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BRAIN CANCER New research restores hope to a child. **p05**

EPILEPSY A young woman's inspirational journey. **p06**

NEUROLOGICAL CONDITIONS

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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.

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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.

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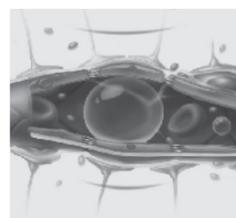




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How it can affect the health of future generations.
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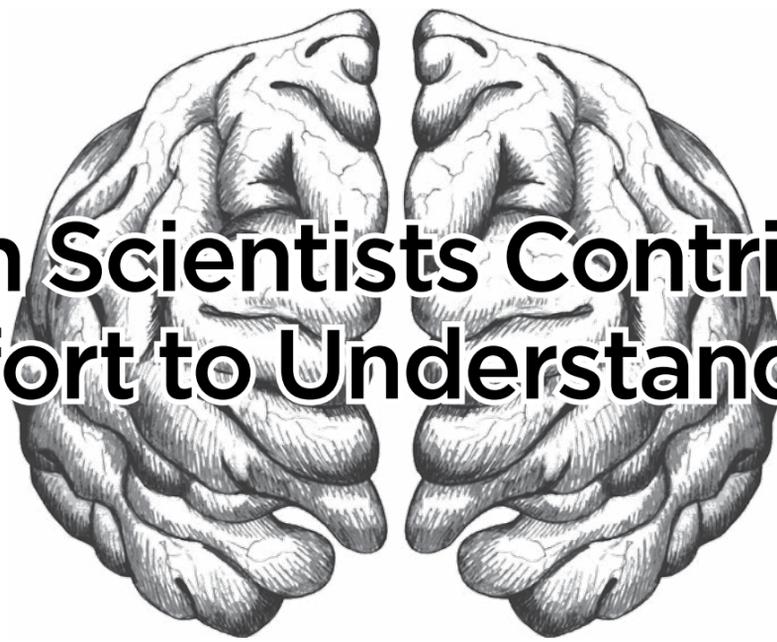


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Canadian Scientists Contributing to Global Effort to Understand the Brain



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.

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, 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

Brain disorders carry an economic burden that is greater than cancer and cardiovascular disease combined. 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 human brain is underway. Currently, nine large-scale brain projects across four continents have been launched or are in the planning phases. Canada, the United States, the European Union, Japan, China,

and other countries have committed an amount upwards of \$7-billion over the next decade to new initiatives to better understand the brain and brain disease.

A culture of collaborative brain research

Canada's contributions to brain research began in 1934 when Dr. Wilder Penfield founded the Montréal Neurological Institute and Hospital — 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 is a model that has been adopted around the world. Since that time, brain research centres have been established across Canada and Canadian scientists have made some of the most important 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 clinicians. Understanding the brain is



Inez Jabalpurwala
CEO, Brain Canada

“There are about 1,000 disorders of the brain, and it is estimated that **1 in 3 Canadians** will be directly impacted.”

no longer just about neuroscience — it's about joining disciplines such as chemistry, physics, mathematics, engineering, computer science, and ethics. Canadian research has always 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 are also emerging, with Canada leading a public-private partnership to increase investments in brain research. In 2011, the Government of Canada established the Canada Brain Research 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 discovery, to the translation of discoveries into useful products or services, and their application to people with brain disorders.

While Brain Canada does not fund outside this country, we encourage and foster linkages between Canada and other countries. Our partnerships with the Alzheimer's As-

sociation and the U.S. BRAIN Initiative are examples of how Canada is working with international partners to accelerate the pace of discovery. Our partnership with Canadian Institute for Advanced Research (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 patients, 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.

