RESEARCH

Baycrest

ROTMAN RESEARCH INSTITUTE

UNIVERSITY OF
TORONTO

Baycrest is a health sciences centre fully
affiliated with the University of Toronto

REDEFINING THE FRONTIERS OF COGNITIVE NEUROSCIENCE

BAYCREST'S ROTMAN RESEARCH INSTITUTE SCIENTISTS ARE AT THE CUTTING EDGE OF RESEARCH TO ADVANCE OUR UNDERSTANDING OF THE HUMAN BRAIN AND THE JOURNEY OF AGING.

REALIZING NEW ADVANCES IN NEUROSCIENCE RESEARCH

AT BAYCREST, WE'RE FINDING NEW ANSWERS AND REALIZING NEW POSSIBILITIES ALONG THE FULL RESEARCH CONTINUUM, FROM DISCOVERY SCIENCE TO TRANSLATIONAL RESEARCH TO CLINICAL PRACTICE.

The quest to understand brain function is one of the most colossal intellectual challenges of humankind. Science strives to understand how our brain supports hearing, speaking, seeing and remembering, and importantly how it changes as we age or when there is damage or disease. Taking on these challenges are some of the world's leading scientists at Baycrest's Rotman Research Institute (RRI). With an increase in the aging population globally, our scientists must find answers to the question: how do we keep our minds sharp through this journey of aging?

Scientific discoveries that contribute to answering this question are the hallmark of RRI. Since its inception, RRI has provided an environment in which scientists advance our understanding of the brain changes across the human life span. We are collaborating across disciplines asking how changes in the brain affect our moods and behaviours; how to use massive amounts of brain imaging data to gain new insight; how the environment, genetics, food and exercise shape our minds and; how to evaluate our programs in order to provide optimal care and support to those who encounter brain injuries and illnesses as patients, families or caregivers.

Baycrest's environment supports knowledge translation and mobilization, ensuring that the world does not have to wait to benefit from our research. Over the years, our scientists' global collaborations have resulted in breakthroughs and developments with far-reaching implications, such as the world's first Virtual Brain; the Integrated Neuro-Cognitive Assessment System (INCAS), a tablet to assess cognitive deficits for early detection of dementia, and an innovative neuroinformatics platform that enables researchers from around the world to share brain imaging data.

As we continue to advance research in cognitive and clinical neuroscience, the rapid transformations in the world will demand more from us. We are ready. Our trainees are poised to advance our long-term aspirations of providing solutions that directly impact care and cognitive health in aging. With the support of our global partners, our research will continue to shape our understanding of the best means to maintain good brain health across the life span.

DR. RANDY MCINTOSH
VICE-PRESIDENT OF RESEARCH, BAYCREST
DIRECTOR, ROTMAN RESEARCH INSTITUTE
SENIOR SCIENTIST
REVA JAMES LEEDS CHAIR IN NEUROSCIENCE AND RESEARCH LEADERSHIP

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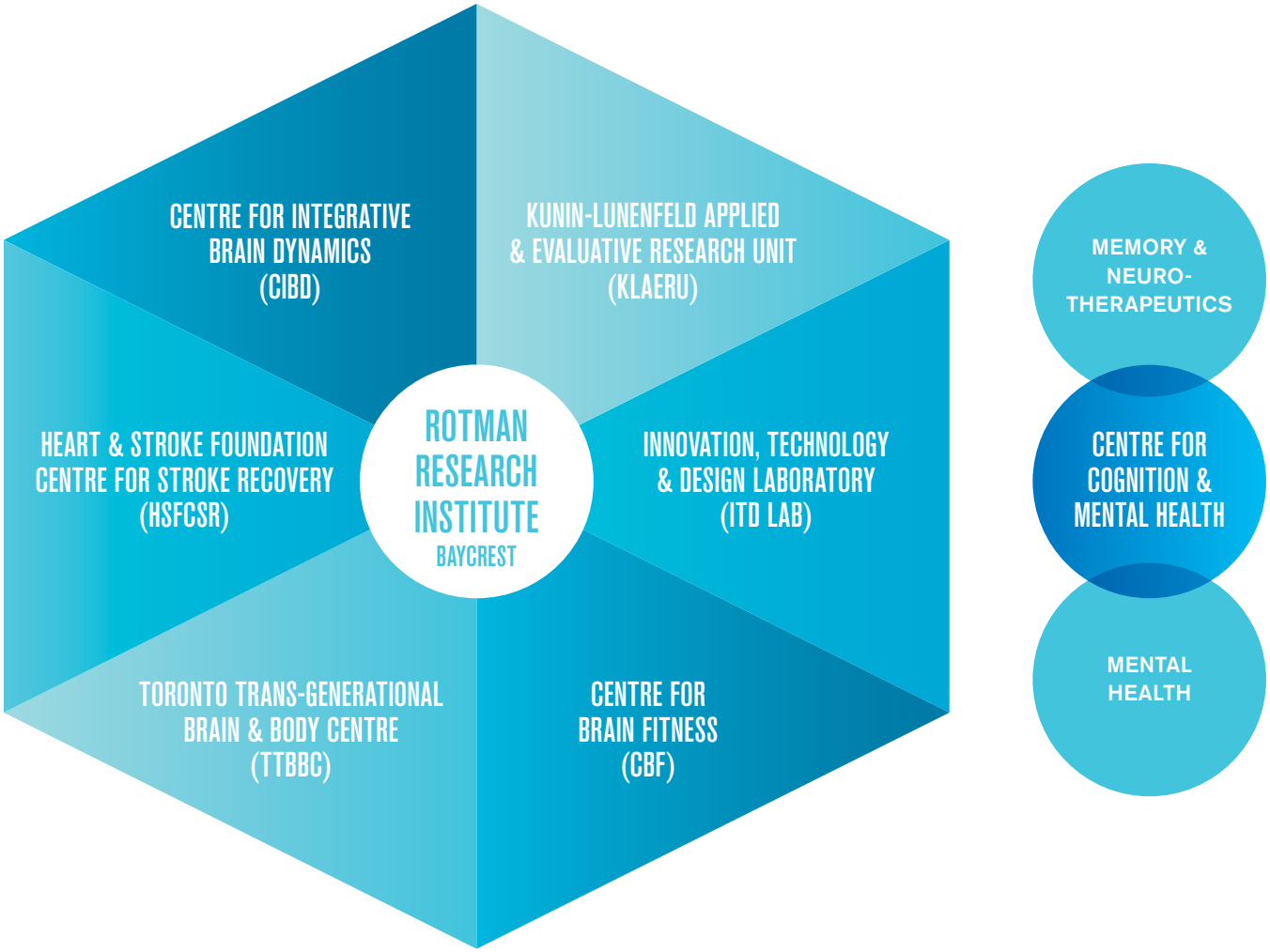
RESEARCH AT BAYCREST

THE NEXT GENERATION OF DISCOVERY AT BAYCREST WILL SEE US TRANSFORM THE JOURNEY OF AGING THROUGH THESE UNIQUE RESEARCH CENTRES:

