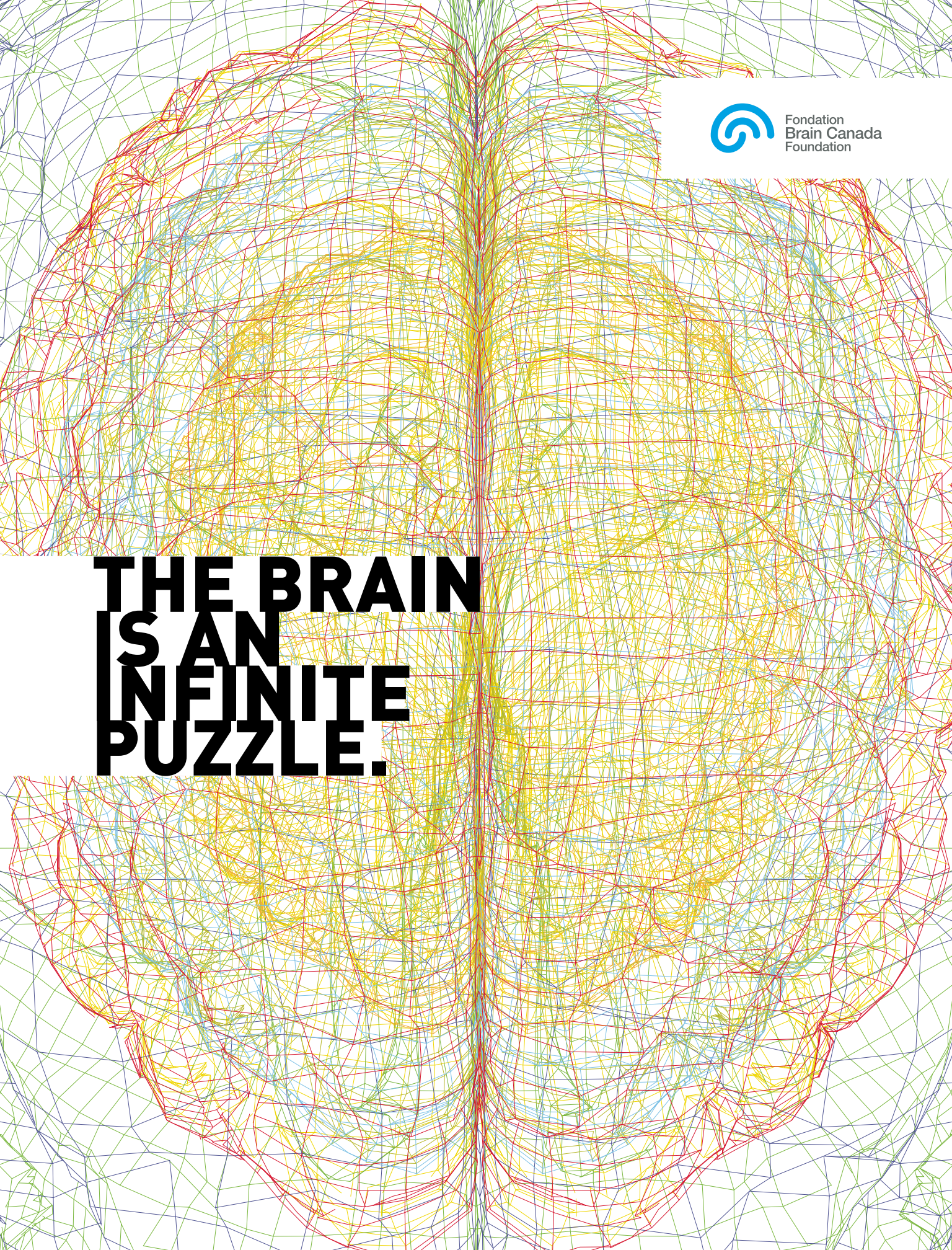

Fondation
Brain Canada
Foundation
THE BRAIN
IS AN
INFINITE
PUZZLE.

MEET 21 INFINITELY GIFTED PUZZLE SOLVERS.

Brain Canada's Future Leaders in Canadian Brain Research program is driving the next wave of discoveries in neuroscience. By supporting early-career researchers, this initiative empowers a new generation of scientists, equipping them with the resources and opportunities to push the boundaries of what we know and understand about the brain. The program is supported by an anchor gift from the Azrieli Foundation, a testament to the transformative power of collective generosity. Since the beginning, this visionary contribution has inspired many others to join the cause, amplifying the program's impact. Together, Brain Canada's donors have created a powerful ripple effect, enabling more early-career researchers to pursue bold and innovative ideas that drive critical advances in brain science.

