Concussions took her game away. Research will help others stay on the field.

Natasha’s athletic career as a rugby player is being sidelined by the impact of repeat concussions. A unique research study at Robarts Research Institute will help athletes like her and their coaches better understand the signs and symptoms of concussions – especially as they reoccur.

It’s one more way Robarts is revolutionizing health care today and for generations to come.

Learn more at robarts.ca

Life After Concussions

Canadian NHL legend, Eric Lindros, shares his story and the work he’s doing to help researchers improve the lives of others.

p03
The brain is our command center and determines how we live, how we think, how we feel, and who we are. Unravelling the mystery of it is one of the last frontiers in human science.

However, when a brain is damaged from disease or injury — the impact can be devastating.

I n recent years, there has been increased awareness of the impact of neurological diseases, brain injuries, and mental illnesses on people living with these conditions — and on their families, caregivers, and the economy and society. There are about 1,000 disorders of the brain, and it is estimated that one in three Canadians will be directly impacted by them at some point in their lives.

The enormous burden of brain disorders endocrine disorders carry an economi- cal burden that is greater than can- cer and cardiovascular disease com- bined. But, funding for research to understand, diagnose, treat, and eventually cure brain disorders — as well as funding to understand the brain — has historically lagged behind investments in these other areas. That situation is changing, a global effort to understand the hu- man brain is underway. Currently, many large-scale brain projects across four continents have been launched or are in the planning stage, and it is estimated that one in three Canadians will be directly impacted by them at some point in their lives.

A culture of collaboration brain research

Canada’s contributions to brain re- search began in 1934 when Dr. Wil- liam Penfield endowed the Montreal Neurological Institute and Hospi- tal — which became the birthplace of neuroscience, the largest center dedicated to the brain in Canada, and among the largest in the world. A seamless integration of research and patient care was and remains the vision, and a model that has been adopted around the world. Since that time, brain research cen- tres have been established across Canada and Canadian scientists have made some of the most im- portant discoveries in this field. As researchers delve deeper into our understanding of the brain, the complexity of the challenge increases, and so too does our need to join different disciplines and approaches. Collaborations are now extending beyond linking researchers and clin- icians. Understanding the brain is a science and the true understanding of specific diseases; it’s about joining disciplines such as chemistry, physics, mathematics, engineering, computer science, and ethics. Canadian research has al- ways been a collaborative effort and that spirit is all the more important in today’s context.

Partnerships that are enabling a Canadian brain community

New funding models on all emerg- ing, with Canada leading a pub- lic-private partnership to increase investments in brain research. In 2011, the Government of Canada established the Canada Brain Re- search Fund, through which it is matching funds raised by Brain Canada and its partners on a one-to-one basis to create a $200-million fund for Canadian brain research. Grants are supporting all stages of the research process, from basic dis- covery, to the translation of discover- ies into useful products or servi- ces, and their application to people with brain disorders. While Brain Canada does not fund outside this country, we encourage and foster linkages between Can- ada and other countries. Our part- nerships with the Alzheimer’s As- sociation and the U.S. BRAIN Initiative are examples of how Canada is working with international part- ners to accelerate the pace of dis- covery. Our partnership with Can- adian Institute for Advanced Re- search (CIFAR) is enabling Canadian researchers to be part of a network that spans 17 countries.

Partnerships with Canadian health charities are ensuring that our efforts include the voices of pa- tients, families, and caregivers, and that we are advancing our understanding of specific diseases — while also contributing more broadly to understanding common underlying mechanisms shared by multiple conditions.

In Canada: and — is at the forefront of brain research. For it to remain forefront we need to en- sure that we increase funding to a level that matches the capacity of Can- ada’s world-class researchers. With timely investments in research and infrastructure, Canadian scientists will continue to make major con- tributions to the global quest to understand the brain and to pro- moting brain health — to the bene- fit of all Canadians.

In September 2014, the Government of Canada and Neurological Health Charities Canada released a $200-million fund for Canadian brain research.

