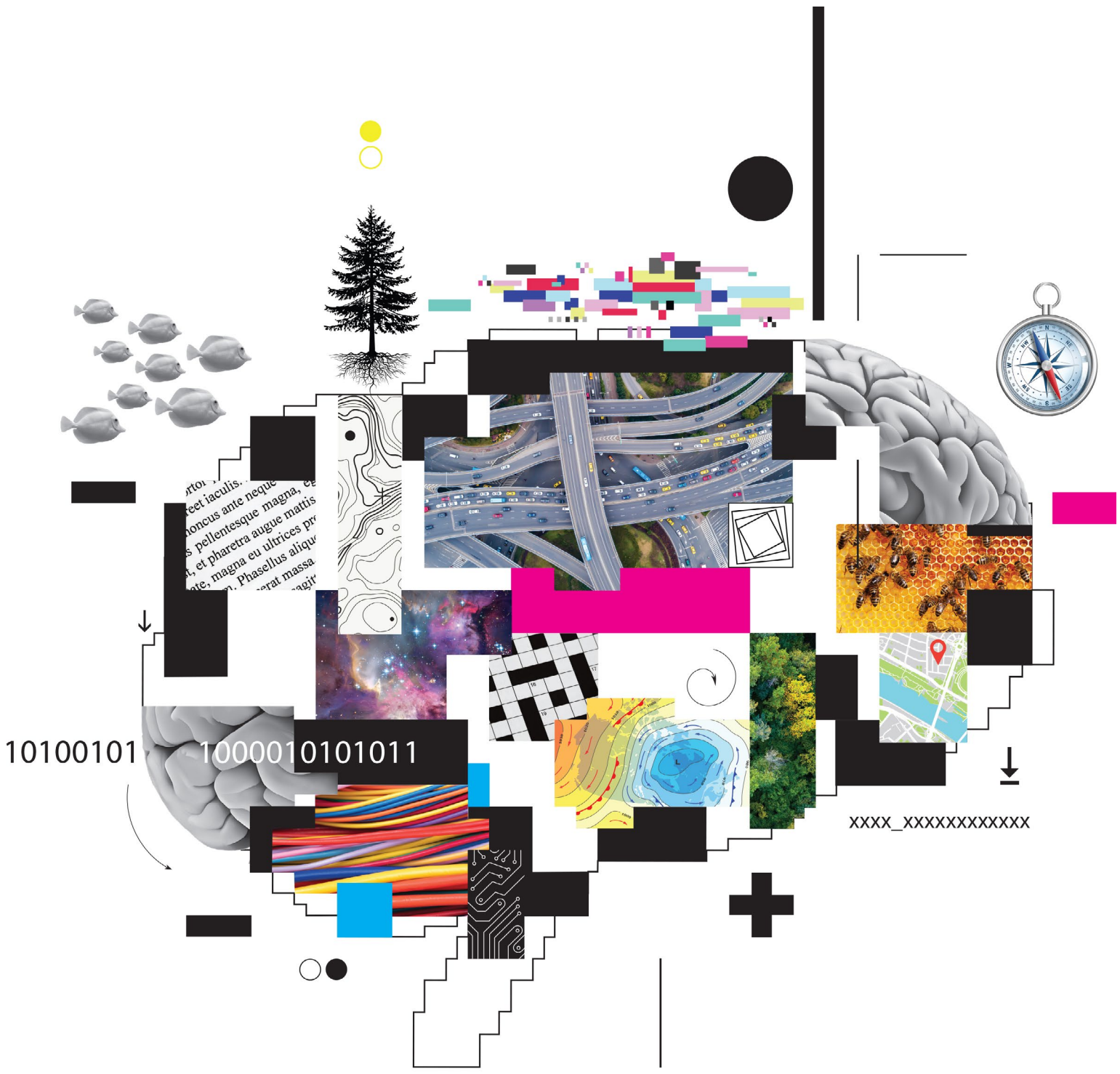
Brain Canada Foundation



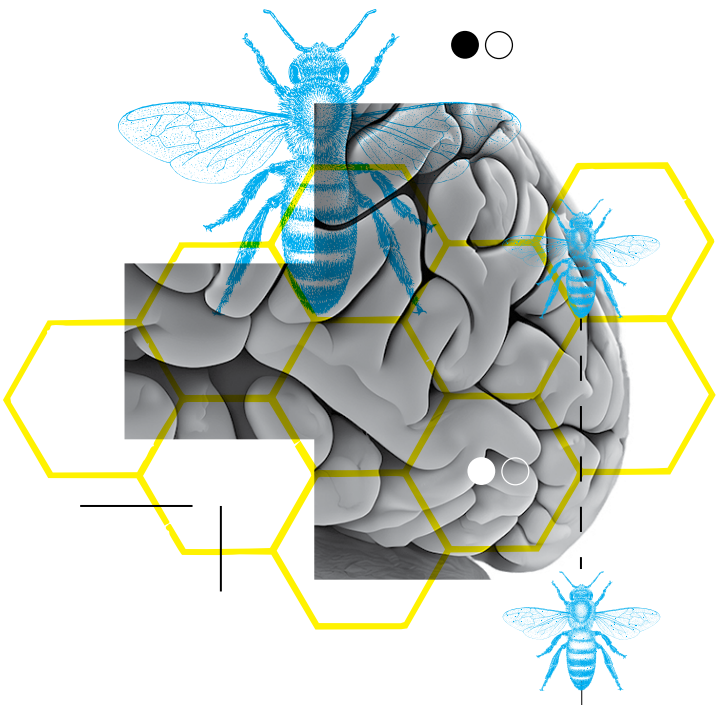
The future of brain health is in the eye of the innovator.

Meet 22 innovators.

By viewing the brain through rare perspectives and bold vision, they're redefining neuroscience for all to see.

A root system. A highway. A hive. Seen through innovative eyes, the brain is all this and more, an evolving matrix of interaction, connection and terrain where unique perceptions can unlock clues to unprecedented discovery. It's a new reality driven by Canada's emerging brain researchers, bold leaders using daring insight and next-gen technology to reveal how the brain behaves, changes, and ultimately shapes our lives.

That's why Brain Canada, with a generous donation from the Azrieli Foundation, created the Future Leaders in Canadian Brain Research program in support of researchers whose novel approaches are seeing through, past and around known barriers, opening new possibilities for diagnosis, treatment and care. Their vision today is the world's sightline to the future.



More ways of seeing. More reasons for support.

In a changing world, the evolution of brain health demands the pursuit of high-risk, high-reward discoveries. Which is why this year's Future Leaders will each receive $100,000, for a total investment of $2.2M in bold research. Their game-changing investigations in neurodevelopment, neurodegeneration, epilepsy, mental health and more spotlight the urgency of supporting far-seeing, transformative innovations.

The future is on our watch.