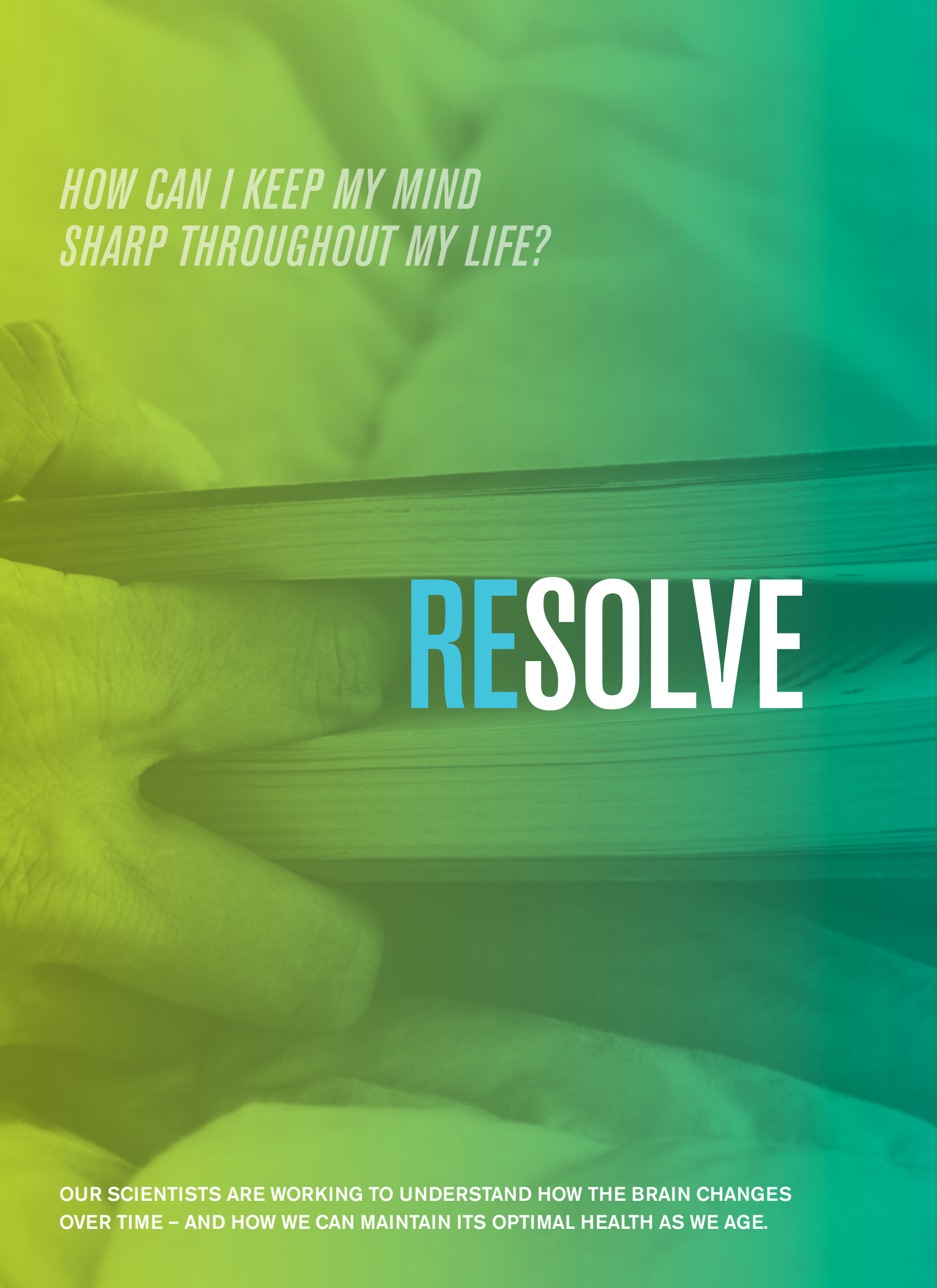


MISSION

TO PROMOTE EFFECTIVE CARE AND IMPROVED QUALITY OF LIFE THROUGH RESEARCH INTO THE COGNITIVE AND BEHAVIOURAL CHANGES ASSOCIATED WITH THE AGING PROCESS. THE PRIMARY RESEARCH FOCUS IS ON MEMORY AND THE EXECUTIVE (FRONTAL LOBE) FUNCTIONS OF THE BRAIN, BOTH IN NORMAL AGING AND IN THE PRESENCE OF DISEASES AND CONDITIONS THAT AFFECT THE BRAIN, SUCH AS STROKE, TRAUMATIC BRAIN INJURY, ALZHEIMER'S DISEASE AND OTHER DEMENTIAS.

VISION

TO POSITION OURSELVES AS LEADERS IN THE FIELD OF COGNITIVE NEUROSCIENCE THROUGH A CONTINUED FOCUS ON SCIENTIFIC EXCELLENCE.



HOW CAN I KEEP MY MIND SHARP THROUGHOUT MY LIFE?

RESOLVE

OUR SCIENTISTS ARE WORKING TO UNDERSTAND HOW THE BRAIN CHANGES OVER TIME – AND HOW WE CAN MAINTAIN ITS OPTIMAL HEALTH AS WE AGE.

A HUB OF ACTIVITY

How do we keep older people's brains working efficiently? How can we train them to work even better? Dr. Cheryl Grady is studying how brain activity varies as we age, and which areas of the brain are best for helping older adults maintain functions. Using functional magnetic resonance imaging (fMRI), she and her colleagues are able to measure brain activities in volunteers as they are asked to learn and retrieve information. This imaging technique enables the researchers to see which areas of the brain are more active or less active as age increases. In developing our understanding of brain activity in older adults, and which parts of the brain actually help memory performance, the hope is that this knowledge can ultimately be used to design better methods of rehabilitation.

DR. CHERYL GRADY
SENIOR SCIENTIST
CANADA RESEARCH CHAIR IN NEUROCOGNITIVE AGING (TIER 1), UNIVERSITY OF TORONTO

DR. ASAF GILBOA
SCIENTIST

FAST LEARNERS

How does the brain acquire knowledge? Dr. Asaf Gilboa's research is devoted to finding the answers. He and Dr. Morris Moscovitch, together with Tali Sharon from Haifa University, Israel, have found that a learning mechanism called "fast mapping" allowed patients with dense amnesia to learn and retain new information.

In Dr. Gilboa's lab, researchers are investigating the principles that allow patients to tap into the brain's primordial memory processes to quickly learn words and facts they had never heard before, like names of exotic fruits and animals. The researchers found that learning is incidental – picked up in the process of doing something else – rather than through repetition. This process is similar to the way many researchers believe young children learn new words. The findings from this research may offer far-reaching implications for rehabilitation techniques for people who suffer from memory loss.

