# Sunnybrook

SAVING LIVES, ONE INNOVATION AT A TIME


## a sharper image how advances in medical imaging are transforming care for Sunnybrook patients

*Saving the limbs (and lives) of diabetics || In pursuit of an elusive cure for ALS || Cochlear implants: a biomedical marvel*

Sunnybrook

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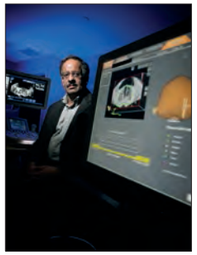
***ON THE COVER***



Dr. Masoom Haider, chief of medical imaging, is guiding Sunnybrook into an innovative future of diagnostics and treatment. He is pictured with the new Artemis system supporting better image-navigated prostate-cancer biopsies.

*Photography by Tim Fraser*

IN EVERY ISSUE

# Sunnybrook

**PUBLISHERS**
Craig DuHamel
Pamela Ross

**EDITOR-IN-CHIEF**
Simon Beck

**ART DIRECTOR**
Frank Perito

**FEATURE WRITERS**
Marjo Johne, Patrick Lynch, Celia Milne

**CONTRIBUTORS**
Dan Birch, Chantal Braganza, Laura Bristow, Natalie Chung-Sayers, Alexis Dobranowski, Sybil Edmonds, Precilla Edwards, Jennifer Foster, Sally Fur, Wendy Glauser, Marlene Habib, Monica Matys, Katherine Nazimek, Nadia Radovini, June Rogers, Katie Rook, Marie Sanderson, Paul Taylor

**PHOTOGRAPHY**
Tim Fraser, Doug Nicholson, Jennifer Roberts

**PRODUCTION MANAGER**
Michelle MacKay

**GLOBE EDGE**

Teena Poirier
DIRECTOR, CLIENT ENGAGEMENT & GLOBE EDGE

Charlene Rooke
EDITORIAL DIRECTOR, GLOBE EDGE

Liz Massicotte
PROGRAM MANAGER, GLOBE EDGE

Sally Pirri
DIRECTOR, PRODUCTION, THE GLOBE AND MAIL

Isabelle Cabral
PRODUCTION CO-ORDINATOR, THE GLOBE AND MAIL

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**ALL CORRESPONDENCE**
Sunnybrook
2075 Bayview Avenue, Suite D100
Toronto, Ontario M4N 3M5

questions@sunnybrook.ca
www.sunnybrook.ca

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# WE ARE SUNNYBROOK

*faces of our staff and our community*

*the* MEDICAL EQUIPMENT MAN

## NO MACHINE LEFT BEHIND

Keith Laycock sits comfortably in his office filled with artifacts he's collected from various corners of the world. He has an international reputation – and has even had children named after him – as a result of his goodwill and generosity.

Over the last 13 years, Laycock (who retired last month from his position as Sunnybrook's director of biomedical engineering) has created a means to reduce, recycle and reuse in an extraordinary way. Medical equipment such as fetal monitors, computers, X-ray machines, ventilators, defibrillators or furniture such as beds, operating tables, dressers and even wheelchairs are all refurbished and rebuilt, then shipped to hospitals in need around the world.

"Every day I get an e-mail – it could be at 2 a.m. from a contact in a faraway country, telling me how our equipment has impacted a family or helped someone walk again," says Laycock. "I believe that it's important to give back. It's a relatively small donation for a really big outcome."

Along with ensuring that all of the electronic medical equipment is working and operating effectively in the hospital, Laycock and his staff volunteer their spare time to test, restore, rebuild and adapt items for use in faraway developing countries.

A few years ago, bedside monitors, suction pumps and other equipment were sent to help rebuild the Guyana Burn Care Unit, the only burn unit in the Caribbean. A team of Sunnybrook nurses from the burn unit flew down to train the local nurses, and local doctors were invited back to observe and train at Sunnybrook. Final result: a 40 per cent increase in burn-injury survival rates in Guyana.

To date, approximately 36 developing countries have benefited, and the list continues to grow. The one condition, according to Laycock, is that the items must work self-sufficiently for at least two years. "Even though the items are used, they are completely safe. If we wouldn't use it, we won't ship it," says Laycock.

Originally trained as an emergency medical technician (ambulance), Laycock saw his share of upset and trauma working long and varied shifts in Banff National Park. Newly married, he decided to go back to school and pursue electrical engineering. When he completed further training in Boston to become a biomedical instructor, he knew that he'd found his real calling.

"Looking back, it was during my first job, when I worked for a large computer tech company, that I saw skids of equipment being destroyed and simply wasted. That was the beginning of my concern and frustration. I realized then that so much more could be done with old equipment. I can't stand to see anything wasted."

Laycock is not one to take all the credit. Teamwork is huge for him. Originally it was just Laycock's department involved and then word soon spread to staff throughout the hospital. It wasn't long before other medical staff such as doctors and nurses (some of whom have relatives or loved ones in far-off places needing help) became involved.

"Every year it's the anticipation of where we're going to go and how we can help that is exciting," he says. "It just doesn't end; it's my social life."

*– Sally Fur*


# LOVING THROUGH JOY AND HEARTBREAK

As a nursing student, Wendy Moulsdale's clinical rotation in a neonatal intensive care unit (NICU) turned out to be a life-altering experience. "As soon as I got there, I thought, 'This is for me.' I knew I wanted to spend my career in the NICU," says Moulsdale.

Twenty-seven years later, she now works as a nurse practitioner in Sunnybrook's NICU. She is passionate about helping families through their NICU journey, which can best be described as an emotional roller coaster.

A difficult reality in the NICU is that not every story has the outcome parents and staff were hoping for. "Bereavement is one part of a family's NICU experience that is so hard. We try to make it the best it can be, and make it a beautiful moment," she says. A member of the unit's bereavement committee, Moulsdale and her colleagues work to help families through their losses, from parents who've lost a premature child to women who have experienced a miscarriage.

While there are moments of heartbreak in the unit, Moulsdale says the NICU is a joy-filled place. "We get to know the families well because they are often here for months, so we love it when they come back to visit," she says. "Since we meet them during such an intensely stressful period of their lives, seeing them in their natural state as a family is a gift."

Staying closely involved in the care of the babies and their families is important to Moulsdale, and becoming a nurse practitioner was the best way to do this. "Being that person of consistency in a baby's care, and being able to connect with the family to see how they're doing is so important," she says.

The ability to mentor new nurse practitioners is something Moulsdale also enjoys. Early in her career she looked up to others in the unit who had gone back to school to become nurse practitioners. "They were my role models, and I ended up following in their footsteps," she says. "It's rewarding to take the next generation under your wing and watch their knowledge grow."

*– Sybil Edmonds*





# AN INSTRUMENT OF HELP

Amy Canter has been a social worker for nearly four decades. Her attraction to the work proves the strength of family ties. "My father was a psychologist so I wanted to somehow get into the helping field. Life just unfolded, and I had an opportunity to go into social work."