Since its inception, the Future Leaders in Canadian Brain Research program has made remarkable strides in launching careers and advancing the field of neuroscience. With an impressive $10.9 million invested in brain research, the program has supported 109 emerging researchers across Canada, resulting in an additional $65.1M in funding for projects from other sources – a powerful tribute to the success of the program.

By funding research in all areas of neuroscience, from the effects of exercise on the aging brain to personalized medicine for children with language disorders, the Future Leaders program is paving the way for groundbreaking discoveries that will shape the future of brain health for generations to come. As more supporters join this effort, the potential for breakthroughs in brain science continues to expand, promising a brighter future for all.

DECODING THE MYSTERIES OF MOTIVATION

Corey Baimel
Dalhousie University

Motivated, goal-directed behaviours are essential for sustaining life, helping us navigate the world, pursue rewards and avoid threats. Dr. Baimel and team will investigate how dopamine influences specific cells in the brain's basolateral amygdala, which helps integrate sensory cues and guide behaviour. This research is critical because motivated behaviours affect all aspects of life, dopamine plays a key role in many neuropsychiatric and neurological disorders, and dopamine-related therapies are common and accessible treatment mechanisms.

ALL THE RIGHT MOVES FOR THE AGING BRAIN

Cindy Barha
University of Calgary

As the aging population grows, effective, personalized lifestyle recommendations for healthy cognitive aging are needed. Dr. Barha and team are studying physical activity as a strategy for brain health, investigating who benefits most, how it affects the brain, and how to tailor exercise for maximum value. They are evaluating how biological sex and cognitive health diagnoses affect the brain's response to exercise. This work could empower the aging population to protect themselves against cognitive decline by making the right healthy lifestyle choices.

HOW TWO GENES COULD HELP HUNDREDS OF KIDS

Robert Beattie
University of Manitoba

Rett syndrome is a severe neuro-developmental condition affecting 1 in 10,000 to 15,000 Canadian children, predominantly females, with onset at 12-18 months and characterized by a decline in motor skills, coordination, and communication. Over 95% of cases are associated with a malfunction in the MECP2 gene. However, researchers have found that mutations in another gene, FAN1, can reduce the severity of symptoms. Dr. Beattie and team are studying how FAN1 and MECP2 interact at the DNA level in individual brain cells and how this affects brain development. This research may pave the way for much-needed treatments.

> The key message here is the importance of seed-based funding for up-and-coming scientists. In my case it was a stepping stone towards being able to research and develop a new therapy that's now on the cusp of being implemented as a therapeutic for people living in the community. This is the dream of all medical scientists, and for good reason – that's how you make an actual impact."
>
> **Dr. Aaron Phillips**
> 2019 Azrieli Future Leader in Canadian Brain Research

A NEW RX FOR NEONATAL DRUG EXPOSURE

Gabriel Bossé
Université Laval

In Canada, an estimated 5% (or 15,000 annually) of all infants are exposed to multiple drugs at birth due to substance use during pregnancy. Little is known about the long-term consequences, but Dr. Bossé and team have found that this exposure can lead to sleep difficulties and increased stress in zebrafish, mirroring observations in humans and other animals. They are investigating how multiple drug exposures affect gene expression of brain cells and brain activity patterns. This work will advance our understanding of the effects of neonatal drug exposure and potentially inform development of therapeutics to mitigate these effects.

THE STIMULI STUDY STIMULATING DISCOVERY

Justine Clery
McGill University

Our senses are constantly stimulated throughout the day, and our brains combine and process these sensory inputs to provide the right response. During childhood, sensory input is critical for brain development, affecting cognition, perception and social behaviour. However, we do not fully understand this process. Dr. Clery and team are using brain imaging and other techniques to investigate how sensory input affects brain development and behaviour. Understanding how environmental inputs can influence the brain is key to fostering healthy development and has important societal implications.

BREAKING THE PARKINSON'S BARRIER WITH A CHIP

Aurélie de Rus Jacquet
Université Laval

Many brain disorders, including Parkinson's disease, need new and effective drugs. A major challenge in drug discovery is predicting whether a drug candidate will cross the blood-brain barrier. Dr. de Rus Jacquet and team are bioengineering a chip scaffolded with brain cells and blood vessels derived from patients' own cells to resemble a functional blood-brain barrier, allowing them to screen drug candidates for Parkinson's treatment. This work could provide a platform for personalized, de-centralized, and cost-effective preclinical trials, and expand access to populations that may otherwise be unable to access clinical trials.

