



SCIENCE WITHOUT BARRIERS OR BORDERS

ANNUAL REPORT 2017



**Brain Canada
Foundation**

The brain is the most critical organ in the body but the least understood – it has often been described as the last frontier in human science. To address this complex challenge, we need to join different disciplines and pursue new thinking and new approaches.



- Disorders of the brain are an enormous public health burden; **1 in 3 Canadians are directly impacted**, as well as their families, caregivers, society and the economy;
- **Twenty percent** of Canadians will experience a mental illness in their lifetime;
- Brain disorders are the **leading cause of disability**.

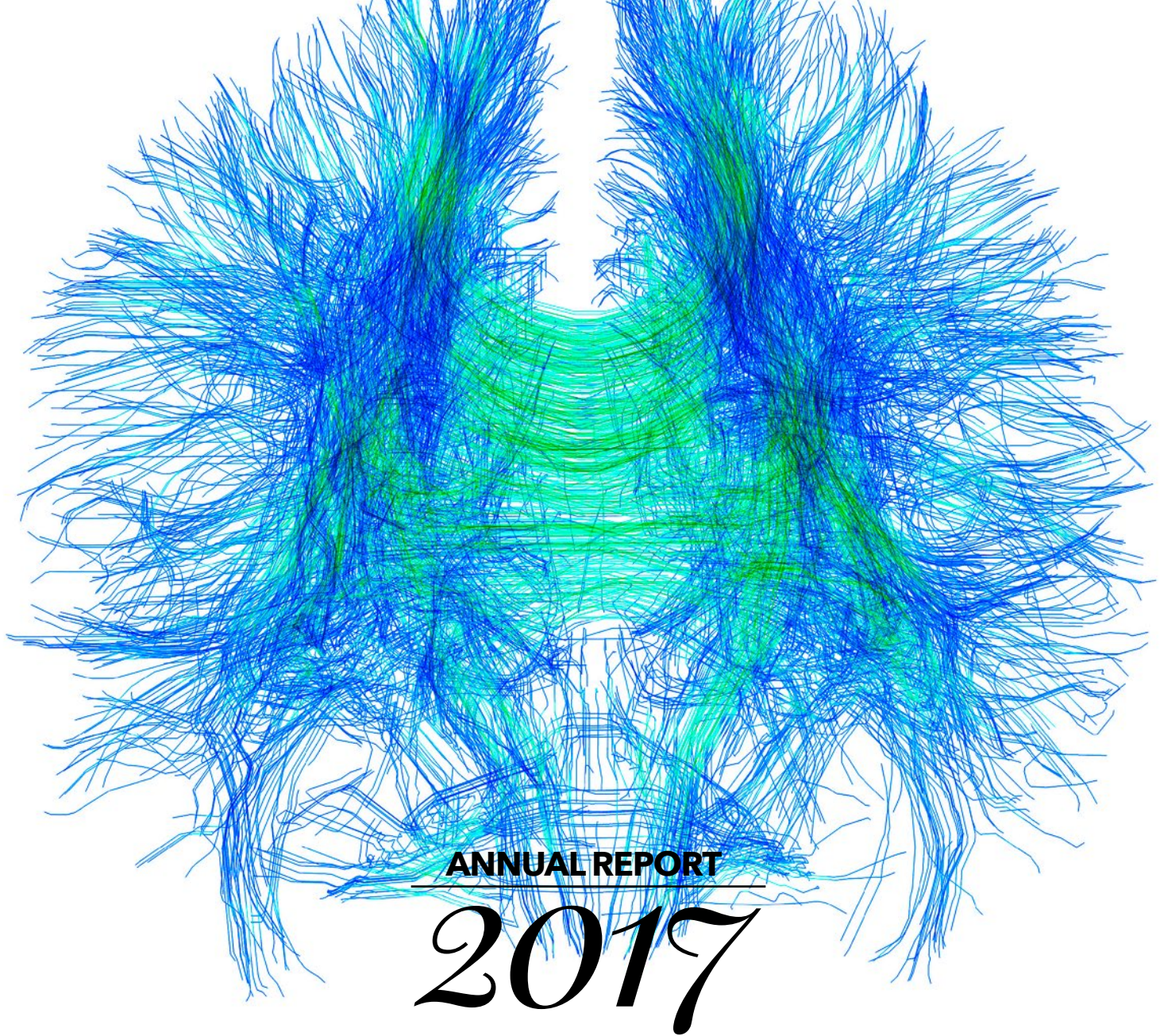


- The burden on the Canadian economy every year is **more than the cost of cancer and cardiovascular disease combined**, as neurological and psychiatric conditions account for 38% of the global burden of disease;
- Today, the medical and indirect (lost earnings) costs of dementia total **\$33 billion per year**. If nothing changes, these costs will rise to **\$293 billion by 2040**.



- Enhancing our ability to **diagnose disorders sooner**, to provide clarity to patients and families, and to begin treatments earlier;
- **Bringing innovation to treatment options**, making them less invasive, and discovering new medications—a critical factor since many treatments have not changed in decades and some disorders have no treatment at all;
- **Reducing the stigma** associated with brain disorders—whether mental illnesses, addictions, epilepsy, post-traumatic stress disorder (PTSD) or others—as we better understand their underlying mechanisms;
- Increasing our understanding of how to **live healthier lives**;
- Ultimately, seeing much greater success in **preventing** brain disorders and/or getting to **cures**.

Much progress has been made in the past decade, but more can be and is being done to accelerate the pace of brain research in Canada. Meaningful progress, in turn, can improve the quality of life for countless Canadians, reduce the burden on the health care system, and lead to a stronger economy and more prosperous society.



ANNUAL REPORT

2017

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Brain Canada is a national registered charity headquartered in Montreal, that enables and supports excellent, innovative, paradigm-changing brain research in Canada.
Registration number: 89105 2094 RR0001.

Message from the Chair and President

Since Brain Canada's founding in 1998, there have been remarkable technological advances and shifts in attitude about the free exchange of data, tools and expertise amongst scientists. These have provided the basis for transformative discoveries in our understanding of the brain and brain disorders. Brain Canada's research program has been centred around our belief that joining people, labs and platforms—across the country and around the world—is the best way to accelerate the pace of discovery and foster innovation. We have proudly been at the forefront of providing funding to enable collaborations across disciplines and institutions, which has led to new thinking and new approaches. The result is more than 1,000 researchers across the country, from about 75 disciplines, working in teams to address the greatest challenge of our time: unraveling the mysteries of the brain.

The theme of this year's Annual Report, Science without barriers or borders, reflects our vision of collaboration in science, and our belief that a diverse and interconnected brain research ecosystem will enable Canada to make even greater contributions and to effectively engage with other countries.

This approach to science was most recently boosted by the launch of the Canadian Open Neuroscience Platform (CONP) – a national platform to “hard-wire” Canadian neuroscience, to collect, link and analyze data from across the country in order to achieve improved patient outcomes more rapidly.

“The theme of this year's Annual Report, Science without barriers or borders, reflects our vision of collaboration in science, and our belief that a diverse and interconnected brain research ecosystem will enable Canada to make even greater contributions and to effectively engage with other countries.”

The CONP is bringing together many of the country's leading scientists in basic and clinical neuroscience to form an interactive network involving 15 research entities across Canada. You can read more about this groundbreaking project on page 35 of this report. The platform carries tremendous potential for breakthroughs that will improve the health outcomes of patients living with brain disorders such as Alzheimer's.

The CONP is one of 228 projects that we have supported through the Canada Brain Research Fund, our partnership with Health Canada, for a total of \$209 million invested directly into research. From pages 22 to 32, we highlight other projects that have shown remarkable progress and promise. These are just some examples of the research we are supporting—from basic science to knowledge translation and dissemination—from small grants of \$50,000 to large clinical trials and national networks of up to \$10 million. We recognize the need to fund research at all stages: where every discovery carries the potential for a paradigm shift in our understanding and approach.



Naomi Azrieli, Chair and Inez Jabalpurwala, President and CEO

Since our founding, our funded researchers have made breakthrough discoveries resulting in 764 publications, which have been cited more than 14,500 times.

The projects we fund are selected through open and partnered competitions, using rigorous international peer review, and monitored throughout against agreed-upon milestones. On pages 6-7 you will find a description of that process. 367 researchers and clinicians from 24 countries have been involved in our review process over the last 10 years.

Our work has been accelerated through the engagement of donors and partners, now numbering more than 100, which include private philanthropists and foundations, corporations, research institutes, provincial agencies and voluntary health organizations. We are particularly grateful to the Government of Canada, and especially to Health Canada and our Minister of Health, The Honourable Ginette Petitpas Taylor, for their valued partnership. Through the Canada Brain Research Fund, Health Canada is matching the funds raised by Brain Canada and our partners on a 1:1 basis.

We extend a heartfelt thank you to all of our supporters across the country, to the dedicated researchers and clinicians carrying out this important work, to our committed Board and much-valued staff. Brain Canada has always been and will always be a collective effort.

We close by sharing that Brain Canada is celebrating our 20th anniversary. Over the course of the year, we will be highlighting our track record as a driver of innovation in brain research. Our contributions to this space have been both as a major funder and as a leading voice in changing the way we do research. This has resulted in a more networked and collaborative community, supporting science without barriers or borders.

Naomi Azrieli
Chair, Brain Canada

Inez Jabalpurwala
President and CEO, Brain Canada

One Brain One Community

For 20 years, Brain Canada has made the case for the brain as a single, complex system with commonalities across the range of neurological disorders, mental illnesses and addictions, brain and spinal cord injuries. Looking at the

brain as one system has underscored the need for increased collaboration across disciplines and institutions, and led to smarter ways to invest in brain research that are focused on outcomes that will benefit patients and families.

“We chose to invest in Brain Canada because of its reputation for excellence as a leading funder of brain research and its unparalleled convening power in the community.”

– Mary Deacon
Chair, Bell Mental Health Initiative

For too long research has been fragmented and siloed, by disease, discipline or institution. By promoting the One Brain approach, Brain Canada is encouraging researchers to broaden their perspective, to widen their scope of inquiry, and to connect with other scientists. This has led to paradigm-changing discoveries.

2018 is Brain Canada's

Our impact over the past 20 years:

\$250M

invested



1,000+

**researchers
funded**

281

**grants
awarded**

Brain Canada is the only national organization focused solely on research to understand the brain.

Brain Canada is an independent organization that is nimble and flexible, able to rapidly respond to gaps and emerging opportunities, and to directly appeal to the public for funds.

WE CONVENE CANADA'S BRAIN COMMUNITY

- Brain Canada serves as a national convener of the community of those who support and advance brain research, which encompasses researchers and clinicians (and their institutions), governments, voluntary health organizations, philanthropists, patients and caregivers, and business and community leaders.

WE LEVERAGE AND GRANT FUNDING FOR WORLD-CLASS BRAIN RESEARCH

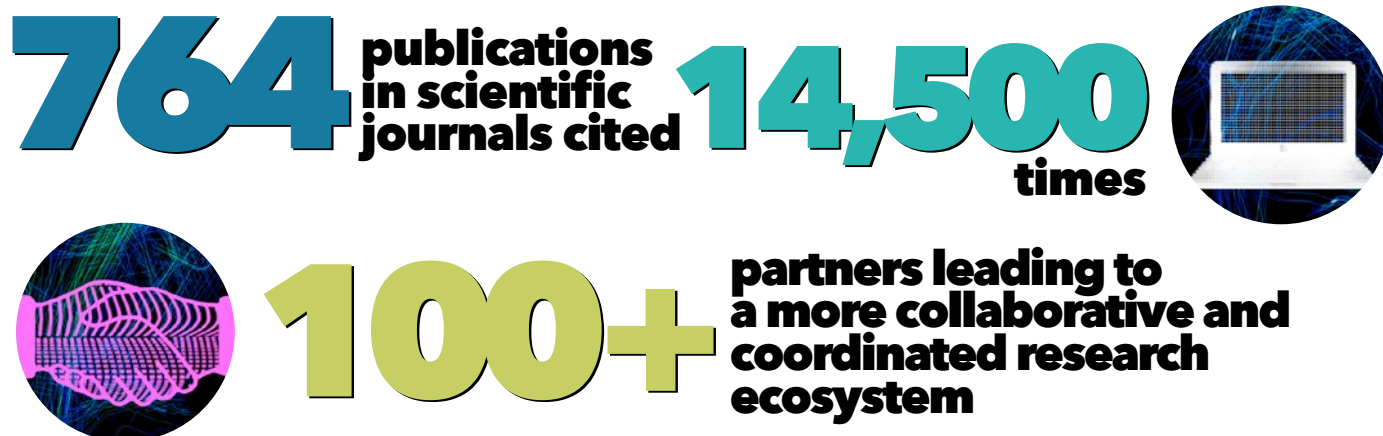
- We support research that fosters multidisciplinary collaboration and novel approaches, rewards excellence and innovation and takes risk to advance high-potential ideas.
- We foster a robust Canadian research talent pipeline through training and career development support programs.
- We support large team projects that would not otherwise be funded.
- We are helping to create national networks that connect researchers across the country.

WE STRENGTHEN THE GLOBAL BRAIN RESEARCH COMMUNITY

- We facilitate linkages with the global brain science community: Canada's exceptional research contributes to broad technological, data-driven initiatives, and bottom-up initiatives in labs from multiple countries.
- Brain Canada has sought partnerships to enable Canadians to participate more meaningfully in global efforts. These include the US BRAIN Initiative, Alzheimer's Association, and three brain-focused collaborations selected through the Canadian Institute for Advanced Research's Global Call for Ideas.

WE RAISE AWARENESS ABOUT THE IMPORTANCE OF INVESTING IN BRAIN RESEARCH

20th anniversary.



Review process

Brain Canada allocates funding, first and foremost, on merit.

A key to Brain Canada's success in bringing new funds into the brain-research ecosystem lies in the rigour of the organization's scientific review process, which gives donors and partners a trusted mechanism to ensure projects are chosen on the basis of excellence and innovation.