Brain Canada recognizes true visionaries by seeing them through the lens of expertise and experience. Awardees are selected by an international peer review of neuroscientists with a diverse background of research approaches, allowing them to zone in on deserving recipients whose projects are poised to expand knowledge and point the way to tomorrow's breakthroughs.

A psychedelic look at psych disorders

Psychedelic drugs, known for their profound effects on perception, are showing increasing promise as long-lasting treatments for depression, particularly where current therapies are ineffective. However, although the effects of psychedelics have been noted, their mechanism of action is not fully known. Dr. Aguilar Valles and team are investigating how a non-hallucinogenic variant of LSD works, in particular how it affects myelin (the protective coating that surrounds brain cells) and whether this mechanism is essential for its antidepressant effects. Unlocking exactly how psychedelics work is an important step in developing safe and effective therapeutics.

Dr. Argel Aguilar Valles
Carleton University

Waking up to a new day for Alzheimer's treatments

Aging is typically associated with effects on cognition. Dr. Anreiter and team are interested in whether altered sleep patterns can cause acceleration or worsening of cognitive decline, leading to deficits in learning and memory and the onset/ progression of neurodegenerative conditions such as Alzheimer's. In particular, they are investigating whether different levels of m6a—a tiny chemical modification inside cells which influences how parts of our DNA are used—can affect the process. Cracking this m6a code could lead to strategies to treat aging-related cognitive decline and neurodegeneration.