The last 15 years of Canter's career have been dedicated to the dialysis unit at Sunnybrook. "Kidney disease exerts a huge burden on people, and their treatments are demanding," she says. "Our patients are complex medically and that can make their lives challenging. I can help by coming up with creative solutions to make life less complicated and, hopefully, more enjoyable."

Social workers offer assistance to both patients and families by connecting them to community resources like transportation, finances and home care. They also help elevate a patient's quality of life as they adjust to a life on dialysis. Social workers like Canter are, quite literally, a lifeline.

Part of that role is keeping patients connected. She has spearheaded a regular patient newsletter, and the Patient Council, which keeps patients informed and is part of the decision-making process. She works with the Kidney Foundation and organizes the annual Dialysis Patient Memorial Service. She's also helping prepare patients for the eventual move out of the existing dialysis unit to its new location.

Canter says the challenges of her work are balanced by the moments of gratitude. Pulling a folder from her filing cabinet, she opens it to share the cards and letters of thanks she's received over the years. She fondly shares one particular letter that especially touched her.

"This patient was a Holocaust survivor, and after he passed away, the family planted a tree in Israel in my name. They were so grateful because they weren't able to assist with the little things that helped him live, and that's what I did," she says.

"Being able to use myself professionally as an instrument of help is a wonderful thing. I think that's what motivates all social workers."

*– Monica Matys*


# A SLEUTH ON THE TRAIL OF BUGS

"It's always detective work. Every situation is different," says Dr. Mary Vearncombe, who was introduced to the field of microbiology as a medical student. She was immediately intrigued by the patterns of behaviour of organisms: How they cause disease and in what populations.

"Infectious diseases are always emerging. On the prevention side, you have to constantly apply that knowledge – to be vigilant and responsive. On the control of infections, you have to review every step and track every activity that went on to solve the puzzle."

Dr. Vearncombe's teacher, an accomplished microbiologist, was a strong role model. That mentorship led her to do her specialty training, in Medical Microbiology at the University of Toronto. Together with courses in infection control from renowned institutions such as the Centers for Disease Control and Prevention, she embarked on a career in infection prevention and control, and is the program's medical director at Sunnybrook.

"Infection prevention and control is a separate body of knowledge that needs specific and continuous training," she says. "It's really fascinating because it takes you into every aspect of a hospital's functioning, and it applies to the way we design hospitals and how we care for patients, the efficiencies of water systems, heating and ventilation, how we move patients and how we use hospital products."

"When I started in the early eighties, infection prevention was a relatively new field that few physicians specialized in," says Dr. Vearncombe. "But two major events, HIV in the eighties and SARS in 2003, completely changed the way we think about infection prevention. We gained new respect for the risk of contact with blood and body fluids through HIV and, later, for the risk of contact with droplets from coughing and sneezing related to SARS."

Both infections had a tragic impact on the world. The only benefit, says Dr. Vearncombe, is that we learned from our mistakes, never to repeat them, and raised the bar in infection protection for those receiving care and those giving it.

Dr. Vearncombe has a special interest and commitment to the occupational health aspects of infection prevention. "You can't have a well-functioning program unless it protects both patients and health-care workers," she emphasizes.

She came to Sunnybrook from Women's College Hospital and welcomed the opportunities and challenges of practising, especially in the care of perinatal, critical care, burn, dialysis and oncology patients. She is proud of her multidisciplinary team of infection prevention and control co-ordinators for their collaboration with each of the clinical programs they support.

Within the community of hospitals, Dr. Vearncombe is keen to share infection best practices and guidelines. As founding member and chair of the Communicable Disease Surveillance Protocol Committee, she has provided leadership in developing communicable disease surveillance protocols that guide infection control and occupational health practices in Ontario hospitals. She is also chair of the Provincial Infectious Diseases Advisory Committee for Infection Prevention and Control and is a member of the Public Health Agency of Canada Expert Working Group on Infection Control Guidelines.

*– Natalie Chung-Sayers*






# HELP FOR LIFE

When asked what she does as a health-care worker, Myrna Moore chuckles and in her soft, sincere voice says she helps plan weddings, anniversaries and vacations.

For more than 20 years, Moore has been helping people live when they are faced with the terminal diagnosis of amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease.

ALS is a progressive and fatal neurological disease in which the neurons that operate the muscles waste away, causing paralysis. Eventually patients lose the ability to use their hands or to walk. They may be unable to speak or swallow their food, until, ultimately, they lose the ability to breathe. (See page 40 for additional information about ALS.) The cause is unknown in most cases, and there is no cure. But to Moore, working with patients of ALS is not about dying. It's about living.

"There's something about these people that pulls you in ... they want to live," she says. "We want to do whatever we can to help them do that."

As the clinical care co-ordinator for Sunnybrook's ALS clinic, the largest multidisciplinary clinic for the disease in Canada, Moore sees patients before their formal diagnosis and routinely throughout their journey.

"If you were suddenly forced to face the reality that you are one day going to die, wouldn't you want to live life to the fullest?" she asks. "I encourage them to keep working, to be as independent as possible, to travel and do what they want to do," she says.

Moore explains that ALS is a very costly disease – emotionally, physically and financially. She works with a team of specialists to address patient needs, from providing assistive devices to liaising with community services. This includes helping them with long-term disability, housing, tax breaks and even finding the resources to help a patient provide a romantic dinner at home with his or her spouse for their anniversary.

Currently the clinic follows more than 450 patients with ALS, and the numbers are growing, says Moore. According to ALS Canada, approximately 2,500 to 3,000 Canadians over the age of 18 currently live with the disease.

"If it meant there was a cure for this disease, I wouldn't mind being out of a job," admits Moore about the career that, she says, has taught her to live each day to the fullest.

*– Katherine Nazimek*


# PROBING ELECTRICAL INJURY

It was a summer day and a young man was tasked with collecting branches that were being cut from the trees above. As he was working, a live power line fell – landing on top of him. Thousands of volts of electricity radiated throughout the young man's body and while it didn't take his life that day, it cost him most of his limbs and left devastating psychological scars.

What can we do to prevent this from happening again? And, if injuries like these do occur, how can we understand what these patients are going through so that we can provide the best, most-effective care possible?

These are the questions that continue to drive Dr. Manuel Gomez, researcher and director of the St. John's Rehab Research Program, years after that young man crossed his path.

"Despite existing preventive measures, personal protective equipment, safety procedures and legislation, something is still missing," says Dr. Gomez. "Through our research we are learning more about how electrical injuries are affecting these survivors, not only to improve their care, but also to show the impact and importance of having necessary measures in place to prevent these injuries from occurring in the first place."

This past year Dr. Gomez received the Chief Public Safety Officer's Special Recognition Award for his contributions to electrical safety and to the care of survivors of electrical injuries. The Electrical Safety Authority (ESA) presents this award annually to recognize and celebrate the leadership and achievement in the promotion of electrical safety in Ontario.

The award-winning research conducted by Dr. Gomez and his team has helped spark change around the world by revealing that not all electrical injuries leave visible marks like burns or amputations. In fact, electrical injury survivors may look perfectly healthy.

