neuroscience
Area of expertise: Sensory and Motor Systems

Rachel F. Tyndale, Ph.D.
Professor, Department of Pharmacology & Toxicology, University of Toronto;
Endowed Chair in Addictions, Department of Psychiatry, University of Toronto;
Head Pharmacogenetics, Centre for Addiction and Mental Health (CAMH)
Area of expertise: Addiction

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Area of expertise: Psychiatry/Behavior/Leader in optogenetics

Arnold Kriegstein, M.D., Ph.D.
Director, Eli and Edy, the Broad Center of Regeneration Medicine and Stem Cell Research,
Department of Neurology,
UCSF School of Medicine (CA, USA)
Area of expertise: Development/photonics, Neural Stem Cells and Embryonic Cortical Development

Lorne Mendell, Ph.D.
Distinguished Professor,
Stony Brook University (NY, USA)
Area of expertise: Pain, neuroplasticity of the mammalian spinal cord

Klaus-Armin Nave, Ph.D.
Head Max-Planck Gottingen, Glial biology and neurodegeneration, Max Planck Institute for Experimental Medicine, Göttingen (GER)
Area of expertise: Glial biology and neurodegeneration

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Stanford School of Medicine (CA, USA)
Area of expertise: Visual perception and visually-based cognition, neural mechanisms of decision making

Angela Roberts, Ph.D.
Professor of Behavioural Neuroscience,
Department of Physiology, Development and Neuroscience, Cambridge (UK)
Area of expertise: Prefrontal cortex/behavior/psychiatric diseases

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Professor of Radiology at the Harvard Medical School;
Professor of Health Science and Technology at the Harvard-MIT Division of Health Sciences and Technology
Director of the Athinoula A. Martinos Center for Biomedical Imaging at Massachusetts General Hospital (MA, USA)
Area of expertise: World leading expert in functional neuroimaging

Rosalind Segal, M.D., Ph.D.
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Area of expertise: Cellular and molecular neuroscience/oncology

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Area of expertise: Basal ganglia/cell metabolics and neurodegenerative disease; Molecular Biology; Movement Disorders; Neuroscience; Parkinson's disease; Physiology; Schizophrenia

Li-Huei Tsai, Ph.D.
Director, The Picower Institute for Learning and Memory,
Picower Professor of Neuroscience, Department of Brain and Cognitive Sciences,
Senior Associate Member, Broad Institute
Massachusetts Institute of Technology (MA, USA)
Area of expertise: Neurodegeneration

Donors

With the launch of the Canada Brain Research Fund (CBRF) in 2011, Brain Canada embarked on a national fundraising campaign. All funds raised from private and non-governmental sources are being matched by Government on a 1:1 basis. Brain Canada encourages all organizations raising funds for brain research to either contribute directly to the CBRF and have their donor dollars matched, or to partner on research programs to further leverage the public-private match. Brain Canada has always taken pride in keeping non-research related expenses to the minimum required for operational efficiency and good governance.

We would like to gratefully acknowledge the following individuals, foundations and corporations who made leadership contributions to the Canada Brain Research Fund.

Lead Donors

Individuals and Private Foundations

The Azrieli Foundation - $ 7.5 million

The Chagnon Family - $ 5 million

The Krembil Foundation - $3.25 million

The W. Garfield Weston Foundation - $ 3 million

$100,000 - $249,999

The Max Bell Foundation

The Jim Pattison Foundation

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$20,000 – $99,999

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The Henry and Berenice Kaufmann Foundation

Marianne Seger and Monica Seger-van Tol

The Barbara Turnbull Foundation

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$620,500

RBC Foundation

$500,000

Bell Canada

CIBC

$200,000

National Bank of Canada

$100,000

Power Corporation

In the past year, gifts were made to honour the following individuals:

John Jin

Dany Dandouni

Mahd

Mark Johnston

Herman McCowan

Joanne Schiewe

Bernie and Janine Weis

We would also like to thank the other many donors who contributed, such as through CanadaHelps.org.

PARTNERS AND SPONSORS

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ALS Society of Canada
Alzheimer Society - Alberta and Northwest Territories
Alzheimer Society of Canada
Alzheimer's Association US
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CHU Sainte-Justine Foundation
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Marigold Foundation
Mount Sinai Hospital Foundation of Toronto
MS Society of Canada
SickKids Foundation
UHN Toronto General & Western Hospital Foundation
University Hospital Foundation
Vitae Foundation
Women's Brain Health Initiative

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Alberta Innovates Health Solutions
Capital District Health Authority
Federation québécoise de l'autisme
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Ontario Brain Institute (OBI)
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Pacific Alzheimer Research Foundation (PARF)
Quebec Pain Research Network
Vancouver Coastal Health Authority (VCHA)

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Le Réseau québécois sur le suicide, les troubles de l'humeur et les troubles associés (RQSHA)

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Les Grands Ballets
Canadian Institute for Advanced Research (CIFAR)
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Mental Health Commission of Canada
National Institutes of Health (NIH)