My Future Leader grant allowed me to hire the people I needed to develop my research program and move it forward. Now we have a portable scanner, which is a quick and low-cost screening tool. It democratizes access to care, helping to even the playing field so that more people can get scanned – and get proper diagnosis and treatment."

Dr. Shannon Kolind
2020 Azrieli Future Leader in Canadian Brain Research

A NEW COMPASS TO NAVIGATE MEMORY

Chelsea Ekstrand
University of Lethbridge

Memory is fundamental to human cognition, allowing us to recall past experiences that shape future actions. Understanding how our brains encode and retrieve memories is crucial for treating memory-related disorders like dementia and Alzheimer's disease. Dr. Ekstrand and team are studying memory formation and access in a real-world setting through a clinical study where participants navigate a building, interact with others, and wear a camera. The events captured by the camera are compared to participants' own recollections while their brains are imaged. By comparing healthy participants and those with mild cognitive impairment, researchers will identify early markers of memory dysfunction, with implications for diagnosis and intervention.

> There remains a wide knowledge gap in understanding how the brain is negatively impacted in disorders with inflammation of the gut. This is particularly important in the case of childhood gut disorders, which could negatively impact the developing brain and cause long-term behavioural impairments."

Dr. Annie Ciernia
2021 Arrell Family Foundation
Future Leader in Canadian Brain Research

HEALTHY LIFESTYLE: 1 DEMENTIA: 0

Maiya Geddes
McGill University

Physical activity, diet, as well as cognitive and social engagement promote late-life brain health and reduce dementia risk, yet over 80% of Canadians do not meet the recommended guidelines. Dr. Geddes and team are using neuroimaging and computational tools to understand how and why older adults are motivated to make lifestyle changes, and how these changes affect the brain. The goal of the project is to promote brain resilience in at-risk individuals by identifying effective strategies to increase lifestyle engagement and prevent or delay onset of dementia, benefiting individuals, their loved ones, caregivers, and the health care system.

SPEECH THERAPY: THIS TIME IT'S PERSONAL

Orhan Selçuk Güven
Centre de Recherche Azrieli du CHU Sainte-Justine

Many children face challenges with speech and language, and while therapy can help, barriers like limited resources, outdated methods, and a lack of access to the latest research hinder progress. Dr. Güven and his team use artificial intelligence to study previous therapy sessions and offer speech therapists the latest personalized, evidence-based strategies. This approach seeks to understand how children learn best and tailor effective therapy techniques accordingly. By applying the principles of personalized medicine, this work has the potential to significantly enhance the lives of children with speech and language disorders, along with their caregivers' and families'.

THE WORLD'S BIGGEST STUDY UNPACKS MS's TINIEST CLUES

Adil Harroud
McGill University

Canada has one of the world's highest rates of multiple sclerosis (MS), which can lead to significant disability. To prevent MS, we must better understand its causes and develop methods for early detection. Dr. Harroud and team are conducting the largest genetic study of the condition by analyzing the DNA of over 80,000 people with MS and comparing it to over a million controls to identify genetic risk factors. They will also look for detectable factors in blood tests before symptoms appear. This work could predict, detect, and allow early interventions for MS.

PROTECTING THE BRAIN FROM HEART ATTACKS

Ryan Hoiland
University of British Columbia

After a heart attack, interrupted blood flow to the brain can cause severe brain injury, and even when resuscitated, low oxygen levels can lead to poor health outcomes for which there are currently no effective treatments. Dr. Hoiland and team will monitor oxygen levels in ICU patients after a heart attack and analyze their blood, cerebrospinal fluid and brain tissue to identify factors that contribute to brain injury. Understanding these mechanisms may reveal targets for therapeutics to minimize brain damage after a heart attack.

DECRYPTING EPILEPSY FROM THE OUTSIDE IN

Lisa Julian
Simon Fraser University

Our brains are built from neural stem cells, which produce all specialized neurons and astrocytes as the brain develops. The choroid plexus lies deep inside the brain and makes cerebrospinal fluid (CSF), which can influence the activity of neural stem cells. Dr. Julian and team are using human cells with genetic mutations associated with epilepsy and neurodegenerative disorders to grow pseudo-choroid plexus in the lab. They will identify factors present in CSF and assess how they affect neural stem cells as they build the brain. This could lead to better understanding of rare genetic disease pathology and help with early detection.