"People who survive electrical injuries can experience long-term neurological dysfunctions, like muscle fatigue, weakness or loss of sensation. They may have difficulty doing simple things like walking or using everyday tools," explains Dr. Gomez. "The worst part is that these patients may live undiagnosed and misunderstood, only adding to the suffering."

Findings have emphasized the need for education and also preventive strategies that could decrease the risk of electrical injuries. Other research at St. John's Rehab has helped develop prevention programs to reduce electrical burn injuries caused by the use of multimeters, for example.

Dr. Gomez and his team are now looking to identify what personality traits may be common among people with these injuries, just as young extroverts are proven to be more prone to motor vehicle collisions. He hopes the answers will help education and prevention initiatives.

"I strongly believe that the best treatment, the best investment, is prevention. We can prevent the disability, the pain and the suffering not only for the patients, but also for their families," says Dr. Gomez.

*– Katherine Nazimek*

# pumping *up the* volume

*Sunnybrook is not only Ontario's go-to centre for cochlear implants, its physicians are working on new ways to restore sound to people facing deafness*

By Celia Milne

## *A cochlear implant didn't just give Faryn Wegler the ability to hear;* **it gave her a voice.**

And that voice will help her find a career she loves. "Before my implant, I was very shy," says this 24-year-old Thornhill, Ont., student. "I purposely avoided conversations because I couldn't hear what people were saying. I thought I'd have trouble finding work."

"Now," says Faryn, "I know what's going on around me and I connect better with people. I'm confident I'll get a job in my field."

Faryn, who is a postgraduate student in Fashion Management and Promotions at Humber College, has a progressive and mysterious type of hearing loss that was discovered when she was 13 years old. Because she was such a good student, she made it through elementary and high school with "my own accommodations," such as sitting in the front row and learning to read lips. But, still, she often felt embarrassed by her secret. "No one was ever directly mean to me, but I felt left out. I would ask people to repeat themselves and they'd say, 'Oh, never mind.'"

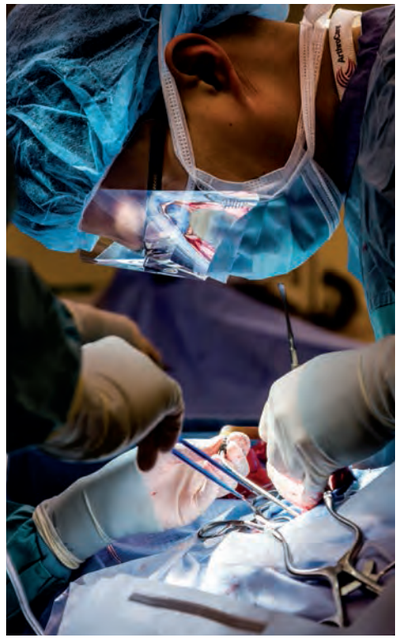
In 2013, the hearing in her right ear had deteriorated to the point that she qualified for a cochlear implant. Faryn came to the right place – Sunnybrook, which performs about 120 cochlear implants a year. It offers the largest adult cochlear implant program in Canada and is one of the top three in North America.

"Cochlear implantation is a fast-expanding biomedical marvel that combines a sophisticated microprocessor and an electrode system in the inner ear, to restore hearing," says Dr. Joseph Chen, director of the Cochlear Implant Program and chief of the department of otolaryngology (head and neck surgery) at Sunnybrook. Until recently, cochlear implants were only considered for the most profoundly deaf patients, who had no hearing at all. But because of improvements in technology, they are an option for a much larger number of people, including those with moderately severe hearing loss. "Now," says Dr. Chen, "people who struggle with hearing aids are candidates for cochlear implants."

Sunnybrook, which is fully affiliated with the University of Toronto, is the co-ordinating site for all four of Ontario's cochlear implant centres, including the Hospital for Sick Children. Sunnybrook has worldwide stature in the field and is hosting an international cochlear implant symposium in 2016.

"As a group, we've moved the program forward by increasing its scope and size. Greater funding in recent years has reduced our waiting list to six months, from up to three years," says Dr. Chen.

Faryn's surgery was conducted in May 2013 by Dr. Chen. Like most people who live with hearing loss, Faryn's auditory nerve was still functioning, but the tiny hair cells inside the cochlea in her inner ear were damaged.



*"This is a medical miracle for many patients," says Dr. Joseph Chen. "They go from silence to hearing speech immediately at switch-on."*

# Can hearing be regenerated?

Sunnybrook's state-of-the-art Sonja N. Koerner Hearing Regeneration Laboratory is exploring new scientific frontiers in reversing hearing loss.

One of the main reasons for deafness is thought to be damage to tiny hair cells in the inner ear. These hair cells detect sound and convert it into neural signals that travel to the brain. "Once they are damaged or lost, these vital cells are capable of regenerating in birds and fish, but they are never recovered in humans. Why?" asks internationally renowned hearing researcher Dr. Alain Dabdoub, who has moved his laboratory from San Diego to Sunnybrook to help answer this question.

"The goal of the laboratory is to understand how these cells develop in the first place during embryonic development and then learn to regenerate them, thus reversing hearing impairment," he says.

Dr. Dabdoub and clinician-scientist Dr. Vincent Lin are focusing on several cutting-edge areas of research: Activating molecular pathways that play a role in early development of these hair cells, using gene therapy or medications to turn on hair cell development and reprogramming cells that have been damaged.

Recent work at Dr. Lin's lab has found that, with aging, there is a definite decline in the density of blood vessels in the cochlea. He is studying what happens at the cellular level during that decline, in the hopes to reverse it one day. This will be good news for the three million people across Canada who live with some kind of hearing disability. – *Celia Milne*

**HOW IT WORKS**

Here's how cochlear implants work: The surgeon implants a small receiver into the bone behind the ear and feeds an array of electrodes into the snail-shaped cochlea in the inner ear. Externally, a small speech processor is attached behind the ear. The patient is given a month to recover from the surgery before the device is turned on. Once activated, sounds enter a microphone and travel to the processor. There, they are converted into digital information that is sent to the electrodes, which stimulate the auditory nerve to send information to the brain.

Some patients have to do hearing exercises for weeks or even months to relearn sound, while others hear normal sound as soon as the device is activated.

Paul Wheeler, the recipient of Sunnybrook's 1,000th cochlear implant in 2012, was choked up with emotion when he heard normal sound on the day of his activation. His implant restored 90 per cent of hearing to his left ear, which had been virtually deaf. "This is a medical miracle for many patients," says Dr. Chen. "They go from silence to hearing speech immediately at switch-on. They start to cry."

For Faryn, the miracle arrived gradually, propelled by hard work. At activation, she heard only beeps; after a week, the beeps started sounding like words. Three months of listening to audio books and working with a verbal therapist gave her back the hearing she had lost as a child. "Now, I go to movies with my friends, and I can hear about 80 per cent of what's going on," she says.

