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MEDIA PLANET

ADVANCEMENTS IN NEUROSCIENCE

4 STEPS IN RESEARCH AND INNOVATION

CANADIAN NEUROSCIENTISTS

Studying the brain as a path to new treatments and cures

Neuroscience studies what makes us who we are: our emotions, thoughts and behaviors are products of our brain activity, and are communicated to all parts of our bodies by a network of nerves. Together the brain, spinal cord, nerves throughout our body, and the cells that support them form the nervous system. Understanding this complex system is what neuroscientists across the country are achieving, helping to learn how to keep it healthy, and discovering how to repair it when it is affected by disease or injury.

Prevalence

One in three Canadians will be affected by a neurological disorder, injury or psychiatric disease in their lifetime, making these a leading cause of disability. Depression, schizophrenia, Alzheimer's disease, traumatic brain injury and multiple sclerosis are only a few of the over 1000 known conditions affecting the nervous system. They can strike anyone, irrespective of their age, income or culture, often without warning, and many have chronic consequences.

The costs of brain-related conditions, both personally and to our economy, are immense. Health Canada has estimated the economic burden of neurological and psychiatric conditions in a given year to be over $22 billion, which represents 14% of the total burden of disease in this country, more than cardiovascular disease and cancer. Brain Canada estimates that when the costs of living with a neurological or psychiatric condition are considered, the economic burden balloons to $60 billion. And that does not take into account the pain and suffering of many patients and the effects on their families.

Funding research

These patients know too well that there are no cures for neurological or neuropsychiatric conditions, and few effective treatments. Paradigm changing new ideas are needed to help them. Canadian neuroscientists, who are amongst the best in the world in terms of productivity and quality of research, are actively seeking the new avenues of research that will lead to breakthrough discoveries. These researchers need support from the public, the government, charities, and the private sector to reach their goals.

Funding for neuroscience research in our country is only about $7 per person. We urgently need increased funding to learn about how the brain and nervous system works, in order to accelerate the path from discovery to treatments and cures. Just this year, the federal government recognized this, and provided $100 million over five years to the Canada Brain Research Fund, administered by Brain Canada and developed in partnership with the Canadian Association for Neuroscience, to support novel and innovative neuroscience research. Brain Canada will match these funds by raising $100 million from private donors and charitable contributions, a welcome boost for neuroscience research. This type of investment, while significant, is modest compared to the economic impact of brain diseases, and will hopefully be the start of increased funding for biomedical research from government to the Canadian Institutes of Health Research, and from the private sector.

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Common threads

Neuroscientists have already found commonalities underlying the more than 1000 neurological and psychiatric conditions that occur when the nervous system is defective or injured. All of these conditions are due to one of these four causes: cells die, cells malfunction, a chemical or molecular imbalance occurs, or the connections between cells goes awry. Only by understanding these root causes and mechanisms can we hope to find effective therapies, and eventually cures.

Canadian neuroscientists are using state-of-the-art techniques to study the nervous system. Neuroscience today is a truly multidisciplinary field, integrating medicine, biology, chemistry, physics, mathematics and psychology to understand the nervous system. The integration of all these tools will allow us to understand what makes us who we are, lead us to discover how to keep our brains healthy and eventually, help patients recover their health.

The Canadian Association for Neuroscience (CAN) is the largest association dedicated to neuroscience research in Canada.

Branding neurological Disorders

The over 1000 neurological and mental health conditions are represented by a seemingly equal number of charities, each dedicated to individual conditions such as autism, schizophrenia, Multiple Sclerosis, Alzheimer's, and Parkinson's. However, there are important similarities and consequences to the brain between each of these conditions. In Alzheimer's and Parkinson's, for example, brain cells prematurely die, and patients with these neurological conditions exhibit impairments in their mental health. It is likely that a cure for one neurological condition will be used for many others, given their similarities. We should consider neurological and mental illness as one disease, much as the over 100 different cancers are considered by the Canadian Cancer Society and the Canadian public as a single word, "cancer". Like the Canadian Cancer Society does for cancer, a national non-profit charitable foundation dedicated to finding cures for all neurological and mental health conditions would be best positioned to lead the fight for research and be a unified voice for patients and their families, caregivers, and scientists.

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CHALLENGES

Elevating brain health on the policy agenda

The brain is the least understood organ of the body and yet the most important. When an individual is faced with a brain condition, every aspect of their life may be compromised. There are over 1,000 different types of brain disorders - neurological, developmental and psychiatric - affecting people at every age and stage of life. Some are linked to genetics, others, more random. While neuroscience continues to make amazing discoveries, information about the cause and cure of most neurological conditions remains a mystery.

A united front

According to the World Health Organization, neurological disorders affect approximately one billion people world-wide. In Canada that number is 5.5 million. Currently, it is expected that 1 in 3 Canadians will experience a brain or mental health condition at some point during their lifetime.

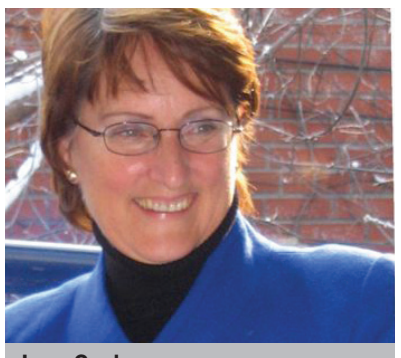
In 2008, Neurological Health Charities Canada (NHCC) was formed as a collective of charitable organizations tasked with working to improve the quality of life for all persons living with chronic brain conditions, disorders and injuries, and their caregivers, by elevating brain health to the top of government agendas and ensuring that research, prevention, treatments and supports for those living with chronic brain conditions are universally accessible. For the first time in Canadian history, the momentum to elevate the importance of the brain on the policy agenda is beginning to build.

At the provincial level we have recently witnessed the birth of organizations like the Ontario Brain Institute and the Brain Research Centre at the University of British Columbia. At the federal level, when NHCC first approached Parliament, we focused on three key objectives: to establish a population health study to measure the prevalence and incidence of brain conditions in Canada, to make brain health a key priority for policy decision makers, and to establish a Canadian Brain Strategy. The response has been swift.

A plan of action

In 2009, the Government of Canada provided $15 million to fund the National Population Health Study on Neurological Conditions, a project managed jointly by NHCC and the Public Health Agency of Canada (PHAC). Later that year, and in parallel to the "Study", the federal Health Committee passed a motion for parliamentarians to conduct their own review of brain conditions.

This past June, the federal Health Committee's review was completed and its findings tabled to the House of Commons in a report entitled: Focusing on the Brain: An Examination of Neurological Diseases in Canada. The report focused on three broad themes: the brain as a whole, fostering neurological research in Canada, and improving the quality of life for those with brain conditions. It also provided key recommendations including, that "the Government of Canada consider using the results of the National Population Health Study on Neurological Diseases in collaboration with the provinces and territories, as the basis of a pan-Canadian strategy for neurological diseases".(p.11).