MAPPING MS: WHERE GENES AND AGING COLLIDE

Kaarina Kowalec
University of Manitoba

Brain and cognitive "reserve" refers to the ability to tolerate age-and disease-related changes to the brain without symptoms. In multiple sclerosis (MS), lower reserve and higher brain atrophy (the loss of brain mass) tend to have poorer health outcomes. Dr. Kowalec and team are studying how gene combinations or gene scores associated with aging traits affect cognitive reserve and brain atrophy in MS. The goal is to identify factors that influence brain and cognitive health in MS to reduce decline and atrophy, benefitting those living with the condition and helping to target effective therapies.

SEEING SOCIAL SKILLS THROUGH VIRTUAL EYES

Qian Lin
University of Toronto

Our brains are constantly processing multiple things simultaneously, with different regions communicating to manage this information. Dr. Lin and team are investigating how this decision-making process works during social interactions by studying whole brain activity. They are using zebrafish in a virtual reality environment that mimics their real world and social experiences to monitor brain activity at a single-cell level. This research aims to improve our understanding of social behaviour and provide insight into disorders that impair social skills.

A WAY AHEAD FOR KIDS HELD BACK

Paul Marcogliese
University of Manitoba

NEDAMSS (Neurodevelopmental disorder with abnormal movements, loss of speech and seizures) is a severe brain disorder in children that causes movement problems, seizures, and loss of speech around the age of five, with no current treatment or cure. Dr. Marcogliese and team identified the mutated IRF2BPL gene, which is also linked to some cases of autism. They are investigating how this gene interacts with other genes in brain cells and how it varies between cell types. Understanding this mechanism could uncover what the best therapeutic target may be to treat this disorder.

> I hope that, over the next 20 years, my work can lead to greater molecular understanding of fetal and neonatal brain injury. My dream is to develop new therapies for brain injury in newborns to improve their long-term neurodevelopmental potential."

Dr. Brian Kalish
2022 Azrieli Future Leader in Canadian Brain Research

TREATING VCP BY THINKING OUTSIDE THE SPINE

Dale Martin
University of Waterloo

VCP disease is a rare and severe group of diseases that affect the brain, bone, and muscle due to mutations in the VCP gene, which can also lead to amyotrophic lateral sclerosis (ALS). Dr. Martin and team work with molecules known as antisense oligonucleotides (ASOs) to target the genetic changes, but ASOs require direct injection into the spinal cord to reach the brain. This project aims to develop ASOs to target the mutated VCP gene and to create nanoparticles for less invasive delivery to the brain and nervous system. By addressing the challenges of drug delivery and the rarity of these diseases, the project could improve treatment options and patient lives.

DECIPHERING ALS: THE MATRIX BEYOND THE MOTOR

Silvia Pozzi
Université Laval

ALS is a neurodegenerative disease marked by muscle degeneration and the loss of motor neurons, which guide movement. Approximately 4,000 Canadians have ALS, with only 20% surviving beyond 2-5 years post-diagnosis. While most ALS research focuses on motor neurons, Dr. Pozzi and team are exploring the extracellular matrix — the connective medium vital for neuron survival. They are trying to understand how the remodelling of this matrix contributes to the pathology. This project aims to uncover how ALS damages the brain and identify new treatment targets.

PINPOINTING THE FINER GRAINS OF COCAINE ADDICTION

Rachel Rabin
The Douglas Research Centre

Cocaine is a highly addictive substance, with approximately 10% of Canadians aged 20-24 reporting current use. It has many negative effects, including poor heart health, psychosocial consequences (such as violence), and produces various psychiatric symptoms. However, there are no approved medications to help people quit cocaine and stay abstinent for the long term. Dr. Rabin and team are conducting a clinical study to investigate if cocaine addiction is associated with dysregulation of a specific brain system. This work may help identify novel targets in the brain for the development of medications to successfully treat cocaine addiction.

Researchers who have recently completed their training and have just begun their careers are uniquely positioned to develop groundbreaking brain research initiatives. Brain Canada is thrilled to see how our signature Future Leaders program has grown, enabling us to provide increased support to a growing number of researchers during this pivotal stage of their careers."