Canadian Scientists Contributing to Global Effort to Understand the Brain

Canadians affected by neurological conditions. In recent years, there has been increased awareness of the impact of neurological diseases, brain injuries, and mental illnesses on people living with these conditions — and on their families, caregivers, and the economy and society. There are about 1,000 disorders of the brain, and it is estimated that one in three Canadians will be directly impacted by them at some point in their lives. For people with a neurological condition who is a at a higher risk of experiencing a mental health disorder — it their caregivers as well. From a sample of parents caring for their children with a neurological condition, a third of the parents survey- ed, it is a significant need. Canadian research has always been a collaborative effort and that spirit is all the more important in today’s context. The report finds that although there are higher mental health needs in Canadians with neuro- logical conditions, access to ad- equate service can be challeng- ing. Nearly a third of publically funded acute care hospitals, long- term care facilities, and commu- nity outpatient centres across Canada indicated that they did not accept individuals with psychi- atric or severe behavioral disorders. Furthermore, less than 10 percent had access to a neuropsychologist and only 3 percent had access to a neurologist.

Working together to improve the lives of Canadians with neurological conditions.

In this issue

Women’s Brain Health

Ancestral Stress
can affect the health of future
generations.

Mental Health Challenging Canadians

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Nine years after hanging up his skates, NHL legend Eric Lindros is active in promoting research into concussions, which took a serious toll on his career and are now a growing problem in sports at all levels. He recently took some time out of his busy life as a father of four young children to discuss the most memorable moments of his time on the ice, the joy of sport, and the importance of rebooting your brain.

Top Researchers Striving to Develop Treatment Programs for Concussions

Concussions have had an overwhelming effect on ordinary people, our military personnel, and athletes of all ages. Research has begun to reveal the cellular and molecular problems that underlie the result of concussion. Researchers at Western University are applying these findings to develop novel strategies to treat concussion.

For many, a concussion might seem quite black and white: a direct and damaging blow to the head. However, according to Dr. Arthur Brown of Western University’s Robarts Research Institute, what people need to understand is that even mild, undetectable hits to the head or the body may result in a concussion. Repeated mild blows are what can lead to long-term problems, like Chronic Traumatic Encephalopathy (CTE), which can often have a crushing effect on its victims.

With CTE comes all sorts of problems in brain function, Dr. Brown explains, from entering the site of injury where they need to understand is that even mild, undetectable hits to the head or the body may result in a concussion. Repeated mild blows are what can lead to long-term problems, like Chronic Traumatic Encephalopathy (CTE), which can often have a crushing effect on its victims.

Eric Lindros

I once went to a game and had a concussion, and we continued playing that night. I had a mean streak in me. One thing that seems to be unanimous amongst the top researchers in this field, it is that the most effective form of prevention of these types of injuries is awareness. This is why Dr. Michael J. Strong, Dean of the Schulich School of Medicine and Dentistry at Western University and doctors Gregory Dekaban and Arthur Brown, are also involved in concussion awareness programs like See The Line, with Canadian hockey legend Eric Lindros. According to Dr. Strong, Immune systems like Concussions are a result of a long and potentially life-impacting injury. They should be taken very seriously. If they are diagnosed early and treated correctly, in all likelihood you will make a full recovery. It is important for people to have a good understanding of the facts so that they can understand that even in the long run, your mental health is more important than getting back to the top of your game.

Eric Lindros

If my three children decide to play, I would certainly support my children to continue playing and see the support from the NHL’s players association (NHLPA) towards evolving this research and hope that it will result in reducing long-term effects of concussion and open the door to help in other areas of brain injury that is not solely concussions related. For example, amyotrophic lateral sclerosis (ALS). We need more funding to continue the research and hope we can achieve those goals. I will continue my support of this work, where it shows concussion research, care and awareness. I truly hope we can make a difference.

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Parkinson’s disease (PD) is the second most common neurodegenerative disorder after Alzheimer’s disease and affects almost 70,000 Canadians. It is characterized by stiffness of movement, freezing, and tremor. PD can lead to depression, anxiety, cognitive impairment, and a host of other symptoms. The cause is unknown and there is no known cure.

For many people living with the disease, medical management is their only recourse. Patients can require up to 30 pills a day to control their symptoms but, for suitable candidates, a procedure called deep brain stimulation (DBS) is used to treat symptoms.

