



Written Submission to the Standing Committee
for Science and Research

Study on International Moonshot Programs

**A National Brain Research Initiative for the Health,
Social, and Economic Advancement of Canada**

By: Canadian Brain Research Strategy
<https://canadianbrain.ca/>



The Canadian Brain Research Strategy and its broad network of stakeholders recommends the following:

Recommendation 1: That the Government of Canada make research on the brain and mental health a national priority with targeted investment in a Canadian Brain Research Initiative.



EXECUTIVE SUMMARY

- Our brains define who we are, how we behave, what we strive for, and how we interact with each other and our environments. Because our brains are so integral to our capacities to live good lives, brain research has the promise to improve the lives of all Canadians.
- More than 7.5 million Canadians reported living with a neurological or mental health disorder in 2019¹, and that number is growing rapidly since the COVID-19 pandemic and with aging demographics. Understanding the brain - in health, development, disease, and resilience - will be crucial to Canada's success and well-being in the 21st century.
- Canada is a world leader in many fields of neuroscience and mental health research, and Canadians already specialize in neuroscience more than any other research area and more than other countries². We need to protect Canada's competitive advantage with a national brain research initiative to ensure that we will continue to be a leading contributor to global efforts.
- We are at a critical inflection point in making progress to understand the human brain. In order to reap the health, societal and economic benefits from technology and intellectual property that is arising from cutting-edge brain research across the country, Canada needs to establish our own national brain research initiative.
- The Canadian Brain Research Strategy (CBRS) has united Canada's neuroscience and mental health researchers, in coalition with Indigenous Knowledges Holders, people with lived experience of brain disorders, private and public science funders, and industry. Together, we have developed a clear and compelling vision for targeted investment in brain research to drive policy as well as social, health, and economic advancement for Canada and the world^{3,4,5,6}.

The coalition convened by the CBRS believes that the time for a Canadian Brain Research Initiative is now. We have the network, partnerships, vision, and strategic plan in place. Now we need the funding to catalyze this network into concerted, bold, and concrete action.



WHY IS A CANADIAN BRAIN RESEARCH INITIATIVE SO IMPORTANT NOW TO TRANSFORM THE LIVES OF CANADIANS?

Our brains are at the centre of everything we do and are - they store our memories, create our passions, produce our art and commerce, and shape and build our societies. Every Canadian deserves to have a healthy brain to help them realize their full potential, throughout their lives.

The sad reality is that virtually every Canadian family has been impacted by a neurological disorder, brain injury, mental illness or addiction. Brain disorders (see Figure 1) are the leading cause of disability in Canada and worldwide. Even in the early stages of many brain disorders, cognition, emotional well-being, quality of life, day-to-day activities and the ability to work can be markedly affected. Since people with brain disorders tend to live longer than those with heart disease or cancer, the cumulative burden of living in less-than-ideal health has tremendous impacts on individuals, families and care partners, society, and the economy^{1,7,8}.

As of 2019, more than 7.5 million people – 1 in 5 Canadians – reported living with a brain disorder¹. Persistent challenges in neurological disorders and mental health have only been worsened by COVID-19. Three-in-ten Canadians have been diagnosed with anxiety or depression since the onset of COVID-19⁹. The prevalence of brain disorders is also expected to rise with Canada's quickly aging population – between 2016 to 2021, the percentage of Canadians over the age of 65 rose from 16.9% to 19.0%¹⁰. At 67.5%, Canada has the largest and youngest working-age population in the G7¹¹, but working productivity is expected to be greatly impacted by the increasing need to care for aging parents with dementia and other disorders⁸. Increasingly, we are seeing the "sandwich" generation, where families face multiple challenges at once across generations.

Unfortunately, for the vast majority of brain disorders, including mental illness, there are limited treatment options – or none at all. For many, there are no cures. **Research is the hope. Because the only path to prevention, treatments and cures is to gain new knowledge, through research**^{7,12,13,14,15,16,17,18,19,20,21,22,23,24}. Even a small delay in the onset of a brain disorder brought by having better prevention or treatments can make a large impact. More than 600,000 people are currently living with dementia in Canada, with 350,000 unpaid care partners⁸. Giving Alzheimer's disease patients just 5 more years to be free of dementia would reduce the number of caregiving hours by more than 800 million hours per year by 2050⁸ – recovering the equivalent of more than 380,000 full-time jobs in lost productivity.