Before her implant, Faryn was depressed and unsure of herself. Now, she's thrilled by her prospects and is already doing an internship as a fashion editor. She is so pleased with her implant that she's on the waiting list for one in her left ear.

"It is extremely satisfying to be able to help these people," says Dr. Chen. "It really gives patients a new lease on life."

**MILESTONES IN HEARING**

More than 300,000 people have been implanted around the world, 80 per cent of them in the last decade. Because of the modern technology's massive global impact, its developers were awarded the Lasker-DeBakey Clinical Medical Research Award (known as the baby Nobel) in 2013.

Sunnybrook has been active in cochlear implants since 1984, when Dr. Julian Nedzelski pioneered the program. Now part of Sunnybrook's leading Brain Sciences Program, the otolaryngology team has enjoyed many "firsts" in Canada: The first-ever cochlear implant in a patient with single-sided deafness (see sidebar) and the first-ever Bonebridge surgery in a patient with single-sided deafness. The Bonebridge procedure involves surgically implanting a device behind the ear, where it produces vibrations through the bone and reroutes sound from the good ear to the deaf ear.

Sunnybrook also performed the first MED-EL auditory brainstem implant (ABI) in North America. This highly intricate, groundbreaking surgery is an option in people whose inner ear is not accessible for a cochlear implant because of a tumour or severe inner ear abnormality. The idea is to bypass the inner ear and stimulate the brain directly. Dr. Chen and colleague Dr. Farhad Pirouzmand, who specializes in skull base surgery, conducted this historic implant in July 2012, in a procedure that took nine hours. ABI will benefit about 50 Canadian patients a year.

For patients like Faryn and Paul, Sunnybrook's cochlear implant program is life-altering, as it helps them connect with a world of sound they were missing. "It's not only about hearing improvement," says Dr. Chen. "Cochlear implants can be transformative in getting people back to work, increasing their productivity and quality of life."



# Single-sided deafness

Joseph Sathananth is making history. He is the first adult patient in Canada to receive a cochlear implant for deafness in only one ear.

On a cold winter day, he is at Sunnybrook to have his implant, which was surgically inserted a month before, turned on for the first time. This 56-year-old research analyst at an investment company will find out whether the device has reintroduced sound to his left ear. He has not heard a thing out of that ear since February of 2012, when medication he was taking for dental pain damaged his inner ear, resulting in complete hearing loss on that side.

"At home and at work, you feel embarrassed because you can't hear what people are saying and doing," says Joseph, who lives in Brampton, Ont. "My sister-in-law came to our house to visit. She rang the bell for half an hour, and I didn't hear her. I felt terrible." Balance problems and tinnitus (ringing in the ear) are also common deficits in single-sided deafness.

Up until now, cochlear implants (CI) have been reserved for cases of profound deafness in both ears. Sunnybrook is one of the leading sites in North America for CI, having done about 1,300 operations. Dramatic improvements in technology and surgical techniques have opened up these devices to people with partial deafness.

"It is very exciting that we can now offer this technology to a wider group of patients," says Dr. Vincent Lin, the otolaryngologist (head and neck surgeon) who conducted Joseph's surgery. "In the past, the only option for these patients was hearing aids, but now early research in Europe has shown that sound quality can be very, very good with a combination of natural hearing on one side and a cochlear implant on the other."

After surgery, patients are given about a month to recover before they return to the hospital to have the device turned on for the first time, a process called "activation." Sunnybrook audiologist Tara Millman, who is doing Joseph's activation in her office at Sunnybrook, tempers his expectation by explaining that patients shouldn't expect much on the first day. It usually takes months of rehabilitation and therapy to train the brain to hear in this new way.

Activation involves first programming each of the 16 electrodes that have been surgically implanted in Joseph's inner ear. There's a different pitch for each electrode. Joseph's job is to tell Millman when the beeping reaches a comfortable level. "Way too low," he says as she adjusts the volume on the first electrode from her computer, then, "Too low," then, "Ya, that's enough."

Finally all of the electrodes are set. The hope is that when they are all working together, Joseph's brain will interpret the noises as familiar sounds.

Before activating the device, Millman puts an earplug in Joseph's right ear, the good ear. She says something, and he cannot hear her.

She turns on the cochlear implant.

"What did you have for breakfast?" she asks Joseph.

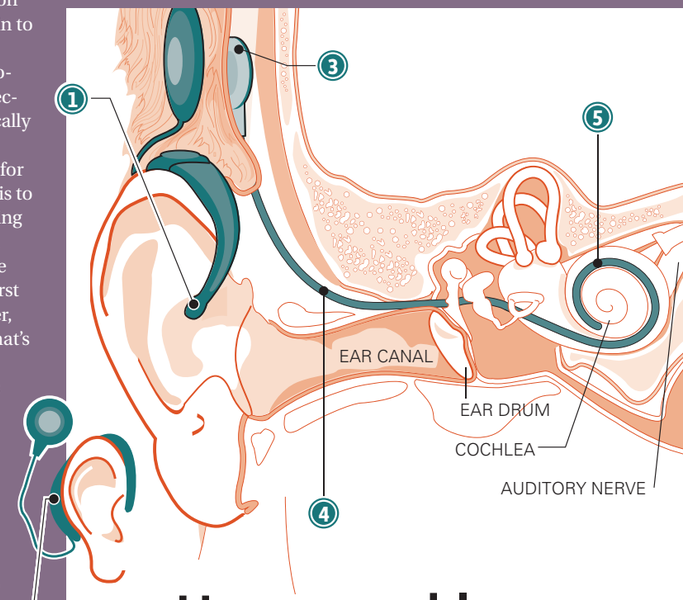
"A Subway sandwich," he says.

"When is your birthday?" she asks.

"Next Friday!" he says triumphantly.

Joseph is not only the first adult patient in Canada to receive a cochlear implant for single-sided deafness, but also lucky enough to experience hearing on the very first day. There's an echo in the background, but this is expected and will diminish over the course of his follow-up appointments.

"I'm feeling great," he says before heading home in the snow. "I am born again, after two years!" – *Celia Milne*




TONIA COWAN • SOURCE: ADVANCEDBIONICS.COM

# How a cochlear implant works

*A cochlear implant system consists of two main components: The external component and an implant, which delivers sound to the hearing nerve.*

1. Sound is captured by a **microphone** on the sound processor.
2. The **sound processor** converts the captured sound into detailed digital information.
3. The magnetic headpiece transmits the digital signals to the **internal implant** under the skin.
4. The implant turns the received digital information into electrical information that travels down the **electrode array** to the auditory nerve.
5. The **auditory nerve** sends impulses to the brain, where they are interpreted as sound.

COVER STORY

# Images of the future of medicine

Advances in medical imaging at Sunnybrook will dramatically improve outcomes for cancer, cardiac and many other patients

By **Marjo Johne**
Photography by **Tim Fraser**

*Sue Walsh, a breast-cancer patient who took part in a trial of an innovative imaging technique called Quantitative Ultrasound, a technology that can pinpoint dead cancer cells.*

For seven months, Sue Walsh received chemotherapy for breast cancer at Sunnybrook. The treatment itself wasn't new, but there was something different this time around: Instead of having to wait six to eight months until the end of the chemo to see if the drugs worked, Sue and her doctors were able to detect the cancer changing within a few weeks of each treatment.