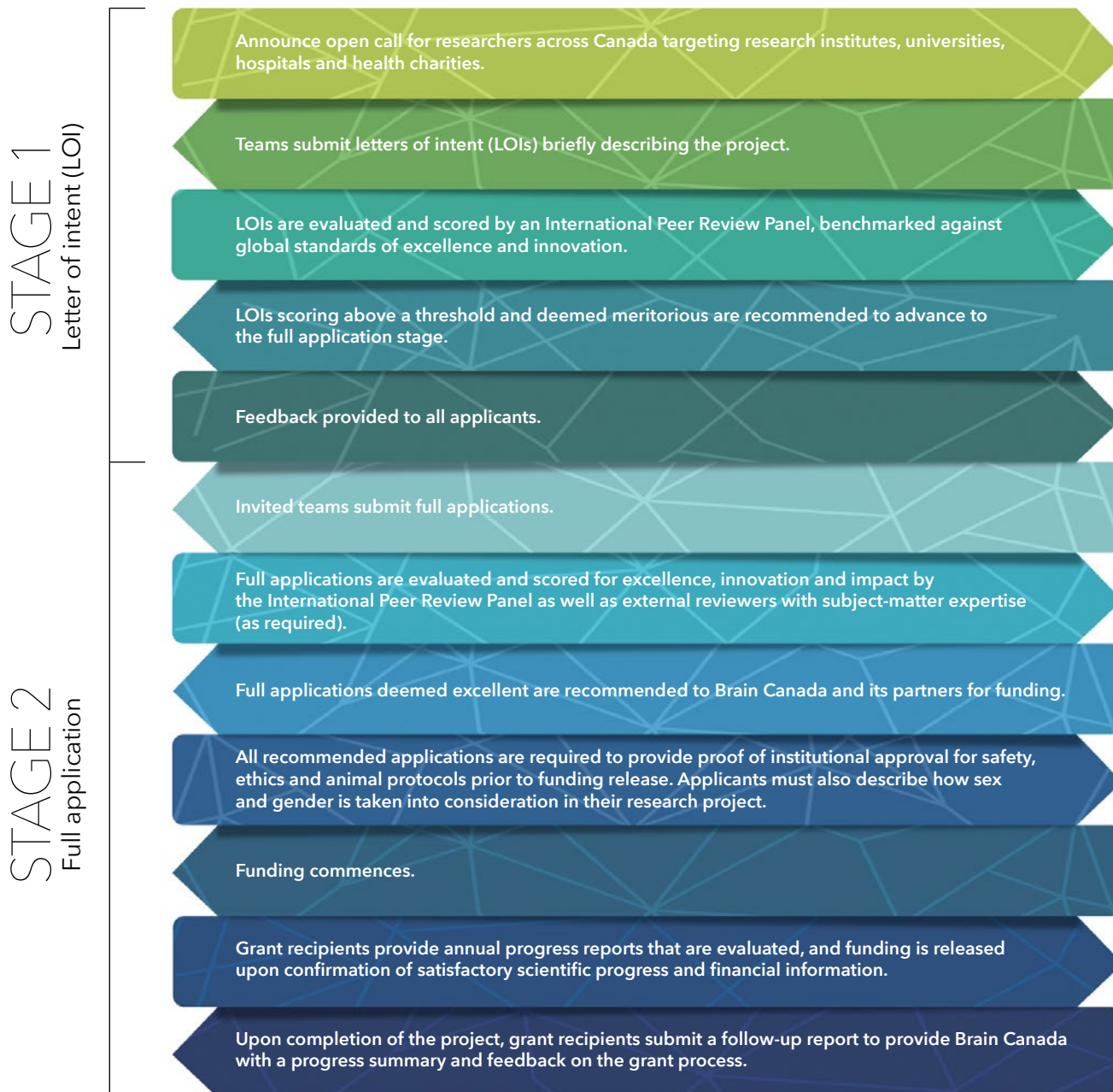
Funding recipients are selected through open and partnered competitions and a rigorous international peer review that: reduces the risk of conflicts of interest; allows us to benchmark against international standards; and creates a network of ambassadors and new connections for Canada.

“Thanks to the excellent external review process performed by the Brain Canada Foundation (international neuroscience leaders were recruited), we have 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
President and CEO, CQDM



Brain Canada's review process



Canada Brain Research Fund

A partnership between Brain Canada and the Government of Canada to provide a focused investment in brain research.

“By strategically leveraging government funding with private donor and partner support, and thereby providing funds that would otherwise not be available to Canadian scientists, Brain Canada’s model has been a powerful catalyst towards great research.”

– Naomi Azrieli
Chair, Brain Canada

BY THE END OF
March of 2018 THE CANADA BRAIN RESEARCH FUND
HAD ALLOCATED



\$209 million
in new funding to
support



228 projects across Canada
involving more than



950+ researchers at



115 institutions.

Canada Brain Research Fund

The Canada Brain Research Fund is an innovative partnership between the Government of Canada (through Health Canada) and Brain Canada, designed to encourage Canadians to increase their support of brain research, and maximize the impact and efficiency of those investments. Brain Canada has committed \$115 million from private donors and non-federal partners—now numbering more than 100—which Health Canada has matched with \$120 million.

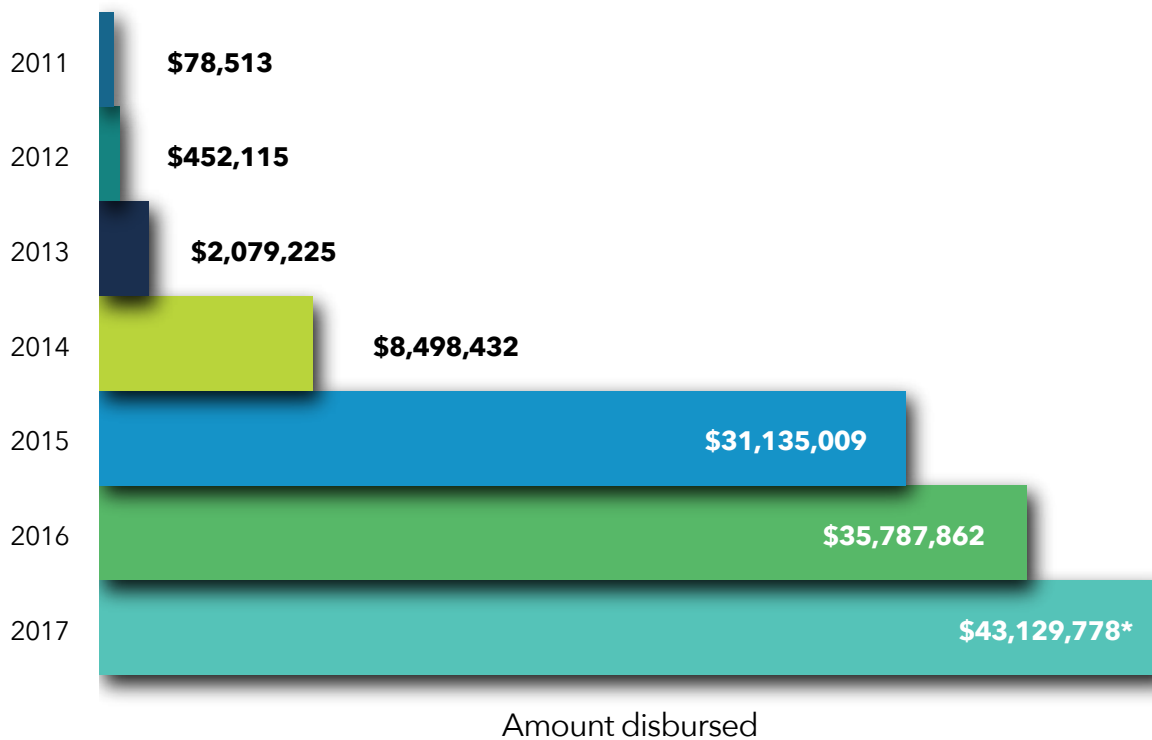
The Fund supports the very best Canadian brain science, fostering collaboration and accelerating the pace of discovery, in order to improve the health and quality of life of Canadians who suffer from brain disorders.

Brain Canada has been able to expand the philanthropic space for supporting brain research, stimulating and rallying private donations to the effort, in order to support high-risk, high-reward research.

Advances in brain research, in turn, support many of the government’s pressing health-related files; from the rising tide of brain disorders impacting our aging population, to mental health challenges and trauma-informed research among Indigenous communities, to the epidemic of opioid overdoses, to addressing mental wellness and issues like PTSD.

Grants and awards disbursed through the Canada Brain Research Fund.

As of Dec. 31 each year



* \$42,527,060 disbursed by Brain Canada + \$602,718 sent directly to host institutions by partners = \$43,129,778.

Review of 2017/2018

Research programs highlights.

Brain Canada is proud to announce that more than \$43 million was disbursed to research grants in 2017, a new record for the Foundation. Over the course of 2017, we were supporting more than 150 active projects, which connected more than 75 scientific disciplines and covered a wide range of diseases, disorders and injuries of the brain.

We also launched several innovative new projects and programs in 2017/2018*.

NEW PROJECT HIGHLIGHTS AND PROGRAM LAUNCHES

Improving Health Outcomes and Quality of Life

This patient-oriented program supports three-year multidisciplinary team research projects that address improving health outcomes, including quality of life, over a reasonably short period of time. The competition is intended to provide opportunities for unorthodox collaborations between multidisciplinary teams of researchers (including social sciences), clinicians, allied-health workers, carers and patients. To date, six projects have been funded, and cover diverse research areas including stroke recovery, standardizing the diagnostics for Alzheimer's disease, care for the neuropsychiatric symptoms of dementia, and implementing a clinical pathway for the acute care of pediatric concussion.

Recipients:

Jaynie Yang, University of Alberta, *Parent-therapist partnership to provide early, intensive exercise to enhance walking outcome in children with perinatal stroke* - \$537,000

Benjamin Goldstein, Sunnybrook Research Institute, *Toward exercise as medicine for adolescents with bipolar disorder* - \$779,000

* March 2017 to March 2018.

Keith Yeates, Hotchkiss Brain Institute, *Implementation of a Clinical Pathway for Acute Care of Pediatric Concussion: Uptake, Outcomes, and Health Care Impacts* - \$429,000

Ian Graham, The Ottawa Hospital Research Institute, *Stroke Recovery in Motion* - \$1,203,000

Tarek Rajji, CAMH, *Improving Quality of Life in the Elderly by Standardizing Care for Neuropsychiatric Symptoms of Dementia* - \$1,405,889

Mari DeMarco, St Paul's Hospital/University of British Columbia, *Translating research into practice: Investigating the impact of Alzheimer's disease diagnostics in Canada* - \$684,000

Early-Career Capacity Building

In close partnership with the Azrieli Foundation, the Early-Career Capacity Building program has the potential to be transformative at a career stage when there is too often a significant funding gap. It is vitally important to retain, support, and build capacity in our brightest early-career investigators and their research programs, in order to enable and facilitate the major contributions and impact that they could make to Canadian brain research. This program is designed to accelerate novel and transformative research that will fundamentally change our understanding of nervous system function and dysfunction and their impact on health. The goal is to reduce the social and economic burden of neurological and mental health problems by prevention, early diagnosis, and treatment. A minimum of 10 grant recipients are expected to be announced in Fall of 2018, and the awarded projects will receive up to \$100,000 in funding over two years.

Research Programs by the numbers

\$43
million
**DISBURSED TO GRANTS
AND AWARDS IN 2017**

6 grants focused
on health outcomes
and improving
quality of life
\$5 million



Connecting
75+
scientific
disciplines

Canadian Open Neuroscience Platform

With a budget of more than \$10 million, this initiative will lead to the development and maintenance of a large-scale neuroscience network, as well as funding its operating costs, for three years.

The platform grant, led by Alan Evans at the Montreal Neurological Institute and Hospital, will help bring together existing Canadian neuroscience platforms, initiatives, and networks. Importantly, it will also allow them to link, leverage, enhance, and expand to form a truly integrated pan-Canadian network. The network will emphasize and support inter-operability between the existing platforms across the country and promote open neuroscience and data sharing. The project was officially launched in February of 2018. (For more information on this project, please see page 35)

Project MinE

Project MinE is a multi-national initiative with more than 15 participating countries. The goal is to create a database of whole genome sequences for 15,000 people with ALS and 7,500 control subjects. This unprecedented effort is something that no one country could do alone due to the high cost and resources involved. To facilitate the Canadian aim to provide 1,000 sequences for the project, Brain Canada and the ALS Society of Canada are helping to fund the first cohort of this multi-year project, which brings together some of Canada's top ALS geneticists from across the country. This will provide a global resource of human genomic data that will enable scientists worldwide to understand the genetic signature that leads someone to develop ALS. This will result in a set of samples that are representative of ALS cases across Canada.



Ian MacKenzie, University of British Columbia

A total of \$300,000 has been awarded to four researchers from across Canada, primarily for sequencing costs associated with Canadian samples.

Recipients:

Guy Rouleau, McGill University

Nicolas Dupré, Université Laval

Ekaterina Rogueva, University of Toronto

Ian MacKenzie, University of British Columbia

Canadian Parkinson Network and Registry

Across Canada there are leading researchers in the area of Parkinson's disease and related disorders. However, platforms are not currently available to link this pan-Canadian expertise. Through a partnership between Brain Canada and Parkinson Canada, the Canadian Parkinson Network and Registry program seeks to increase data-availability and promote integration across sites, to increase the access to and impact of this data. This platform will support diverse projects from bench to bedside that will inform us on mechanisms and markers of Parkinson's disease progression, novel treatments and treatment strategies as well as clinical trials. Funding for the platform is expected to begin in Fall of 2018.