Joyce Gordon
Chair, Neurological Health Charities Canada and CEO and President, Parkinson Society Canada

"In this report, you will learn about some of the most exciting research and innovations coming from the minds of Canadians, the potential impacts on discoveries being made in Canada, and overlapping benefits these potential cures and treatments can have."

This recommendation was not only strong but very timely. The National Population Health Study on Neurological Conditions will conclude in 2013 and we are hopeful that the collected data will be used to form an evidenced-based Canadian Brain Strategy. We strongly encourage all Canadians to get involved in the support and development of this strategy.

A more intelligent future

In the fall of 2013, NHCC and PHAC will be conducting a consultation process with the public through online surveys as well as with key stakeholder groups through regional meetings. Feedback from this process will be used to help finalize a report on the Study's key findings to be tabled to the federal Minister of Health. Your voice matters. Please get involved by joining our National Brain Community. Register at mybrainmatters.ca and help us build a National Brian Strategy for all Canadians.

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Cutting edge innovations

Science and medicine are sometimes synonymous when it comes to finding ways for patients to lead more normal lives.

The neuroscience research being done at the Krembil Neuroscience Centre at Toronto Western Hospital is on the cutting edge for breakthroughs in spinal cord injury, Parkinson's disease and other neural disorders.

The focuses of the overall research may vary, but the scope and implications suggest that intriguing advancements in modern science and biotechnology might lead to a lasting change for what are otherwise debilitating ailments.

Dr. Michael Fehlings is both a neurosurgeon and neuroscientist at the hospital, where the body of his work is aimed at uncovering how neural stem cells could proliferate and create nerve tissue to induce repair in spinal cord injuries.

Stem cell challenges

"We've injected these neural stem cells into the spinal cord where they find a path in the white matter, which is where nerve fibres are, and they help rebuild the residual nerve fibres to partially restore function," says Dr. Fehlings. "We develop these stem cells by taking skin cells and then introduce transcription factors, which essentially unlock areas of the DNA to transform that skin cell into an induced pluripotent stem cell."

Dr. Jonathan Brotchie has devoted his research to understanding the neural mechanisms that relate to movement disorders, particularly in Parkinson's disease. Research and testing have led to hundreds of novel chemicals over the last few years, 14 of which are drugs in clinical testing. The challenge is in showing they are safe to use in people without causing side-effects, and that they work, he says.

Breaking new ground

"We now have a good understanding that altering the levels or actions of several brain chemicals, including histamine and serotonin, both of which can suppress side effects of current treatments, and growth factors, which could change the course of the disease, can have benefits," says Dr. Brotchie. "With most of the treatments we are developing, we are breaking new ground, these are the first drugs of their specific class, and thus we have to constantly innovate to solve problems that we have not encountered before nor ever anticipated."

A deeper understanding

Other research at the Neuroscience Centre for neural disorders, like Parkinson's, Alzheimers and depression, has been focused on Deep Brain Stimulation (DBS), which treats these conditions with electrical stimulation akin to a pacemaker for the brain.

One of the leading researchers in DBS is Dr. Andres Lozano, also a neurosurgeon and neuroscientist. DBS surgery is considered "world-leading" in Toronto, and has been used to treat patients suffering from Alzheimers and depression, as well as techniques for Parkinson's.

"Various circuits in the brain control specific functions, and they malfunction with those illnesses, but we're now able to pinpoint those circuits and modify their activities," says Dr. Lozano. "Neurons are firing off, causing tremors in Parkinson's patients, while parts of the brain shut down with those who have Alzheimers. We're able to stimulate those using electrodes in DBS surgery, and we're now in trials to see how this will work with patients suffering from depression."

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WE RECOMMEND

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MEDIA PLANET

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Help lift the burden of a brain tumour

- Every day 27 Canadians are diagnosed with a brain tumour. There is no cure. Brain tumours are unpredictable and complex. They can affect vision, hearing, memory, balance and mobility. Their effects are physical, emotional, financial, and last a lifetime.
- A brain tumour is a growth of abnormal cells that is either within or around the structure of the brain. They can be primary or secondary in nature, and referred to as low-grade or high-grade and also as benign, non-malignant or malignant.
- Brain Tumour Foundation of Canada raises funds to lead research and provide vital services for the estimated 55,000 Canadians living with a brain tumour. Learn more at www.braintumour.ca.

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INSPIRATION

STEP 1

PUBLIC PRIVATE PARTNERSHIPS FAST TRACK COMMERCIAL VIABILITY

LIVING WITH DEMENTIA
Today's rate of 500,000 Canadians living with some form of dementia will double in the next 20 years.

Strategies toward a healthier Canadian brain

The World Health Organization and Alzheimer's Disease International warn that by 2030 there will be 65.7 million people around the world living with dementia – almost double today's number. Alzheimer's is the most common cause of dementia in older adults.

In this country, there are 500,000 Canadians living with some form of dementia today and that number will also double in the next two decades, according to the Alzheimer Society of Canada's Rising Tide Report. The impact of dementia on the health system, the economy and families will have enormous consequences if we don't slow down the tide of brain failure that is anticipated with an aging population.

Unfortunately, there does not appear to be any Alzheimer's blockbuster drugs on the immediate horizon. An emerging consensus in the field is that for an Alzheimer's therapy to be most effective, it will need to target the very earliest stages of disease possible. This may be at least a decade before clinical symptoms of memory loss even appear. Clinical trials of experimental drugs in symptomatic patients with Alzheimer's are vital and must continue, but they are just one piece of a multi-pronged approach that is needed for tackling the dementia problem.

Several promising initiatives are already underway in this country:

- The Canadian government has committed $100 million to establish the Canada Brain Research Fund – with the aim of attracting matching funds from the private sector to support promising research focused on finding new treatments for many different brain disorders, including Alzheimer's.
- The Canadian government is investing through the Ontario Brain Institute (OBI) to accelerate the commercialization of innovative neurotechnology devices, cognitive screening tools and software to improve cognitive abilities.
- A landmark project is underway to build what is planned as one of the world's largest brain research databases. The information repository will be like a Google for neuroscience and help lead to breakthroughs in earlier detection of illness and better treatments.
- Canada is also in a global race to build the world's first "virtual brain" designed to mimic the structure and functions of a real brain and its capacity to reorganize and be repaired after damage. The computer model will be a powerful tool for research and help clinicians customize cognitive rehabilitation programs for post-stroke patients and those with early Alzheimer's and other related disorders.
- Public and private sector investments have supported the the creation of MaRS Discovery District (an innovation centre) and Baycrest's Centre for Brain Fitness to fast-track development of commercially-viable products and services for the global marketplace.