Canada has been — and is — at the forefront of brain research. For it to remain forefront we need to ensure that we increase funding to a level that meets the capacity of Canada's world-class researchers. With timely investments in research and infrastructure, Canadian scientists will continue to make major contributions to the global quest to understand the brain and to promoting brain health — to the benefit of all Canadians. ●

Mental Health Challenging Canadians

In September 2014, the Government of Canada and Neurological Health Charities Canada released *Mapping Connections: An Understanding of Neurological Conditions in Canada*. A critical part of the report focused on the experience of mental health challenges faced by Canadians diagnosed with a neurological condition.

The report found that Canadian adults with a neurological condition experience mood and anxiety disorders at a rate two and a half times higher than the general population. It was also found that not only do



they have a higher likelihood of experiencing a mental health disorder, but the severity of the condition is also significantly higher.

It is not only the person with a neurological condition who is at a higher risk of experiencing a mental health disorder — it is their caregivers as well. From a sample of parents caring for their children with a neurological condition, a third of the parents interviewed had accessed mental health assistance. For caregivers of Canadians with neurological conditions where cognitive impairment is present — like Alzheimer's disease, other dementias, and Huntington's disease — caregiver distress more than doubles.

The report finds that although there are higher mental health needs in Canadians with neurological conditions, access to adequate services can be challenging. Nearly a third of publically funded acute care hospitals, long-term care facilities, and community outpatient centres from across Canada indicated that they did not accept individuals with psychiatric or severe behavioural disorders. Furthermore, less than 10 percent had access to a neuropsychologist and only 3 percent had access to a neuropsychiatrist. ●

Jacquie Micallef, Manager, Neurological Health Charities Canada

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Working together to improve the lives of Canadians affected by neurological conditions.



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NHL Legend Eric Lindros a Champion of Concussion Research

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 three 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.

Mediaplanet What was the highlight of your hockey career?

Eric Lindros I am very proud to have had the opportunity to represent Canada at various levels of international hockey, from World Junior Championships at 16 years old to 3 separate Olympic games. I still wear my Canadian Olympic boots.

MP What was the lowest point?

EL Injury and the realization that although contributing, I was a shadow of my former self on the ice and was not enjoying the game anymore because of that.

MP What kind of impact did concussions have on your career?

EL There are many layers to this question. There is the physical impact, knowing that you aren't able to play to the level you are used to; the mental impact, where you have fears of your future in life during — and after — hockey; and then the game impact, whereby other players take liberties knowing that you are playing with a dent in your armour.

MP How would your career have been different if you hadn't suffered concussions?

EL I would have enjoyed the game more. I wouldn't have had the fear of cutting through the middle of the ice in the second half of my career. I would have played more games and been able to contribute more.

MP What message do you have for professional and amateur athletes about concussions?

EL Concussions are a real and potentially life impacting injury. They should be taken very seriously. If they are diagnosed early and treated with caution, in all likelihood you will make a full recovery. It is a difficult message for competitive athletes to understand but in the long run, your mental health is more important than getting back into the game too soon.

MP Do you have a particular message you would like to send to kids playing sports or their parents?

EL Sports are fantastic and an important part of children's lives. There are so many positive life lessons in sport — including teamwork, striving to be the best that you can be and of course, having fun. Concussions should not prohibit children from playing sports. Concussions are a risk in sport, just as they are with riding a bike and many other situations where accidents can happen. Know your child. Be aware of your child's behaviour in their day-to-day demeanour. Make sure you are medically cleared before getting back into the game.

MP What development in concussion research are you most enthusiastic about and why?

EL Dr. Arthur Brown's research at Western University, Roberts Research Institute. [Editor's Note: Read more about Dr. Brown's research on page 3]. It is the first time I have seen work that could result in a quicker recovery from concussion symptoms. I am excited to 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 concussion based: for example, amyotrophic lateral sclerosis (ALS). We need more funding to continue the research and I hope we can achieve those goals. I will continue my support of this world-class concussion research, care, and awareness. I truly hope we can make a difference.

MP Given that you're a father now, how would you feel about your kids playing competitive hockey when they get older?