Understanding the brain - in health, development, disease, and resilience - will be critical to Canada's success and well-being in the 21st century.

WHY IS A CANADIAN BRAIN RESEARCH INITIATIVE CRITICAL FOR BRAIN SCIENCE?

The human brain is the most complex biological system in the known universe, but we are verging on a new era of brain science. **Canadian neuroscientists and mental health researchers rank in the top five in the world and are on the threshold of making a major leap - a moonshot - in understanding the brain^{2,25}.** Canadians scientists pioneered the research and development of artificial neural networks that became one of the corner stones of artificial intelligence (AI) and now, AI and machine learning have the potential to radically change what is even possible in brain research. Advances in our understanding of the brain will inform increasingly better AI models in a virtuous cycle of mutual reinforcement.

Data on the brain is also accumulating faster than at any time in history and through this, we now realize that many neurological diseases have related underlying causes. Uncovering new knowledge about the brain allows us to better understand how to fix it when things go awry. Discoveries in one brain condition can benefit other conditions in preventative measures and the development of new treatment approaches^{7,13,24}. With more data, we can recognize that brain disorders are not discrete conditions, and that mental health challenges co-occur frequently across brain disorders and other maladies^{7,13,24}.

The complexity of the human brain and associated disorders necessitates far-reaching collective efforts that span countries and political boundaries. **Large-scale national and pan-national efforts that can provide targeted and sustained support are the new model that is needed to advance our understanding of the human brain (Table 1).** The EU launched their decade-long Human Brain Project²⁶ in 2013, followed shortly by similar programs such as the US BRAIN initiative²⁷, Japan Brain/MINDS Program²⁸, China Brain Project²⁹, Korea Brain Initiative³⁰. Many other nations currently have brain research initiatives under development, including the Australia Brain Alliance³¹, Neurocenter Finland³², Brain Research New Zealand³³, the Latin America Brain Initiative (LATBrain)³⁴ and the Brain Research Africa Initiative³⁵.

Canada is a world leader in many fields in neuroscience and mental health research and needs to be able to keep up with, connect to, and draw on these international efforts.

National research initiatives in other fields have been successfully launched by our Government, such as the Pan-Canadian AI Strategy which saw AI centres across Canada evolve into a coordinated and flourishing ecosystem³⁶. Another recent approach, announced in Budget 2021, is the allocation of \$360 million to launch a National Quantum Strategy to grow the quantum ecosystem and establish Canada as a global leader. A Canadian Brain Research Initiative fits well into the brain science and larger research ecosystem that already exists within Canada, centred around large-scale collaboration to address complex problems.



HOW IS A CANADIAN BRAIN RESEARCH INITIATIVE AN OPPORTUNITY FOR CANADA TO LEAD?

Canada is ready to lead a paradigm shift in the scale and scope of collaborative brain research so that we can tackle the enormous societal challenge and urgent need to understand the human brain. **A Canadian Brain Research Initiative will enable Canada to develop and train a world-class transdisciplinary brain science workforce and scale up the excellence in brain research that extends from our smallest research centres to the largest hubs.**

For a tiny percentage of the current economic cost of brain disorders, we can implement a national brain research strategy to reap the societal and economic benefits arising from cutting-edge brain research across the country and improve the lifelong wellbeing of our citizens, families and communities. Better health outcomes for brain disorders will translate into tens of billions of dollars in savings for the Canadian economy per year in recovering direct medical health care costs, social care costs, income support, loss of productivity, private insurance claims, and public disability payments^{1,7,8,37,38}.

A country's future prosperity is also determined by the talented and skilled individuals who hold jobs that are key for innovation and technological progress, and ultimately contribute to stronger economic growth. Years of underfunding research³⁹ imperil our global leadership in brain science. In a similar manner as the Pan-Canadian AI Strategy, **national-level resources to coordinate the brain research ecosystem will position Canada internationally to better develop, attract, and retain Highly Qualified Personnel. This will in turn create a critical mass of talent for a spectrum of Canadian academic, industry, and other sectors to succeed.** Canadians already specialize in neuroscience more than any other research area and more than other countries² and a Canadian Brain Research Initiative will ensure the success of the next generation of young scientists.