Dr. William Reichman
Professor of Psychiatry at the University of Toronto and President and Chief Executive Officer of Baycrest Health Sciences

In addition to these efforts, a **National Brain Health Strategy** would be a welcome development and something those of us in leadership positions must continue to advocate for. The strategy should include:

- Public awareness campaigns to educate Canadians about the risk factors and early warning signs of dementia, and the healthy lifestyle practices that may protect brain function through the lifespan;
- Promotion of early diagnosis which can include computer-based cognitive screening programs that worried adults can do at home to determine if their cognitive changes are normal or they should see their doctor, new diagnostic tools for the doctor's office, and enhanced training for family physicians to diagnose and treat the disorders that cause dementia, including related conditions of disturbed memory ability such as Mild Cognitive Impairment;
- Accelerated investment in all areas of dementia research, including methods to detect Alzheimer's before symptoms begin, clinical drug trials, and non-drug research that explores the effectiveness of cognitive training programs for young and old, and how participation in the arts, post-retirement volunteering, cardiovascular exercise, healthy nutritional choices and intergenerational programs that bring young and old together in classrooms, may protect the aging brain;
- Enhanced supports for family caregivers who shoulder the heavy responsibility of caring for loved ones with dementia at home.

Like our fine Olympians who demonstrated this summer the tremendous commitment that is required to build optimal physical and mental fitness, we must all accept a personal responsibility to look after our health, including our brain health, and to make this a lifelong commitment. Physical exercise, healthy diet, cognitive stimulation – these are all good habits that must start in childhood and continue into old age. A healthy brain supports a healthy mind, and a healthy mind enables us to derive the greatest pleasures from all that life can offer, no matter how old we are.

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Understanding traumatic brain injury

It can be said that people take their brains for granted. The most complex and powerful organ in the human body, the brain is what helps us to breathe, think, move, interact and make decisions during every second of our daily lives. When the brain is injured due to trauma, everything can change in a split second. .

A traumatic brain injury, or TBI, is an insult to the brain resulting from a mechanical force occurring though an external blow to the head, or a significant jolt that throws the head back and/or forward. Viewed along a spectrum, concussions, or mild TBI are at one end, and severe TBI at the other. Eighty percent of TBIs are concussions/mTBI, with 10% moderate injury and 10% severe.

Traumatic brain injury occurs among the very young and the very old and everyone in between, however these two age groups are particularly at risk. Each year in Canada there are 50,000 TBIs of various degrees. This statistic is viewed as a gross underestimate because concussions/mild TBIs can be misdiagnosed, undiagnosed or initially overlooked. Because of the complexity of the brain, no two brain injuries are alike.

TBI is a major cause of death and disability worldwide. In Canada it is estimated that there are half a million people living with TBI. Common consequences are cognitive, physical and psychosocial in nature, and affect an individual, their family and daily life. Effects differ according to the severity of the injury, the person's life experiences, health and status before the injury and the amount of rehabilitation and support they receive. Most concussions/mTBIs resolve within a week to a few months but some can take years to get over. Sometimes the effects of TBI aren't immediately visible and can be misunderstood or judged by others. Someone can be walking and talking and seem fine, but can have great difficulty with memory or organizing their thoughts or activities, or may have trouble with impulse control and social awareness and get into arguments with those around them. A severe TBI will have lifelong consequences requiring ongoing supports to maximize the person's function and community participation. Return to prior employment rates after TBI are only around 38%, and children can have special requirements in returning to school as well as in their development over time. Depression and anxiety are common, and substance use issues can also be a factor. Stress on families is very high.

> "In Canada it is estimated that there are half a million people living with TBI "

Research in TBI over the past 20 years has led to significant advances. Improvements in pre-hospital, neurosurgical and intensive care protocols have saved the lives of people who would have died from similar injuries decades ago. Advances in imaging have enabled researchers and physicians to better understand the nature of TBI and consequences and are advancing knowledge about neuroplasticity. Evidence is showing that certain rehabilitation interventions and treatments are more effective than others, and that community supports are effective and necessary to improve the quality of life of people with TBI. There is more to be learned and more to be done.

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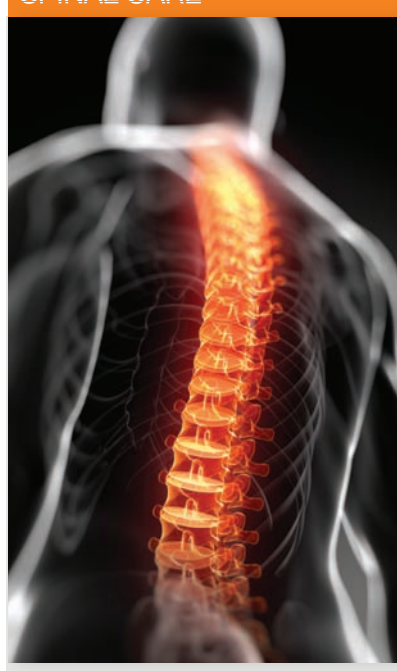
SPINAL CARE



Providing the best care is simply a matter of keeping up with science.... OR IS IT?

A spinal cord injury (SCI) disturbs the way people's body's work and learning to manage these problems is often difficult. Making sure that the skin is protected is very important because SCI lessens or removes the ability to feel problems with the skin. If the skin breaks down, people with SCI are at high risk of getting skin ulcers or pressure sores. Having a pressure sore reduces a person's quality of life and is costly to the health care system. Having to stay in bed, needing surgery or weeks, months or years of healthcare is common if a person gets a pressure sore. But skin break down is very preventable and manageable with lots of science and experts to explain how. So why are pressure sores still a problem even though many healthcare providers know the science and listen to the experts? The reason is that healthcare needs to be coordinated between teams of nurses, therapists, doctors, patients and other caregivers. If even one of the healthcare team is not on the same page as the others, the end result will not be as expected and may even be damaging to the patient.

Six rehabilitation centres in London, Toronto, Montreal, Quebec City, Calgary and Edmonton make up the The Spinal Cord Injury Knowledge Mobilization Network (SCI KMN). Supported by the Rick Hansen Institute, Alberta Paraplegic Foundation and Ontario Neurotrauma Foundation, all six sites are working together to work out the details of giving the best available care according to the science. Risk assessment for skin break down is the current topic area for SCI KMN and improving the ability to find skin problems and begin early treatment is the goal for this pan-Canadian network. Even though the science can be summed up in a single sentence for recommended care, a large part of providing excellent care is to know the details behind the science. For example, the science says to use a proven tool to assess the risk. However, there are many tools to choose from and staff need to learn who should, and how and when, to use the tools. Training, retraining and other staff supports must also be in place for the tools to be effective. SCI KMN will ensure that all lessons learned are in materials that can be shared over time and with other sites and caregiver organizations to adapt and customize. A key to the work of the SCI KMN is to measure the results of our work in order to continuously improve the delivery of the best available care.