EL Hockey is a wonderful game. The best game in the world in my eyes. That said, there are a few rule changes that I would like to see altered including rink width and the two line pass rule. The more space there is on the rink, the more space there will be for the players to manoeuvre. If my three children decide to play, I would certainly be supportive and have a ball playing with them. **Q**

+ Read more from answers from Eric Lindros at personalhealthnews.ca

"I was a shadow of my former self on the ice and was not enjoying the game anymore."

Photo: Eilif Rey

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 Roberts Research Institute, what people need to understand is that even mild, unremarkable hits to the body or the head may result in a concussion.

Repeated mild hits are what can lead to long-term problems, like Chronic Traumatic Encephalopathy (CTE), which can often have a crushing effects on its victims. "With CTE comes all sorts of problems in terms of mood disorder," says Dr. Brown. "People tend to have problems controlling their temper, and a very high rate of suicide, which is so devastating. These people spend their lives entertaining us, we love and idolize them. They then go into retirement only to have these unfortunate problems arise."

One thing that seems to be unanimous amongst the top researchers in this field, is that the most effective form

of prevention against 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, luminaries like Lindros are actually integral to the cause.

"Everybody uses the word transformational a little bit too much, but I think it's actually applicable here," says Dr. Strong. "To have somebody like Eric who, at the peak of his career, says 'I'm done' because of the long-term risks, is really inspirational."

After the blow

Though awareness is paramount, once a concussion occurs medical science currently offers little in the way of therapies beyond mandatory complete rest.

Doctors Dekaban, Brown and Strong are taking a three-pronged approach in an effort to develop new therapies for concussion. The first is led by Dr. Dekaban. The goal is to reduce inflammation in the damaged brain by blocking white blood cells from entering the site of injury where they cause more harm than good.

The second prong is to maximize brain function after injury. Dr. Brown's laboratory has focused on developing a strategy to augment what he calls neuroplasticity,

the brain's natural ability to rewire itself.

"After the nervous system is done developing, it needs signals telling it to stop growing," said Dr. Brown. "Every green light, needs a red light in the body because you don't want to be constantly rewiring your nervous system. The problem is, once the nervous system is damaged, those red lights are still there. So what we've done is found a master switch protein that turns off the red light. By blocking it we decrease the inhibitors in the brain and the spinal cord and we therefore open up greater opportunities for plasticity."

The third prong is to prevent a form of dementia called CTE, perhaps the most debilitating consequence of concussion. Dr. Strong's laboratory is investigating why abnormal proteins aggregate in brains of individuals with multiple concussions with an eye on strategies to block this buildup.

These research programs are showing promise at various stages of preclinical development and ignited the interest of Eric Lindros.

"Developing therapeutics is a long and hard road to climb," said Dr. Brown. "We have been incredibly fortunate to have Eric Lindros helping by pulling and pushing us up this hill. The sheer force of his conviction that this work needs to get done is a huge boost to our programs. Though not a scientist, Eric is definitely part of the team." **Q**

Daryl Keating



Dr. Arthur Brown
Associate Professor,
Roberts Research
Institute



Dr. Gregory A. Dekaban
Scientist, Professor,
Roberts Research
Institute



Dr. Michael Strong
Dean, Schulich
School of Medicine
and Dentistry

April is Parkinson Awareness Month

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Groundbreaking Research Offers Hope to Parkinson's Patients

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

Dr. Adam Sachs, a neurosurgeon at The Ottawa Hospital, improving deep brain stimulation therapy. Photo: Submitted

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.

Seizing the opportunity

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 underwent DBS in 2014 and became one of Dr. Sachs' research volunteers.

"With the tremor gone, I looked normal... It gave me a new lease on life."

"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



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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.

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Driven by compassion.

Brightening the Future for Children with Brain Cancer

Meet seven-year-old Jax, a pediatric brain tumour survivor whose tragic story is all too common. Groundbreaking brain cancer research hopes to change that.

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, phys-

icians 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." 