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REFINED INTERVENTION

Today's standard neurological tests are often not sensitive enough to detect the subtle cognitive deficits resulting from brain damage. Dr. Brian Levine and his team are working to change that. Using novel assessment and rehabilitation techniques – coupled with new brain imaging tools such as structural and functional magnetic resonance imaging (fMRI), electroencephalography (EEG), and magnetoencephalography (MEG) – Dr. Levine's research aims to enable a better understanding of real-life memory and attention processes and how they are affected by brain disease. Dr. Levine and his team have developed and are testing targeted interventions designed to help patients recovering from brain damage improve executive functions such as working memory, planning and goal management.

DR. BRIAN LEVINE
SENIOR SCIENTIST
SITE LEAD, HEART AND STROKE FOUNDATION CENTRE FOR STROKE RECOVERY

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DR. LYNN HASHER
SENIOR SCIENTIST

DRIVEN BY DISTRACTION

There is plenty of research that shows older adults are more easily distracted than young adults. Can this be used to their benefit? In a recent study, Dr. Lynn Hasher and her team found that older participants, when asked to perform a task, were more bothered by extraneous information present in an environment. They also found that those who were easily distracted were also better able to use the extraneous information to solve problems later in the study. This research and others suggest it's possible to employ carefully chosen distractions to boost the cognitive functioning of older adults. Dr. Hasher continues to refine her research with the hope that it will eventually lead to interventions that can help people maintain memory performance.

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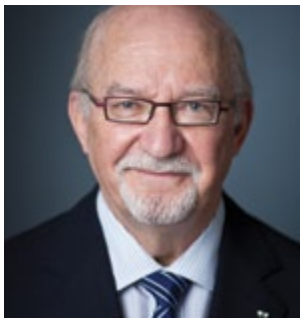
DR. MORRIS MOSCOVITCH
SENIOR SCIENTIST
MAX AND GIANNA GLASSMAN CHAIR IN NEUROPSYCHOLOGY AND AGING

Over the past 25 years, Dr. Morris Moscovitch has built an impressive body of research in the areas of memory, attention and face recognition. His outstanding career and enormous impact on the field of cognitive neuroscience was recently honoured by the Cognitive Neuroscience Society (CNS), which awarded Dr. Moscovitch its inaugural 2012 Distinguished Career Contributions Award. This award recognizes senior cognitive neuroscientists for their distinguished career, leadership and mentoring in the field. Dr. Moscovitch holds the Glassman Chair in Neuropsychology and Aging and is also a Fellow of the Royal Society of Canada.

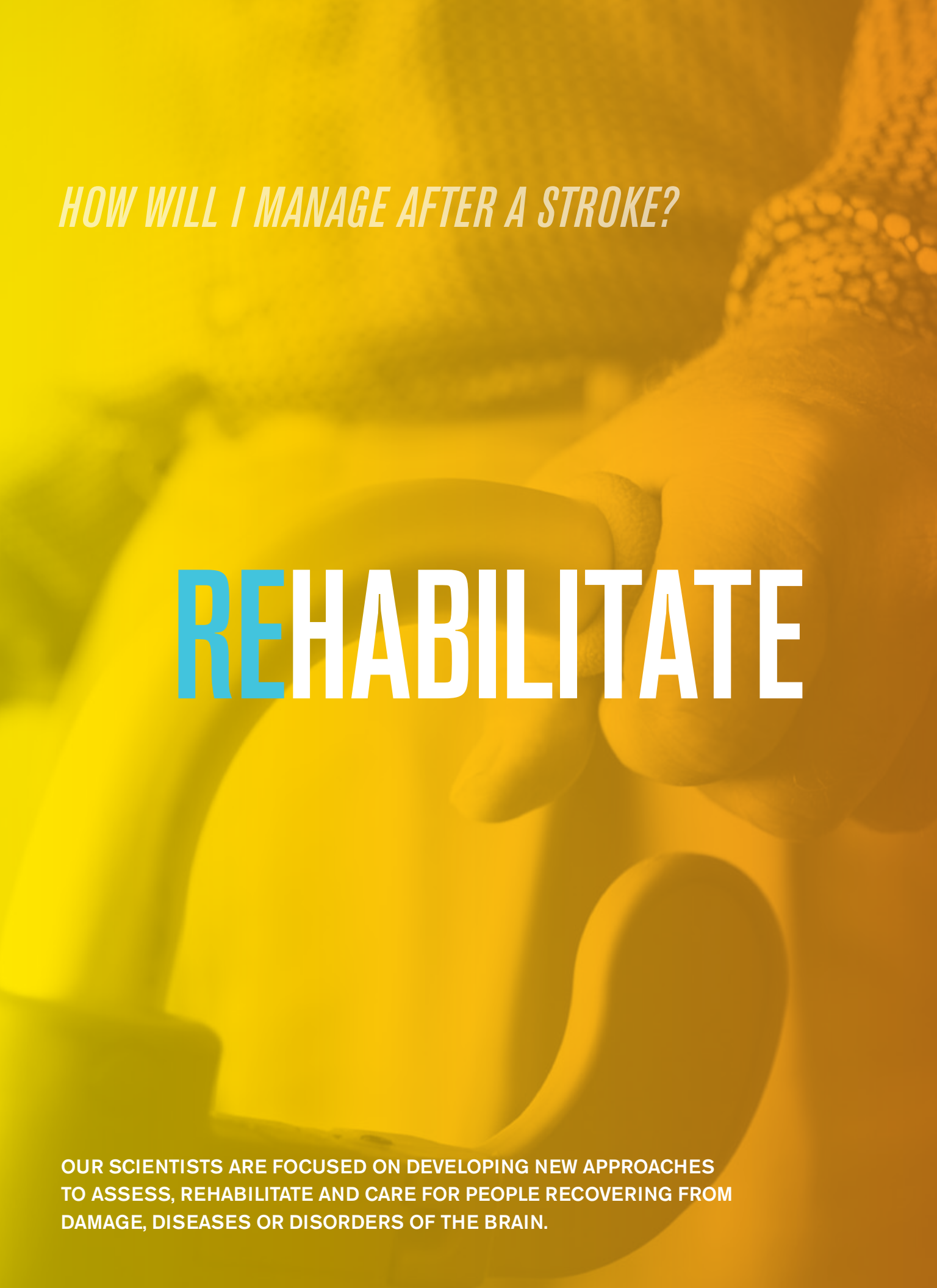


DR. DONALD STUSS
SENIOR SCIENTIST

Dr. Donald Stuss's seminal work in the field of frontal lobe research has greatly influenced our understanding of frontal lobe functions and their role in memory, cognition and consciousness. The former vice-president of Research at Baycrest and founding director of the Rotman Research Institute, Dr. Stuss spearheaded the growth of the RRI to its world-renowned status today as a leader in neuroscience research. During his career, Dr. Stuss has received numerous honours and awards including being named a Fellow of the Royal Society of Canada and Member of the Order of Ontario. In 2010, he was appointed president and scientific director of the newly launched Ontario Brain Institute (OBI), where he will continue to help shape the future of brain research, translation and innovation.