ALS Canada – Brain Canada Trainee Program 2018

ALS Society of Canada and Brain Canada have partnered on a new program that aims to attract the brightest young minds to ALS research to contribute to a succession plan for the Canadian ALS research community. Through this program, doctoral awards will be funded at \$25,000 per year for up to three years and postdoctoral fellowships will be funded at \$55,000 per year for up to three years. Awards will be announced in August of 2018 with funding expected to begin in the Fall of 2018. This program complements the other three successful Brain Canada/ALS Canada partnered programs: The Hudson Translational Team grants, Discovery grants and Career Transition awards.

Research Programs by the numbers

\$10
million
DIRECTED TO OPEN SCIENCE

150
active research projects

ONGOING PROGRAMS

Alzheimer's Association International Research Grant

Brain Canada has partnered with the Alzheimer's Association (USA) to co-fund projects led by Canadian principal investigators through the Alzheimer's Association International Research Grant program.

Four projects were funded:

Cindy Barha, University of British Columbia, *Sex differences in exercise efficacy: Possible role of BDNF and stress axis* - \$175,000 USD

Walter Swardfager, Sunnybrook Research Institute, *Neuroinflammatory susceptibility to vascular disease as a dementia driver* - \$149,985 USD

Nicole Gervais, University of Toronto, *Sleep, cognition, and inflammation following natural or surgical menopause* - \$139,458 USD

Paula Duarte-Guterman, University of British Columbia, *The impact of motherhood and APOE genotype on the aging brain* - \$175,000 USD



Cindy Barha, University of British Columbia

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 20, 2006. Dr. van Tol greatly valued mentoring young researchers and recognized the importance and value of international experiences in the early 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 provides

up to \$5,000 to enable 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. The 2017 recipients of the travel awards were **Iska Moxon-Emre** and **Josiane Mapplebeck** both based at The Hospital for Sick Children in Toronto. Iska Moxon-Emre attended the 35th annual Nordic Society of Pediatric Hematology in Sweden last year, and Josiane Mapplebeck will use her award to attend the European Pain School in Italy.



Iska Moxon-Emre, The Hospital for Sick Children

Creating HD Clinician-Scientist-to-Patient Virtual Network

Brain Canada and the Huntington Society of Canada have partnered on an initiative that supports research projects that connect clinicians with scientists, and scientists with the HD community. The multidisciplinary and multi-investigator approach is expected to maximize the opportunity for discovery and translational research that will speed up the search for treatments, while expanding the overall understanding of HD therapy in humans.



Blair Leavitt, University of British Columbia

Research Programs by the numbers



4 Projects announced through the Alzheimer's Association International Research Grant program

\$600,000+*

* This amount is in USD

1 new project focused on Huntington's disease
\$950,000

In 2017, the second Creating HD Clinician-Scientist-to-Patient Virtual Network grant was awarded.

Recipient:

Blair Leavitt, University of British Columbia, *Development of novel oligonucleotide delivery modalities for Huntington disease* - \$950,000

Quantum Leap Initiative

Brain Canada and CQDM have partnered on several initiatives linking neuroscience research to the biopharmaceutical industry. In 2017/2018, one Quantum Leap grant was awarded, supported by Brain Canada, CQDM and AbCellera. This 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.

Recipient:

Carl Hansen, University of British Columbia, *Microfluidic Screening Technology for the Discovery of Function-Modifying Antibodies Against Membrane Protein Targets* - \$1,425,000

NIH BRAIN Initiative

The BRAIN Initiative is part of a US Presidential focus aimed at revolutionizing our understanding of the human brain. Brain Canada has partnered with the 10 NIH Institutes that are part of the NIH BRAIN Initiative to support the involvement of Canadian researchers in the NIH BRAIN Initiative.

Recipients:

Katalin Toth, Université Laval, *Bringing laser focus to voltage imaging: Enhanced indicators and advanced scanning methods for two-photon recording of dense networks in vivo* - \$319,200 USD

Taufik Valiante, University of Toronto, *Neuronal mechanisms of human episodic memory* - \$794,755 USD

Robert Campbell, University of Alberta, *Northern Lights collaboration for better 2-photon probes* - \$324,000 USD



Katalin Toth, Université Laval

Multiple Sclerosis Progression Cohort

The Multiple Sclerosis Society of Canada (MS Society), Brain Canada, and Biogen have partnered on an initiative to support a platform to address research questions related to the mechanisms of progression, treatment, and impact of MS. A single team advanced from the letter of intent phase, and received a planning grant in 2017. This team will submit their application in May 2018, and work on the platform is expected to commence as early as the Summer of 2018. This program has a research budget of \$6.59M over the next five years, and may also continue to grow because of high interest from additional provincial and pharmaceutical partners.

Hudson Translational Team Grant

The Hudson Translational team grant is one of a suite of programs that has been created from a successful and ongoing partnership between Brain Canada and the ALS Society of Canada. The Hudson Translational team grant program is designed to bring together researchers from across the country to accelerate therapeutic development by: 1) identifying and testing a relevant therapeutic target or candidate therapy and/or 2) addressing critical needs for early diagnosis and biomonitoring of clinical progression applied to clinical research. Research in all stages of development is welcomed, from basic/preclinical to phase I, II and III clinical trials. These projects range from a term of three to five years. In 2018, one team grant was awarded.

Recipient:

Heather Durham, McGill University, *Enhancing the efficacy of heat shock protein inducers by cotreatment with a histone deacetylase inhibitor - A therapeutic strategy for ALS* - \$1,727,424

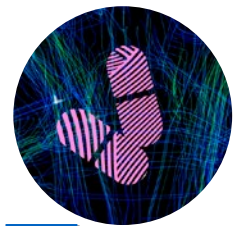


Heather Durham, McGill University

Research Programs by the numbers

NEARLY
\$7
million

to fund the first Canadian cohort in Multiple Sclerosis



NEARLY
\$1.5
million

through the Quantum Leap program devoted to innovative technologies to accelerate the drug discovery process

3

NIH brain initiative projects announced totaling

\$1.4 million*

* This amount is in USD

Training Awards in Developmental Neuroscience Research

Brain Canada partnered with the Kids Brain Health Network 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 are all encouraged to 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. Nearly \$1.5 million was awarded over 2017/2018 to support nine doctoral scholarships and eight post-doctoral fellowships.

Recipients:

Marie-Ève Brien, CHU-Saint Justine, *Non-infectious inflammation induced by uric acid during pregnancy and its impact on neurodevelopment* - \$70,000



Marie-Ève Brien, CHU-Saint Justine

Mathilde Chevin, University Health Centre, *Interleukin-1 blockade along with hypothermia to prevent cerebral palsy arising from refractory neonatal asphyxia* - \$70,000

Alexandra Decker, The Hospital for Sick Children, *Testing white matter pathway's influence on neural communication: A combined structural and functional neuroimaging study* - \$70,000

Kayleigh Campbell, BC Children's Hospital Research Institute, *Early Brain Development Following Prenatal Exposure to SSRI Antidepressants and Maternal Depression* - \$60,000

Ayesha Siddiqua, McMaster Autism Research Team, *Social determinants of prevalence, health service use, and developmental outcomes of children with Autism Spectrum Disorder: A population-level study* - \$70,000

Mehdi Hooshmandi, McGill University Health Centre, *Dysregulation of integrated stress response (ISR) pathway in Fragile X syndrome* - \$70,000

Heather Shearer, Holland Bloorview Kids Rehabilitation Hospital, *Understanding how pain varies and its effect on well-being in children and youth with cerebral palsy: A mixed methods study* - \$70,000

Seyedeh Zeinab Mohanna, BC Children's Hospital Research Institute, *CRISPR/Cas9-Mediated Gene Therapy to Correct Aniridia in a Mouse Model* - \$60,000

Kaela Shea, Holland Bloorview Kids Rehabilitation Hospital, *BCI Integrated Augmentative and Alternative Communication* - \$70,000

Malvina Skorska, University of Toronto, *Effects of Sex Hormone Therapy on Brain Development in Adolescents Experiencing Gender Dysphoria: A Magnetic Resonance Imaging Study* - \$110,000

Aya Sasaki, University of Toronto, *In utero exposure to glucocorticoids in humans and an animal model: Epigenetic and transcriptional signatures* - \$110,000

Lara Eid, CHU-Saint Justine, *Cortical GABAergic interneurons migration impairment in genetic epileptic encephalopathies* - \$110,000

Kristina Safar, The Hospital for Sick Children, *Investigating the Neurodevelopmental Trajectory of Emotional Face Processing in Autism Spectrum Disorder* - \$110,000

Arijit Chakraborty, BC Children's Hospital Research Institute, *Neurophysiological basis of amblyopia and its treatment* - \$100,000

Vivian Lee, McMaster University, *An Evaluation of the Acceptability of the Family Check-Up Intervention for Caregivers of Young Children with Autism Spectrum Disorders* - \$110,000

Sabrina Schlienger, IRCM Université de Montréal, *Characterization of a novel medulloblastoma tumor suppressor* - \$110,000

Silvia Orlandi, Holland Bloorview Kids Rehabilitation Hospital, *Three-dimensional Video-based Analysis of Infant's Movements for Early Detection of Motor Impairment* - \$110,000

For more information about Brain Canada's research programs, visit our website, featuring a searchable directory of projects: www.braincanada.ca

Research Programs by the numbers



17

capacity building grants
awarded through the
Kids Brain Health Network

\$1.5 million



OVER 90%

of funds go
directly
to research

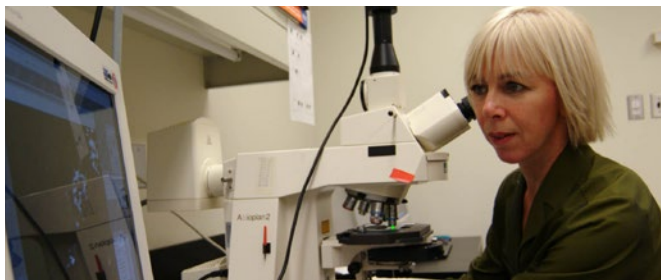
Looking back - Brain Canada's Brain Repair Program

In 2003, Brain Canada (then called NeuroScience Canada) launched the Brain Repair Program™, with the goal of accelerating collaborative, multidisciplinary, multi-institutional brain repair research. Brain repair is a field of research aimed at exploring the brain's ability to be repaired or to repair itself. This field focuses on mechanisms common across brain and nervous system disorders, such as cell loss, the abnormal functioning of nerve cells, and chemical and molecular imbalances. Five teams were selected through an open call process and national and international peer review, and each team received \$1.5 million over three years to pursue novel, paradigm-changing ideas. All five teams, composed of world-class Canadian researchers, made major discoveries within the term of their grants.



The discovery that the immune system plays a key role in chronic pain, which offers new opportunities to develop effective therapeutics.

Principal Investigator: **Michael Salter**, The Hospital for Sick Children
Team Members: **Yves De Koninck**, Université Laval
Jeffrey Mogil, McGill University, **Karen D. Davis**, University of Toronto
Min Zhuo, University of Toronto



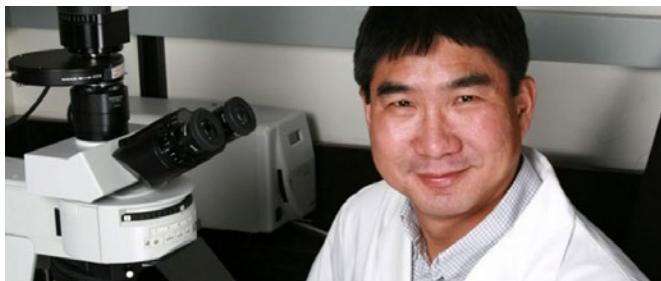
The discovery that stem cells from skin can repair damaged, demyelinated nerve cells. While this type of nerve damage is most closely associated with Multiple Sclerosis, it is also implicated in other neurological and psychiatric conditions such as schizophrenia and spinal cord injuries.

Principal Investigator: **Freda Miller**, University of Toronto
Team Members: **David Kaplan**, University of Toronto
Wolfram Tetzlaff, University of British Columbia, **Samuel Weiss**, University of Calgary



The determination of the role of genes associated with developing Parkinson's, and the discovery that the brain cells that cause Parkinson's disease die because they require too much energy and eventually "overheat".

Principal Investigator: **Louis-Éric Trudeau**, Université de Montréal
Team Members: **Edward Fon**, Montreal Neurological Institute
David S. Park, University of Ottawa, **Yong Rao**, McGill University
Heidi McBride, University of Ottawa



The benefits of a properly controlled inflammatory response to clear amyloid plaques (for Alzheimer's) and myelin debris (for remyelination in MS).

Principal Investigator: **V. Wee Yong**, University of Calgary
Team Members: **Luanne Metz**, University of Calgary
Christopher Power, University of Alberta, **Peter Stys**, University of Calgary
Fiona Costello, University of Calgary, **Serge Rivest**, Université Laval



Experimenting with a novel method for treating psychiatric disorders, whereby drugs can target the specific processes in brain cells in need of repair, and restore the normal brain function, with no obvious negative side effects.

Principal Investigator: **Yu Tian Wang**, University of British Columbia
Team Members: **Stephen S.G. Ferguson**, University of Western Ontario
Alaa El-Husseini, University of British Columbia, **Ridha Joober**, McGill University
Anthony G. Phillips, University of British Columbia

Brain Canada as a Convenor

Mental Health Initiative Workshop

April 25, 2017

A workshop was organized by Brain Canada on April 25, 2017 at the Fairmount Royal York in Toronto to convene 30 thought leaders in mental health research to advance a major national mental health initiative. The workshop was divided into three main sections: research needs, governmental priorities and fundraising. The session on governmental priorities was attended by the Honourable Jane Philpott, former Minister of Health.



Mental Health Initiative workshop held on April 25, 2017 in Toronto.

Launch of Canadian Open Neuroscience Platform and Plenary Meeting

February 19, 2018

On behalf of the Minister of Health, the Honourable Ginette Petitpas Taylor, MP David Lametti, Parliamentary Secretary to the Minister of Innovation, Science and Economic Development, joined Brain Canada to announce a \$10.17-million grant to establish the Canadian Open Neuroscience Platform (CONP). The announcement was made on the first day of the inaugural plenary meeting of the CONP, and included remarks by Suzanne Fortier, Principal and Vice-Chancellor of McGill University; Guy Rouleau, Director of the Montreal Neurological Institute and Hospital; and Inez Jabalpurwala, President and CEO of Brain Canada. The goal of the accompanying plenary meeting was to bring together the members and funders of the platform to discuss infrastructure, training, and governance, as well as the research priorities and opportunities.