Ishani Nath



Dr. Michael Taylor
Neurosurgeon,
The Hospital for Sick Children



Susan Marshall
CEO, Brain Tumour
Foundation of Canada,



“ For us, what's worse than the cancer itself is the treatment that's caused so much damage to Jax. Candace, Jax's mom ”

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.



INSIGHT

Research Holds the Key to Unlock the Parkinson's Mystery, Find Treatments, and a Cure



Geoffrey Hesketh
Cell Biologist,
Lunenfeld
Tanenbaum
Research
Institute



Dr. Sean Udow
Neurologist,
Sunnybrook
Research
Institute

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 stigma and daily challenges of living with this complex neurological disease. By 2031, 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 this year as a Clinical Movement Disorders fellow 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 Lunenfeld 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 Parkinson Canada funded research, he 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. ●

Kelly Mills



Epilepsy Treatment Gives Ontario Woman a New Lease on Life

It's been four years since Katelyn Lewis had the unsettling dream, but she can still recall it in vivid detail. She dreamt that her boyfriend asked her to marry him. When she said yes, he dipped her low and told her she would never regret it. The dream was bittersweet.

Cody had suffered a seizure while sleeping a few weeks before and suffocated in his pillow. Katelyn, her father, and two of the young man's friends found him face down in his bed.

"His friends told me Cody had been planning to ask me an important question," she says. "I found out he was about to ask me to marry him. If he had lived, we would have been engaged two days later."

The couple had been dating for three months, united by common interests and a common experience. They were both among the 300,000 Canadians who suffer from epilepsy and they faced unique challenges because of it. "At certain points in our lives, we had both been told that we would never lead full, well-rounded lives," she says.

About 16,000 Canadians diagnosed each year

Epilepsy can begin at any age. Katelyn was barely a year old when she had her first seizure. Her situation worsened and, in time, she was suffering dozens of tonic clonic (grand mal) seizures daily. Seizures are brief episodes caused by a temporary disruption of regular brain activity and typically last from seconds to a few minutes. She was one of the unfortunate few for whom medication didn't work.



Approximately
1 in 100 people
have epilepsy



In 50% of cases the
cause is unknown



There are more than
300,000 Canadians
living with epilepsy



Epilepsy is **NOT contagious,**
a disease or a mental disorder

Source: Epilepsy Ontario



Katelyn Lewis, now seizure-free living in her hometown, Thunder Bay, Ontario. Photo: Submitted

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 a coma. Her prospects had never looked more bleak.

But, a year later, in 2009 surgeons removed the right temporal lobe of her brain, where her seizures originated, and her life changed. She is now seizure-free and is a student at Confederation College, near her home in Thunder Bay, Ontario, where she is studying to become a personal support worker.

The surgery diminished her memory to an extent but she has found a way to cope. "Watching and listening isn't enough for me to retain the information," she explains, "so when it comes time to prepare for exams, I read aloud or use flashcards."

Katelyn, 22, takes anti-seizure medication as a precaution. Medication is the first line of treatment and about two-thirds of people become seizure free with it.

Epilepsy Inspiring career change

Katelyn, who is also taking nursing classes, plans to devote her life to helping others, including some of the 16,000 Canadians who are diagnosed with epilepsy each year. She attributes that decision to the disease that almost took her life.

"Epilepsy had a lot to do with my career choice," she says. "I've spent a lot of time in hospital and I've been treated by many wonderful nurses. It's their care and compassion that made me decide to make a difference in people's lives."

Katelyn will never forget the young man with whom she shared a unique bond. "To meet Cody and have his love and support was wonderful," she says. "I don't believe in coincidences. He came into my life for a reason." ●