Dr. Ina Anreiter
University of Toronto

The Big Picture

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PEER-REVIEWED PUBLICATIONS

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

Deciphering circuitry, defusing obesity

The brain regulates appetite, and when key processes in the brain are disrupted, it can lead to excessive weight gain. Obesity affects millions of people, causing tens of thousands of deaths and costing the health care system billions annually. A class of medications called GLP-1 receptor agonists have gained rapid popularity worldwide recently, and are highly effective, but come with side effects like nausea that cause people to stop taking them. Dr. Caron and team are studying the brain regions and pathways that these drugs target in order to develop and refine next-generation obesity treatments that enhance effectiveness and reduce side effects.

Dr. Alexandre Caron
Institut Universitaire de Cardiologie et de Pneumologie de Québec (IUCPQ), Université Laval

Seeing young brains through AI's eyes

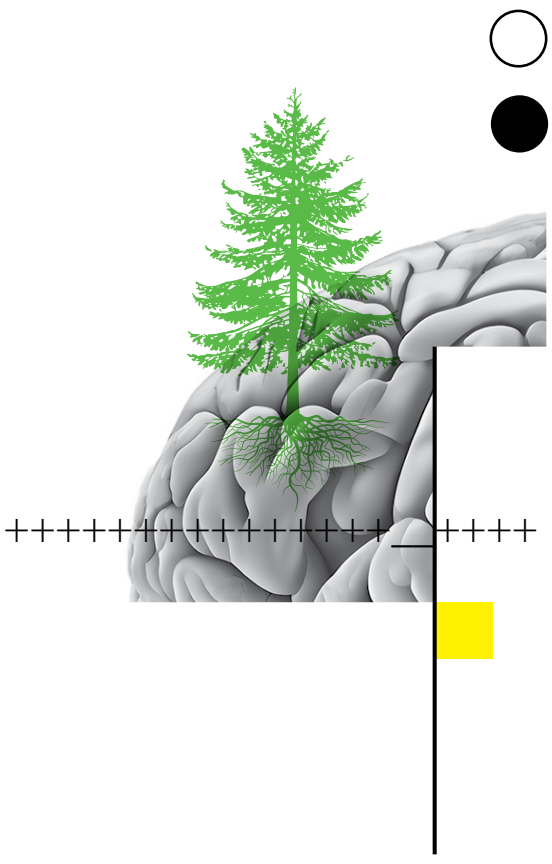
Concussions in children can have long-term impacts on cognitive, social, and emotional development. The period from ages 0 to 5 in brain development is key but relatively few studies have looked at regular individual variability among children. Dr. De Leener and team will use neuroimaging and artificial intelligence to build brain growth curves for kids, much like the height and weight charts commonly used. They will test the model on brain scans of children who have had concussions. The goal is to provide reference standards of brain development, facilitate early detection of any issues, and potentially help guide policies aimed at preventing concussions among children.

Dr. Benjamin De Leener
Polytechnique Montréal / Centre de recherche Azrieli du CHU Sainte -Justine

Rethinking the rogue gene in Rett's

Rett syndrome is a severe neurological disorder that primarily affects girls, occurring in about 1 in 10,000 births and causing developmental challenges like difficulty with movement, communication, and repetitive behaviours. Dr. Flamier and team are investigating how the mutated MECP2 gene, known as the main cause of Rett syndrome, changes the structure of some brain cells, affecting their ability to communicate with each other and function.

Dr. Anthony Flamier
Centre de recherche Azrieli du CHU Sainte-Justine / Université de Montréal



Zoning in on tumours' time zones

The most common type of malignant brain cancers are diffuse gliomas. Currently available treatments can prolong survival, but they come with negative side effects and fail to reliably achieve cures. Substantial variation between tumours of the same type and within a tumour itself as it changes over time have a profound effect on our ability to understand who will benefit most from targeted therapies. Dr. Fortin and team are working to understand how differences between tumours and changes in a single tumour over time affect drug response, with the end goal of being able to tailor the right drug to the right person at the right time.