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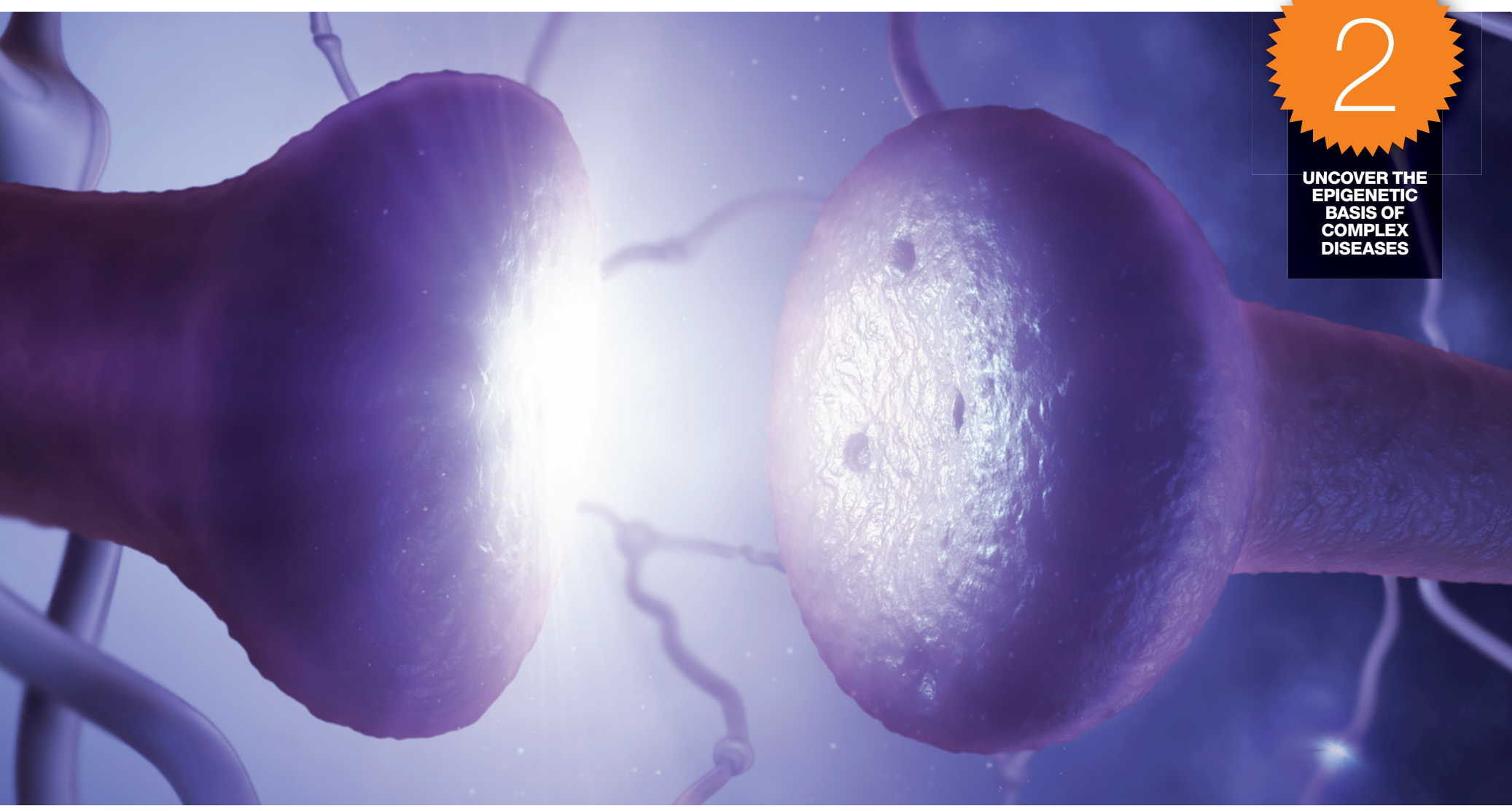
INSIGHT



Neuroplasticity and epigenetics: Neuroscience at a historic turning point

Epigenetics is a new field arising from the discovery that gene function can change and be inherited even if the underlying DNA does not change. It is the study of our genes – what we inherit from our ancestors (our DNA), and how they can change due to environment and other outside factors.

For example: If there are identical twins in the family, and one develops cancer and one doesn't. Does that mean the twins were not actually identical in every way, or are there outside factors - such as living in different areas of the country or contracting a disease the other did not? The most astonishing implication of this discovery is that the recent decoding of the human genome; an historic milestone, seems meager to the much larger issues now possible in understanding how genes work in human beings.

Nature vs. nurture

Neuroplasticity refers to changes in the structure of the brain due to experience. Specifically, it addresses changes in neural pathways and synapses which are due to changes in behavior, environment and neural processes, as well as changes resulting from bodily injury. In essence, the very act of thinking and learning makes physical changes to the brain, and this does not stop when children's brains mature as was thought earlier.

Neuroplasticity is modulated in part by genetic factors and in part by dynamic, epigenetic changes that influence the expression of genes without changing the DNA sequence. Epigenetic processes are of particular clinical interest because their external triggers (such as early parental care, diet, drug abuse and stress) can affect a person's vulnerability to many diseases, including psychiatric disorders. In addition, in contrast to genetic sequence differences, epigenetic alterations are potentially reversible, and thus amenable to public health policy interventions.

Changing our minds

Conventional wisdom would suggest that certain people are at risk to specific diseases because they "run in the family", and epigenetics studies are looking to understand what role genes play in the heritability of diseases when there's no change in the DNA sequence.

At the forefront of this research is Dr. Art Petronis, senior scientist and head of the Krembil Family Epigenetics Laboratory at the Campbell Family Mental Health Research Institute at CAMH (Centre for Addiction and Mental Health). His work has looked to uncover the epigenetic basis of psychiatric and other complex non-Mendelian diseases, (called such because they don't relate to Gregor Mendel's laws of heredity) like schizophrenia, bipolar disorder and Type 1 diabetes.

"In our lab, we take a different perspective on complex non-Mendelian diseases, hypothesizing that it's not so much a DNA sequence problem, but more a problem of regulation of DNA sequences," says Petronis. "It sounds simple but it's a radically different view of an old problem because in Mendelian diseases, like sickle cell anemia or cystic fibrosis, there's no doubt that DNA sequence variants play the key role."

Precision in predisposition

Petronis adds that one of the most consistent findings in human disease biological studies is evidence for inherited predisposition. Traditionally, evidence of inheritance led directly to investigating the DNA sequence, but this usually only works for simple Mendelian diseases where the mode of transmission is clear. DNA sequence strategies haven't been very productive for complex non-Mendelian diseases, he says.

Two decades of research have so far garnered modest outcomes, Petronis admits, but the scientific community is very eager to understand what specific genes and mutations account for the heritability in these complex diseases.

"We don't have specific genes that are predisposed for schizophrenia or bipolar disorder," he says. "We can only explain a tiny fraction of heritability by concrete specific DNA sequence-based factors, so this is why we are investigating other mechanisms."

"With the Human Genome Project, if we could identify the primary genetic basis of human diseases, then we can come up with very powerful strategies for diagnosing the disease precisely for those who are at actual risk, instead of telling people something general like they have a 'five times higher chance' for a certain inheritable disease," he says.

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DON'T MISS!

Restoring physical functionality through brain re-training

How can a damaged brain be "repaired" in order to restore physical functionality lost due to a stroke or spinal cord injury? Through collaborative partnerships and funding, the Rick Hansen Institute (RHI) has been helping researchers find the answer.