Randi Druzin



Inspired by patients.
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of those with epilepsy -
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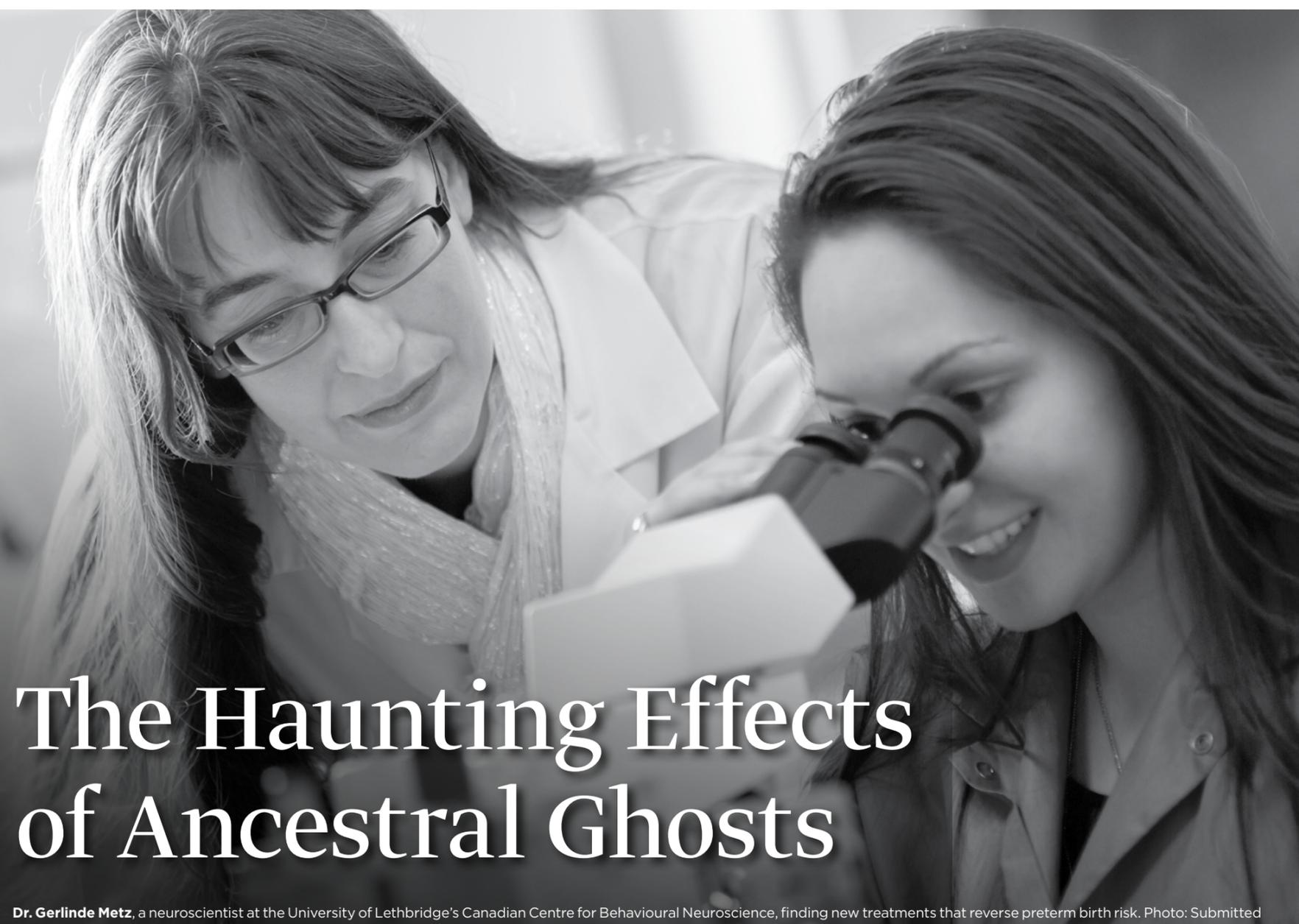
HOW DOES TRANSGENERATIONAL INHERITANCE OF STRESS IMPACT NEWBORN HEALTH?

Dr. Gerlinde Metz, a neuroscientist at the University of Lethbridge Canadian Centre for Behavioural Neuroscience, is pioneering research showing that ancestral stress can influence a mother's risk of preterm birth, diabetes and the development of her baby. Her research could translate into new treatments to reverse preterm birth risk and improve maternal and newborn health outcomes.