DR. GORDON WINOCUR
SENIOR SCIENTIST

One of the Rotman Research Institute's original pioneers, Dr. Gordon Winocur has made an immense contribution to the field of neuroscience with his research into memory and how it changes through the process of normal aging or through injury. In an important brain injury study with rats, which garnered him the Donald T. Stuss Award for Research Excellence, Dr. Winocur demonstrated that memories could be preserved after severe amnesia – findings that have potential implications for new therapies to help people with brain injuries regain their independence.



HOW WILL I MANAGE AFTER A STROKE?

REHABILITATE

OUR SCIENTISTS ARE FOCUSED ON DEVELOPING NEW APPROACHES TO ASSESS, REHABILITATE AND CARE FOR PEOPLE RECOVERING FROM DAMAGE, DISEASES OR DISORDERS OF THE BRAIN.

DR. MORRIS FREEDMAN
SENIOR SCIENTIST

TELLING TIME

According to Dr. Morris Freedman, there is a marked difference between how a normal person draws a clock and how someone with certain cognitive problems will draw it. Dr. Freedman together with Dr. Larry Leach and their colleagues have pioneered tests to help physicians diagnose Alzheimer's disease earlier. One such test in wide use involves asking a patient to draw a clock. The ability of a patient to reproduce a clock representing a specified time can help determine whether that patient's cognitive function is normal or impaired. Diagnostic tools such as Dr. Freedman's clock-drawing test assist in the diagnosis of Alzheimer's and other dementias, allowing physicians to begin treating the disease sooner.

DR. TIFFANY CHOW
CLINICIAN-SCIENTIST

TAKING CARE OF THE CAREGIVERS

While awareness of Alzheimer's disease has grown in recent years, one unseen aspect of the disease is the effect it has on the children who are living at home with a family member who has Alzheimer's or frontotemporal dementia. Until recently there have been no written resources to guide children and teens – or even for the well parent to assist their children through the caregiving experience.

Dr. Tiffany Chow, a clinical researcher specializing in diagnosing and treating early-onset dementia, is the driving force behind the website *When Dementia is in the House*. Developed in collaboration with writer Katherine Nichols, the site is designed to help family members learn strategies to manage the emotional conflicts and unpredictable behaviours associated with early-onset dementia in their loved ones – and to find ways, despite the upheaval, to enjoy quality moments of family time. Plans are underway to extend the educational effort to children too young to access the Internet yet and those families living with Alzheimer's disease.

DR. LINDA MAH
CLINICIAN-SCIENTIST

FACING THE CHALLENGE

Why is it harder to treat people who suffer from depression later in life? Dr. Linda Mah has identified an important clue in the search for the answer. In Dr. Mah's study, researchers found that older adults with depression were less sensitive to the effects of positive or negative facial expressions. That is, when shown photos of different faces, depressed patients were less engaged by happy, sad or fearful faces compared to older adults without depression. Depressed patients also made more errors in labelling neutral faces. The study suggests that it's more than cognitive decline that is behind the challenge of treating older patients with depression – and points to a greater need to focus on emotions in trying to understand the underlying factors of late-life depression.

Dr. Mah is currently using functional magnetic resonance imaging (fMRI) to evaluate emotional processing and brain activity in geriatric patients with depression. The hope is that this knowledge will inform the development of new and better strategies for treating depression in late life.

BRAIN REGAIN

Higher-level brain processes, or executive functions, help us manage nearly every aspect of our lives – from planning tasks to remembering details. Brain injuries and illness can impede these processes from functioning optimally. Baycrest scientists such as Dr. Deirdre Dawson are investigating ways that cognitive interventions can help people after serious brain injury get the most out of their brains and improve their quality of life.

Dr. Dawson's rehabilitation programs equip patients with strategies to manage day-to-day tasks, whether it's as simple as getting dressed, or handling money and shopping. The tools patients acquire enable them to go on to identify their own problems and devise their own solutions in everyday life.

DR. DEIRDRE DAWSON
SENIOR SCIENTIST

DR. NICOLE ANDERSON
SENIOR SCIENTIST

PREVENTION IS THE BEST MEDICINE

There is currently no known cure for dementia. Until a cure is discovered, it's important to develop tools and interventions that prevent or slow its progression. Dr. Nicole Anderson's research looks at the measures we can take in our everyday lives to maintain cognitive functioning and reduce the risk of developing dementia.

In one ongoing study, she is exploring the protective benefits of volunteer work for people over the age of 55. The BRAVO study (which stands for "Baycrest Research About Volunteering among Older adults") is based on the understanding that older adults who engage in more physical, cognitive and social activity in their daily lives demonstrate better cognitive functioning and a lower risk of dementia. The study assesses subjects at different stages of their volunteer program, factoring in the complexity of their volunteer role, to determine whether – and to what degree – these activities help to protect individuals' physical, cognitive and psychosocial functioning.

DR. KELSEY SIMONS
SOCIAL WORK SCIENTIST

LONG-TERM GAIN

People living in long-term care homes typically have a variety of physical, social and mental health needs. The complexity of caring for these individuals poses unique challenges for healthcare providers, especially when staff at the point of care, such as personal support workers or nursing assistants, aren't commonly trained in best practice approaches to care.

In a recent study, Dr. Kelsey Simons and her colleagues are looking to address this gap in knowledge by examining approaches to providing interprofessional psychosocial care in Canadian long-term care facilities. Their overall goal is to identify current and best practices for enhancing the well-being of elders and their family caregivers in long-term care.

DR. ELSA MARZIALI
SENIOR SCIENTIST

SUPPORT NETWORKED

Family caregivers and people self-managing chronic diseases in the home literally save the healthcare system billions of dollars in North America. Yet, these groups don't often receive the adequate support services they need to manage such tasks at home. For more than a decade, Dr. Elsa Marziali has been working to develop Web-based, video-conferencing intervention programs for family caregivers and older adults with neurological diseases such as dementia, Parkinson's disease or stroke. Her studies have shown that providing effective online support to family caregivers helps to reduce stress and mental health problems among caregivers, which in turn prevents them from becoming ill and further burdening the healthcare system.

In another Web-based e-health program, Dr. Marziali is looking into the many barriers – be it social, economic or cultural – that prevent older people with chronic disease from adhering to their rehabilitation programs, and then devising ways to help them get back on track.

WHAT'S THE LINK BETWEEN MY BRAIN AND BEHAVIOUR?

RECONNECT

OUR SCIENTISTS ARE STUDYING HOW THE BRAIN SHAPES BEHAVIOUR, AND EXPLORING THE FACTORS THAT INFLUENCE COGNITION AND MENTAL HEALTH.

THE EYES HAVE IT

A person's eyes can tell you a lot – often more than we realize. Dr. Jennifer Ryan is investigating what our eye movements tell us about memory performance. What we remember, and when we remember it, is revealed through the way in which we move our eyes. In the first study of its kind, Dr. Ryan and her colleagues are using eye tracking combined with magnetoencephalography (MEG) imaging technology to look at which areas of the brain are "online" when subjects are asked to think about or remember something.