"To be able to tell early on if a treatment is working is truly amazing," says Sue, a Toronto resident who was part of clinical studies in 2012 for a made-in-Sunnybrook innovation known as QUS (Quantitative Ultrasound), a technology that uses advanced software and ultrasound imaging to pinpoint dead cancer cells. "In my case they could see it was working and that it reinforced what the oncologist's physical exams were saying – the tumour was shrinking. When they did the biopsy [at the end of the study] to confirm the results, they saw that the number of cancer cells was significantly less."

Sue's experience is just one example of how doctors at Sunnybrook are using state-of-the-art medical imaging technology and techniques for the way they diagnose, target the delivery of treatments and track treatment responses to better tailor treatment.

"These are exciting times," says Dr. Masoom Haider, chief, department of medical imaging at Sunnybrook and senior scientist at Sunnybrook Research Institute's Odette Cancer Research Program. "Sunnybrook is definitely doing leading-edge work in the area of imaging – from using it to better assess patients to applications where imaging is used to guide the treatment and see how it's working,"

Imaging projects at Sunnybrook fall into three main categories: diagnostic, therapeutic and "theranostic" – a hybrid of the first two categories. Diagnostic imaging is focused on imaging to detect and characterize disease, while therapeutic uses imaging to guide treatment. In the third category, imaging is used to predict effectiveness of therapy and to provide patients with the greatest benefit from treatment.

To support its advanced imaging projects, Sunnybrook has made a number of recent capital investments, including the purchase of a cyclotron, a machine that creates the radioactive isotopes injected into patients ahead of a positron emission topography (PET) scan of their internal organs.

The isotopes from the cyclotron go into decay within minutes. Having the machine right at Sunnybrook will allow doctors to produce this material on-site, says Dr. Haider. This is more cost-effective and also makes it easier for Sunnybrook scientists to develop new chemical agents that can provide more insight into a wide variety of diseases.

An example of an advanced imaging project in Dr. Haider's department is the "smart biopsy," which involves the use of magnetic resonance and ultrasound imaging to diagnose prostate cancer. By fusing magnetic resonance images with ultrasound results, doctors are able to locate and trace a tumour and zero in for a biopsy.

"Right now what happens is, when a PSA (prostate-specific antigen) test comes back abnormal, the patient needs to get a biopsy where a needle is used to take tissue samples in a grid pattern with eight to 16 samples," explains Dr. Haider. "But the problem is, in a lot of men this process doesn't find the cancer, and they have to undergo yet another biopsy. With the combination of MR imaging and ultrasound, we can direct the needle exactly to where the cancer is and make a diagnosis with as few as three to four samples."

This makes the diagnostic process less painful and disruptive for patients, says Dr. Haider. More importantly, it increases the chances of catching and treating the cancer early, leading to better outcomes.

This novel application of MRI technology made all the difference for Kim Stewart, who learned in the fall of 2012 that his PSA levels were abnormally high.

After a 15-needle biopsy at another medical facility failed to detect cancer, Kim was referred to Sunnybrook, where an MRI-guided biopsy enabled his doctor, Dr. Danny Vesprini, radiation oncologist of Sunnybrook's Odette Cancer Centre Genitourinary Cancer Care Team, to definitely confirm he had cancer. Kim had surgery last October to remove the cancer and says he is now in the clear.

"Knowing my PSA was very high, but not being able to confirm whether or not I had cancer – that was very confusing and worrying," he says. "The fact that Sunnybrook was able to find the cancer through the MRI and do a biopsy that took only six needles was pretty amazing."

Sunnybrook's work in imaging cuts across a wide range of diseases, from cancer and heart disease to stroke and Alzheimer's disease. With some imaging projects at Sunnybrook, the technology is homegrown, while in others it's the application of existing equipment that's unique and innovative.

What all these projects have in common is their quest to visualize what has long been invisible so doctors can, finally, have the information they need to give their patients the most appropriate and effective care.

"It's the stuff of science fiction," says Dr. Sandra Black, Brain Sciences Research Program director at Sunnybrook. "But it's happening now, and our hope is that it's going to make a huge difference for patients with serious conditions."

## THERAPEUTIC: PET-MRI WITH TRANSCRANIAL-FOCUSED ULTRASOUND HELMET

In the future, patients with early-stage Alzheimer's disease or dementia could come into a hospital, put on an ultrasound helmet and get stem cells or a combination of drugs injected with precision into the affected parts of their brain.

Sounds far-fetched? This cutting-edge treatment could be coming soon to Sunnybrook, thanks to the innovation of its scientists and a multimillion-dollar investment in a PET-MRI system.

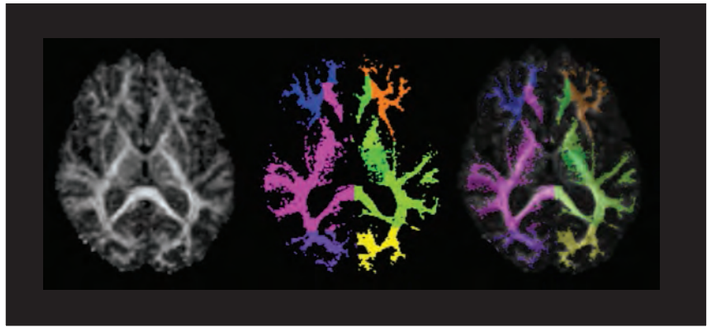
The much-anticipated system will be housed in the future Slaight Centre for Image-Guided Brain Therapy and Repair, which is being funded by a $10-million donation from the Slaight Family Foundation at Sunnybrook Research Institute. The PET-MRI system will be modified for integration with a transcranial-focused ultrasound device fashioned as a helmet.

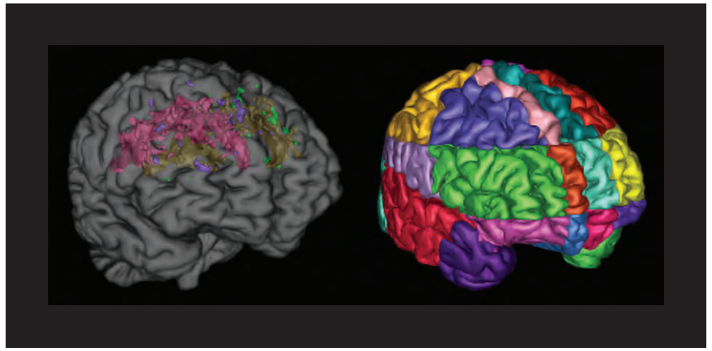
Developed by Sunnybrook scientist Dr. Kullervo Hynynen, the ultrasound device uses ultrasound beams and harmless, tiny gas bubbles to create a temporary opening in the brain's blood barrier. This allows large molecules, such as growth factors, antibodies and even stem cells, to get into the brain through the barrier posed by tight junctions in the tiny blood vessels called capillaries which otherwise would keep them out. Real-time imaging from the PET-MRI scanner ensures the ultrasound and therapeutics are targeted precisely to a specific area of the brain.