The University of Lethbridge congratulates Dr. Metz and her team for bringing new light to ways we can promote healthy futures for generations to come.

ulethbridge.ca





The Haunting Effects of Ancestral Ghosts

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.

Now, new research by Dr. Gerlinde Metz at the University of Lethbridge's Canadian Centre for Behavioural Neuroscience, shows just how damaging and pervasive stress may be — its effects even crossing multiple generations through pregnancy.

“We have developed models to explore how stressful experiences can travel from one generation to the next to influence stress resiliency and risk of disease,” says Metz, a professor of neuroscience and the U of L's Board of Governors Research Chair in Healthy Futures. “Our work has shown that experience not only in parents, but also in grandparents and generations beyond can influence health and disease from early development to old age.”

Her team's pioneering research has shown for the first time that remote ancestral stress — several

generations removed from a mother — can influence her risk of preterm birth, diabetes, and the development of her baby.

“These are important new insights, because in about half of the cases of preterm birth the causes are not known,” she says. “Here we have identified a new mechanism that allows us to better predict the risk of preterm birth for a mother. Together with our collaborators, we plan to use this knowledge to find new treatments that can prevent early labour.”

Funded by the Natural Sciences and Engineering Research Council of Canada, the Canadian Institutes of Health Research, and the Alberta Centre for Child, Family & Community Research, Metz's team includes work by both graduate and undergraduate students.

Understanding ancestral stress may help better disease prediction and prevention

“Together with our exceptional team of collaborators and trainees, our next step is to identify mechanisms — including how

“Stress generates an ancestral ghost that will affect the health of **future generations.**”

the brain translates stress to alter pregnancy health — and identify diagnostic markers of prenatal stress that guide future human studies of early biomarkers in risk assessment,” says Metz.

She highlights that transgenerational inheritance of stress responses may explain many complex diseases and mental health conditions for which the causes are poorly understood. Often, the risk of such conditions runs through families.

“It is as if stress generates an ancestral ghost that will affect the health of future generations. These ancestral experiences are not passed on through changes in the genetic code of the DNA. Instead, stress induces an epigenetic footprint that will be passed on to future generations,” says Metz. Epigenetics refers to an external influence that changes the expression of a gene, meaning that a stressful experience can essentially leave a mark that is transferred from one generation to the next.

Making a recovery

Metz and her team's latest work is focused on translating epigenetic signatures of stress into the discovery of new predictive biomarkers of disease, thereby creating the opportunity to develop personalized medicine.

To advance preventive therapies, her research also determines if environmental enrichment and drug treatment are able to improve maternal and newborn long-term health outcomes.

“We have some new intriguing findings that demonstrate that an enriched environment can reduce the impact of ancestral stress,” she says. “While we cannot reverse the stressful experiences of our ancestors, healthy lifestyle changes are a means to intervene at any time in life. We hope that these encouraging results will translate into new treatments that promote healthy futures for our children and next generations.”

Dr. Gerlinde Metz

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 Awareness Week, news of an exciting first for women is taking place here in Canada: the announcement of the Wilfred and Joyce Posluns Research Chair in Women's Brain Health and Aging to

act as a leader in developing qualitative knowledge on the subject of brain health.

Our differences do matter

Through my philanthropic work with the Women's Brain Health Initiative, I became increasingly aware of how few research initiatives specifically looked at the impact of the sexes with respect to brain health. Women suffer from depression, stroke, and dementia twice as much as men as we

age, 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, they 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



Wilfred and Joyce Posluns, Research Chair in Women's Brain Health and Aging. Photo: Submitted.