From left to right: Sean Hill, Director of the Krembil Centre for Neuroinformatics; Alan Evans, CONP's Scientific Director; Jane Roskams, Executive Director, the BRAIN Commons; Suzanne Fortier, Principal of McGill; David Lametti, Member of Parliament for LaSalle-Émard-Verdun; Inez Jabalpurwala, President and CEO of Brain Canada; and Guy Rouleau, Director of the Montreal Neurological Institute and Hospital.

Knowledge Translation activities

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 2017/2018.



Women's Brain Health Initiative (WBHI)

Brain Canada and the Women's Brain Health Initiative (WBHI) have formed a partnership to engage and educate Canadians on the importance of brain health. To date Brain Canada has sponsored four editions of the WBHI publication *Mind Over Matter*, a magazine featuring articles geared to women about brain health and the prevention of age-related cognitive decline.

March 2018 and October 2017 editions of *Mind over Matter*.

The fifth edition was released in October of 2017. For the most recent edition, released in March of 2018, 130,000 copies were distributed through the *Globe and Mail* and *Toronto Star* as well as to doctors' offices, hospital waiting rooms, care centres, Canadian and US speaking engagements and global symposia. 7,500 French copies were distributed to Quebec doctors' offices and healthcare-related waiting rooms. Additionally, as part of the partnership, Brain Canada and WBHI have co-organized 12 Engaging Millennial Minds events in Toronto designed to educate young Canadians on the importance of brain health and on research focused on gender differences in brain aging. The most recent events were: Get More From Your Glass of Wine (March 2017), Pump Up Your Brain (March 2017), Be Kind to Yourself (November 2017), Heart Health & Brain Health (December 2017), Traumatic Brain Injury (January 2018), and Stress at Work (March 2018).

Capitalize for Kids

Brain Canada has partnered with Capitalize for Kids to translate capacity building research and strategies into evidence-based solutions for mental health service providers. The goal of Capitalize for Kids' work is to increase capacity for mental health service providers – to help them do more with their existing resources. This will reduce wait times for children requiring mental health services, and will ultimately help more kids get the help they need. With the pro-bono support of management consulting firms such as Bain & Company, McKinsey & Company and the Boston Consulting Group, Capitalize for Kids identifies opportunities to improve the efficiency of their beneficiaries. With the help of partners like Brain Canada, they then fund and support the implementation of solutions that will help capitalize on these opportunities. The results of these consultations are published and shared with other organizations, helping other mental health service providers to build their own capacity and improve their efficiency.

The Hon. Michael H. Wilson, P.C., C.C., Chair, Mental Health Commission of Canada, Louise Bradley, President and CEO, Mental Health Commission of Canada, George Cope, President and CEO, BCE and Bell Canada, and Mary Deacon, Chair, Bell Mental Health Initiative announce \$1 million to develop a national standard for post-secondary student mental health.



Olympic gold medalist Rosie McLennan (centre) speaking at the Engaging Millennial Minds event "Traumatic Brain Injury (TBI) - Know it when it happens" on January 31, 2018.

Mental Health Commission of Canada

The Mental Health Commission of Canada is developing a National Standard for Psychological Health and Safety of Post-Secondary Students. This project, supported by the Rossy Family Foundation, through Brain Canada, along with Bell Canada, will result in guidelines to help Canada's academic institutions protect and promote students' psychological health and safety, and support students' success. Brain Canada is involved in the knowledge translation portion of the project which will begin in late 2019.

A second project with the Mental Health Commission, which received a total of nearly \$150,000, involved adapting the *Road to Mental Readiness* for Emergency Medical Technicians and their families. This toolkit will be available in both English and French, and seeks to reduce stigma and improve mental health in this vulnerable population.



Knowledge Translation activities

International Women’s Forum (IWF) Annual General Meeting “The ethics and issues behind technology and artificial intelligence”

June 16, 2017

Inez Jabalpurwala chaired a panel discussion featuring Yoshua Bengio and Joelle Pineau, two researchers receiving support from Brain Canada through CIFAR’s Learning in Machines and Brains program, and Kristen Thomasen, Assistant Professor of Law, Robotics and Society at the University of Windsor. Topics discussed included Montreal and Canada’s role as a leader in Artificial Intelligence (AI), the value of AI research for health applications, and the ethical, social and legal implications of AI research.



Inez Jabalpurwala, President and CEO of Brain Canada and Yoshua Bengio, Scientific Director of the Montreal Institute for Machine Algorithms.



Joelle Pineau, Head, Facebook AI Research (FAIR) and Co-Director of the Reasoning and Learning Lab and Kristen Thomasen, Assistant Professor of Law, Robotics and Society at the University of Windsor.

Between Life and Death: Exploring the boundaries of consciousness with Adrian Owen and Paul Kennedy

November 7, 2017

Brain Canada and CIFAR co-organized an event featuring *Into the Grey Zone*, a book written by Adrian Owen, Co-Director of the Azrieli Program in Brain, Mind & Consciousness, which Brain Canada supports. Inez Jabalpurwala gave opening remarks at this sold-out event, which were followed by remarks from Alan Bernstein, President and CEO of CIFAR, and a discussion between Adrian Owen and Paul Kennedy, host of CBC’s Ideas, about Adrian Owen’s book, his research, and its implications.



Adrian Owen, speaking at the event Between Life and Death: Exploring the boundaries of consciousness.



Knowledge Translation activities

Your Turn: Launch Party – 150 Brilliant Canadian Women Event

November 28, 2017

For Canada's 150th birthday, 150 brilliant Canadian women were asked for the one piece of advice they would give to the next generation of leaders. Inez Jabalpurwala, Brain Canada's President and CEO, was one of the women selected to be included in the book. The 150 responses were compiled into a book titled *Your Turn: Powerful Thoughts from Today's Women to the Next*, with one intention: to share with the millions of tomorrow's leaders, at no cost. The launch party for the book was held in Toronto on November 29, 2017.



“My advice to young women starting their careers is to create your own narrative and be the hero of that story. In someone else's narrative, the most you can aspire to be is a supporting character.”

– Inez Jabalpurwala
President and CEO, Brain Canada

Healthy bodies, healthy minds

February 22, 2018

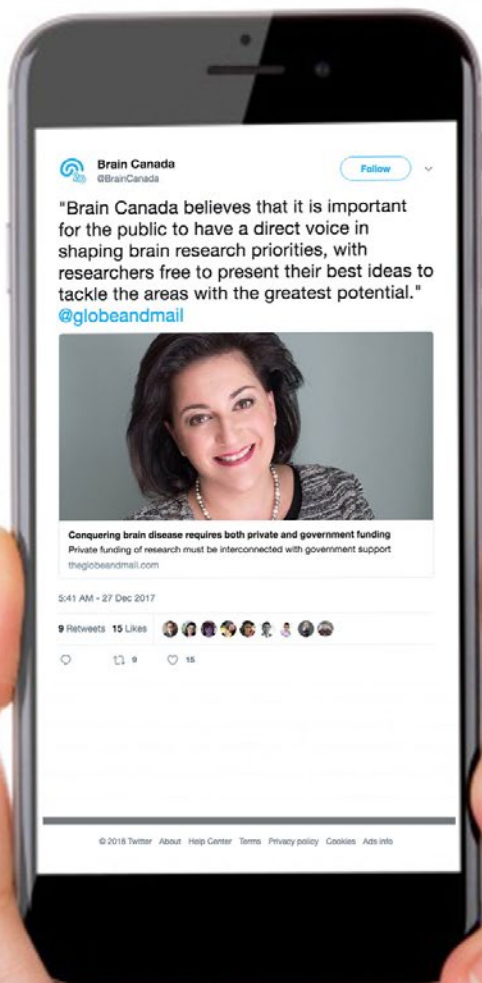
As part of the Montreal Chapter of the International Women's Forum, Brain Canada organized a panel of distinguished speakers, including Lynn Posluns, Founder and President of the Women's Brain Health Initiative; Dana Ades-Landy, CEO of the Quebec Heart and Stroke Foundation; and Nathalie Tremblay, CEO of the Quebec Breast Cancer Foundation. Inez Jabalpurwala moderated the panel which addressed the topic of prevention and sex/gender differences across different diseases.



From left to right: Inez Jabalpurwala, President and CEO of Brain Canada; Dana Ades-Landy, CEO of Heart and Stroke, Quebec; Lynn Posluns, Founder and President of the Women's Brain Health Initiative; Nathalie Tremblay, CEO of the Quebec Breast Cancer Foundation.

Brain Canada in the news

Featured Tweet



549 

and

557

**followers on Facebook
by the end of March 2018**

5,394

**followers on Twitter
by the end of April 2018**

Nearly

14,000

**website users since the
launch of Brain Canada's
new website**

Collaboration leads to innovation

Team Grants.

Brain research is no longer just neuroscience — it now includes such diverse disciplines as engineering, computer science, chemistry, physics, and ethics. By collaborating across these different fields, researchers can exchange methods, hypotheses, and techniques, enabling them to generate new thinking and new perspectives. Brain Canada has long believed in the success of this approach and has made funding multidisciplinary team science the cornerstone of our granting programs.

Brain Canada's team grants allow investigators with a range of complementary expertise and approaches to come together to pursue big, bold ideas that have the potential to become tomorrow's big, bold discoveries. Projects are evaluated primarily on innovation and originality, multidisciplinary and teamwork, feasibility, and potential for impact. These highly competitive grants provide support for the direct operating costs of research related to any area of neural function and dysfunction. They usually offer three to five years of funding, typically up to \$500,000 CAN per year.

“Brain Canada's impact is phenomenal and critical for seeding the formation of these inter- and multi- disciplinary research teams and training of the new generation of researchers that combine skills and expertise across multiple institutions, fields of research and different labs and principal investigators.”

– Mirza Faisal Beg
Simon Fraser University

\$113 million awarded
to team grants

100 projects

Team Grants.

Accelerating the discovery of new treatments for autism.

Grant amount: \$2,497,761

Grant title: *Co-clinical trials in mice and humans in autism.*

Co-Principal Investigators: **Evdokia Anagnostou**, Holland Bloorview Research Institute, **Jason Lerch**, University of Toronto

Team Members: **Jane Foster**, McMaster University, **Barry Greenberg**, Krembil Research Institute,

Robert Nicolson, University of Western Ontario, **Teresa Bennett**, McMaster University, **Rosanna Weksberg**, The Hospital For Sick Children, **Stephen Scherer**, The Hospital For Sick Children

Partner: The Azrieli Foundation



Holland Bloorview Research Institute team members.



A member of The Hospital for Sick Children team analyzing results.

The issue

Autism Spectrum Disorder (ASD) is characterized by difficulties in social interactions, repetitive behaviors and restrictive interests. It has many causes, yet to date no single gene accounts for more than 1% of cases in children and youth with ASD. This makes treating difficulties associated with autism a challenge, since how somebody responds to treatment might depend on their underlying genetic makeup. These results show that it is unlikely that a single treatment or behavioural therapy will ever be effective for most cases. Instead, a new compound or behavioural therapy will likely be effective in a subset of children with autism. The challenge is therefore to simultaneously test promising new compounds while at the same time understanding and predicting which patients will respond to which therapy.

The project

For this project, Evdokia Anagnostou and her team are trying out an innovative new approach which aims to accelerate the discovery of new treatments in ASD. They are testing novel compounds with already established early safety profiles simultaneously in children with autism and in multiple lines of mice bearing autism mutations. This represents the first co-clinical trial in humans and animal models in ASD. Using mice allows the team to isolate some of the individual causes of autism, and they can therefore test whether the drug works better in mice with one particular biology than mice with another. Extensive information on both human and mouse populations is collected for each trial to provide insight into the effectiveness of each compound being tested and to help in determining which subsets of patients would most benefit from each treatment. The team's hope is

that these co-clinical trials in children/youth and mice will lead to the creation of individual plans for each patient so that he or she can benefit from new treatments for ASD.

To date, the team has completed one trial in humans and its respective study in mice and analysis is currently underway. A new trial will be starting during the summer of 2018 in both children and mice and they have already completed another mouse study to complement a trial in children with ASD that was already completed before the grant was funded. The grant has also facilitated the creation of a community of basic scientists and clinical researchers that examine the issue from different perspectives to expedite discovery.

“Clinical trials are very difficult to fund and conduct. In addition, the cross species trials are the first of their kind in ASD and therefore a high-risk proposition that would not be considered by traditional funding sources.”

– Evdokia Anagnostou
Holland Bloorview Research Institute

Team Grants.

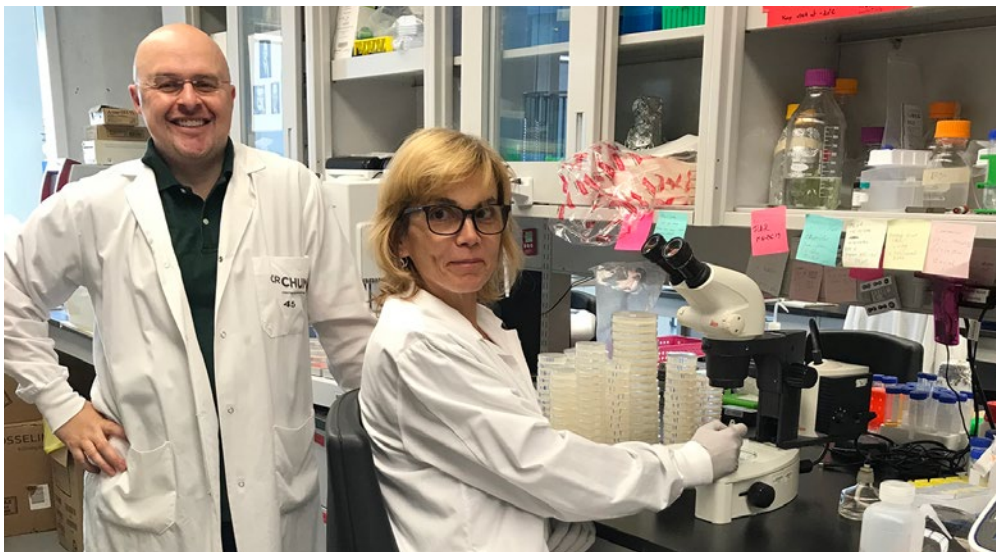
Using worms to investigate the disease mechanisms of ALS.