In March 2011, the RHI funded an important multi-centre trial of the ReJoyce workstation. Invented by biomedical engineers Jan Kowalczewski and Arthur Prochazka at University of Alberta, the system uses user-triggered game technology designed to improve hand function.

By improving a patient's ability to grasp, ReJoyce technology may significantly increase a patients' autonomy. Small gains — the ability to hold a pen, use a computer or get dressed without assistance — mean big changes in a patient's personal and professional life.

RHI has also funded two trials to test functional electrical stimulation (FES) technology. Using a Walkman-sized device, FES uses electricity to spark muscles into action and "retrain" the central nervous system. Like ReJoyce, the goal of FES is to help patients regain mastery over small tasks, which makes a big difference in their lives.

A single trial involving 21 patients ended in 2011. In December 2012, a multi-centre trial began involving 84 quadriplegics in Alberta, Quebec, New Brunswick and Ontario.

Both projects reflect RHI's vision: "a world without paralysis after spinal cord injury (SCI)". Through collaboration and supporting applied research, RHI hopes "to reduce the incidence and severity of paralysis after SCI, improve health care outcomes, reduce long-term costs and improve quality of life for those living with SCI".

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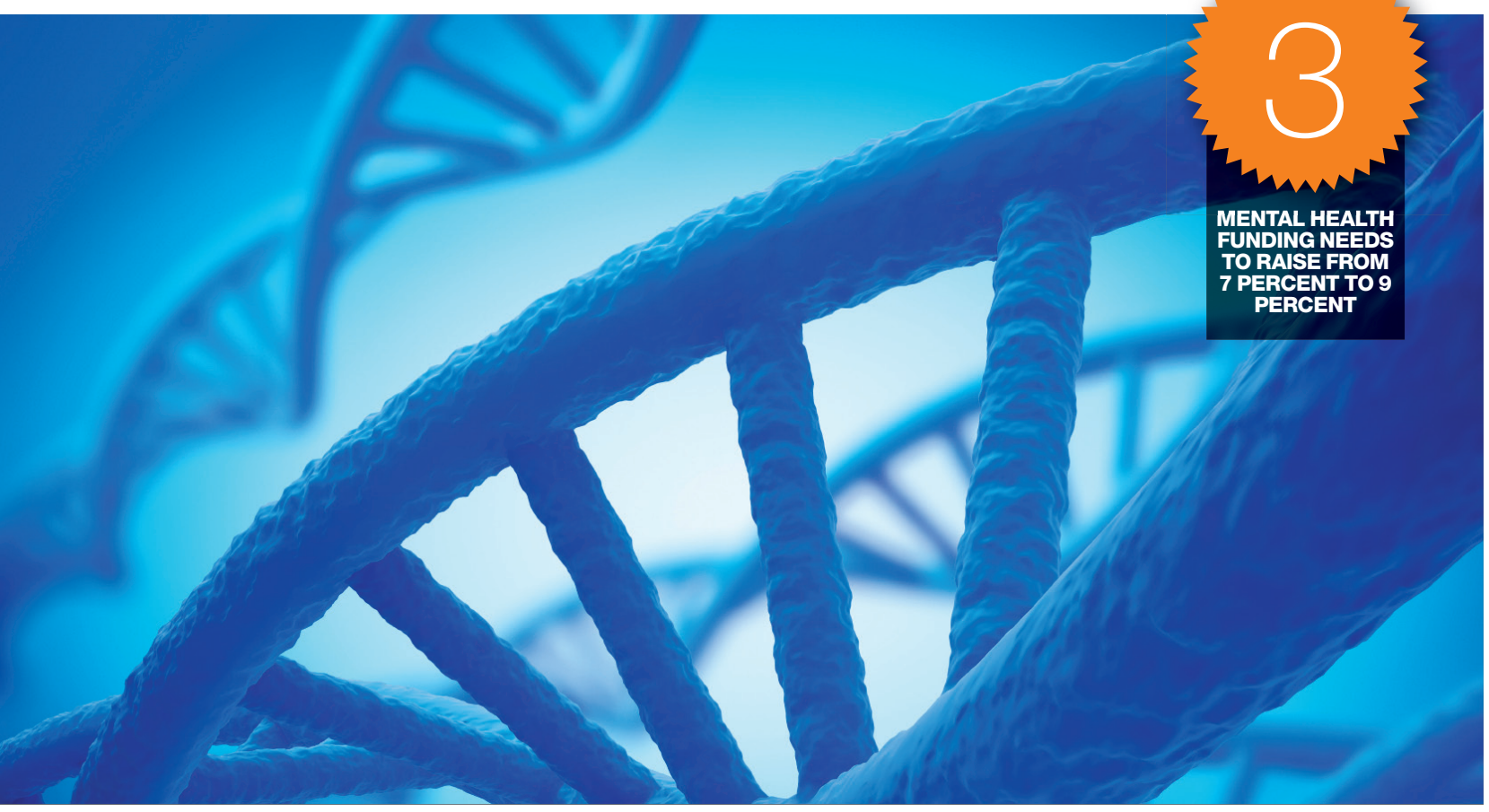

Combating stigma leads to breakthroughs

Mental health in Canada

To the one in five Canadians who will experience a mental health problem or illness in any year, the progress that has occurred within Canada over the last decade provides increased hope and reason for some optimism. Mental health organizations, researchers, mental health professionals and health care providers are also experiencing a new level of inclusion and respect that had been previously, to a large degree, missing.

This is all about families. Your family, your neighbours' family, with one in five Canadians directly affected, I cannot think of one household that is not touched by the impact of mental illness.

Why attention should be increased

In 2007 the government created the Mental Health Commission of Canada (MHCC). In the years since, the MHCC has made significant advancements within the country and truly been a catalyst for change. Pulling together the mental health community and providing a far better awareness to the general public, the MHCC launched Canada's first ever mental health strategy this past May. This document provides a road map to bringing increased and improved mental health services and supports to all Canadians.

Early intervention is key to addressing mental illness. Awareness of a potential issue is the first step; acceptance by the person who is experiencing the issue is the second and reaching out for help is the crucial third.

Dave Gallson
Associate National Executive Director
Mood Disorders Society of Canada
Co-Chair Canadian Alliance on Mental Illness and Mental Health

"The more we accept mental health and illness as acceptable and changing conditions of our psyches, the sooner those of us experiencing these changes will feel confident coming forward in finding help."

One of the main barriers to moving to the third step has been the stigma that is associated with mental illness. Anti-stigma programs and awareness campaigns have made great strides but so much more still needs to be done to help Canadians realize that mental illness affects us all, our family, our friends, at home and in the workplace. When we reduce the stigma, we increase the speed in which a person will take that crucial third step and the sooner the recovery process begins. The more we accept mental health and illness as acceptable and changing conditions of our psyches, the sooner those of us experiencing these changes will feel confident coming forward in finding help.