Dr. Viviane Poupon
President and CEO of Brain Canada

PREVENTING MS: DEACTIVATING A VIRAL TIME BOMB

Raphael Schneider
Unity Health Toronto

Multiple sclerosis (MS) is a chronic neurological condition where the immune system turns against the affected person. Immune cells mistakenly attack the brain and spinal cord, leading to progressively worsening neurological symptoms. While the exact cause of MS remains unknown, the Epstein-Barr virus (EBV) is believed to play a crucial role in triggering this aberrant immune response. Dr. Schneider and team are employing cutting-edge techniques to investigate how EBV-specific immune cells are activated and contribute to the onset and progression of MS. Targeting these cells with novel therapies holds the potential to transform MS prevention and treatment.

DISRUPTING THE DISRUPTOR BEHIND BRAIN TUMOURS

Yoshiaki Tanaka
Centre intégré universitaire de santé et de services sociaux de l'Est-de-l'Île-de-Montréal

Glioblastoma (GBM) is a malignant brain tumour with poor survival rates and limited treatment options. Normally, specialized immune cells called microglia clear abnormal cells and debris from the brain, but GBM evades detection and even reprograms microglia to support the tumour. Dr. Tanaka and team are studying which genes the tumour cells rely on for this process and how to disrupt them. This work could lead to new therapies that harness microglia to attack the tumour instead of helping it, offering hope to individuals with this currently incurable disease.

MAGNIFYING ATTENTION ON ATTENTION-DEFICIT DISORDER

Scott Yuzwa
University of Toronto

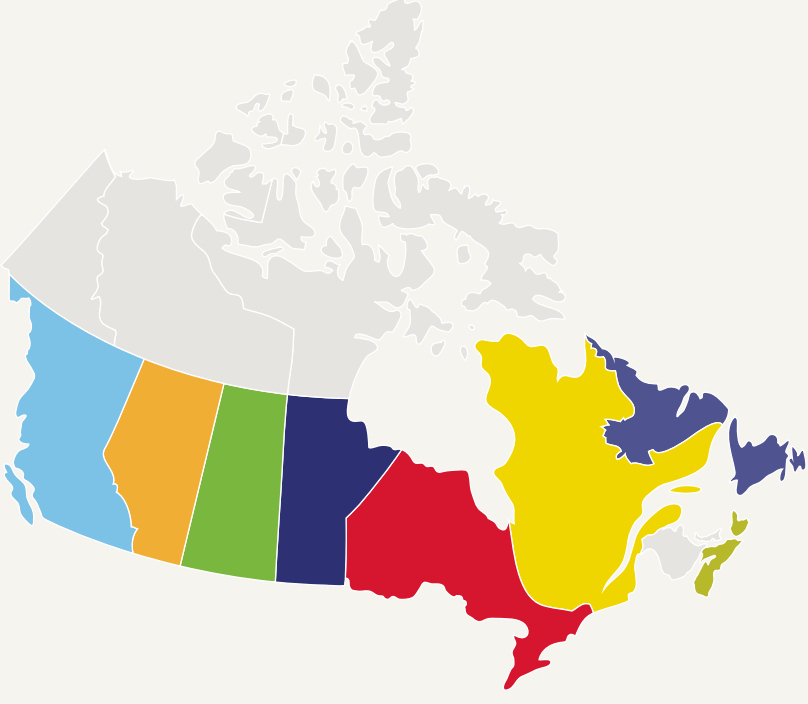
Attention-deficit hyperactivity disorder (ADHD) is the most common brain development disorder, characterized by hyperactivity and inattention. Current medications have limitations and side effects. ADHD is highly genetic, but the role of the genes involved is unclear. Dr. Yuzwa and team found that many of these genes are active in a specific cell type of the brain called astrocytes. They are investigating the functions of these genes and their impact on astrocyte activity during brain development. Understanding how astrocytes contribute to the development of ADHD could empower future work to identify improved therapies.

EXPANDING THE MAP OF CANADIAN RESEARCH

Brain Canada is the leading foundation dedicated to advancing neuroscience in this country. The Future Leaders program not only empowers the next generation of leaders with mentorship, resources, and collaboration, but also fosters a vibrant community of forward-thinkers who will shape the future of neuroscience."