Grant amount: \$100,000

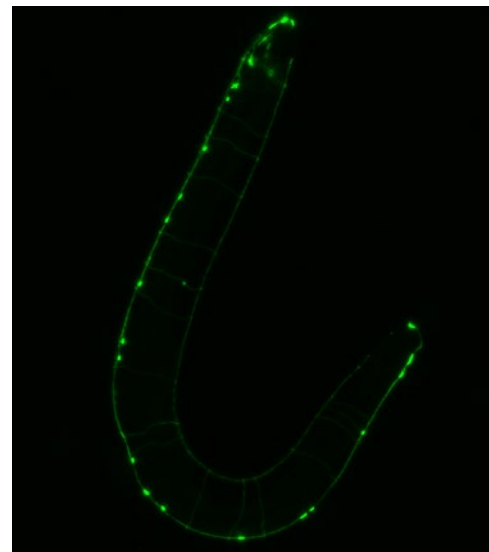
Grant title: *Investigation of the innate immune system and motor neuron degeneration in genetic models of ALS*

Principal Investigator: **Alex Parker**, Université de Montréal

Partner: ALS Society of Canada



Alex Parker and research assistant Claudia Maios.



Fluorescence microscopy image of *C. elegans*.

The issue

Amyotrophic lateral sclerosis (ALS) is a fatal neurodegenerative disease characterized by the progressive and selective death of motor neurons. The disease is typically diagnosed in middle-age and death often occurs within 5 years. Although recent advances have discovered many of the genetic causes of ALS, it remains an incurable disease. Currently, the only approved drug for ALS is riluzole, which can improve survival for up to six months, but does not relieve any symptoms. A better understanding of disease pathogenesis is crucial for disease diagnosis and intervention strategies.

The project

Alex Parker and his team are focused on developing and using simple models to study brain diseases, specifically ALS. The model system they use is the *Caenorhabditis elegans* (*C. elegans*) worm. This small, transparent worm has just 300 neurons, but is a powerful genetic system used by researchers to model neurodegenerative diseases, among others, and to facilitate drug discovery. By using worms that are genetically engineered to display human ALS traits, Alex Parker studies genes that are thought to be associated with ALS to learn how they function in health and disease. In previous studies, the team discovered a link between the immune system and the death of motor neurons in ALS. Their hypothesis was that mutant ALS proteins inappropriately trigger an immune response as well as a neuronal cell death program leading to motor neuron degeneration.

In 2014, the group received an ALS Canada-Brain Canada Discovery Grant to continue this line of enquiry and further examine how this immune response, known as “innate immunity,” is activated and how it causes motor neurons to die. The goal of their project was to investigate the signaling pathway of this degenerative response using *C. elegans* to provide a roadmap for future investigations of disease mechanisms and therapeutic approaches in vertebrate systems. They identified the TIR-1/Sarm pathway as a key regulator of neurodegeneration associated with mutant proteins and found that blocking the immune response reduced motor neuron degeneration. These key findings were published in the June 2015 edition of *Nature Communications*. Alex Parker’s team is now investigating if the TIR-1/Sarm pathway regulates motor neuron degeneration in mouse models of ALS (supported by the Muscular Dystrophy Association). This could eventually provide new treatment targets to slow down ALS progression in humans.

Team Grants.

Deep brain stimulation to improve memory function.

Grant amount: \$1,387,294

Grant title: **Modulating memory circuits: focal DBS treatments to improve medial temporal lobe function**

Principal Investigator: **Kari Hoffman**, Vanderbilt University (formerly York University)

Team members: **Sylvain Williams**, Douglas Mental Health University Institute, **Taufik Valiante**, University Health Network

Andres Lozano, University Health Network, **Mallar Chakravarty**, Douglas Mental Health University Institute

Jason Lerch, University of Toronto, **Milos Popovic**, University of Toronto

Partner: The Krembil Foundation



Kari Hoffman speaking at the 2018 Brain Canada AGM.



Andrea Gomez Palacio Schjjetnan, lead trainee in Kari Hoffman's lab.

The issue

Alzheimer's disease (AD) and temporal lobe epilepsy (TLE) are two diseases that have different symptoms and show very different clinical trajectories, yet nevertheless have led researchers to identify dysfunction in a common brain network. Both disorders have been shown to affect circuits in the brain involved in memory function and lead to impaired memory. Gaining a deeper understanding of these "memory circuits" and how to modulate them could lead to potential treatment options for these two devastating disorders.

The project

In 2014, Kari Hoffman and her team were awarded a team grant to investigate the use of deep brain stimulation (DBS) as a potential treatment method to improve the function of the memory circuits impaired in AD and TLE. The multidisciplinary team consisted of leaders in DBS and

imaging, biomedical engineers in brain-machine stimulation interfaces, and clinician scientists who are all using complementary approaches to investigate memory function.

DBS, which has been around for over 50 years, involves the implantation of a neurostimulation device that sends electrical impulses to specific regions of the brain. Although it has been successfully used to treat symptoms of Parkinson's disease, the exact mechanisms of therapeutic action are not completely understood. Understanding the mechanisms involved in DBS would contribute significantly to advancing our knowledge of normal and pathological memory processes, of DBS technology and of protocols for clinical trials. The goal of this project was to answer the questions – how do the neurons in the memory circuit work? and consequently can this process be altered or improved by DBS in cases where memory is impaired?

Through testing in preclinical animal models and analysis of epilepsy and AD-fDBS patient data, the team was able to advance the research towards clinical-trial-ready stimulation protocols to modulate memory circuits. They found two stimulation frequencies that appear to modulate memory function. They also developed a roadmap of structural changes in the brain that occur with stimulation, for use in ongoing patient research and future clinical trials. Team member Taufik Valiante is currently refining the stimulation approach for use in epilepsy patients and Andres Lozano is continuing the work that has resulted from this grant, using the protocols that were developed in AD patient studies using DBS.

The work from the Chakravarty lab also resulted in some interesting potential sex differences which will warrant further research into the role of sex in memory function and treatment.

Building regional, provincial and national capability for multiple neuroscience investigators

Platform Support Grants.

High-impact research in brain science has always required skill, imagination, determination and insight, and nowadays it also requires access to shared equipment, facilities, services, databases, computing and informatics facilities, patient repositories, and biobanks, collectively referred to as technology “platforms.”

The Platform Support Grant program was developed in consultation with the Canadian Institutes of Health Research (CIHR) and the Canadian Foundation for Innovation (CFI) and is funding a gap in the current research ecosystem: the need for operating funding to ensure investments in infrastructure are fully utilized, available to a broad community of users, and sustained.

“Through the 80’s and 90’s, Canada had created a number of world-class imaging research centres that depended upon major platform operating support from CIHR. When these funding mechanisms were abruptly discontinued, we endured a decade of privation that nearly ended these programs. Fortunately, Brain Canada’s Platform Support Grant mechanism appeared to restore stability and re-vivify the brain research landscape.”

– Alan Evans
Montreal Neurological Institute and Hospital

\$69
million awarded to
platform support grants

42
projects

Platform Support Grants. Boosting the brain imaging ecosystem in Quebec.

Grant amount: \$138,750

Grant title: *Le Consortium d'Imagerie en Neurosciences et santé mentale de Québec: leader régional en neuroimagerie humaine*

Principal Investigator: **Pascale Tremblay**, CERVO Brain Research Centre & Université Laval

Team members: **Philip Jackson**, Université Laval, **Catherine Mercier**, Université Laval, **Cyril Scheider**, Université Laval

Amélie Achim, Université Laval, **Shirley Fecteau**, Université Laval, **Carol Hudon**, Université Laval, **Laura Monetta**, Université Laval

Simon Duchesne, Université Laval, **Maximiliano Wilson**, Université Laval

Partner: Institut universitaire en santé mentale de Québec (IUSMQ)

The issue

The Consortium d'Imagerie en Neurosciences et santé mentale de Québec (CINQ) was funded in 2009 to develop a community of neuroscientists interested in studying the human brain using brain imaging techniques. CINQ researchers use state-of-the-art brain imaging and brain stimulation methods to study the neurobiological bases of human behaviour and cognitive processes including emotions, memory, language and social interactions, in adults of all ages and in children. These processes are being studied both in healthy research participants and in individuals with brain diseases (from psychiatric to neurological and neurodegenerative). The goal of the CINQ is to develop, organize and promote brain imaging research in Eastern Quebec through scientific activities, student training activities, knowledge transfer activities and more.

The project

The CINQ, which is led by Dr. Tremblay and Dr. Jackson, received a platform grant from Brain Canada in 2015, in partnership with the CERVO Brain Research Centre, to boost the regional brain imaging ecosystem by increasing the number of scientific activities, student and training opportunities, and research and technical-support capacity. The grant ended in 2018 and the team has



Pascale Tremblay with a student.

accomplished a tremendous amount over the three year period. Since receiving the grant, they have organized 39 scientific talks, four hands-on workshops on brain imaging methods that were attended by over a hundred graduate students and postdoctoral scholars, four scientific days, two international summer schools and one international symposium. One of the summer schools on the topic of brain connectivity was the largest event ever organized by the CINQ and included 15 speakers from Canada, Italy, France, and the US. The sold-out event attracted 90 participants from across Quebec and was very well received. They also launched a knowledge translation program to promote (and demystify) brain research to the

general public, as well as a student award program, which allowed several students to attend international conferences while promoting Canadian brain research and expertise abroad. They created an equipment-sharing program and a start-up program to help launch novel brain imaging protocols, both of which were important levers to increase their researchers' productivity.

These programs and activities have had immense impact, enabling the CINQ to expose their community to world-renowned experts in various disciplines of neuroscience. It has also improved the quality and diversity of graduate student training offered, boosted the productivity of researchers, and created a stronger community of students and researchers interested in brain imaging. This in turn has increased the profile of Université Laval and CERVO.

Most importantly, the grant was instrumental in the awarding of a \$29-million infrastructure project from the government of Québec in November of 2016. This project involves the creation of a new translational brain imaging facility in Québec City, which will be spearheaded by the CINQ. This centre will contribute to bridging the too often wide gap between animal research and discoveries about the human brain and its diseases. This new facility will bring Québec City, Université Laval and the CERVO research centre at the forefront of brain imaging research.

“As funds to support research training opportunities, international scientific activities, and to operate research infrastructure are rather scarce these days through regular operation grants, the contribution of the Brain Canada Foundation to the vitality and growth of the Canadian brain research ecosystem is extremely important.”

– Pascale Tremblay
CERVO Brain Research Centre & Université Laval

Platform Support Grants. Facilitating the use of stem cells to treat patients.

Grant amount: \$1,526,250

Grant title: **Human inducible pluripotent stem cells (iPSC) platform**

Co-Principal Investigators: **Edward Fon**, Montreal Neurological Institute and Hospital, McGill University, **Jack Puymirat**, Université Laval

Team members: **Francesca Cicchetti**, **Sebastien Herbert**, **Jacques P. Tremblay**, **Sachikko Sato** CRCHUQ-CHUL, Université Laval,

François Berthod, **François Gros-Louis**, CRCHUQ Enfant-Jésus, Université Laval,

Solange Landreville, CRCHUQ-St Sacrement, Université Laval

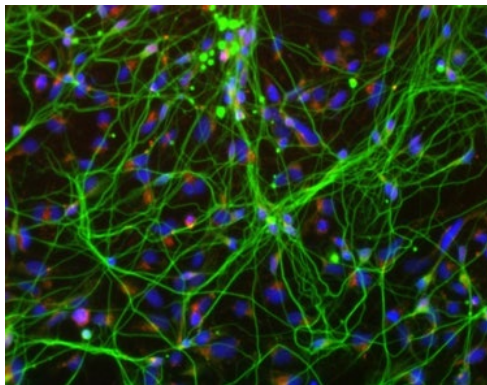
Mohamed Chahine, **Michel Maziade**, **Jean-Pierre Julien**, Institut de recherche en santé mentale de Québec, Université Laval

Amit Bar-Or, **Philip Barker**, **Bernard Brais**, **Heidi McBride**, **Peter McPearson**, **Guy Rouleau**, **Eric Shoubridge**, **Stifano Stifani**, Montreal Neurological Institute and Hospital, McGill University

Nicole Leclerc, **Louis-Eric Trudeau**, Université de Montreal

Xavier Roucou, Université Sherbrooke

Partners: The Marigold Foundation, RMGA, McGill University, Quebec Pain Research Network



hiPSC derived neurons.

The issue

Stem cells have the remarkable potential to develop into many different cell types in the body during early life and growth. In 2006, researchers made a breakthrough by identifying conditions that would allow some specialized adult cells to be “reprogrammed” genetically to assume a stem cell-like state. This new type of stem cell, called induced pluripotent stem cells (iPSCs), are adult cells that have been genetically reprogrammed to an embryonic stem cell-like state by being forced to express genes and factors important for maintaining the defining properties of embryonic stem cells. iPSCs are useful tools to establish cell-based disease models, to develop new cell therapies using iPSC and to screen drug libraries, however the derivation of human inducible pluripotent stem cells (hiPSC) is a time-consuming, complex and highly sophisticated procedure that is too expensive for a single research laboratory.