Why government funding should be increased

The economic impact of mental illness in Canada is over $51 billion dollars annually. This refers to the direct and indirect costs including measures such as rates of short and long-term disability, lost productivity, and the cost of delivering medical services. While mental illnesses constitute more than 15 per cent of the disease burden in Canada, a disproportionately small fraction of total health funding is allocated to mental health care—six per cent in Canada in fiscal year 2003/04, which is below the level in most European and other developed countries.

The Mental Health Strategy recommends governments increase the proportion of health spending devoted to mental health from 7 to 9 per cent over the next decade. This two percent increase will require an estimated 4 billion dollars for implementation. Mental illness is now costing us many times this annually, with a significant percentage of this attributable to outdated processes and segmented services. We cannot afford to wait on this investment, nor can our citizens' health afford to wait until the tail end of this decade for that investment. Wait times for psychiatric/psychological services in this country for many people for example are up to 12 months on average. Up to 70 per cent of mental health problems and illnesses begin in child¬hood or adolescence and as many as three in four children and youth experiencing these do not have access to services and treatments.

Working collaboratively

Our governments, mental health stakeholders, professionals, health care and the private sector must work collaboratively to further our nation's growing needs. In order to better serve our families, we need to ensure the patient is at the centre of care and that we deliver services more effectively through a better coordinated system that takes best practices and shares them throughout all regions.

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Neurodegenerative diseases in Canada

Neurodegenerative diseases are one of the leading causes of death and disability in Canada.

These diseases result in a progressive loss of function of neurons in the brain including the death of neurons. Neurodegenerative diseases present differently with a range of symptoms that could lead to cognitive, physical, emotional and behavioural decline, depending on the disease. As the population ages the incidence of neurodegeneration increases. An aging population may significantly add to the burden of treating and caring for those living with a degenerative brain disorder.

Some more prevalent neurodegenerative disorders in Canada include, Alzheimer's disease, Parkinson's disease, multiple sclerosis, amyotrophic lateral sclerosis (ALS) and Huntington disease. For most diseases symptoms get worse over time and unfortunately few of the diseases are curable or have reliable treatments to stop or slow the disease progression.

Hunting for the cure

Of the Neurodegenerative diseases Huntington disease (HD) is a particularly difficult disease that impacts generations of a family. HD is a genetic disease, which means that at least one of the two copies of the huntingtin gene has a defect that can cause the disease. Parents with HD have a 50% chance of passing on the disease to each child, and with each generation, HD starts earlier and earlier in life. With a definitive genetic test, a person can know if they will get HD later in life, or not. Symptoms usually appear in people between the ages of 30 and 45 but Juvenile HD can appear in young children and late onset HD can appear in senior adults. HD causes neuron death in the brain and in time people with Huntington's experience loss of motor control, cognitive decline and behavioural and emotional disturbances. Where symptoms of Huntington disease may vary between individuals they do lead to incapacitation and death. Huntington's disease (HD) is a progressive brain disorder that affects 1in 8000 people worldwide.

Unlike Parkinson's or Alzheimer's diseases, Huntington's disease has only one definitive known cause, and is only caused by a defect in one gene. This is a huge advantage for researchers in understanding how an ageing brain degenerates in these types of diseases. Researchers have created accurate models of HD in mice that allow the animals to get disease in a manner similar to humans. This has not yet been possible with Parkinson's or Alzheimer's diseases. Even with much lower incidence than other neurodegenerative diseases, HD research is far more advanced at understanding the exact mechanism of how brain cells are not working properly, leading to early loss. Many of the pathways of cell loss seen in HD are now known to be seen in Alzheimer's disease, suggesting that there may be some common pathways affected in brain cells for all of these neurodegenerative diseases, including Frontal-temporal dementia (FTD).

Finding the funding

There are 5.5 million Canadians living with a brain disease, disorder or injury. The dollar cost to government is staggering and the physical, emotional and economic costs to individuals and families, is frightening. The time is right to identify opportunities and strategies to improve health care for all Canadians with neurological conditions.

For more information please contact the Neurological Health Charities Canada at www.mybrainmatters.ca

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? DEMENTIA AND ALZHEIMER'S DISEASE—IS THERE A DIFFERENCE?

What is the difference between dementia and Alzheimer's disease? It's a question the Alzheimer Society is frequently asked.

Dementia is a term used to describe a general group of brain disorders that are progressive and degenerative and eventually fatal. Symptoms include memory loss, poor judgment and language difficulty as well as sudden or unusual changes in behaviour and personality. Alzheimer's disease is the most common form of dementia. Other types include Vascular dementia, Frontotemporal dementia and Lewy body dementia.

Age is the biggest risk factor, but the causes for dementia are not fully understood. Until a cure is found, early diagnosis and intervention are our best hope. The Alzheimer Society encourages Canadians to learn the warning signs.

Warning Signs:

- Repeating questions multiple times
- Forgetting recent events, conversations, appointments and faces
- Getting lost or confused in familiar places
- Having problems following simple instructions, operating appliances or even driving
- Confusing dates, having difficulty counting change or calculating numbers
- Showing signs of apathy, agitation, isolation or paranoia

Why is early diagnosis important?

Depression, thyroid disease or a toxic reaction to medication sometimes result in dementias that can be reversed and possibly cured. Early diagnosis rules out these treatable conditions that often mimic the signs of dementia.

Diagnosis will help identify the type of dementia because each one has different characteristics. People with Lewy Body dementia, for example, will experience profound visual hallucinations. Knowing that a particular behaviour is part of the disease process is reassuring for families.

Early diagnosis also makes all the difference in the way people live with dementia when support and appropriate treatment begin early in the disease process. The Alzheimer Society offers many programs and services, including education seminars, support groups and counselling, in over 150 communities across Canada.

Can Alzheimer's be prevented?

Not yet, but you can reduce your risk.

- Get moving. Physical activity keeps your heart pumping. A healthy heart means a healthy brain.
- Stay connected and challenged. Social and mental activity help build cognitive reserve.
- Eat right. A diet that benefits your heart is also good for your brain.

For more about Alzheimer's disease and dementia visit the Alzheimer Society of Canada website: www.alzheimer.ca

FACTS

- Over half a million Canadians have dementia today; this number will top 1.1 million by 2038.
- Dementia will cost $153 billion dollars per year by 2038.
- Demand for services will intensify. Today family caregivers provide 231 million hours per year looking after someone with dementia; by 2038, their annual hours will more than triple to 756 million.
- After age 65, the risk for dementia doubles every five years.
- One in four Canadians wait a year or more before seeing their doctor after noticing the first signs of dementia.

COURTESY OF THE ALZHEIMER SOCIETY OF CANADA

PANEL OF EXPERTS

David Kaplan
Ph.D. Senior Scientist, Cell Biology Program, Hospital for Sick Children, Professor, Department of Molecular Genetics, University of Toronto

Question 1:
How is neuroscience currently funded in Canada?

The investment by government, charities, and foundations in neuroscience grant funding is approximately $220 million, or about $7 per Canadian, compared to Brain Canada's estimate of the $60 billion cost of neuroscience-related neurological diseases and mental illnesses to Canada. The US, realizing the burden of the 1000 neurological and mental health conditions on patients, their families, and the economy, invests 40 times more in neuroscience research.