Brain research is inherently a transdisciplinary effort, and **a coordinated national effort to understand the brain will fuel innovations that can be applied to understanding other complex systems, expand the boundaries of technology, and drive the development of new tools to benefit science and society.** Brain research can also inform new programs that can improve the quality of education, and lead to a more skilled and productive workforce. A brain research initiative for Canada is also an investment in human capital – as brain science can help to improve our understanding of how to optimize human potential, it can lead to the development of new methods to improve brain health, prevent brain disorders, and promote healthy aging.

THE VISION FOR A CANADIAN BRAIN RESEARCH INITIATIVE

CBRS Leadership

Indigenous Knowledges
Holders Group



UNIVERSITY OF ALBERTA
NEUROSCIENCE AND
MENTAL HEALTH INSTITUTE



HOTCHKISS
BRAIN INSTITUTE



Institute for
Neuroscience and
Neurotechnology

Djavad Mowafaghian
CENTRE FOR BRAIN HEALTH



UNIVERSITY OF
SASKATCHEWAN
Neuroscience
Research Cluster

UNIVERSITY OF
TORONTO

UHN Krembil
Brain Institute

camh | Campbell Family Mental
Health Research Institute

Baycrest - SickKids

Western
BrainsCAN
Transforming brain research.



Université
de Montréal



CIRCA

McGill neuro

Douglas

Healthy Brains, Healthy Lives

Centre de recherche - Research Centre

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UNIVERSITÉ
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Sentinel North



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Neuroscience
Program

BRAIN REPAIR

Institut de recherche
sur le cerveau
Brain and Mind
Research Institute

uOttawa

centre for
neuroscience
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ATYON UNIVERSITY

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Tackling the enormous societal challenge and urgent need to understand the human brain requires a united, diverse, and cross-Canada coalition across all sectors of the brain research ecosystem.

CBRS leadership is comprised of the Directors of more than 30 neuroscience and mental health institutes and programs across the country, along with representatives of early career researchers, Indigenous Knowledges Holders, and patients and caregivers⁴⁰. Our coalition also brings together more than 25 organizations funding brain research, including federal and provincial granting agencies, non-profits, health charities, and private foundations. Organizations supporting knowledge mobilization, health and community services are on board with the understanding that treatments can only come from new knowledge on the brain, and will ensure that new knowledge and treatments will be rendered into meaningful solutions that are available to all Canadians. We have consulted with and continue to deepen our relationship with industry and entrepreneurs who play a crucial role in translating the benefits of research into economic growth by developing practical applications and commercial products and services.



The collective national vision for brain science and societal impact represents a deep, informed perspective to leverage Canada's unique strengths in brain research. Our coalition has aligned on six near-term priorities and ways to strategically scale up successful models of open, collaborative, transdisciplinary and ethical brain research⁴¹. This includes building:

- **Talent:** Designing novel training programs that link across institutions and previously disparate disciplines to break silos and train new generations of scientists and highly qualified personnel with the ability to tackle the unique complexities of brain science
- **Research:** Supporting new and existing pan-Canadian resources with stable, predictable funding that will provide coordinated, collaborative, open-science infrastructure to accelerate discoveries and give an unprecedented competitive edge to Canadian brain researchers as we connect with and draw on international efforts
- **Ecosystem:** Creating platforms for cross-sector convergence of different fields of science and non-academic stakeholders to solve previously unsolvable problems in brain science and bridge translation, commercialization and adoption to ensure that Canadian ideas and knowledge are mobilized here at home

The coalition convened by the CBRS believes that the time for a Canadian Brain Research Initiative is now. We have the network, partnerships, vision, and strategic plan in place. Now we need the funding to catalyze this network into concerted, bold, and concrete action.