The project

A \$1.5 million platform grant awarded by Brain Canada in 2015 in partnership with the Marigold Foundation, McGill University, the Quebec Pain Research Network, and the Réseau de médecine génétique appliquée, allowed Principal Investigator Jack Puymirat and his team to create a Quebec core facility dedicated to the production of pluripotency-induced human stem cells (hiPSC). The goal of the platform was to produce cost-effective, high quality hiPSCs using advanced methods that could be used by researchers across Quebec. The hope was that this would increase the pace of stem cell research, and help build translational bridges that facilitate the clinical use of stem cells to treat patients. Additionally, the platform would create hiPSC lines from patients with brain diseases which would lead to a better understanding of the molecular mechanisms that underlie these neurodegenerative, neurodevelopmental and neuropsychiatric diseases in order to help develop novel treatments.

The grant ended in 2018 and significant progress was made over the three years. In addition to the establishment of the core facility in Quebec, the platform was also used as leverage to obtain new grants, to develop new collaborations, and to

educate the public about hiPSCs and their potential as therapeutic agents.

The core facility was able to produce very high quality hiPSCs at 50% of the costs. Over the past two years, 50 lines of iPSCs were developed for different researchers, which would not have been possible without the Brain Canada grant. In addition, the platform allowed for the creation of a biobank of hiPSCs for several neurodegenerative diseases such as Parkinson’s disease.

In a second step, the platform was able to form new partnerships with the Parkinson Network of the FRQS and the Montreal Neurological Hospital and Institute at McGill University to expand the scope of the project to include a neural production platform and a genome publishing platform.

The core facility also played a role in training students. An iPSC production training workshop and iPSC symposium were organized, which brought together 50 and 140 participants, respectively. Outreach activities were also developed to educate the public about human iPSCs and their therapeutic uses.

“The large-scale production of hiPSC from patients with several brain disorders represents a new avenue for modeling neurological diseases, drug screening and the development of cell therapy and personalized medicine.”

– Jack Puymirat
Université Laval

Platform Support Grants. Building capacity and sustainability for spinal cord injury care and research.

Grant amount: \$832,394

Grant title: **Building the Rick Hansen Alberta Spinal Cord Injury Registry**

Principal Investigator: **Chester Ho**, University of Calgary

Team members: **Jaynie Yang**, University of Alberta, **Monica Gorassini**, University of Alberta

Vivian Mushahwar, University of Alberta, **Andrew Nataraj**, University of Alberta, **Brad Jacobs**, University of Calgary,

Dalton Wolfe, Lawson Health Research Institute, **Luc Noreau**, Laval University, **Patrick Whelan**, University of Calgary

Partners: Alberta Paraplegic Foundation, Hotchkiss Brain Institute of University Calgary, Neuroscience and Mental Health Institute of the University of Alberta



RHSCIR AB team members are shown presenting their new model for the long-term community follow-up of persons with a Spinal Cord Injury (SCI) at the National SCI Conference in Niagara Falls in November 2017. Pictured from left to right are Karen Smith, RHSCIR AB Research Assistant, Nicole McKenzie, RHSCIR AB Project Manager, Zahra Bhatia, Spinal Cord Injury AB Client Services Coordinator, and Magda Mouneimne, RHSCIR AB Research Coordinator.

The issue

There are an estimated 86,000 people living with a spinal cord injury (SCI) in Canada, with an annual economic burden of \$2.67 billion for those surviving the initial injury. Approximately half of SCIs are the result of a traumatic (T) incident (ex. motor vehicle accident, sports injury) and the other half are from a non-traumatic (NT) cause (ex. infection, tumor, or deterioration of the bones surrounding the spinal cord). The challenges that result from an SCI have a direct, lifetime impact on the physical, psychological and social well-being of persons with SCI and their families. Long-term tracking of these issues in the form of a registry is crucial for understanding the changing needs of patients so that we are better equipped to manage them proactively and efficiently.

The project

Chester Ho, based at the University of Calgary, and his team, received a Brain Canada Platform Support Grant in 2014 to develop a provincial registry

for patients with traumatic or non-traumatic spinal cord injuries. The overall aim was to integrate research with clinical practice and community supports to improve understanding of the entire SCI population. The Rick Hansen Spinal Cord Injury Registry (RHSCIR) is an existing national registry which collects data on SCI patients from 30 sites in nine provinces across Canada, but was focused solely on traumatic spinal cord injuries. Dr. Ho and his team aimed to enhance the RHSCIR by adding the long-term tracking of persons with non-traumatic spinal cord injuries (a population that makes up 50% of cases of spinal cord injury but is not as well studied as those with traumatic incidents). The resulting Rick Hansen Alberta Spinal Cord Injury Registry (RHSCIR-AB) collects demographic and clinical data on all Alberta SCI patients and is accessible and used by SCI researchers, clinicians, national collaborators and healthcare administrators across the spectrum of care. The team has demonstrated many positive achievements as a result of this three-year grant.

This grant supported the development of a partnership with Spinal Cord Injury Alberta, a non-profit organization serving the needs of the SCI population in the community. This partnership enabled the development and implementation of a novel approach to the long-term follow-up of persons with SCI through the RHSCIR-AB. This integrated approach to long-term follow-up provides the capacity to address the concerns of the registry participants in real time by the appropriate support person/group. This is a much more proactive approach than previous models (which was entirely research-focused) and will ultimately improve people's quality of life.

The team also pioneered the use of administrative health data to define, identify, and collect data on patients who have sustained a non-traumatic SCI

(NTSCI). The algorithm they developed leverages Alberta Health Services data assets to identify NTS-CI patients, which are a very heterogeneous group and therefore challenging to identify and track. This is an important development as this type of injury is increasing in prevalence due to the aging population. This groundbreaking work has significant implications in the care of these patients, and has led to a presentation at the International Spinal Cord Society conference in Vienna, Austria in 2016, and four published manuscripts. This could serve as an international method for defining and identifying NTSCI patients retrospectively.

In addition to the partners listed above, Dr. Ho and the team would also like to acknowledge the Rick Hansen Institute, Alberta's Strategy for Patient Oriented Research, Spinal Cord Injury Alberta, Ward of the 21st century (UofC), Alberta Health Services, Alberta Health, Covenant Health, University of Toronto and Campus Alberta Neuroscience for their important contributions to this work.

“As a result of Brain Canada's generous funding, we have made significant achievements that would have not otherwise been realized. This grant has resulted in a great deal of foundational work that is driving the development and implementation of a model of care for SCI in Alberta.”

– Nicole McKenzie
Project Manager and Spinal Cord Injury
Research Facilitator at the Foothills Medical Centre

Please visit our [website](#) for an interview with project manager Nicole McKenzie who provides more detail on the impact and achievements of the platform grant.

Supporting the next generation of brain researchers

Capacity Building Grants.

Brain Canada believes in the importance of supporting and developing the next generation of researchers. We identify and nurture rising stars and future leaders in Canadian brain research through training and career development support programs designed to help them accelerate their progress and make outstanding research contributions.

Capacity building grants are awarded to graduate students, postdoctoral fellows and early career researchers, as well as to researchers who are convening the brain research community to tackle complex questions about the brain.

“The support of Brain Canada has played a critical role in making my research studies and career trajectory possible, by providing financial, networking, and training opportunities that otherwise would not have been available to me. In a time of restrictive funding opportunities for young career researchers and research all around, Brain Canada provides a critical role in ensuring that Canada remains a world leader in neuroscience research and advancements in patient care.”

– Nancy Butcher
The Hospital for Sick Children
Recipient of 2012 Bell Mental Health Training Award
and 2014 Dr. Hubert van Tol Travel Fellowship

\$27 million awarded
to capacity
building grants

81 projects

Capacity Building Grants.

The effect of pregnancy on brain aging in women.

Grant Amount: \$175,000 USD

Grant title: ***The impact of motherhood and APOE genotype on the aging brain***

Principal Investigator: **Paula Duarte-Guterman**, University of British Columbia

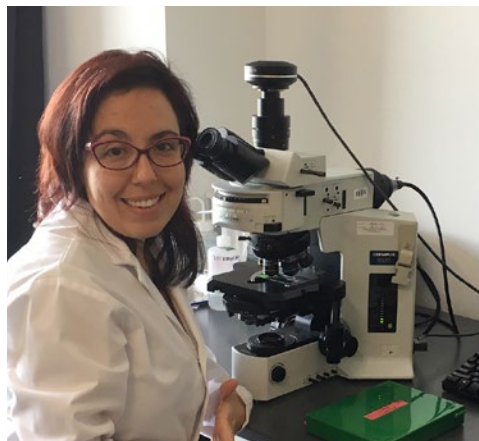
Partner: Alzheimer's Association (USA)

The issue

Alzheimer's disease is a degenerative disease that results in the progressive loss of cells in the brain, in particular in an area important for the formation of new memories, called the hippocampus. Women are more likely to be diagnosed with Alzheimer's disease and show greater brain pathology and memory loss with the disease than men. In addition, women are more likely to develop Alzheimer's disease especially when they have certain genes (APOE4) and a previous history of multiple pregnancies. It is clear that tailored treatments based on sex, genetics, and possibly reproductive history need to be developed to best treat individuals with Alzheimer's disease. Aging can be detected at the level of brain cells and is evident in Alzheimer's disease patients. However, to date, no studies have investigated whether past pregnancy, motherhood and genetics can increase cellular aging and inflammation in the brain.

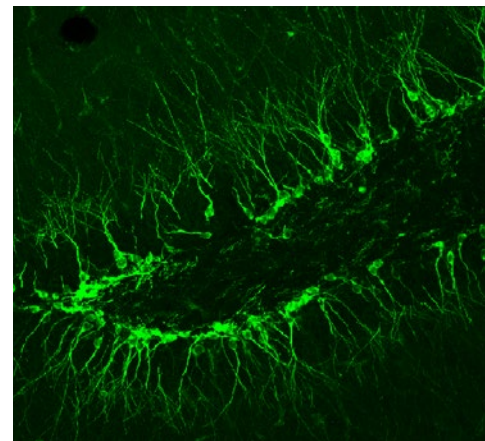
The project

Paula Duarte-Guterman received a research grant in 2017 to investigate some of the possible reasons that women experience greater cognitive decline than men. She is looking at two angles: past reproductive history, and females that carry the APOE4 gene – a gene known to be associated with Alzheimer's. Using animal models that express the human form of APOE4, she will study female



Paula Duarte-Guterman.

rats with or without APOE4 and with or without the experience of pregnancy and motherhood. Dr. Duarte-Guterman will focus specifically on changes in an area of the brain called the hippocampus and will measure biomarkers in the brain associated with cellular aging (telomeres) and inflammation. She will also measure and compare the expression of genes in the female hippocampus between aging moms and non-moms (via RNA sequencing) and hopes to determine whether recorded changes are influenced by motherhood or APOE4. In addition, she will look for other genes in the rat brain that may distinguish moms from non-moms, and that could possibly make the moms more vulnerable to brain cell aging and dementia.



Confocal microscope image of the rat hippocampus highlighting an area where neurogenesis continues in adulthood. Immature neurons are represented in green.

This work will help to better understand the increased susceptibility of women, and especially women with past reproductive experience, for Alzheimer's disease. Though the funding for the grant just began in October of 2017, Paula Duarte-Guterman is already making great progress. She is currently collecting data on the mothers and non-mothers. Her early results earned her a young investigator award to attend and present at the Parental Brain Conference taking place this summer in Toronto.

“Pregnancy's long term consequences have not received much attention, yet to fully understand women's physiology, reproductive experience needs to be taken into account in research. The support from Brain Canada has allowed us to continue this work and incorporate new research techniques in cellular aging and global gene expression.”

– Paula Duarte-Guterman
University of British Columbia

Capacity Building Grants.

An interdisciplinary approach to understanding the microbiome.

Grant amount: \$6,340,786

Grant title: *Humans and the Microbiome*

Co-Directors: **Brett Finlay**, University of British Columbia, **Janet Rossant**, The Hospital For Sick Children

Fellows: **Thomas Bosch**, Universität Kiel, **Eran Elinav**, Weizmann Institute of Science, **Tamara Giles-Vernick**, Institut Pasteur

Philippe Gros, McGill University, **Karen Guillemin**, University of Oregon, **Frédéric Keck**, Musée du quai de Branly

Sven Pettersson, Karolinska Institutet, **Hendrik N. Poinar**, McMaster University, **Tobias Rees**, McGill University

Philippe Sansonetti, Institut Pasteur, **Liping Zhao**, Shanghai Jiao Tong University

Partner: CIFAR



Janet Rossant, Co-Director of CIFAR's *Humans and the Microbiome* program.

The issue

All animals are colonized by large numbers of microorganisms on surfaces such as skin, mucosal membranes, teeth, and in the gastrointestinal tract. These microbes are numerous, outnumbering human cells by 10 times, and are collectively referred to as the microbiome. Gut microbes help us digest food, educate our immune system, influence the development and aid in the functioning of our nervous system. They also help us adapt to new environments. To date, the microbiome has been associated with many conditions including type I diabetes, autism, allergies, obesity, cancer, and asthma. There is currently extensive research being conducted to understand the complex interactions between the microbiota and humans, however much is still not understood. To understand this complexity, we need to bring together biological, historical and anthropological perspectives.

The project

Brain Canada is a partner on the CIFAR research program called *Humans and the Microbiome*. The program aims to look into the role the microbiome plays in human development and behaviour, as well as how it is affecting our evolution and society. The program consists of 19 Fellows and Advisors, spanning a variety of disciplines and geographic areas. Expertise in the program to date is provided in the areas of microbiology, developmental and stem cell biology, metabolism and human physiology, evolutionary biology, history and social science, and anthropology. Through an interdisciplinary approach, the program will shed new light on broad issues of human health, such as healthy aging, human development and the effects of diet and drug treatments.

Research has shown that bidirectional signalling exists between the gastrointestinal tract and the brain, called the gut-brain “axis” or “connection”. The microbiome plays an integral part in the gut-brain connection and is implicated in a range of issues related to brain dysfunction from neurodevelopmental disorders to neurodegeneration, depression, ADHD, and even to jet lag and fetal development.