DBS uses a surgically implanted medical device called a neurostimulator — similar to a heart pacemaker — to deliver electrical stimulation to targeted areas in the brain that control movement and can allow those living with PD to drastically reduce their medication.

State-of-the-art research carried out during brain surgery is revolutionizing how doctors treat Parkinson’s disease.

Groundbreaking Research Offers Hope to Parkinson’s Patients

Doctors at The Ottawa Hospital are seizing the opportunity to undertake groundbreaking research into the disease during DBS procedures. Patients undergoing DBS remain awake for most of the surgery, which can last up to 13 hours. During this time, Dr. Adam Sachs, a neurosurgeon at The Ottawa Hospital, places patients in a virtual reality environment and records their brain activity as they complete various tasks.

“Our research is aimed at improving the therapy, of possibly giving rise to treatments that may be responsive to the real-time activity of the brain,” says Dr. Sachs. “What we’re hoping to do is give better treatment to people who may be candidates for DBS.”

Dr. Jacques Theriault, a retired family physician from Hawkesbury, Ontario underw ent DBS in 2014 and became one of Dr. Sachs’ research volunteers.

“During the procedure, I was given virtual reality goggles and I was controlling things spatially with my mind,” says Dr. Theriault. “It was just amazing.”

Moving forward before his procedure, Dr. Theriault was taking 19 pills a day to control his symptoms, many at toxic levels. He underwent the procedure and recovered quickly. Within a week, his doctors switched on the neurostimulator and Dr. Theriault’s tremors disappeared immediately.

“With the tremor gone, I looked normal,” says Dr. Theriault. “It gave me a new lease on life.” He now takes just three pills a day.

Dr. Sachs received intensive training at Stanford University before launching the DBS program and research facility. Instrumental in the program’s development was Postdoctoral Fellow, Chad Boulay, and an extensive team of experts.

“We don’t know this for sure but we have some preliminary data that suggests that participants may be able to control the activity of the brain,” says Dr. Sachs. “If they are able to, then the question is: what does this let them do? Does this improve the smoothness of their movements, the reaction time, the accuracy?”

Research on both DBS patients and non-human primates at a facility in Waterloo continues to pave the way towards improved treatment for those living with Parkinson’s disease.

“It’s hard to put into words,” says Dr. Sachs. “It’s been a very rewarding experience.”

Bronwen Keyes-Beven

The Ottawa Hospital has one of Canada’s leading neuroscience specialty clinics boasting 158 staff including scientists, clinician investigators, trainees and research staff. We care for more than 10,000 patients and oversee more than 113 neurological-related clinical studies.

We are turning neuroscience discoveries into real-life success stories for patients everywhere — everyday.

Find out more about neuroscience breakthroughs at The Ottawa Hospital at TenderLovingResearch.ca
When some people look at seven-year-old Jaxson, they see a brain tumour survivor who is now unable to breathe, eat, or stand on his own, but Candace Breynaert simply sees her son. Jax was just a toddler when he started vomiting profusely and losing developmental milestones, to the point that he could barely lift his head off the floor. His family decided enough was enough and took him to the hospital, where the tiny two-year-old had a seizure in his mother's arms. After extensive scans, physicians found out why. Jax had a medulloblastoma tumour, the most common form of childhood brain cancer.

“It was heart wrenching,” says Breynaert. Jax endured surgery and high-dose chemotherapy, and was eventually declared tumour-free — but eight months later, his cancer returned.

Hearing it the second time, that was the worst feeling,” says Breynaert, who left her job to care for Jax full-time. “You’re not left with many options because you’ve pretty much exhausted them the first time around.”

Jax’s story is tragic, but not uncommon, says Susan Marshall, CEO of Brain Tumour Foundation of Canada, who lost her son to medulloblastoma.

Every day 27 Canadians learn they have a brain tumour, a diagnosis that is particularly challenging for children. Brain tumours are the leading cause of solid cancer-related death in children, and the 60 percent of children who do survive often live with long-term side effects.

“Your brain is so central to your life and your quality of life that there is a sense of urgency around this,” says Marshall. “We really need to do something better for these patients and their families.”