Question 2:
What are a few of your recommendations to increase funding in neuroscience?

Canada is acknowledged worldwide as having superb neuroscientists. There are presently no cures for neurological and mental health conditions, and few effective and long-term treatments. We need to take advantage of the renowned quality and creativity of our neuroscientists by dedicating significant amounts of new funding for discovery research to create breakthroughs in our understanding of the brain and the causes of brain illnesses, that will eventually lead to effective therapies and cures.

Question 3:
What are some of the potential benefits we could see with further funding into this field?

While there are over 1000 neurological and mental health conditions, all result in only four consequences to our brain and nervous system: cells die, nerve cells lose their connections, much as a plug coming out of an electrical outlet, there are chemical imbalances in the brain, or the circuitry of the brain that allows us to optimally function and think is perturbed. If we understand how to prevent these from occurring, we will be able to make discoveries that should help treat many different conditions.

John McLeish
McLeish Orlando LLP

Question 1:
How are recent advances in neuroscience helping your clients?

Neurodiagnostic imaging is crucial in treating individuals who have suffered a brain injury. Neuroimaging helps identify both the type and the extent of a brain injury and assists physicians in determining appropriate treatment. What can be seen on CT and MRI scans today could not be seen 10 years ago, and the technology is still progressing. Neuroimaging tools like functional MRI, PET scans and SPECT scans, now in their infancy, show great promise for helping TBI survivors in the future.

Question 2:
How will advances in technology effect the cost of future care?

Advances in technology come at a price. One problem with technological innovation is that sometimes it can be slow to reach the general public. Provincial healthcare systems cannot always afford to have the best equipment available. An example of this is a Functional MRI, which reveals much more than a conventional MRI. This leaves a brain injured individual, to pay for it on his own. Identification of the parts of an individual's brain that has been damaged is important if the person is to receive the most effective treatment.

Question 3:
What effect can a mild brain injury have on someone's future quality of life?

A 'mild' brain injury is a misnomer in terms of the effect it can have on one's life. A so-called mild brain injury can permanently affect a person's ability to think, to reason, to exercise good judgment and to make decisions. Without accurate diagnosis and treatment, people who have suffered mild brain injuries can lose their jobs, not be able to form or stay in a relationship and sink into a life isolated from family and friends.

Treating Schizophrenia: A three-dimensional challenge

Not so ago, a diagnosis of schizophrenia meant being permanently exiled from the social mainstream.

Today, innovations in treatment make it possible for those with schizophrenia to function and even thrive as contributing members of society.

Schizophrenia is a mental disorder that blurs the lines between reality and non-reality. Symptoms include hallucinations, delusions and disorganized thinking as well as a lack of visible emotion, low energy, spontaneity or initiative, difficulty enjoying once-enjoyable activities and impaired concentration. Identifying an effective drug regimen can take years and the side effects can be debilitating. Also, no pill can eliminate the stigma attached to the illness.

Support for recovery

Tammy Lambert, 30, knows how difficult the journey from diagnosis to recovery can be. At 15, after a major breakdown, she was hospitalized the first of many times. "The hospital was a revolving door for me," she said "Then I was blessed with a really amazing support network that decreased my hospitalization substantially."

> "Then I was blessed with a really amazing support network that decreased my hospitalization substantially."

Thanks to her support network, which includes the staff at the Manitoba Schizophrenia Society (MSS), and an effective drug regimen, Lambert has made significant strides forward. Last year, she graduated from the University of Manitoba with a B.A. in psychology and now works in a group home. To counter drug-related fatigue and weight gain, she has started jogging and is now within 10 or 15 pounds of her ideal weight. When she's not working, she enjoys visiting family and friends. As for the stigma, she just wishes people could "put themselves in our shoes".

Gifts and talents

Terry Broza, now 42, also wound up in the hospital. At 17, sure that her son's behaviour was more than a difficult adolescence compounded by his coming out as gay, Broza's mother fought tooth and nail to find the right treatment. Profound side effects from prescribed drugs complicated Broza's journey. Feeling twitchy, sluggish and looking "drugged out" all the time led him to run away repeatedly, once as far as Los Angeles.

After years in and out of hospitals, Broza now lives with supportive friends, including Lambert. Despite the usual ups and downs, the household has been an important source of comfort and strength. Estranged from his family since the death of his mother in 2005, he considers his housemates and his support network his family. He volunteers in administration at the MSS, experience which will be a big boost as he pursues a future career as an administrative assistant. Most importantly, at MSS he has learned he has "gifts and talents", which helps him battle hurtful stereotypes.

It takes a village

Both Lambert and Broza embody the philosophy of Chris Summerville, Executive Director at the MSS. To combat the myriad individual and societal impacts of schizophrenia, Summerville champions a holistic, three-dimensional approach that addresses the mind, body and spirit.

Summerville believes that recovery from mental illness is possible but it takes the support of a caring community.

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The Ontario Neurotrauma Foundation – Adding value

Knowledge improves lives

All Ontarians deserve to live full and productive lives. People living with a complex chronic disorder such as a traumatic brain injury or spinal cord injury have the opportunity to live productive lives as full citizens of this province but they need responsive health care and support to live as independently as possible. Making this a reality forms the mission of the Ontario Neurotrauma Foundation (ONF) to reduce the incidence and prevalence of neurotrauma and to improve the quality of life for those people living with these injuries.

In the fields of neurotrauma prevention and care, ONF has created a value for Ontario that cannot be equaled. ONF's innovative strategy embraces not just the transfer of knowledge but most importantly the implementation of knowledge at the point of care or service. No other organization has moved as assertively to fulfill this mandate.

From strategy to implementation

Value for the public investment is more than identifying the best or most promising solution. It is ensuring implementation at a provincial scale. Real value comes with the improvement in the quality of life of Ontarians living with a neurotrauma injury.

Neurotrauma injuries cost the province well over $ 3 billion on an annual basis. 46% of those injuries occur on the road. Neurotrauma affects every Ontario community and will touch over half a million Ontarians on an annual basis.

> "Neurotrauma injuries cost the province well over $ 3 billion on an annual basis. 46 percent of those injuries occur on the road."

Today there is no cure for traumatic brain or spinal cord injury. However there are many promising strategies that, when fully implemented, can have a significant impact on the lives of those living with these injuries and reverse some of the devastating consequences.

Catalyst for change

Ontario is an international leader in neurotrauma research. Through the Foundation's capacity building programs and extensive partnerships, Ontario investigators are leading globally in identifying solutions that address the challenges of these injuries. Our Ontario SCI Research Network, our SCI Best Practices Implementation, falls prevention work, our mild Traumatic Brain Injury strategy, and our national and global partnerships create the impetus for change.

Change however doesn't happen without leadership. The Foundation's role is to be the catalyst to take its research and put it into practice with the explicit goal of improving outcomes. Without this significant effort the investments in research will not create the value expected by funders and consumers.