Dr. Jerome Fortin
The Neuro (Montreal Neurological Institute-Hospital), McGill University

Catching cancer creep: a new POV on MRI

Glioblastoma is the most common malignant brain tumour in adults, with the worst prognosis. Before patients undergo surgery to remove the tumour, magnetic resonance imaging (MRI) is used to determine where the tumour is and to define its borders for effective removal. After surgery and treatment, MRI is used to detect tumour recurrence. Glioblastoma is known to be highly infiltrative, that is, tumour cells travel outwards from the tumour mass and infiltrate the areas around it, which MRI has difficulty detecting. Dr. Gagnon and team are working on developing a new model to define tumour geometry more accurately, optimizing how images are processed. The ultimate goal is to improve MRI accuracy for better detection of tumour infiltration to help guide surgical removal, and earlier detection of recurrence.

Dr. Louis Gagnon
CERVO Brain Research Centre / Université Laval

Youth suicide: connecting the dots on social connections

Depression is one of the most common mental health challenges faced by young people, yet choosing the right treatment remains a process of trial and error without reliable tests to predict what will work best or who might be at risk of suicide. Dr. Gifuni and team aim to use electroencephalography (EEG), a safe and non-invasive way to measure brain activity, to better understand how the brain responds to social rejection and inclusion and whether these patterns predict how well therapy or medication will work. The goal is to help doctors make more informed treatment decisions for earlier and more precise intervention, and improve outcomes for young people living with depression.

Dr. Anthony Gifuni
Douglas Mental Health University Institute / McGill University

Decoding the misfits behind malignancy

Glioblastoma (GBM) is the most common primary malignant brain tumour in adults. Even with treatment, nearly all patients with GBM experience tumour re-growth within 7-9 months of diagnosis, and recurrent tumours are currently untreatable. Dr. Han and team are investigating the fundamental biological processes of GBM cells, particularly how they interpret their genetic coding through a process called alternative splicing, in order to uncover mechanisms that can be targeted by therapeutics. Their out-of-the-box approach explores a new avenue for urgently needed treatment options for GBM.

Dr. Hong Han
McMaster University

The Big Picture

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RESEARCHERS FUNDED TO DATE

Finding confidence at the cellular level

Confidence is a key aspect of our everyday lives, guiding how we behave and the decisions we make. Dr. Masset and team are interested in understanding how our brains function at the level of interactions between brain cells when we sense our environment, make decisions, gain confidence, and process rewards or deterrents. They will use rodent models and complex behavioural tasks together with brain recordings and computational models to understand how different brain areas and types of brain cells contribute to cognition in health and disease.

Dr. Paul Masset
McGill University and Mila - Quebec AI Institute

A deeper dive into anxiety's depths

Amid an increasing prevalence of anxiety- and depression-related disorders worldwide, current therapeutic strategies have proven insufficient. One significant barrier to better therapies is an incomplete understanding of what is happening in the brain at a cellular level in those experiencing mental health challenges. Dr. Murphy-Royal and team are investigating the role of a type of cell in the brain called an astrocyte, and whether fine-tuning its activity in a specific region called the amygdala can actually control anxiety states and/or sensitivity to stress. The final intention is to uncover therapeutic targets that can be translated to the clinic to improve mental health in individuals.

Dr. Ciaran Murphy-Royal
CRCHUM (Université de Montréal's affiliated Hospital Research Centre)

Detangling dementia's vascular roots

Mixed dementia is the most common form of dementia and occurs when Alzheimer's disease (AD) combines with vascular disease, affecting both the blood vessels and the immune function in our brain. As this happens, memory difficulties develop. However, AD research and treatment typically does not account for blood vessel health and inflammation, limiting our ability to detect and treat in the most effective way. Dr. Ottoy and team aim to clarify how and when vascular and immune changes contribute to mixed dementia, to better predict who might benefit from treatments targeting blood vessel health, leading to more personalized care.