Several Fellows from the *Humans and the Microbiome* program are pursuing research related to this gut-brain connection, which has resulted in collaborations both between researchers within the program and across different CIFAR programs.

A CIFAR-funded collaboration is ongoing between CIFAR Fellows Sven Pettersson of the Karolinska Institute in Sweden, and Janet Rossant of the Hospital for Sick Children. They are interested in untangling how the prenatal microbiome of the mother affects brain development in the fetus. Previous work suggests that microbial metabolites could penetrate the placenta and affect the timing and direction of brain development. Thanks to the collaboration, Katherine Martine, a PhD student of Pettersson's, will spend six months in the lab of the University of Calgary's Guang Yang working on the project.

The CIFAR program has also organized several events to facilitate collaboration among researchers and with the public. Co-Director Brett Finlay presented the CIFAR-Royal Institution Public Lecture at the Royal Institution for Science in London, and the program hosted a roundtable discussion in conjunction with the talk. Program members also met with federal policy makers and health officials in Ottawa to discuss the role of the microbiome in public health.

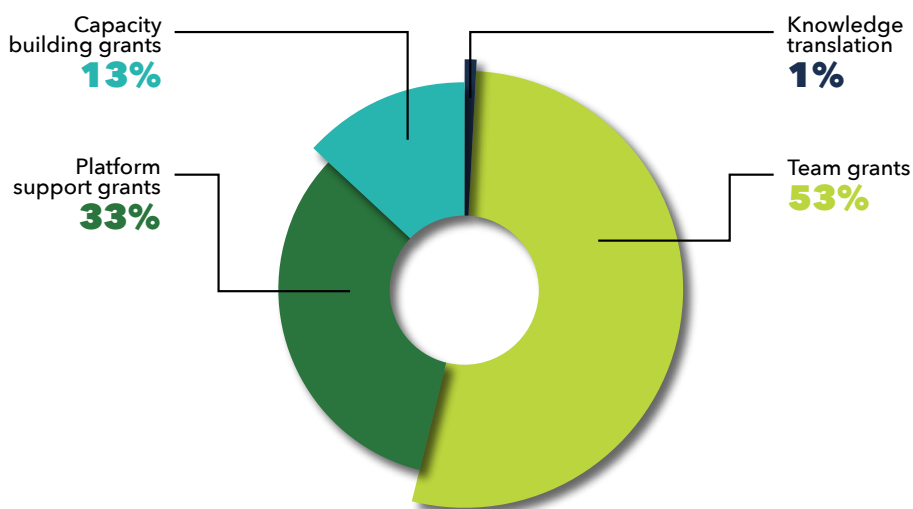
“The impact of Brain Canada’s funding programs (Team grants, Platforms Support grants and Training Awards) is well recognized in the neuroscience community and has greatly contributed to Canada retaining its best scientists and to stopping the brain drain that is so detrimental for this country.”

– Diane Gosselin
President and CEO, CQDM

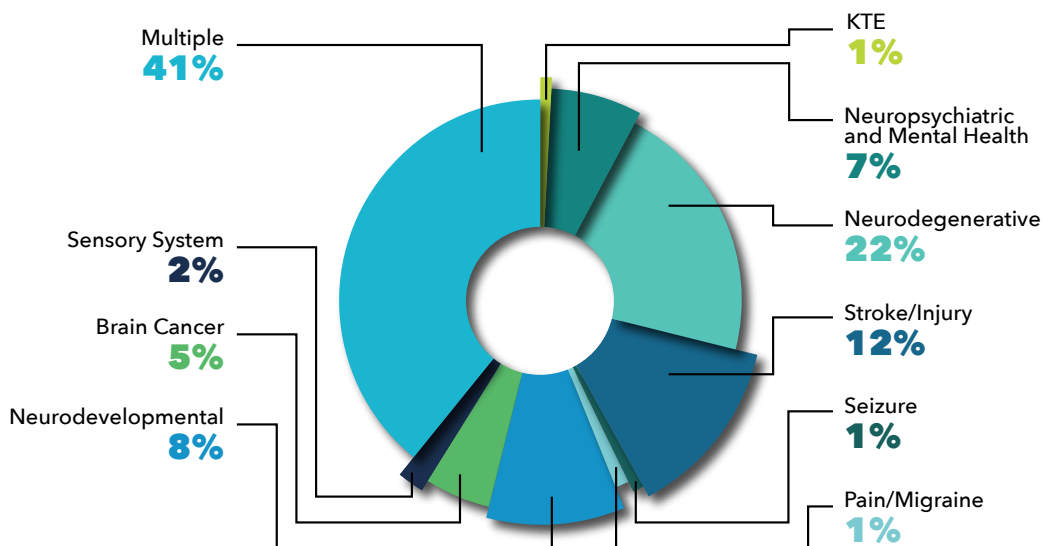
“We appreciate and value Brain Canada’s focus on building platforms and supporting team-based approaches. Their exceptional peer review process, expert leadership, and oversight provides a level of confidence that our funds are being allocated to innovative and promising research.”

– Mark Krembil
President and CEO, The Krembil Foundation

Amount of funding by grant type.



Amount of funding by research area.



Science without barriers or borders

Open Science.

Brain Canada believes that, as researchers delve deeper into understanding the brain and the complexity of the challenge increases, so too does our need to join people, labs and platforms across the country and around the world; and to pursue new thinking and new approaches.

Open Science is the practice of science in such a way that others can collaborate and contribute, where research data, lab notes and other research processes are freely available, under terms that enable reuse, redistribution and reproduction of the research and its underlying data and methods¹.

“Data sharing between scientists across the globe is a science diplomacy exercise of the first order.”

– Martha Crago
Vice-Principal, Research and Innovation, McGill University,
at the Students & Science Diplomacy Workshop.

1. Foster Open Science. <https://www.fosteropenscience.eu/content/what-open-science-introduction>.

Open Science. A national platform for open sharing of neuroscience research data.

Grant amount: \$10,170,000

Grant title: **Canadian Open Neuroscience Platform**

Principal Investigator: **Alan Evans**, McGill University

Partners: Simon Fraser University, University of Calgary, Laval University, University of Toronto, University of Western Ontario, École polytechnique de Montréal, Ontario Brain Institute, Institut de Cardiologie de Montréal, McGill University

For a full list of team members, please visit our website at www.braincanada.ca

The issue

Neuroscience research can produce massive amounts of data in multiple forms such as genetic, behavioural data and brain imaging. This information can support a wide range of research, such as work to identify early signs of Alzheimer's disease or research to advance drugs that could stop neurodegeneration. The challenge facing researchers is that 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 modeling 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.



Members of the CONP and dignitaries who attended the inaugural meeting on February 19, 2018.

The project

The Canadian Open Neuroscience Platform (CONP) is a national platform for the open sharing of neuroscience research data. It brings together many of the country's leading scientists in basic and clinical neuroscience to form an interactive network of collaborations in brain research, interdisciplinary partnership, clinical translation and Open Publishing. The goal of the platform is to improve the accessibility and re-usability of neuroscience data and, by increasing awareness of ongoing and past research efforts, it will reduce unnecessary duplication and overlap, resulting in a more efficient use of funding support. The CONP will also engage young

investigators across the country in order to develop the next generation of "open" scientists.

The platform will provide a unified interface to the research community and will propel Canadian neuroscience research into a new era of open neuroscience research with the sharing of both data and methods, the creation of large-scale databases, the development of standards for sharing, the facilitation of advanced analytic strategies, the open dissemination to the global community of both neuroscience data and methods, and the establishment of training programs for the next generation of computational neuroscience researchers.

The CONP aims to remove the technical barriers to practicing open science and improve the accessibility and reusability of neuroscience research to accelerate the pace of discovery. Through the CONP, neuroscientists from across Canada will be able to pool data from diverse sources making this information easier to access and share. Access to the CONP and the data within it will help researchers find patterns that can potentially lead to breakthroughs to prevent, diagnose and treat neurological conditions. Ultimately, the CONP will help researchers collect, link and analyze data from across the country more easily, leading to better and faster outcomes for patients.

“The Government of Canada is committed to supporting Canadians with neurological conditions. The platform being created with this funding will be a central repository for innovative brain research. With access to such data, researchers will be better equipped to pursue medical breakthroughs that will improve the lives of Canadians living with brain diseases and disorders.”

– The Honourable Ginette Petitpas Taylor
Minister of Health

Providing a base of evidence

Pilot projects.

Pilot projects are designed to test the feasibility and usefulness of research ideas. They are used to reduce risk by allowing researchers to try out different approaches, develop evidence-based strategies, identify good practices, and provide preliminary data for the benefit of larger, future initiatives.

Looking back – “Housing First” Pilot Project .

With a generous donation from Boardwalk Charitable Trust Fund, in 2004, Brain Canada provided \$100,000 to support a pilot project led by James R. Dunn and Paula Goering: *Feasibility Study for a Two-City Demonstration of Supportive Housing for Individuals with Severe Mental Illness*. This project evaluated the “Housing First” model, which promotes the position that for many people with severe, persistent mental illness, stable housing is a precondition to participating successfully in psychiatric treatment and dealing with addictions. The study was one of the key references used by the Mental Health Commission of Canada (MHCC) to make the case to the federal government to allocate \$110 million towards research to help the homeless living with mental illness. Paula Goering became the research advisor to the MHCC for the design and development of the At Home/Chez Soi program, a four-year, five-city study on the “Housing First” approach.

Pilot projects.

Testing the benefits of expressive writing in youth.

Grant Amount: \$190,385

Grant title: **Evaluation Study of the Kids Write Network (KWN)**

Principal Investigator: **Danielle Groleau**, McGill University

Team member: **Ingrid Sladeczek**, McGill University

Partners: Jewish General Hospital Foundation, Bell Canada

The Issue

Adolescence can be a very stressful time. Teenagers often have to deal with a range of issues, from bullying to conflicts with friends to problems with family members. Helping adolescents foster resilience, regulate their emotions and develop other healthy behaviours to deal with stress and adversity has been shown to lead to better mental health outcomes in both the short and long term. School-based programs that promote emotional well-being, especially for adolescents at risk of developing psychosocial problems, are urgently needed.

The project

Expressive writing is one method that has been shown to have a positive effect on mental health. In an expressive writing intervention, participants disclose details and emotions associated with a stressful or difficult past event, in the form of a written narrative, with the aim of more fully understanding the negative emotions triggered by the event.

Though there have not been extensive studies involving adolescents and expressive writing, research conducted with this age group has shown that expressive writing can contribute to the reduction of internalizing problems and problem behaviours as well as to the improvement of social adjustment, school participation, and school performance.

For this particular grant, Principal Investigator Danielle Groleau and her team are conducting a formal evaluation of the Kids Write Network



Danielle Groleau reading with students.

(KWN) – a brief school-based intervention that uses expressive writing to promote mental health and well-being among youth. It is a creative intervention in which children and adolescents are assisted by a facilitator to reflect deeply on a stressful or difficult event they have experienced or witnessed (e.g., bullying, conflict with significant others), find positive ways to cope with similar situations, and ultimately lead them to write and illustrate a story based on real events to be published. The goals of this expressive writing intervention are to enhance self-expression, self-esteem, and self-confidence and also to develop a sense of agency and voice in participating children.

The facilitator works with participating children within a five-step process (brainstorming, characters, settings, conflict-resolution, ending - moral lesson) with the objective, for each participating

child, of writing a story to be self-illustrated and published within two weeks after the manuscript is completed. To date, more than 1,000 children have participated in the program and 85 books have been published.

The team is using a mixed-methods design to document the implementation process of the KWN, to understand the experience of participating children, and to measure mental health outcomes. The data collected from this pilot project will be used to develop a future randomized control trial on the intervention. Results from the team's evaluation will also contribute to the published knowledge on expressive writing and adolescents in the area of school-based mental health promotion programs.

The grant has enabled the team to develop a theoretical model for this intervention, to test the suitability of mental health outcome measures and qualitative methods to collect and code the qualitative data, and to identify appropriate recruitment strategies for a school-based randomized controlled trial. They are in the process of documenting and analyzing students' experiences and psychological processes and are currently preparing to evaluate students' mental health outcomes as a result of the intervention in two schools.

If the randomized control trial yields positive mental health outcomes for students, the goal is to implement the expressive writing intervention in more schools.

“If positive mental health outcomes are exhibited, the current research will provide teachers and schools with a low-cost and low-technology school-based program to promote wellbeing and self-esteem among teenagers. Our prospective results should also significantly contribute to the advancement of mental health literature on children in a school-based setting.”

– Danielle Groleau
McGill University

Partnering with others in the space who share our commitment to brain research.

Our philosophy is that every dollar contributed to Brain Canada signifies an investment and a partnership in our collective search to understand the brain.

We gratefully acknowledge the following individuals, foundations and corporations who have made leadership contributions.

LEAD DONORS

The Azrieli Foundation - \$7.5 million
The Chagnon Family - \$5 million
The Krembil Foundation - \$3.25 million
The W. Garfield Weston Foundation - \$3 million
Anonymous Donor - \$1,528,050
RBC Foundation - \$620,500
Bell Canada - \$500,000
CIBC - \$500,000
The Rossy Family Foundation - \$300,000

\$100,000 - \$249,999

Wayne E. Bossert
Goose Nest Inc. (W. David Angus)
The Jim Pattison Foundation
The Max Bell Foundation
National Bank of Canada
Power Corporation
Michael H. Wilson


\$10,000 - \$99,999

Alastair & Diana Gillespie Foundation
The Barbara Turnbull Foundation
Rupert Duchesne
The Henry and Berenice Kaufmann Foundation
The Ira Gluskin & Maxine Granovsky Gluskin Charitable Foundation
Marianne Seger and Monica Seger-van Tol
Medavie Health Foundation
Catherine Zahn

GIFTS WERE MADE TO HONOUR THE FOLLOWING INDIVIDUALS:


Jean Baxter and Cecil Baxter
Carolyn Blank
Dany Dandouni
Frank Jones
Claude Leclerc
Louise Méthot Gourdeau
Audrie Neilsen
Babak Tahvildari
Madeleine Demers Vien and Raymond Vien

We would like to thank the following initiatives that are raising funds to benefit Brain Canada:



PROJECT 7
Eric Pilon Bignell will be climbing the highest mountain on each of the seven continents with the goal of raising funds and awareness for brain research. Funds raised will go to both Brain Canada and the American Brain Foundation. You can track his progress and donate at <http://ericpb.me/project7/>. By the end of 2017, \$5,755 had been donated to Brain Canada.