Through this knowledge, we may better understand how memory is used and how it's transformed with age or injury – knowledge that can lead to better methods for helping people with memory deficits.

DR. JENNIFER RYAN
SENIOR SCIENTIST AND ACADEMIC DIRECTOR
CANADA RESEARCH CHAIR IN COGNITIVE NEUROSCIENCE OF MEMORY (TIER 2), UNIVERSITY OF TORONTO

DR. TOMÁŠ PAUS
SENIOR SCIENTIST
ANNE AND MAX TANENBAUM PROFESSOR AND
CHAIR OF POPULATION NEUROSCIENCE

THE WHOLE PICTURE

Why do certain families, and even ethnicities, live longer, healthier lives? What factors make some susceptible to disease and what factors protect against it? Dr. Tomáš Paus is looking for these answers by studying the complex interactions between environment and genes. At the Trans-generational Brain and Body Centre, located at Baycrest, Dr. Paus and his team use advanced imaging tools to study brain, behaviour and its relationship to physical health, lifelong experiences and genetic variations.

In his current research, Dr. Paus is studying family members spanning three generations (grandparents, parents, children) to explore how nature and nurture interact to shape the brain and body across the lifespan. The goal is to determine the factors that influence whether a person will age in a healthy manner or be at risk of developing disorders such as depression, dementia, obesity and diabetes. In turn, these findings may help us to develop personalized preventive strategies to stay healthy as long as possible.

DR. BRADLEY BUCHSBAUM
SCIENTIST

RELIVING THE EXPERIENCE

When people have a rich and vivid memory of a past experience, it's often described as being transported back in time, or a feeling that we are reliving the moment. In a recent study, Dr. Bradley Buchsbaum and his colleagues showed that there are similarities between how the brain processes a direct perception of a vivid experience and the memory of that experience. Using functional magnetic resonance imaging (fMRI), researchers were able to map the similarities in brain activity when people were asked to watch a diverse set of video clips, and when asked to remember those clips. The results show that complex, vivid memory involves, to some degree, reinstating the same pattern of brain activity as in the original perception. It could be said that we are, in effect, reliving the experience. Such research is expanding our understanding of how the brain processes information, knowledge that may one day yield new ideas about how to help people sustain memory function or prevent its impairment.

DR. JED MELTZER
NEUROREHABILITATION SCIENTIST

DIFFERENCE IN THE DETAILS

Assessing language function in patients with neurological conditions has traditionally been done by conducting behavioural tests. These tests, however, don't capture the subtle variability in language use – especially those associated with milder forms of impairment as in patients with dementia or traumatic brain injury.

Dr. Jed Meltzer and his colleagues are exploring the use of new computational linguistics tools to improve diagnosis and treatment of cognitive impairment. His research focuses on how language is processed in the brain, with emphasis on how undamaged neural pathways can be used to recover cognitive and linguistic abilities. Employing brain-mapping tools such as magnetoencephalography (MEG), Dr. Meltzer and his team can view and measure the involvement of specific pathways and how they change over time – knowledge that offers the potential for future behavioural intervention and stroke rehabilitation strategies tailored to individual patients.

EXPLORING THE DETERMINANTS OF COGNITION

DR. CAROL GREENWOOD
SENIOR SCIENTIST

FOOD FOR THOUGHT

For more than a decade, Dr. Carol Greenwood has explored the relationship between diet, nutrition and brain health. She and her colleagues are working to understand what factors in our diet can increase our risk of cognitive loss as we age, and what we can do proactively through our diet to help retain our brain function. Dr. Greenwood was the first researcher to show that the average North American diet, if consumed in middle age, can contribute to cognitive decline. Now, Dr. Greenwood and her colleagues are using brain imaging technology to map and understand the biological factors that connect diet to dementia, and ultimately to identify food strategies that can help to set our brains up for healthy aging.

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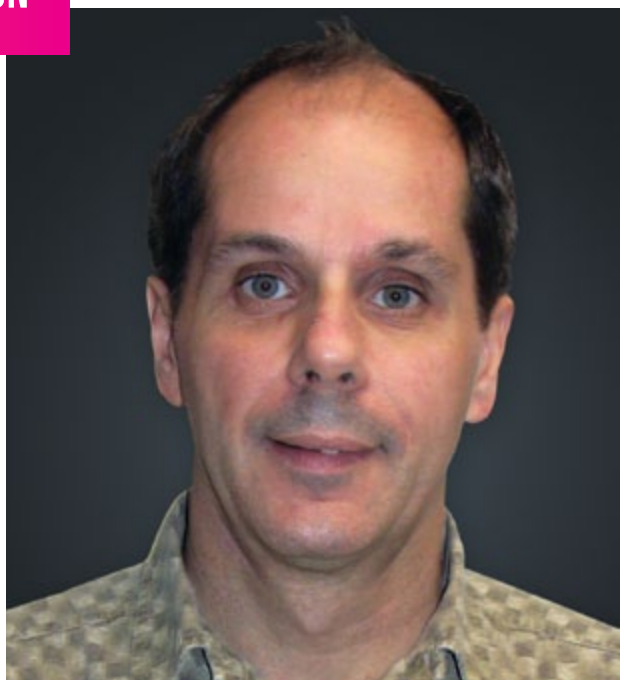


DR. CLAUDE ALAIN
SENIOR SCIENTIST AND ACADEMIC DIRECTOR

SIGNALS TO NOISE

You're at a cocktail party. There are people conversing all around you. How do you follow one specific conversation and sort it from the rest of the background noise? It seems that as we get older, this ability becomes increasingly difficult. Dr. Claude Alain's research is focused on investigating how our perception of sound changes as we age. Why, for example, do older people have more difficulty listening in multi-conversation environments like the aforementioned cocktail party?

Using a variety of brain imaging techniques such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI), Dr. Alain and his colleagues are able to look at how the brain processes auditory information. The researchers can gauge, for example, whether specific frequencies are causing the problem, or if it's related to processes in a certain part of the brain – knowledge that can lead to improvements and refinements to the way we design hearing aids or other clinical tools.

DR. MALCOLM BINNS
STATISTICIAN SCIENTIST

SUPER MODELS

How do we make sense of the vast amounts of neuroscience data we have at our disposal? What are the patterns that we can identify in this data? And how can we use these patterns to predict future outcomes? As a statistician scientist, Dr. Malcolm Binns is involved in developing mathematical models for neuroscience data. His research focus spans a number of areas – from developing models that predict how brain functions such as memory and attention change as we age, to applying and improving statistical methods to investigate cognitive deficits and behavioural disturbances in specific patient populations such as those with Alzheimer's disease, frontotemporal dementia or traumatic brain injury. In making use of improved statistical methods and mathematical models, Dr. Binns's research work is helping to extend our knowledge of human cognition and behaviour.