Dr. Julie Ottoy
Sunnybrook Research Institute / University of Toronto

The Big Picture

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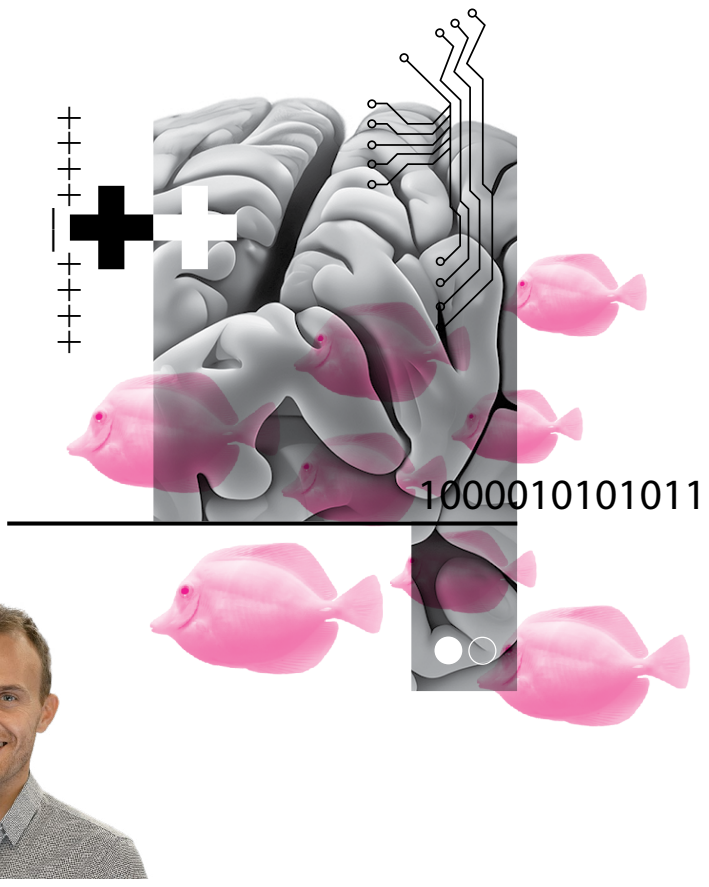
COLLABORATIONS

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



Neurons and obesity: a new treatment menu

Our brains control all kinds of processes, including appetite and body weight regulation. Obesity is an increasingly alarming global health concern, and there is a growing need to understand how the brain regulates appetite and body weight. Dr. Sabatini and team are investigating one of the cell types involved in this process, POMC neurons, to understand how subsets of these cells in the brain are activated, interact with each other, and coordinate, better defining their role in energy balance. The overall goal is a better understanding of the underlying causes of obesity and potential mechanisms that can be targeted as treatment options.

Dr. Paul Sabatini
RI-MUHC (Research Institute of the McGill University Health Centre)

A rare approach for a rare epilepsy

The brain's development relies on precisely coordinated genetic programs that ensure proper wiring and function, the disruption of which can result in neurodevelopmental disorders. Lennox-Gastaut Syndrome (LGS) is a rare and severe childhood epilepsy that is often resistant to current treatments. Dr. Samarut and team identified variations in the THAP12 gene in individuals with this syndrome and are now investigating further to understand its specific role in brain development. Their aim is to identify alternative therapeutic options for kids with LGS and potentially pave the way for new therapies for other neurodevelopmental disorders.

Dr. Eric Samarut
CRCHUM (Université de Montréal's affiliated Hospital Research Centre)

Psilocybin: growing hope for depression therapy

In Canada, over 1 million people have been diagnosed with bipolar disorder (BD) in their lifetime, but current therapeutic options only work on some. Psilocybin has been identified as a potential option to alleviate the symptoms of depression but it is not yet fully understood how it functions in the brain. Dr. Saraf and team will use brain scans of people with bipolar II disorder being treated with psilocybin to understand whether the drug causes an increase in the connections between brain cells, known as synapses, and if this effect is associated with cognitive or mood changes. The goal of this work is to provide insight into how psilocybin acts as an antidepressant.

Dr. Gayatri Saraf
The Ottawa Hospital Research Institute, Institute of Mental Health Research

The body's secret weapon against epileptic deaths

People living with epilepsy are three times more likely to die early, including from a condition called sudden unexpected death in epilepsy (SUDEP), with the risk being higher for those with frequent seizures. For about a third of people with epilepsy, current medications do not work. The cause of SUDEP is currently unknown but research suggests it may be related to the body's network of nervous system cells that handle unconscious tasks like breathing and heartbeat (termed autonomic functions). Vagus nerve stimulation (VNS) is a therapy that uses electrical signals to control seizures and has been shown to reduce the risk of SUDEP, though it is unknown how. Dr. Suller Marti and team will evaluate individuals before and after VNS therapy using brain scans and other testing to answer this question. The objective is ultimately to improve treatments for people with epilepsy, reduce the risk of SUDEP, and lead to better health outcomes.