"Right now intravenous infusions or injections of monoclonal antibodies are inefficient because you get only 1 per cent of them into the brain, and these are very expensive biological treatments," says Dr. Sandra Black. "But if you could increase their access into the brain and in targeted areas where they are needed, that could be very beneficial."

Focused ultrasound at high frequency (HiFU) is already being used in trials for other conditions, including treatment of severe tremors, notes Dr. Black. It is called knifeless surgery. Low frequency focused ultrasound (LoFU) is already in trials at Sunnybrook to deliver drugs into brain tumours by opening the blood-brain barrier as the chemotherapy is being infused.

Sunnybrook researchers are hoping they will also soon be able to use focused ultrasound to break up blood clots in the brain vessels of patients with stroke and to get drugs into the brains of people with Alzheimer's disease. If the preliminary studies continue to go well, they hope to launch the first clinical trials using LoFU in Alzheimer's disease within the next few years.





**TOP Left:** *Structural MRI with Diffusion Tensor Imaging (DTI), used in the study and treatment of neurological disorders, shows the flow of water through the tracts of the brain.* **Middle:** *The multicoloured image shows the white matter of the brain, segmented into different regions using SABRE/Lesion Explorer, a unique software developed by Dr. Sandra Black and her team at Sunnybrook that quantifies and measures regions of the brain. The colours highlight all white matter of the brain.* **Right:** *Segmented SABRE/Lesion Explorer imaging when it is merged with structural MRI-DTI.*

**BOTTOM Left:** *Standard MRI with SABRE/Lesion Explorer overlay. The multicoloured areas show different types of lesions per side or hemisphere of the brain. This image shows a brain with small vessel disease. Dr. Black and her lab look at dementia and Alzheimer's disease, and how they may interact with small vessel disease.* **Right:** *A three-dimensional view, using SABRE/Lesion Explorer to segment the brain for further study.*

## DIAGNOSTIC: HEART METABOLIC MRI

A new imaging method pioneered at Sunnybrook is giving doctors new perspective into a patient's heart, allowing them to detect heart failure at an early stage and identify the best therapy.

Using a new, $2-million imaging system known as a metabolic MRI, Dr. Charles Cunningham, a physicist in the Schulich Heart Research Program, developed a technique for non-invasively measuring the metabolism in the heart muscle, capturing chemical reactions as they occur.

"As the human heart begins to fail, it starts to use glucose instead of fat as its preferred fuel," explains Dr. Cunningham. "That's one of the metabolic changes that occur, and there are drugs that reverse that."

Dr. Cunningham's new method uses a "hyper-polarizer" machine to add magnetic signals to pyruvate – a chemical compound produced when the body metabolizes glucose or sugar. When injected into a patient, this magnetized pyruvate can be captured visually using an MRI scanner.

"We make images of the pyruvates as well as other metabolic products such as carbon dioxide and glutamate produced within the heart muscle," says Dr. Cunningham. "We know what the changes are for those products in early heart failure."

Magnetic resonance imaging is already used today to visu-


*An MRI combined with ultrasound was used to guide the biopsy and find the occult prostate cancer of Kim Stewart, shown here with Dr. Laurent Milot.*

alize the pumping of a patient's heart. Integrating the hyper-polarizer would add a mere 10 minutes to the process and provide significantly more valuable information that may soon help doctors develop an optimal treatment plan for each patient.

Sunnybrook is now getting ready to embark on its first patient studies using this method for cardiovascular imaging. Dr. Cunningham says his team will also be working with drug companies on ways to target the different patterns in metabolic changes from heart disease, which affects about 1.4 million Canadians today and kills close to 50,000 a year.

"There are a lot of different drugs and they have varying degrees of efficacy for different stages of heart failure," he says. "Our goal with these studies is to be able to identify which patients would be better candidates for certain types of therapy – that would be a huge improvement."

## THERANOSTIC: QUS (QUANTITATIVE ULTRASOUND)

Sunnybrook is making waves in breast cancer treatment with an innovative monitoring technique that can detect within one to four weeks whether or not a patient is responding to chemotherapy.

Known as QUS, the new technology applies specialized software to traditional ultrasound imaging to detect the absence or presence of cell death from chemotherapy.

For women with locally advanced breast cancer receiving pre-surgery chemotherapy, the use of QUS means they'll no longer need to wait months to find out how the treatment worked.

"About 60 to 70 per cent of the time, chemotherapy could be more effective," says QUS study lead, Dr. Gregory Czarnota, Sunnybrook's head of radiation oncology at the Odette Cancer Program, and a senior scientist at Sunnybrook Research Institute. "But the problem with classic diagnostic imaging is that it measures tumour size and extent, and when you're treating tumours, changes in size take many months to happen."

With QUS, doctors will know sooner if they need to switch their patient to a different type of drug or treatment method – a move that potentially stands to change the outcome for women with locally advanced breast cancer.

More than 100 women have signed up to participate in a QUS study, and about 85 of these women have finished their tests.

"The results proved that the technology works – that within one and four weeks we can demonstrate whether the chemo was going to work or not," says Dr. Czarnota. "We're at the stage now where the technology is being expanded to other centres through the Ontario Institute for Cancer Research."

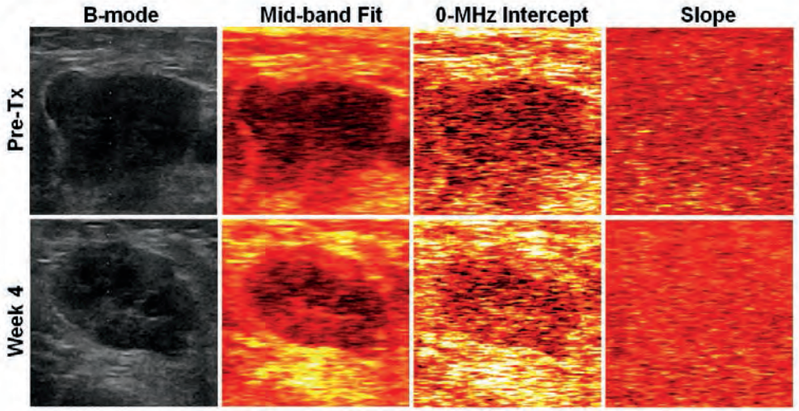
## THERAPEUTIC: MRI-RADIATION TECHNOLOGY

What if you could deliver cancer treatment with laser-sharp precision, killing only the cancer and leaving normal tissues untouched? That's a goal Sunnybrook hopes to help accomplish soon.