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Alberta Children's Hospital Research Institute (ACHRI)
Hotchkiss Brain Institute
University of Alberta
University of Calgary

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BC Children's Hospital Research Institute
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Centre for Heart Lung Innovation (UBC and St. Paul's Hospital)
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Centre for Addiction and Mental Health (CAMH)
McMaster University
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Queen's University
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The Hospital for Sick Children
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University of Toronto
University of Western Ontario
York University

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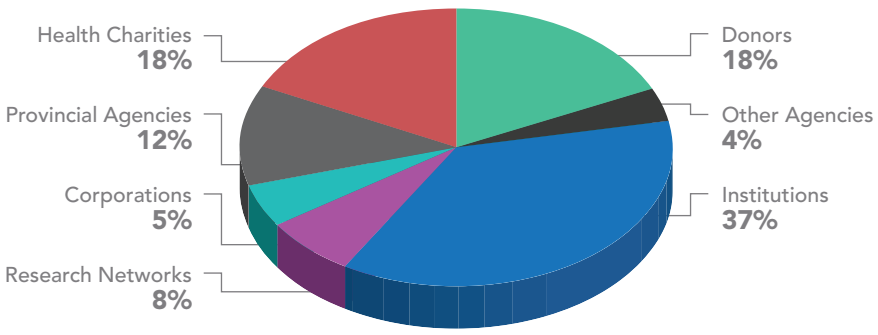
Centre hospitalier de l'Université de Montréal (CHUM)
CHU Sainte-Justine Research Centre
Douglas Hospital Research Centre
McGill University
Montreal Neurological Institute
Research Center of Centre Hospitalier Universitaire de Sherbrooke (RC CHUS)
Université de Montréal
Université Laval

SASKATCHEWAN
University of Saskatchewan

Types of Partners



Brain Canada Foundation

December 31, 2016, with comparative information for 2015

	2016 $	2015 $
ASSETS		
Current Assets		
Cash and cash equivalents	17 984 431	18 796 901
Short-term investments	6 758 542	6 726 828
Accrued interest receivable	43 449	70 849
Advance payments on grants and awards	316 991	334 673
Grants and awards reimbursement receivable	-	274 850
Other receivables	149 012	80 872
Prepaids and deposits	17 963	13 545
	25 270 388	26 298 518
Capital assets	119 826	129 332
	25 390 214	**26 427 850**
LIABILITIES AND NET ASSETS		
Current liabilities		
Accounts payable and accrued liabilities	121 981	58 791
Salaries and benefits payable	265 778	178 527
Current portion of deferred contributions	15 031 239	12 618 404
	15 418 998	12 855 722
Deferred contributions	9 864 450	13 465 362
	25 283 448	**26 321 084**
NET ASSETS		
Unrestricted net assets deficiency	(13 060)	(22 566)
Invested in capital assets	119 826	129 332
	106 766	106 766
	25 390 214	**26 427 850**

Year ended December 31, 2016, with comparative information for 2015

	2016 $	2015 $
REVENUES		
Restricted contributions	38 289 252	33 599 542
Unrestricted contributions	64 954	83 560
	38 354 206	33 683 102
Interest and investment income	59 211	19 630
	38 413 417	**33 702 732**
EXPENDITURES		
Grants and awards	35 787 862	31 135 009
Operating expenses	2 367 884	2 156 660
Administrative expenses charged by other organizations	222 252	376 532
Amortization of capital assets	35 419	34 531
	38 413 417	**33 702 732**
Excess of revenues over expenditures	-	-

The financial statements of Brain Canada Foundation are audited by KPMG LLP and are available upon request.

1998

- NeuroScience Network transformed to NeuroScience Canada Partnership and Foundation.
- Vision: to create a philanthropic organization to advance Canadian brain research.

2001 to 2010

- Developed—through consultation with research community—and launched Brain Repair Program to support brain research on cross-cutting themes.
- Five projects funded at $1.5 million each over three years; every project achieved a paradigm-changing breakthrough.
- Established track record of funding excellent and innovative research with international peer review and rigorous annual progress reporting.

2006

- Published The Case for Canada's Increased Investment in Brain Research, which provided a calculation of the economic burden of brain disorders as one grouping.

2008

- Rallied health charities, which became Neurological Health Charities Canada, to speak with one voice to government for a brain strategy.

2010

- Approached the Government of Canada to form a partnership to support brain research.

2011

- Changed name to "Brain Canada Foundation" to better reflect the focus on brain and not only neuroscience.
- Budget 2011 included establishing the Canada Brain Research Fund (CBRF), a public-private partnership with Brain Canada to match $100 million over six years.

2015

- Reached $100-million goal for a total investment of $200 million, 18 months ahead of schedule.
- Launched slogan One Brain. One Community.

2016

- Budget 2016 included an additional $20 million in matching funds to the CBRF, bringing the total of the Fund to a potential $240 million.

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Brain Canada
Foundation

This annual report is also available in French.
An online version can be downloaded at www.braincanada.ca.