Dr. Ana Suller Marti
London Health Sciences Centre Research Institute / Western University

The Big Picture

$65.1M

IN ADDITIONAL FUNDING SECURED BY FUTURE LEADERS SINCE 2019

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Turning MS insight into MS foresight

Multiple sclerosis (MS) is the most common cause of non-traumatic neurological disability, affecting 1 in 400 Canadian adults. It occurs when the immune system mistakenly attacks the brain and spinal cord, causing nerve damage. MS is characterized by lesions in the brain, some of which worsen into paramagnetic rim lesions (PRL), which have been linked to chronic inflammation and disease progression, but it is unclear why some progress and others don't. Dr. Thebault and team are investigating how immune cells in the blood and cerebrospinal fluid (the fluid that surrounds the brain and spinal cord) can influence PRL formation and cause damage to the brain. This research could lead to better biomarkers to predict disease progression, guide earlier and more targeted treatments, and improve long-term outcomes for people living with MS.

Dr. Simon Thebault
The Neuro (Montreal Neurological Institute-Hospital), McGill University

Digging into autism's building blocks

Autism spectrum disorder (ASD) is a complex condition affecting communication, social interactions, and behaviour in approximately 1–2% of people worldwide. While some cases of ASD can be linked to specific genetic changes, most remain unexplained, leaving families and clinicians without clear answers. Dr. Tripathy and team are doing a deep dive into the genetics of autism to understand which genes are used and how, how rare gene mutations may be playing a role, and ultimately improve diagnoses, leading to better therapies and support for families affected by ASD.

Dr. Shreejoy Tripathy
CAMH (Centre for Addiction and Mental Health) / University of Toronto

Drilling down on smoking up: THC and brain health

Cannabis is one of the most commonly used recreational substances in Canada. Though cannabis containing the psychoactive component THC is widely consumed, research suggests THC may affect the regulation of brain blood flow. Blood flow is essential for delivering oxygen and nutrients to support normal brain function, so Dr. Tymko and team are investigating how inhalation of THC affects its regulation and in turn, brain and nervous system function. This work will help provide a clearer understanding of how cannabis affects brain health and risk for stroke and other brain diseases, delivering key public health insights.

Dr. Michael Tymko
University of Guelph

Activating the self-healing brain

Neurological disorders affect more than 1 in 3 people, making them a leading cause of illness and disability worldwide. They are characterized by cells in the brain deteriorating or no longer functioning as they should. Currently, there are no effective therapies to regenerate those cells and restore function to stop or reverse neurological disorders. Dr. Voronova and team are investigating how a small population of stem cells in the adult brain become activated to regenerate mature functional brain cells, how this process is triggered naturally in the brain, and how we may be able to mimic this triggering with drugs in order to treat neurological disorders.

Dr. Anastassia Voronova
University of Alberta

Using microbubbles as magnetic missiles

Glioblastoma (GBM) is one of the most aggressive brain cancers, with very few treatment options and a poor survival rate. Treatment of GBM is challenging for many reasons, including that each tumour can be very different from the next at the level of the individual cancer cells (known as tumour heterogeneity) and that the brain has a natural protective barrier which makes it difficult for drugs to get to the tumour. Dr. Wang and team are investigating a new way to treat brain tumours using tiny bubbles. Called acoustic microbubble microrobots, they are guided to the tumour using magnets, activated by ultrasound waves to physically break apart the cancer cells, and removed from the brain afterward. The team is designing and testing this new method, which, if successful, could become a completely new treatment option for GBM.

Dr. Xian Wang
Queen's University

Meeting dementia before it arrives

With an aging population, dementia and cognitive impairment in older adults pose an increasing challenge to our health care system as well as to families, caregivers, and loved ones. Identifying dementia early is critical to provide treatment that can slow or stop the disease. Early signs of dementia in the brain include subtle changes in brain composition and communication between different parts of the brain, alongside noticeable changes in cognition. Dr. Zhukovsky and team aim to understand what the early biological changes are that lead to dementia and whether there are factors we can detect using blood tests that can serve as markers of worsening brain and cognitive health. The ultimate goal is to improve quality of life for aging individuals and their support systems.