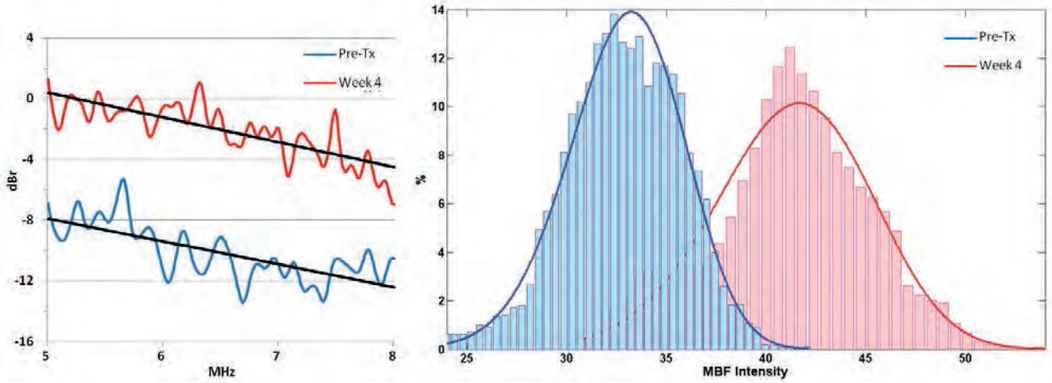
Last year, Sunnybrook joined a research consortium to develop and test a new system that merges magnetic resonance imaging with radiation therapy. This breakthrough technology, which provides exceptional depictions of a patient's soft tissues and tumour, could soon make it possible for doctors to track the treatment site in real-time and reduce side-effects from radiation therapy.

Created by Stockholm-based Elekta AB and Royal Philips Electronics in the Netherlands, the new technology represents one of the most exciting developments in radiation technology in the last decade.

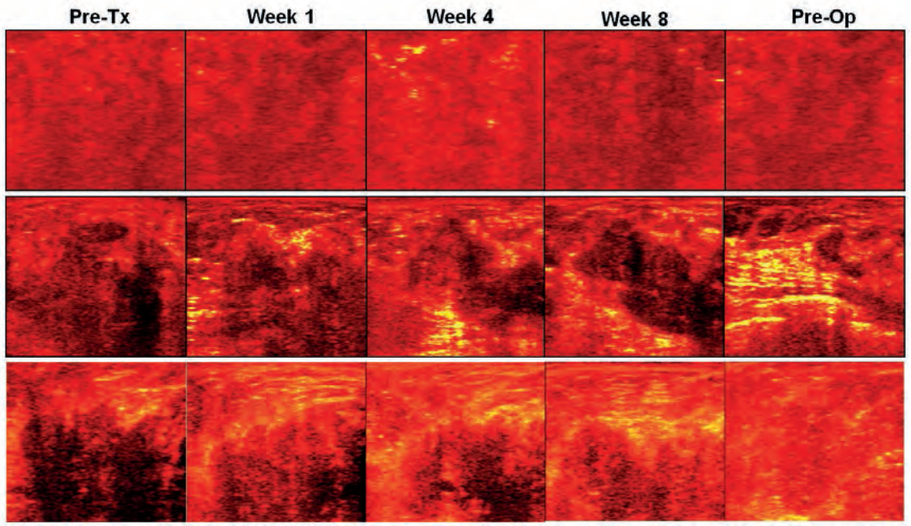
## QUANTITATIVE ULTRASOUND: AN EYE INTO BREAST CANCER




*The top row shows a large breast tumour before pre-surgery chemotherapy treatment and (bottom row) after four weeks of treatment, using four different techniques, starting with black-and-white ultrasound on the left.*




*This graph shows quantitative ultrasound of a case in which the breast cancer tumour is responding to pre-surgery chemotherapy treatment; the blue lines show the tumour before chemo, and the red lines are after treatment.*




*Each row shows a different tumour's response to treatment. Red areas show low signal intensity – i.e. a low response to chemotherapy. Yellow shows high signal intensity, signalling a good response. The top row is a non-responding case; the two lower rows show tumours responding to treatment over a period that starts pre-treatment and progesses to the eighth week of treatment and (in the final square) just before surgery.*

SOURCE: SUNNYBROOK

# *of life and limb*

Diabetics with arterial disease in their lower legs are being given a new lease on life with an angioplasty technique previously used only on cardiac patients

By Patrick Lynch

*Two happy recipients of the surgery: Moisei Korol (left) and Charles Hykawy.*
PHOTOGRAPHY BY TIM FRASER

# "Do you know anyone with diabetes?"

Dr. Giuseppe Papia lets the question hang awkwardly in the air. With almost one in 10 Ontarians diagnosed with the condition, the 40-year old vascular surgeon already knows the answer: "Everyone does."

So he takes it one step further: "Do you know somebody with diabetes who's had a foot ulcer?" A beat, then: "Do you know that statistically their chance of being alive in two years is less than 50 per cent?"

It's a grim stat, but a strong motivator for Dr. Papia and his Sunnybrook colleague, Dr. Andrew Dueck. Together they're perfecting minimally invasive angioplasty techniques to improve the lives of patients with peripheral arterial disease, a narrowing of blood vessels that can lead to lost limbs and even lost lives.

Diabetics with foot ulcers often take a year to get from their family physician to Dr. Papia, which, when you consider their two-year mortality rate, is half a lifetime. And it used to be that when they finally made it to a clinic, the solution was often a life-changer.

"When I was training, and you came in with this problem you just got an amputation," says Dr. Papia. "Nothing we did below the knee worked."

Now, using concepts honed in plastic surgery and techniques developed in the cardiac catheterization lab, Drs. Papia and Dueck are restoring blood flow to extremities below the knee. Instead of trying to bypass a blocked artery – procedures which typically result in long, painful recovery periods, especially for slow-healing diabetics – Dr. Papia uses angioplasty procedures that clear blockages with a guided coronary wire, then open up the artery more permanently with a balloon. Once blood flow is restored, patients go home the same day without ever having undergone general anesthesia. The goal is to quickly restore quality of life to patients coming face to face with their own mortality.

"The day [diabetics] develop a foot ulcer is worse than the diagnosis of most cancers," says Dr. Papia. "Nobody appreciates that. And there's nowhere for them to go. There's no limb centre."

That's true, officially. But at Sunnybrook's Schulich Heart Centre, work is going on that may change all that.

***Below the knee***

It's mid-morning on a frigid winter day, and 74-year-old Moisei (Michael) Korol is flat out on the table in Schulich's catheterization lab. Dr. Papia leans over him, eyes focused on a monitor that shows the progress of a wire moving through Korol's femoral artery en route to an arterial blockage above his right knee.

"I want to go to Cuba in two weeks," Mr. Korol deadpans in a thick Latvian accent.

Dr. Papia's eyes remain on the screen. "Yeah, that's probably not a good idea, Michael."

Like many of Dr. Papia's diabetic patients, Mr. Korol is a repeat client – even with successful angioplasties, the probability of disease recurrence is high. His first angioplasty, in December 2012, helped restore blood flow to an ulcer that had developed on his left foot; his second visit, for pain in his right leg, cleared arteries that had become blocked below the knee; this visit, his third at the Sunnybrook cath lab, has been precipitated by the development of an ulcer on his right foot.