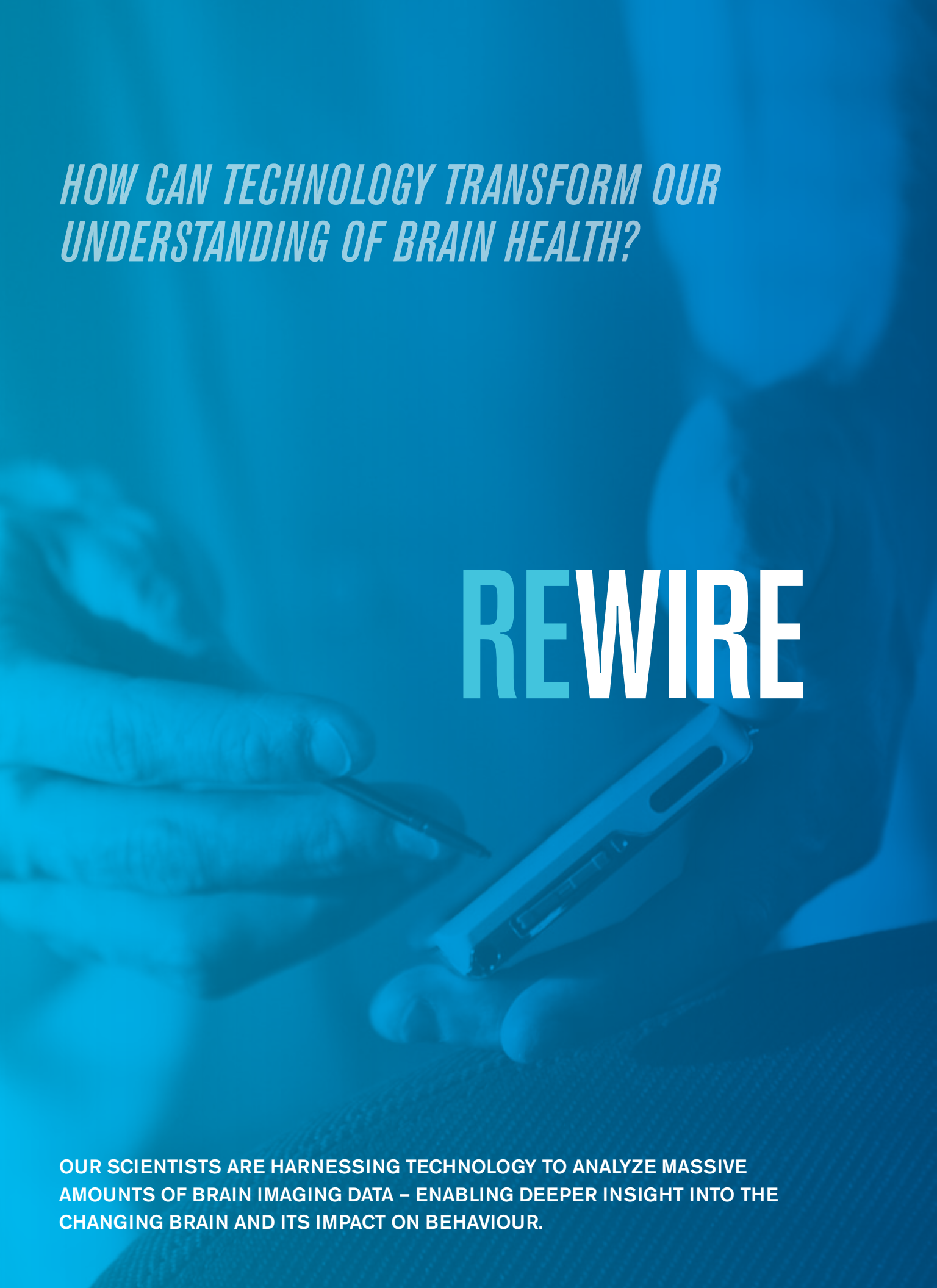
PIONEERS OF COGNITIVE NEUROSCIENCE

DR. ENDEL TULVING
SCIENTIST EMERITUS

Dr. Endel Tulving is considered by many to be the single scientist who has had the greatest impact on our understanding of human memory. An international luminary in experimental psychology, Dr. Tulving's theories on the brain's multiple memory systems have laid the foundation for the entire field of memory research. Best known for his findings on "episodic" memory – or the memory of personal experiences and specific events in time – Dr. Tulving has not only advanced the theoretical understanding of memory, but has had a tremendous influence on the research of neurological disorders such as stroke and Alzheimer's disease. In 2010, Dr. Tulving retired from Baycrest's Rotman Research Institute, but his influence continues to be felt, both at Baycrest, and throughout the fields of cognitive neuroscience, psychiatry and clinical neurology. Dr. Tulving has been elected to six national academies of science worldwide, has received numerous prestigious awards, including the Gairdner Award in 2005, and in 2006 was appointed as an Officer of the Order of Canada.

DR. FERGUS CRAIK
SENIOR SCIENTIST

One of the world's most renowned psychologists, Dr. Fergus Craik has contributed immensely to the understanding of human memory. For more than four decades, his research has been instrumental in shaping our knowledge of how memory works and how these functions change as we age. Dr. Craik's enormous body of work and leadership in the field has earned him the highest honours, including being named a Fellow of the Royal Society of Canada and Fellow of the Royal Society of London. One of the founding pioneers of Baycrest's Rotman Research Institute, Dr. Craik continues to work alongside Baycrest's young, up-and-coming scientists, collaborating on research into human memory and sharing his vast knowledge and experience with the next generation of leading minds.



HOW CAN TECHNOLOGY TRANSFORM OUR UNDERSTANDING OF BRAIN HEALTH?

REWIRE

OUR SCIENTISTS ARE HARNESSING TECHNOLOGY TO ANALYZE MASSIVE AMOUNTS OF BRAIN IMAGING DATA – ENABLING DEEPER INSIGHT INTO THE CHANGING BRAIN AND ITS IMPACT ON BEHAVIOUR.

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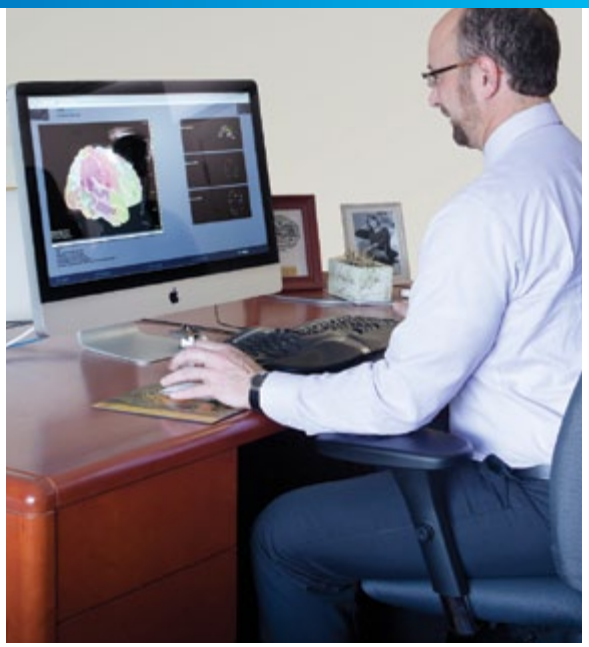