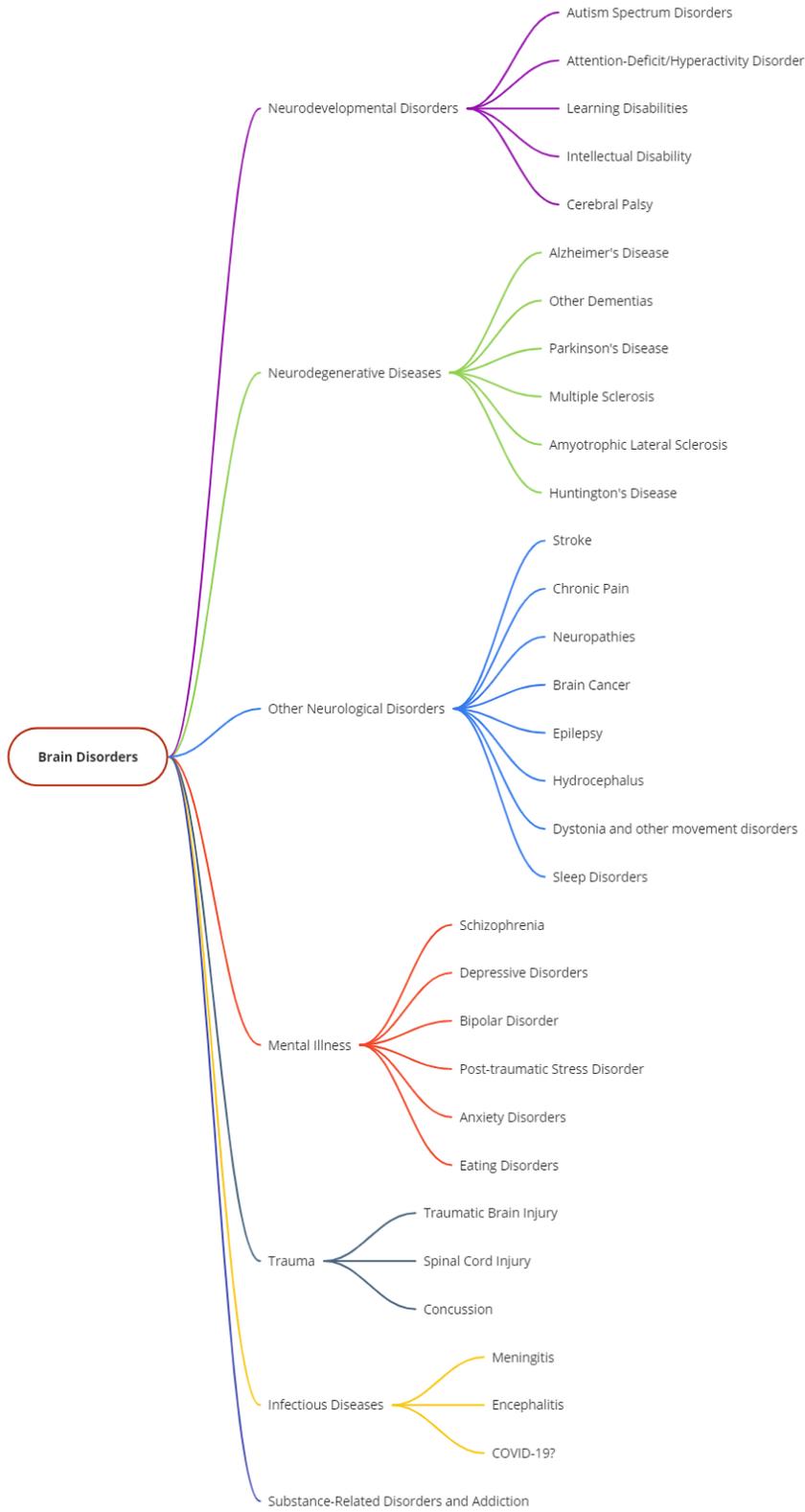


Figure 1. Some example brain disorders.

Country	Research Program	Timeline	Funding
United States	Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative	2014-2026	more than \$5 billion USD
European Union	Human Brain Project	2013-2023	\$880 million USD
Japan	Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS) Program	2014-2024	\$365 million USD
China	China Brain Project	2016-2031	2021-2026: \$746 million USD
Korea	Korean Brain Initiative	2016-2026	Unknown
Canada	Pan-Canadian AI Strategy	2017-2021, 2021	\$466 million CAD
Canada	Quantum Computing Strategy	2021	\$360 million CAD

Table 1. National and pan-national research programs.

¹ Institute for Health Metrics and Evaluation (IHME) (2020) Global Burden of Disease Study 2019 (GBD 2019) Results. Available from <https://vizhub.healthdata.org/gbd-results/>

² Larivière et al (2016) Bibliometric Analysis of INMHA-related Research, 2000-2015. Prepared for the CIHR Institute of Neurosciences, Mental Health and Addiction.