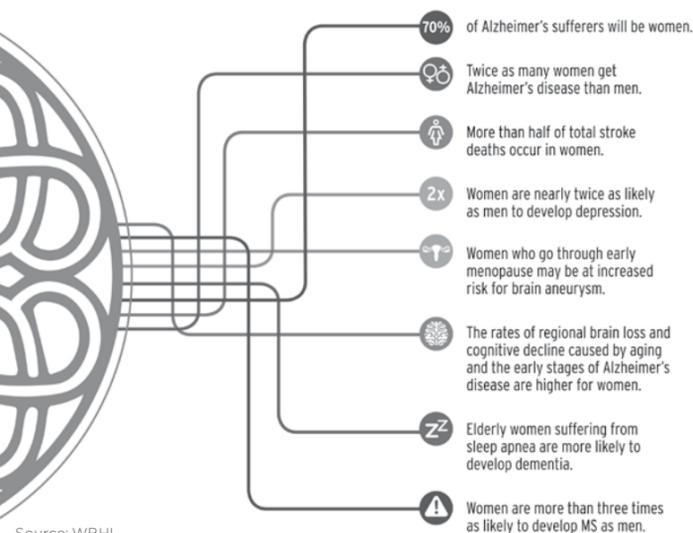
for gender and sex — that is, social and biological influences — on brain health and aging for women. The chair holder will work to translate the research results into gender and sex-sensitive policies and interventions that improve brain health and promote wellness in aging.

This project will contribute sustained resources 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 male 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.

Lynn Posluns, Founder and President, Women's Brain Health Initiative



The Big Bet Theory



A business-based approach to accelerating treatments in the fight against neurodegenerative diseases of aging.

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 transformational 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.



Dr. Isabelle Aubert
Researcher,
Sunnybrook
Research
Institute

Based on its more than money philosophy, the Institute supports researchers with all of the resources required to get a breakthrough off the ground, from financing, counsel, and important networks to clinical trial assistance and business advice.

According to Dr. Aubert, "It is unique in Canada to get such targeted funding, plus all of the additional support it takes to truly advance the science."

When The W. Garfield Weston Foundation established Canada's largest privately funded national initiative in brain research, it committed not only \$50-million but also a full suite of resources for the best and brightest in Canada. At the time, Andres Lozano, Chair of the Institute's Scientific Advisory Board and the Neurosurgery Department at U of T ex-



Alexandra Stewart
Executive
Director,
Weston Brain
Institute

pressed a sense of urgency and a commitment to find and support revolutionary research.

Executive Director Alexandra Stewart says, "We go all-in on projects that are addressing areas of greatest impact." She adds, "To get from research to treatment, we know it takes funding, mentoring and a long list of resources. Canada has a world-class neuroscience research community, but needs more resources to quickly and effectively translate discoveries into treatments. It's a gap that can put Canadian researchers at a disadvantage."

With its focused, business-based approach to support, it's a gap the Weston Brain Institute is determined to close. You can bet on that. **Q**

Rob Mabee

"The focused ultrasound project is one of these big bets: a high risk, high reward research project."

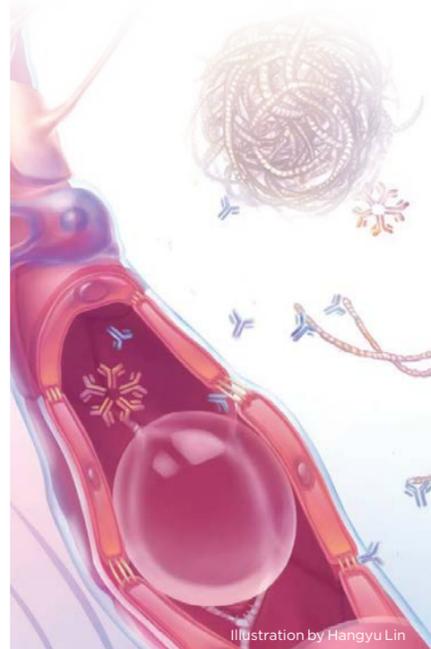


Illustration by Hangyu Lin

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.



COURTESY OF SUNNYBROOK RESEARCH INSTITUTE.



Weston Brain Institute is a proud supporter of Canadian researchers, furthering discoveries in the neurodegenerative diseases of aging.



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