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



A RIDE TO REMEMBER
A group of bikers who have family members with Alzheimer's disease have organized a 140km bike ride that will take place on August 5, 2018. The ride will begin in Lachute, Quebec, continue along the north side of the Ottawa River and finish in Hull, overlooking Ottawa's Parliamentary buildings. Funds raised will go to Brain Canada. By the end of 2017, \$14,994 had been raised. You can donate at www.canadahelps.org/en/pages/a-ride-to-remember/.

Partners

HEALTH CHARITIES

Alberta Paraplegic Foundation
ALS Society of Canada
Alzheimer Society - Alberta and Northwest Territories
Alzheimer Society of Canada
Alzheimer's Association US
Brain Tumour Foundation of Canada
Canadian Cancer Society
CHU Sainte-Justine Foundation
Douglas Mental Health University Institute Foundation
Fondation CERVO
Heart and Stroke Foundation of Canada
Huntington Society of Canada
Jewish General Hospital Foundation
The Marigold Foundation
Mount Sinai Hospital Foundation of Toronto
MS Society of Canada
Parkinson Society of Canada
SickKids Foundation
Sunnybrook Health Science Foundation
UHN Toronto General & Western Hospital Foundation
University Hospital Foundation
Vitae Foundation
Women's Brain Health Initiative

PROVINCIAL AGENCIES

Alberta Health Services
Alberta Innovates Health Solutions
Federation quebecoise de l'autisme
Fonds de recherche du Québec - Santé (FRQS)
Genome BC
Manitoba Health Research Council
Michael Smith Foundation for Health Research (MSFHR)
Network of Applied Medical Genetics (RMGA)
Nova Scotia Health Authority
Ontario Brain Institute (OBI)
Ontario Neurotrauma Foundation (ONF)
Pacific Alzheimer Research Foundation (PARF)
Quebec Pain Research Network
Vancouver Coastal Health Authority (VCHA)

CORPORATIONS

Atuka, Inc.
Biogen
Eli Lilly & Company
Life Chemicals, Inc
Magventure
Trevantis

RESEARCH NETWORKS

Age Well
Campus Alberta Neuroscience
Canadian Partnership for Stroke Recovery
Canadian Stroke Consortium
Canadian Stroke Network
CQDM
Kids Brain Health Network (NeuroDevNet)
Le Réseau québécois sur le suicide, les troubles de l'humeur et les troubles associés (RQSHA)

OTHER ORGANIZATIONS

Canadian Institute for Advanced Research (CIFAR)
Capitalize for Kids
Les Grands Ballets
Martin Family Initiative
Mental Health Commission of Canada
National Institutes of Health (NIH)

INSTITUTIONS

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

British Columbia
BC Children's Hospital Research Institute
BC Women's Hospital&Health Centre
Centre for Heart Lung Innovation (UBC and St. Paul's Hospital)
Djavad Mowafaghian Centre for Brain Health
Institute of Mental Health
International Collaboration On Repair Discoveries (ICORD)
Providence Health Care Society
Simon Fraser University
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University of British Columbia

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Quebec

Centre de Recherche Institut universitaire de geriatrie de Montreal (CRIUGM)
Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal (CRIR)
Centre hospitalier de l'Université de Montréal (CHUM)
CHU Sainte-Justine Research Centre
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CIUSSS-NIM
Douglas Hospital Research Centre
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Institut de Recherches Cliniques de Montréal
Institut universitaire en santé mentale de Québec (IUSMQ) (CIUSSS-CN)
Jewish Rehabilitation Hospital
McGill University
Montreal Neurological Institute and Hospital
Université de Montréal
Université Laval

Saskatchewan

University of Saskatchewan

Brain Canada's Board



Brain Canada Board of Directors:

Back row, from left to right: Celeste Haldane; Glen B. Baker; Wayne E. Bossert; Franco J. Vaccarino; Robert Mark Krembil; The Hon. W. David Angus; France Chrétien-Desmarais; Rupert Duchesne. Front row: Vincent Castellucci; Lawrence Tanenbaum; Naomi Azrieli; Inez Jabalpurwala; Catherine Zahn.

Board developments

Brain Canada is pleased to announce four new additions to our Board of Directors:

Glen B. Baker is a Professor Emeritus in the Department of Psychiatry and Interim Chair of the Department of Pharmacology at the University of Alberta, having previously served as an Associate Vice-President (Research) at that university. Dr. Baker was a Tier I Canada Research Chair in Neurochemistry and Drug Development from 2002 to 2009. He has been very active in service to various professional societies and granting agencies, including serving on the Scientific Advisory Board of the University of Ottawa Institute of Mental Health Research from 2005 to 2013 and as a member of the steering committee for the Canadian Depression Research and Intervention Network (CDRIN).

France Chrétien-Desmarais has extensive involvement with companies and charitable organizations in areas as varied as health, sports, arts, education, heritage and support for youth. Ms. Chrétien-Desmarais serves as Vice-President and Founding Member of both the Guy Laliberté Foundation and ONE DROP Foundation, and is a member of the Board of the Montreal Heart Institute Foundation, the McGill University International Centre for Youth Gambling Problems and High-Risk Behaviors Board and Drug Free Kids Canada.

George Cope is President and CEO of BCE Inc. and Bell Canada and has earned a reputation as a strategic leader and builder of high-performance teams over the past 30 years. Mr. Cope led the launch of the Bell Let's Talk initiative, the largest-ever corporate commitment to Canadian mental health and now one of the country's most prominent community investment campaigns. He received the Queen's Diamond Jubilee Medal for his work on Bell Let's Talk and was appointed a Member of the Order of Canada in 2014.

Celeste Haldane was appointed Chief Commissioner of the B.C. Treaty Commission in April 2017 after serving as an elected Commissioner since 2011. Ms. Haldane was appointed to serve on the UBC Board of Governors and is the first Indigenous chair of the Legal Services Society. She is an active member of the Canadian Bar Association, and a member and director of the Indigenous Bar Association. She is from the Musqueam Nation and has roots in Metlakatla.

“Brain disorders directly impact one in three Canadians, but touch us all. The diversity, experience and passion of our Board are key to finding creative solutions to this complex challenge.”

– Inez Jabalpurwala
President and CEO, Brain Canada

Board of Directors

CHAIR

Naomi Azrieli, DPhil.
Chair and CEO
The Azrieli Foundation (Toronto)

DIRECTORS

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Former Member, Senate of Canada
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Professor Emeritus, Department of Psychiatry
University of Alberta
(Edmonton)

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Risk Management Committee*
Deputy Chairman and Global Head of Ultra High
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**Max S. Cynader, C.M., O.B.C., Ph.D, FRSC,
FCAHS (until June 2018)**
Founding Director
Djavad Mowafaghian Centre for Brain Health
University of British Columbia (Vancouver)

Rupert Duchesne, C.M. (until June 2018)
Group Chief Executive (retired May 2017)
AIMIA Inc.
(Montreal)

Celeste Haldane, LL.M.
Chief Commissioner
BC Treaty Commission
(Vancouver)

Inez Jabalpurwala
President and CEO
Brain Canada Foundation
(Montreal)

Robert Mark Krembil
President
The Krembil Foundation (Toronto)

Ravi S. Menon, Ph.D., FCAHS (as of June 2018)
Professor, Medical Biophysics
Scientist, Robarts Research Institute
Western University
(London)

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Vice-Chair
Chairman and CEO
Kilmer Van Nostrand Co. Ltd.
Chairman, Maple Leaf Sports &
Entertainment Ltd. (Toronto)

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*Chair, Research Policy Committee
President and Vice-Chancellor*
University of Guelph (Guelph)

Catherine Zahn, C.M., M.D., F.R.C.P.(C), M.H.Sc
*Chair, Governance, Nominating and
Ethics Committee*
President and CEO
Centre for Addiction and Mental Health
(Toronto)

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Canadian Astronaut
President and CEO
Southlake Regional Health Centre
(Newmarket)

Thank you to outgoing Directors

Two long-standing Directors completed their terms in June 2018:
Max Cynader (2009 to 2018) and Rupert Duchesne (2005 to 2018).

We thank them both for their much-valued service to Brain Canada.



Max Cynader introducing a speaker at Brain Canada's 2017 AGM.



From left to right: Directors, Franco J. Vaccarino, Rupert Duchesne and Catherine Zahn at Brain Canada's 2018 AGM.

We would like to give special recognition to Rupert Duchesne who was Brain Canada's Board Chair from 2010 to 2017. It was during Rupert's leadership that the Government of Canada established the Canada Brain Research Fund in Budget 2011. The \$100-million commitment of funds was matched 18 months ahead of schedule, which led to a successful approach to Government for an additional \$20 million in Budget 2016.



From left to right: Yves De Koninck and David Kaplan (then co-Chairs, Brain Canada's Science Advisory Council), The Honourable Leona Aglukkaq (then Minister of Health, for the Government of Canada), Rupert Duchesne, and Inez Jabalpurwala at the launch of the Canada Brain Research Fund on May 3, 2012.

Science Advisory Council

CHAIR

Sheena Josselyn, Ph.D.

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

CANADIAN MEMBERS

Jacques Drouin, D. Sc., MRSC

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

Alan C. Evans, Ph.D.

Professor, Departments of Neurology and Neurosurgery, Biomedical Engineering, Medical Physics, McGill University
Area of expertise: Disorders of the Nervous System

Lesley K. Fellows, M.D., DPhil

Associate Professor, Department of Neurology & Neurosurgery, Montreal Neurological Institute
Area of expertise: Neurologist

Kurt Haas, Ph.D.

Associate Professor, Department of Cellular and Physiological Sciences, University of British Columbia
Area of expertise: Model organisms and systems

James L. Kennedy, MSc, M.D., FRCP(C), FRSC

Director of the Neuroscience Research Department and Head of the Psychiatric Neurogenetics Section, Centre for Addiction and Mental Health (CAMH)
Area of expertise: Genetics

Bryan E. Kolb, Ph.D.

Professor, Department of Neuroscience, University of Lethbridge
Area of expertise: Cognition and behaviour

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

INTERNATIONAL MEMBERS

Karl Deisseroth, M.D., Ph.D.

D.H. Chen Professor of Bioengineering and of Psychiatry and Behavioral Sciences, Stanford University, Howard Hughes Medical Institute (CA, USA)
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/photronics, 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

Bill Newsome, Ph.D.

Arman Family Provostial Professor and Professor of Neurobiology and, by courtesy, of Psychology, 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

Bruce Rosen, M.D., Ph.D.

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.

Professor of Neurobiology, Dana Farber Cancer Institute, Harvard (MA, USA)
Area of expertise: Cellular and molecular neuroscience/oncology

D James Surmeier, Ph.D.

Chair, Department of Physiology, Nathan Smith Davis, Professor of Physiology, Northwestern (IL, USA)
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

2017 Financial Report

Brain Canada Foundation

December 31, 2017, with comparative information for 2016

Year ended December 31, 2017, with comparative information for 2016

	2017 \$	2016 \$
ASSETS		
Current Assets		
Cash and cash equivalents	24,683,912	17,984,431
Short-term investments	3,152,299	6,758,542
Accrued interest receivable	61,911	43,449
Advance payments on grants and awards	92,500	248,490
Other receivables	19,259	149,012
Prepays and deposits	27,011	17,963
	28,036,892	25,201,887
Long-term investments	1,700,000	-
Advance payments on grants and awards	182,000	68,501
Capital assets	100,150	119,826
	30,019,042	25,390,214
LIABILITIES AND NET ASSETS		
Current liabilities		
Accounts payable and accrued liabilities	60,001	121,981
Salaries and benefits payable	306,200	265,778
Current portion of deferred contributions	24,715,742	15,031,239
	25,081,943	15,418,998
Deferred contributions	4,830,333	9,864,450
	29,912,276	25,283,448
NET ASSETS		
Unrestricted net assets (deficiency)	6,616	(13,060)
Invested in capital assets	100,150	119,826
	106,766	106,766
Commitments		
	30,019,042	25,390,214

	2017 \$	2016 \$
REVENUES		
Restricted contributions	44,930,050	38,289,252
Unrestricted contributions	161,856	64,954
	45,091,906	38,354,206
Interest and investment income	174,166	59,211
	45,266,072	38,413,417
EXPENDITURES		
Grants and awards	42,527,060	35,787,862
Operating expenses	2,495,312	2,367,884
Administrative expenses charged by other organizations	215,857	222,252
Amortization of capital assets	27,843	35,419
	45,266,072	38,413,417
Excess of revenues over expenditures	-	-

The financial statements of Brain Canada Foundation are audited by KPMG LLP and are available on our website at www.braincanada.ca

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.



20 years of transforming brain research in Canada!

Since 1998, Brain Canada has granted \$250 million to 281 projects involving more than 1,000 researchers based at 115 hospitals, universities and research institutes across Canada. We invite you to visit our [website](#) and social media channels and join us in celebrating this important milestone!

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Canada

Photo credits

Cover image, pages 1, 34: Prof. M. Descoteaux and the Sherbrooke Connectivity Imaging Lab

Pages 3, 16, 25, 35, 40: Owen Egan

The theme of this year's Annual Report, *Science without barriers or borders*, reflects our vision of collaboration in science. Our work joins people, labs and platforms across the country, as well as institutions, organizations and sectors – in order to accelerate the pace of discovery and create the conditions to drive innovation. We believe that a diverse and interconnected brain research ecosystem will enable Canada to excel and to make even greater contributions to the global quest to understand the brain and brain disorders.



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