Changing perspectives

When brain cancer patients are diagnosed, physicians look at the makeup of their tumour to determine the best course of therapy. If the tumours return after treatment, medical teams typically decide the next steps based on what they knew about the tumours at diagnosis. However, new research has found flaws in this approach.

According to a study published in Nature, the genetic makeup of tumours in children with medulloblastoma is vastly different at diagnosis than at recurrence.

“For a long time people thought of cancer as a static thing that wouldn’t change, like a picture of an old relative that hung over the fireplace for 200 years and just stayed the same,” says Dr. Michael Taylor, a neurosurgeon at The Hospital for Sick Children and co-supervisor of the study featured in Nature. “Now we know that cancer is more like a movie — it changes over time.”

With these findings, Dr. Taylor says that when tumours recur, physicians can now provide targeted treatments that are more effective and less toxic, hopefully improving outcomes for brain cancer patients.

“The way things were before, there was only a 1 in 20 chance of anything working,” says Dr. Taylor. “We want to make it so there’s a 20 in 20 chance.”

A brighter future

Marshall says brain tumour research like Dr. Taylor’s study is essential for providing some hope to patients facing unthinkable odds.

“There have been major advancements for some cancers, but not for brain cancer,” says Marshall. “We need to focus on it to make a difference.”

Improving brain cancer treatments does make a difference for patients like Jax.

“Knowing that we have options is everything to us,” says Breynaert. “Options in our world are huge, because we don’t get them very often.”

Because of kids’ growing brains and bodies, chemotherapy and radiation are detrimental to their ongoing development. Those who do survive a brain cancer diagnosis are often left with devastating side effects that change their lives forever — kids like Jax, who was just 21 months old when diagnosed and has battled brain cancer for five years.

Surviving childhood brain cancer isn’t enough. Our kids deserve to thrive.

Find out how your gift DOUBLES when you donate to Brain Tumour Foundation of Canada. Visit www.braintumour.ca/Jax.
Parkinson’s changes everything. It is a disease of the brain that touches almost every aspect of daily living, including: movement, mood, speech, eating and drinking, sleep, and cognitive changes.

Right now in Canada some 100,000 individuals with Parkinson’s are struggling with the symptoms and daily challenges of living with this complex neurological disease. By 2021, the Parkinson’s population is expected to double. With 10 more people diagnosed every day, research into improved treatments and a cure is more urgent than ever, as well as the need to train more movement disorder specialists to address the growing need for their services.

At Toronto’s Sunnybrook Research Institute, Dr. Sean Udow, a neurologist, is dividing his year as a Clinical Movement Disorders fellow between honing his clinical skills and researching the potential connection between blood pressure fluctuations and cognitive deficits in people with Parkinson’s disease and dementia with Lewy bodies. His fellowship and research is being funded by Parkinson Canada’s National Research Program.

“Blood pressure fluctuations may cause small silent strokes or transient alterations of brain networks that may worsen cognitive impairment,” says Dr. Udow.

Basic research is also critical to new advances in Parkinson’s treatment and knowledge. At the Lennard Tannenbaum Research Institute in Toronto, cell biologist Geoffrey Hesketh is investigating the function of the Retromer group of proteins, which he has linked to 10 genes that, when damaged, cause Parkinson’s disease. Through Hesketh’s work, Parkinson Canada funded research will work towards unlocking exactly how these genes work together and what other proteins they communicate with that may eventually point the way to a new drug or therapy that can treat Parkinson’s.

When she was 15 she suffered status epilepticus — a condition in which a seizure lasts too long or when seizures occur so close together the person doesn’t regain consciousness between them — and spent some time in coma. Her prospects had never looked more bleak.

Dr. Randi Druzin

Epilepsy is a condition in which a seizure lasts too long or when seizures occur so close together the person doesn’t regain consciousness between them — and spent some time in coma. Her prospects had never looked more bleak. "At certain points in our lives, we had both been told that we would never lead full, well-rounded lives."
Women's Brain Health and Aging announcement of the Wilfred and Joyce Posluns, research chair in women's Brain health and aging. Photo: submitted.