³ Neurological Health Charities Canada (2021) A National Neurological Strategy for Canada <https://mybrainmatters.ca/wp-content/uploads/NationalNeurologicalStrategyEN-Aug2021.pdf>

⁴ Illes et al (2019) A Neuroethics Backbone for the Evolving Canadian Brain Research Strategy. Neuron. doi:[10.1016/j.neuron.2018.12.021](https://doi.org/10.1016/j.neuron.2018.12.021)

⁵ Menard et al (2021) The Canadian Brain Research Strategy: A Focus on Early Career Researchers. Can J Neurol Sci. doi:[10.1017/cjn.2021.81](https://doi.org/10.1017/cjn.2021.81)

⁶ Perreault et al (2021) An Indigenous Lens on Priorities for the Canadian Brain Research Strategy. Can J Neurol Sci. doi:[10.1017/cjn.2021.501](https://doi.org/10.1017/cjn.2021.501)

⁷ Ontario Brain Institute (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs

⁸ Alzheimer Society of Canada (2022) The Landmark Study: Navigating the Path Forward for Dementia in Canada <https://alzheimer.ca/en/research/reports-dementia/landmark-study-report-1-path-forward>

⁹ Mental Health Research Canada (2022) Understanding the Mental Health of Canadians Throughout COVID-19 and Beyond: Poll #14 <https://www.mhrc.ca/findings-of-poll-14>

¹⁰ Statistics Canada (2022) 2021 Census, The Daily Released: 2022-04-27 <https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427a-eng.htm>

¹¹ Statistics Canada (2022) The Daily April 27th, 2022 <https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427a-eng.htm>

¹² Azrieli Foundation (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs

¹³ Brain Canada Foundation (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs

¹⁴ Brain Injury Canada (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs

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- ¹⁵ Canadian Concussion Network (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ¹⁶ Cancer Research Society (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ¹⁷ Centre for Aging + Brain Health Innovation (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ¹⁸ Dystonia Medical Research Foundation Canada (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ¹⁹ Heart & Stroke Foundation (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ²⁰ Huntington Society of Canada (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ²¹ Hydrocephalus Canada (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ²² Institute for Advancements in Mental Health (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ²³ Multiple Sclerosis Society of Canada (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ²⁴ Neurological Health Charities Canada (2023) Brief for the Standing Committee on Science and Research Study on International Moonshot Programs
- ²⁵ Canadian Association for Neuroscience (2022) Brief for the Pre-Budget Consultations in Advance of the 2023 Federal Budget - Increased Investment in Scientific Research for the Health and Prosperity of Canadians Today and Tomorrow
- ²⁶ <https://www.humanbrainproject.eu/>
- ²⁷ <https://braininitiative.nih.gov/>
- ²⁸ <https://brainminds.jp/en/>
- ²⁹ <https://www.science.org/content/article/china-bets-big-brain-research-massive-cash-infusion-and-openness-monkey-studies>
- ³⁰ https://www.kbri.re.kr/new/pages_eng/sub/page.html?mc=3186
- ³¹ <https://www.ans.org.au/resources/issues/about-the-australian-brain-alliance>
- ³² <https://neurocenterfinland.fi/en/>
- ³³ <https://www.brainresearch.co.nz/>
- ³⁴ <https://latbrain.com/en/overview/>
- ³⁵ <https://brainafrica.org/>
- ³⁶ Accenture & CFIAR (2020) Pan-Canadian AI Strategy Impact Assessment Report <https://cifar.ca/wp-content/uploads/2020/11/Pan-Canadian-AI-Strategy-Impact-Assessment-Report.pdf>
- ³⁷ Mental Health Commission of Canada (2011) The Life and Economic Impact of Major Mental Illnesses in Canada https://www.mentalhealthcommission.ca/wp-content/uploads/drupal/MHCC_Report_Base_Case_FINAL_ENG_0_0.pdf
- ³⁸ Canadian Substance Use Costs and Harms (2020) Canadian Substance Use Costs and Harms Report (2015–2017) <https://csuch.ca/resources/national/>
- ³⁹ Organisation for Economic Co-operation and Development (OECD) Gross domestic spending on R&D 2000-2020. Accessed on 8 October 2022, Chart permanent URL: <https://data.oecd.org/chart/6PLi>
- ⁴⁰ Canadian Brain Research Strategy Leadership <https://canadianbrain.ca/about/>
- ⁴¹ Canadian Brain Research Strategy (2022) Brief for the Standing Committee on Science and Research Study on Successes, Challenges and Opportunity for Science in Canada