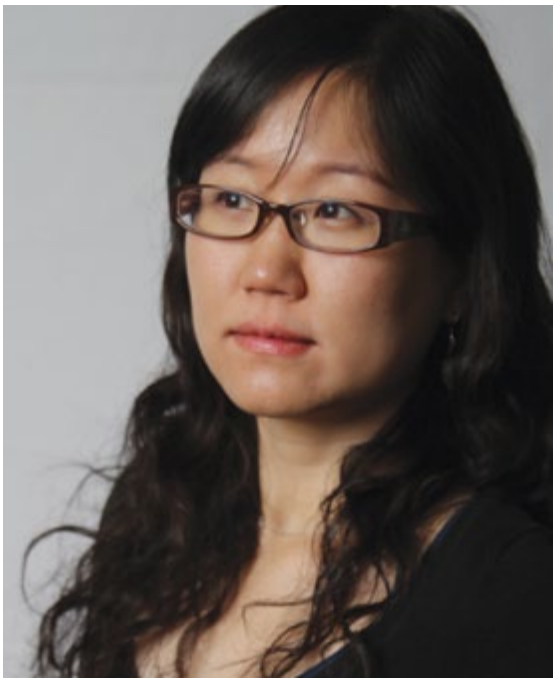
DR. RANDY MCINTOSH

VICE-PRESIDENT OF RESEARCH, BAYCREST
DIRECTOR, ROTMAN RESEARCH INSTITUTE
SENIOR SCIENTIST
REVA JAMES LEEDS CHAIR IN NEUROSCIENCE AND RESEARCH LEADERSHIP

MIND MAPPING

Dr. Randy McIntosh is currently leading a multi-million dollar project to construct the world's first "virtual" brain. The massive 10-year project, which sees the Rotman Research Institute partnering with a team of international neuroscientists, will create a detailed atlas of all the functional networks of the brain.

The project involves uploading vast amounts of data from thousands of human brains, ranging from children to the elderly. Gathered from magnetic resonance images combined with sophisticated mathematical models, the data will map the interplay between different brain areas during mental tasks such as thinking, seeing or feeling. In addition to data from healthy brains, information from individuals with brain damage or disease will be incorporated to show how the brain recovers from cognitive impairment caused by stroke, epilepsy or Alzheimer's disease – potentially transforming how we assess and treat brain disorders in the future.



DR. JEAN CHEN

SCIENTIST

A CLEARER VIEW

Despite the best research efforts, the causes of aging-related illnesses such as dementia still remain unclear, and to date there is no cure. As lead investigator of the functional magnetic resonance imaging (fMRI) Lab at Baycrest, Dr. Jean Chen is working on developing improved methodologies for fMRI technology, and employing this advanced imaging technology to study aging and age-related neurodegenerative diseases. Among her areas of focus, Dr. Chen and her research team are investigating the roles of neurovascular, metabolic and structural health for maintaining brain function, and how these aspects are affected by disease. Dr. Chen's lab also works closely with other RRI researchers to apply fMRI techniques to the study of various aspects of brain health, with the goal of expanding our understanding of the processes and functions of the brain, and translating that knowledge into new and better therapies.

DR. SYLVAIN MORENO
SCIENTIST

TRAINING THE BRAIN

In a recent study, Dr. Sylvain Moreno found that musical training can greatly improve pre-literacy skills in young children. Using a computer-based music program that featured cartoon characters and games, he showed that after only 20 days of classroom instruction, preschoolers were able to boost their verbal IQ scores five times compared to children who received a non-music-based training program.

Dr. Moreno is the lead scientist at Baycrest's Centre for Brain Fitness (CBF), which is focused on transferring technology and scientific discoveries from Baycrest to the world. With a primary interest in neuroplasticity – or the brain's ability to adapt over time – Dr. Moreno's laboratory is developing methodologies and programs designed to train or rehabilitate the brain throughout the life span, from young children to older adults. At the CBF, he is exploring how new technologies can be used to create marketable programs that improve and sustain brain health while also being entertaining or engaging to use.

DR. BERNHARD ROSS
SENIOR SCIENTIST

UNDERSTANDING SPEECH

Elderly people often complain that they can hear but can't understand what is being said, particularly in the presence of noise or other voices. For years, the prevailing thought was that hearing loss was the main cause. However, recent studies have shown that our brain's ability to interpret sound changes as we age. In their research, Dr. Bernhard Ross and his colleagues have demonstrated that brain functions associated with central hearing can change as early as middle age.

A pioneer in the use of magnetoencephalography (MEG), Dr. Ross has applied and refined MEG imaging techniques to assess brain activity in people as they are listening to sounds. By triggering neurons in the brain to respond to stimulus sounds, he and his colleagues have been able to pinpoint the complex brain processes and networks associated with hearing, and how we interpret sound to understand speech. Recently, the researchers discovered that the brain combines individual sound elements much in the same way that we visually "connect the dots" to complete a mental picture. These findings offer potential for developing new training programs to help improve speech understanding for the elderly.

INFORMATION MOTHER LODE

The functioning brain is a highly complex system of interconnected processes. For neuroscientists, this complexity makes it critical to have effective ways to gather, view and analyze large amounts of data associated with brain function. Dr. Stephen Strother and his colleagues are developing advanced techniques to amass and analyze a vast collection of research data using state-of-the-art computational models. This sophisticated "neuroinformatics" expertise and infrastructure puts Baycrest at the forefront of local and international research focused on aging and the brain.

In one such project, Baycrest is collaborating with provincial research partners and the Ontario Brain Institute to build one of the world's largest brain research databases. The Brain-CODE database will provide researchers with better, faster access to massive amounts of neurological data, offering the potential to discover links between different brain conditions, and ultimately leading to better ways to treat brain diseases and disorders. Under the direction of Dr. Strother, Baycrest will contribute its expertise in neuroimaging infrastructure to help create this comprehensive database.