Naomi Azrieli, OC, DPhil
Azrieli Foundation Chair &
Brain Canada Chair

Regional Distribution of 109 Grants



BC	07
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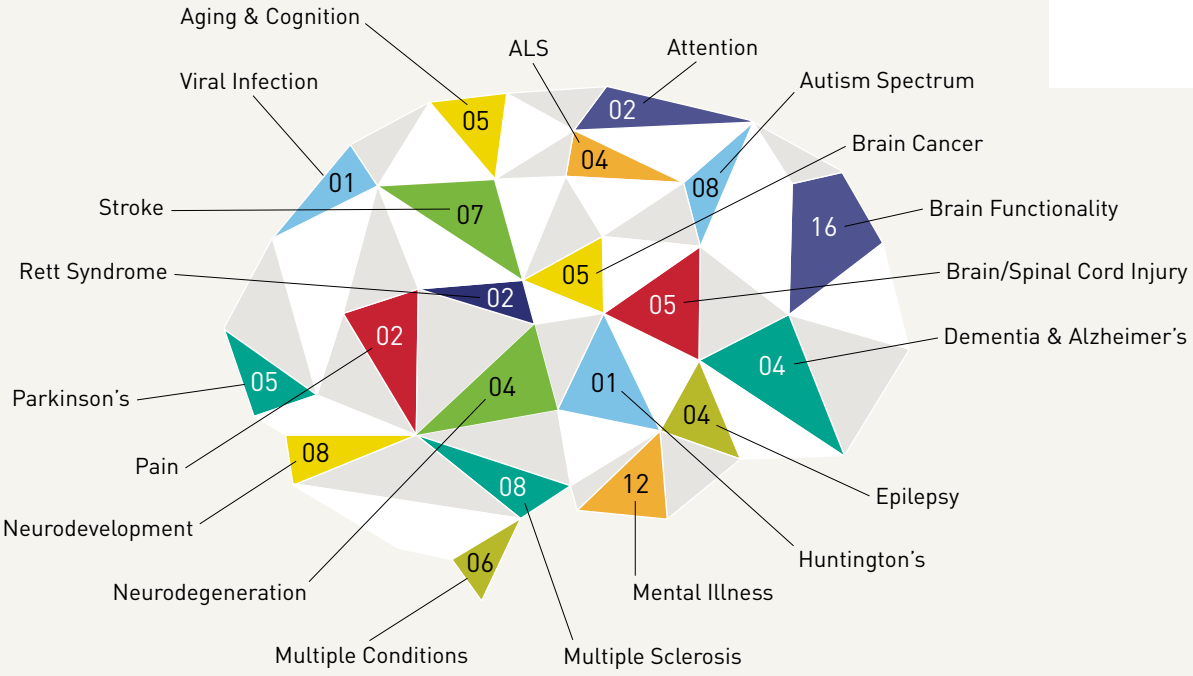
SK	02
MB	05
ON	33
QC	41
NS	02
NL	02
Total	**109**

Counting on Discovery: Brain Conditions Explored



Future Leaders: The Big Picture Snapshot

200
oral and poster presentations

199
students, trainees and highly qualified personnel engaged

$65.1M
additional funding

243
individuals participating in research

5
patents

11
consultations with decision-makers, patients and other researchers

27
awards and recognitions

51
peer-reviewed publications

98
collaborations

*This data illustrates the impact of the first four cohorts of the Future Leaders in Canadian Brain Research program, cohorts 2019 to 2022.

ADVANCING MOMENTUM

As Brain Canada lead donors, we're not just supporting brain research, we are investing in trailblazing innovators, unafraid to ask bold questions and delve into the infinite complexities of the brain."

Laura Arrell
The Arrell Family Foundation

These five investigators were also recently awarded inaugural Brain Canada Momentum Grants. The new program, powered by the Hewitt Foundation, builds on the success of the Future Leaders in Canadian Brain Research initiative by offering additional funding to researchers who have shown extraordinary progress and potential. The Momentum Grants program is intended to sustain and accelerate pioneering work, amplifying impactful and transformative results.

Mark Brandon
Douglas Mental Health University Institute

Mark Cembrowski
University of British Columbia

Annie Ciernia
University of British Columbia

Michèle Desjardins
Université Laval

Stuart Trenholm
McGill University

Future Leaders in Canadian Brain Research 2019-2022

Philippe Albouy
Université Laval

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Boris Bernhardt
McGill University

Lindsay Bodell
Western University

Marco Bonizzato
Polytechnique Montréal

Elie Bou Assi
Université de Montréal

Vincent Breton-Provencher
Université Laval

Lindsay Cahill
Memorial University of Newfoundland

Carlos Camara Lemarroy
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Aravind Ganesh
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Jiami Guo
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Kohitij Kar
York University

Karl Martin Klein
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Shannon Kolind
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Jasmin Lalonde
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Flavie Lavoie-Cardinal
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Michael Mack
University of Toronto

Caroline Ménard
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UNLOCKING POSSIBILITIES, UNWAVERING SUPPORT

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For more information, visit braincanada.ca

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