Dr. Peter Zhukovsky
CAMH (Centre for Addiction and Mental Health) / University of Toronto

The Big Picture

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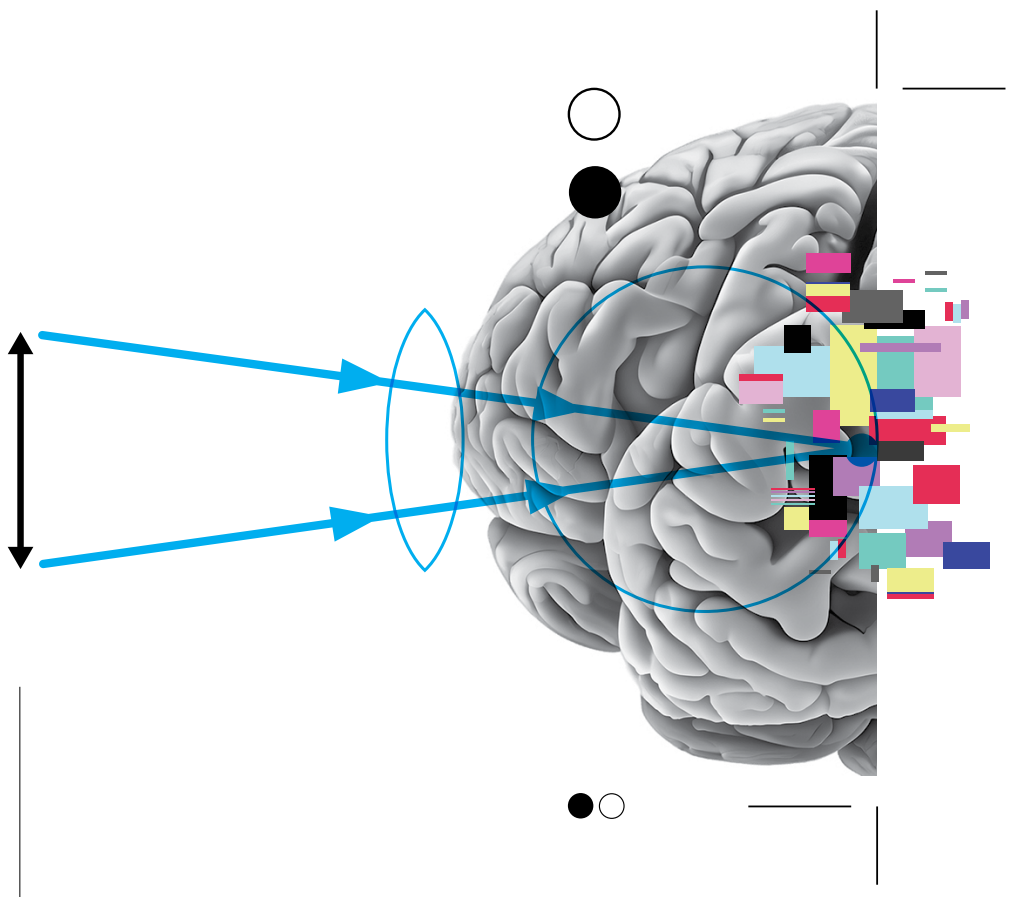
PATENTS

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

An incredible outlook starts with incredible partners.

The Future Leaders program is made possible thanks to an anchor gift from the Azrieli Foundation, which is matched by Brain Canada through the Canada Brain Research Fund (CBRF), a unique public-private partnership between the Government of Canada (Health Canada) and Brain Canada, with the support of additional generous donors—each of whom helps pull us closer to a brighter horizon.



Share our vantage point to a new era.

With every new insight in brain health, we see a better future unfolding. Join the view by learning about the latest approaches to challenges like Alzheimer's, MS and depression, as well as exciting advancements in AI, microtech, cell regeneration and more.

See what's next at **braincanada.ca**.

Registration number: **89105 2094 RR0001**