ONF is at the forefront of change and new developments. Our leadership in knowledge brokering, moving evidence to practice and sustaining the impact at a provincial scale is what sets us apart. ONF has proven to be the best choice for effectively adding value.

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INSPIRATION

Overcoming life altering changes

On August 2, 2002, the life of 15 year old Katherine-Paige MacNeil and her family changed forever.

Katherine was a back-seat passenger in a car when it careened off the road and crashed head first into a ditch.

Katherine suffered a massive open skull fracture, a severe traumatic brain injury and fractures to her face and spine. She was rushed to hospital by air ambulance. When her parents arrived at the hospital, doctors told them she was not expected to survive. Katherine and her family never gave up hope and thankfully, she did survive.

After two months in hospital Katherine was discharged home into the care of her parents, Gord and Kathy. With the support of a dedicated healthcare team, Gord and Kathy determinedly pushed on making many personal sacrifices.

Moving forward

As a result of the damage to her frontal lobe, Katherine lost the ability to exercise judgement and make rational decisions. Her personality and behaviour changed drastically. She is often unpredictable in her actions and at times puts herself, and her parents, in danger.

Gord and Kathy were not prepared to deal with the sudden change. "At first, we didn't know what to do," Kathy said. "It was our legal team that really helped. They hired the best healthcare providers in the province, making sure Katherine got the best care and best rehabilitative team in place to treat her injuries."

Katherine and her family worked incredibly hard with a multi-disciplinary team of health professionals, including: doctors, speech language pathologists, occupational therapists, rehab support workers, psychologists and physiotherapists. Even Sadly, even with all of the help Katherine received was recieving, it became obvious that she would never work at gainful employment and would require around the clock care for the rest of her life.

The consequences of the collision were life-changing, and those responsible for the crash were not prepared to settle the case for a fair amount. Accordingly, the case proceeded to trial. At trial, expert evidence on the extent and severity of Katherine's brain injury was provided by the best traumatic brain injury specialists in the country. Expert evidence was also given by the best life care planners, economists and accountants on the future losses caused by the brain injury.

Thankfully for Katherine and her family, facing unmanageable costs and life altering circumstances, their case was successful. The trial judge assessed the damages at $18,427,207.20 - the highest amount ever awarded in a personal injury case in Canada.

Accidents can happen to anyone at any time. From sports injuries to car accidents; concussions, the potential associated disorders and traumatic brain injury can have lasting, life altering effects to the victims and their loved ones. Thanks to her family's persistence and the care and investment of their legal team, Katherine's future is financially secure and she will receive the highest level of care required over the course of her lifetime.

PROFILE

John McLeish

Partner at McLeish Orlando LLP, a critical injury law firm with offices in Toronto, Barrie and Hamilton. John's practice is dedicated exclusively to representing individuals and their families who have suffered losses through serious injury or the death of a loved one as a result of the negligence of others. He has represented victims in some of the most important critical injury cases in Canada. John has also written extensively on the subject of critical injury and wrongful death law. He is named in the National Post's List of Best Lawyers in Canada and his firm is recognized as one of the top five personal injury law firms in Canada.

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Stroke and cerebral vascular disease

Recent achievements in stroke care

Restoration of lost brain tissue

Dr. Michael Tymianski is a neurosurgeon at the Krembil Neuroscience Centre specialising in neurovascular diseases. In 2011, Neurosurgeons at the Krembil Neuroscience Centre, for the first time, initiated the restoration of lost brain tissue through brain bypass surgery in patients where blood flow to the brain is impaired by cerebrovascular disease.

In cases where blood flow is reduced to the brain as a result of diseased blood vessels, patients experience a progressive loss of brain tissue. This loss of tissue, which comprises the grey matter of the brain, is believed to lead to decreased neurocognitive function (i.e. types of thinking, such as perception, memory, awareness, capacity for judgement) and may hasten the onset of dementia.

At approximately 11 months after patients in the study underwent brain bypass surgery, aimed at restoring blood flow to the brain, researchers observed a 5.1 percent increase in the thickness of the brain tissue on MRI scans.

"We were pretty astounded when we saw the results because they were quite unexpected," said Dr. Tymianski. "Our goal with the surgery was to halt further loss of brain tissue due to strokes, so it was remarkable to see the loss was actually reversed."

This is the first surgical treatment which has been shown to restore lost brain tissue. The average age of the patients in the study was 41 years old.

"The re-growth of brain tissue has only been observed in an extremely limited number of circumstances," said Dr. Tymianski. "We consider this so important because one of the most important health issues facing our population is chronic cerebrovascular disease, which leads to neurocognitive impairment and reduces quality of life."

ELANA technique for stroke surgery

In 2009, Dr. Tymianski was the first neurosurgeon in Canada trained to perform the ELANA Technique.

Bypass surgery involves replacing a diseased vein in a patient's body with a healthy vein taken from another part of his or her body, such as a leg. With a traditional brain bypass, doctors must temporarily clamp off blood flow in the blocked artery before creating a hole in it and attaching the donor vein. The clamping facilitates the surgery by preventing blood from gushing out everywhere. The danger, however, is that cutting off blood flow, even for a short while, puts the patient at risk of stroke.

The technique known as ELANA, which stands for excimer laser-assisted non-occlusive anastomosis, is considered safer because it eliminates the need to temporarily stop blood flow. With this new procedure, doctors suture the donor vein onto the blocked artery and insert a laser catheter through the new vein. The laser beam then penetrates the surface of the blocked artery, creating a perfectly tidy hole.

Most advanced drug to treat stroke

In 2012, Dr. Michael Tymianski developed a drug that protects the brain against the damaging effects of a stroke in a lab setting. At this point, it has reached the most advanced stage of development among drugs created to reduce the brain's vulnerability to stroke damage (termed a "neuroprotectant"). Over 1000 attempts to develop such drugs by scientists worldwide have failed to be translated to a stage where they can be used in humans, leaving a major unmet need for stroke treatment. The drug developed the Krembil Neuroscience Centre is the first to achieve a neuroprotective effect in the complex brain of primates, in settings that simulate those of human ischemic stroke.

"We are closer to having a treatment for stroke than we have ever been before," said Dr. Michael Tymianski, TWRI Senior Scientist and the study's lead author. "Stroke is the leading cause of death and disability worldwide and we believe that we now have a way to dramatically reduce its damaging effects."

During a stroke, regions of the brain are deprived of blood and oxygen. This causes a complex sequence of chemical reactions in the brain, which can result in neurological impairment or death. The PSD95 inhibitor published by the Toronto team acts to protect the brain by preventing the occurrence of these neurotoxic reactions.

The study used cynomolgus macaques, which bear genetic, anatomic and behaviour similarities to humans, as an ideal model to determine if this therapy would be beneficial in patients.

"There is hope that this new drug could be used in conjunction with other treatments, such as thrombolytic agents or other means to restore blood flow to the brain, in order to further reduce the impact of stroke on patients," said Dr. Tymianski. "These findings are extremely exciting and our next step is to confirm these results in a clinical trial."

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