A First For Women's Brain Health

Greater focus on sex-based differences can lead to better health outcomes for both men and women.

As people across the globe pause to increase awareness of the progress and benefit of brain research during Brain Training Week, news of an exciting first for women is taking place here in Canada: the announcement of the Wilford and Joyce Posluns Family Foundation Research Chair in Women's Brain Health and Aging.

The chair will be held by Dr. Gerlinde Metz, a neuroscientist at the University of Lethbridge’s Canadian Centre for Behavioural Neuroscience, finding new treatments that reverse preterm birth risk. Photo: Submitted.

Ancestral stress delivers a one-two punch, affecting our health and well-being both physically and emotionally.

Understanding ancestral stress may help better predict and prevent disease "Together with our exceptional team of collaborators and trainees, our next step is to identify the mechanisms — including how the brain translates stress to alter brain health. Women suffer from Alzheimer's disease more than men, and over 70 percent of new Alzheimer's patients are women. Women are not only at greater risk of developing Alzheimer's disease when compared to men, per capita, but also bear six times the cost of Alzheimer's disease care that men do. Yet research today still focuses on men. If scientists can figure out the mechanism that causes more Alzheimer's disease in women, they might be able to develop treatments that halt the process.

Recognizing that we need to change the dialogue and put women at the forefront of scientific discovery, The Posluns Family Foundation, the Canadian Institutes of Health Research (CIHR), Ontario Brain Institute (OBI), and the Alzheimer Society of Canada (ASC) have joined together to financially support a research chair position to study cognitive aging and associated disorders in relation to sex and gender — the first of its kind in Canada.

Shining light on diseases This chair will support an exceptional researcher working to enhance women's brain health through the study of cognitive aging and associated disorders. More specifically, this initiative will build capacity in research that accounts for gender and sex — that is, social and biological influences on brain health and aging for women. The chair holder will work to translate the research results into gender- and sex-sensitive policies and interventions that improve brain health and promote wellness in aging. This project will contribute substantially to research needs for the next 10 years to examine female brain health concerns in Canada, advancing our understanding of why women experience dementia differently, by doing so we hope to develop effective treatments and a cure that meets women's needs specifically.

The partnership and research chair position shows that Canada has reached a tipping point in which we must address differences between men and female brain health research — that we need to find answers to progress women's brain health. This move is a significant one in the right direction to finding solutions.

Dr. Gerlinde Metz

Dr. Gerlinde Metz is a neuroscientist at the University of Lethbridge's Canadian Centre for Behavioural Neuroscience, finding new treatments that reverse preterm birth risk.
Imagine if every drug for the treatment of diseases like Alzheimer’s and Parkinson’s that has been tested and failed in the past 20 years could be given a second chance. What if one discovery could improve the effectiveness of some or even all of those therapies? What could it mean for the more than 16-million Canadians over this generation who will be impacted by these types of diseases, which until now have been untreatable and incurable?

For most of us, the prospect is almost unimaginable. But, the Weston Brain Institute is betting on it. Literally.

The focused ultrasound project is one of these big bets: a high risk, high reward research project with the potential to make a transformative difference in treating neurodegenerative diseases of aging. Canadian researchers Dr. Isabelle Aubert, Dr. Sandra Black, and Dr. Kullervo Hynynen at Sunnybrook Research Institute and University of Toronto have unlocked a non-invasive way to deliver medication deep into the brain. The technique permeates the blood-brain barrier, a layer of tightly packed cells that acts like plastic wrap, surrounding each of the brain’s blood vessels. This way, treatments that were previously blocked can now reach the areas of the brain they are intended to treat. Simply put, this changes everything.

**Weston Brain Institute helps bring breakthroughs to Canadians - faster.**

Using our unique business-based approach, the Weston Brain Institute identifies high-risk, high-reward research with the potential to transform the treatment of diseases like Alzheimer’s, Parkinson’s and ALS, like the revolutionary focused ultrasound project from the Sunnybrook Research Institute.

We provide researchers with the support necessary to get breakthroughs to Canadians faster – from financing, counsel and important networks to clinical trial assistance and business advice.