DR. STEPHEN STROTHER
SENIOR SCIENTIST

READY FOR THE FUTURE: TRAINING THE NEXT GENERATION OF SCIENTISTS

ADJUNCT AND ASSOCIATE SCIENTISTS

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DR. TAKAKO FUJIOKA

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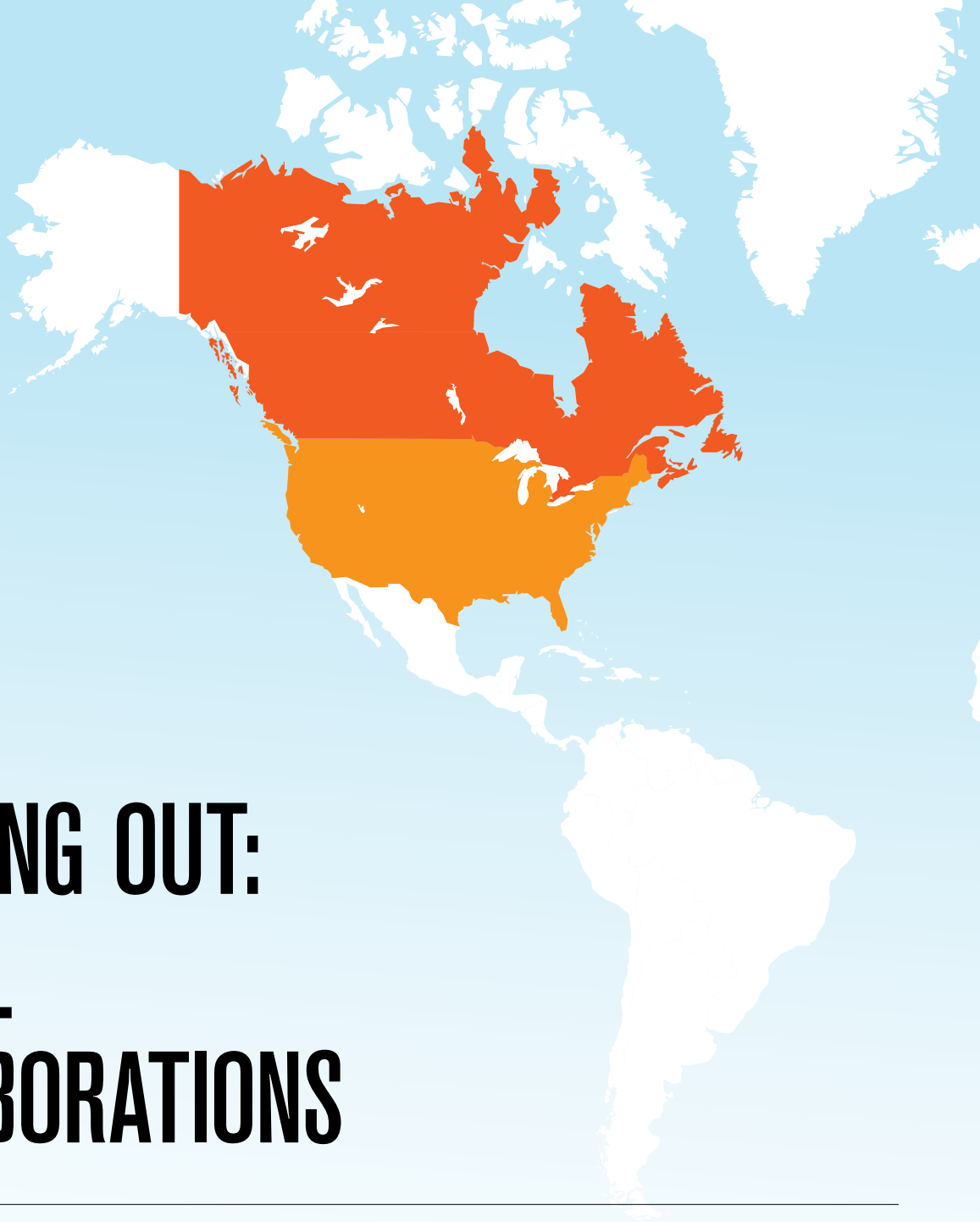

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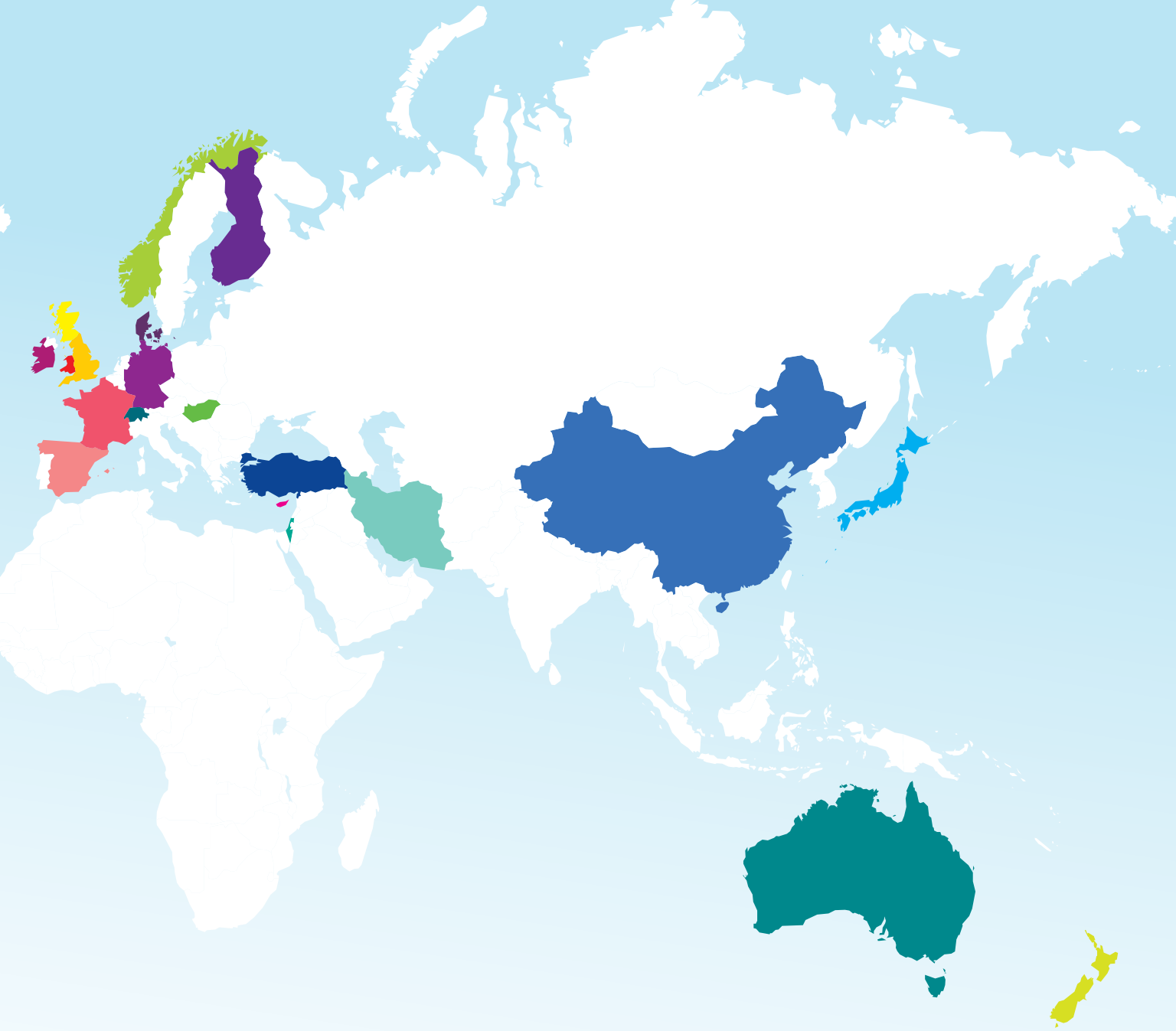

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