Well over an hour into the procedure, Dr. Papia is struggling to get the coronary wire down to the first of two blockages in Mr. Korol's right leg. He tried accessing the arteries from the right hip to no avail. So he tried going in from the left side. No dice. Finally, on the cusp of calling off the procedure, he tries again from the right side, and manages to get his wire to clear the first of two blockages. Moments later, he points to the screen monitoring Mr. Korol's blood flow.

"Beautiful," he cries. "Look at that! Much better, it's just flying down there."

Once dormant arteries are now flush with blood being pumped into the area surrounding the foot ulcer. The taps, as Dr. Papia's plumbing metaphor goes, have once again been turned on.

"How are you feeling, Michael?"

"Better," comes the reply. "The foot feels much easier."

Dr. Papia works his wire out of the leg and commences a bit of cleanup.

"It's time-consuming, that's for sure," he says. "But when it goes well, it's worth any amount of time."

▲ *"The day [diabetics] develop a foot ulcer is worse than the diagnosis of most cancers," says Dr. Giuseppe Papia, shown here in the lab and in surgery performing the below-the-knee angioplasty.*

***Toe to toe***

"Let's face it: This is not sexy work." Dr. Papia is seated on a couch in his Sunnybrook office, explaining how he got into minimally invasive, below-the-knee angioplasty.

"I think we've found a core group of passionate physicians around it, but it's not the heart, you know? It's toes."

Four years ago, there weren't many vascular surgeons who would do work below the knee. Treatment then was largely focused on bypass surgeries. As coronary technologies evolved, however, smaller balloons and wires used in cardiac procedures began to make angioplasties a more sensible option for the typically older patients in need of below-the-knee revascularization. Plastic surgery also provided a game-changer: Surgeons had identified angiosomes – three-dimensional, discrete zones of tissue that are fed by an artery and drained by a vein. These regions exist in places like breasts or cheeks, where plastic surgeries are often performed, but they also exist in six places on the foot. That knowledge provided a road map for targeting blood flow to specific areas of the foot. The efficacy of below-the-knee angioplasties spiked.

After training on such procedures in the U.S. – Dr. Papia at the Cleveland Clinic, Dr. Dueck at the Arizona Heart Institute – the former University of Toronto classmates joined Schulich's cardiac cath lab as part of a joint division of cardiac and vascular surgery. The crossover of disciplines bore fruit: As Drs. Papia and Dueck began their work, they were able to take advantage of the expertise and technology available to them through their cardiac colleagues.

"We realized why a third of these kinds of [below-the-knee] procedures were being done by cardiologists worldwide," says Dr. Papia. "They had the right technology and know-how to do this. It just serendipitously fell together really well."

Five years into their time at Schulich, Drs. Papia and Dueck are now performing 200 procedures every year. Their client list is growing. Their program, however, doesn't have the funding to keep up.

# How it works

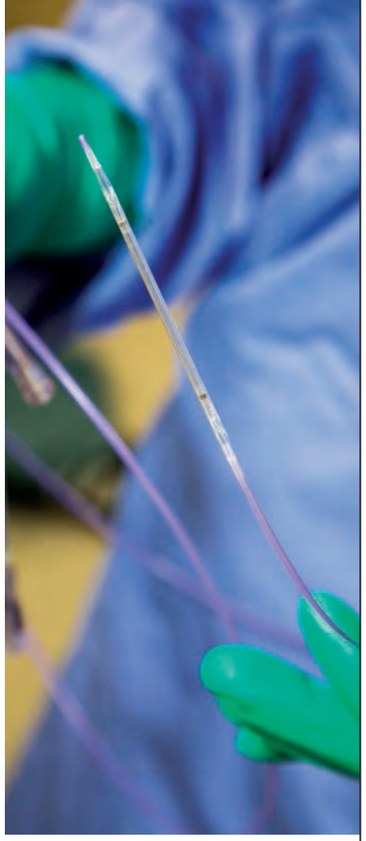
*Plumbing might be the most-apt metaphor to explain the work that Drs. Papia and Dueck are doing at Sunnybrook. When a pipe gets clogged, they go in, like the Roto-Rooter crew of the medical world, and clear that blockage.*

- After undergoing ultrasound tests (that detail blood flow and reveal narrowed arteries or blockages), a physical exam and sometimes a CT scan in the clinic, patients head to the catheterization lab for an angioplasty procedure.

- If the patient requires it, some mild sedation may be offered before Dr. Papia X-rays the groin area to determine what will be the safest point of entry to the patient's femoral artery.

- After administering a local anesthetic, a small surgical cut will be made in the groin on the side opposite the problem leg. (For a right foot ulcer, Dr. Papia prefers to access the femoral artery from the left side of a patient's groin, a technique that offers him the most manoeuvrability down the blood vessel and offers the best picture of what's happening from the aorta all the way down the leg.)

- The artery is then punctured with a needle, and a catheter is fed up and over the middle of the femoral artery, down into the opposite leg. (This is all visible on the X-ray monitor mounted next to the operating table.) A coronary wire is fed through the catheter. Dye is injected through the catheter, allowing Dr. Papia to see the blood flow and vessels via moving X-ray pictures (fluoroscopy).



- A blood thinner is administered (catheters can sometimes block blood flow and start clotting in the artery), then the wire of choice is fed through the catheter down to the target area. The wire is used to clear the blockage, then a tiny balloon is slid down to the site of the angioplasty. Using a small hand pump, Dr. Papia inflates the balloon inside the artery, leaving it in place for three minutes or so, opening up blood flow through the vessel.

- The balloon, wire and catheter are removed from the patient, and the wound is closed with a closure device. Patients go home four hours postprocedure and return for a diagnostic checkup in a month's time.

- The goal – to restore inline continuous blood flow to the ulcer – can often be seen happening in real-time on the X-ray monitor. As Dr. Papia exclaimed mid-procedure: "Amazing! Look at it flying down there!"

***Living without pain***

"It was like somebody was sticking knives in the back of my calves." Charles Hykawy, a 64-year-old patient of Dr. Papia, is describing what drove him to his family doctor and, eventually, to the Schulich Heart Centre. A diabetic who works a physically demanding job doing home repairs in Pickering, Ont., Hykawy found himself unable to walk more than 50 feet before he was crippled by debilitating pain caused by claudication, a restriction of blood flow to the muscles often caused by peripheral arterial disease.

Seven months after two procedures with Dr. Papia – his left leg, later followed by his right – the claudication is gone.

"I do a lot of walking when I go to the Home Depot," he says. "Before I could only walk partway around the store before I'd have to stop. Now I can walk around and buy all the materials I need and everything, and I don't have a problem; it doesn't hurt anymore."

That ability to restore quality of life is what's at the core of the work Dr. Papia is doing at the Schulich Heart Centre.

"You have to evaluate what the bar is," he says, referring to the old school of cardiovascular thought that insisted on bypass surgery as the best course of action for patients with peripheral arterial disease. "If the bar is palliating the pain, healing the ulcer and giving patients a better quality of life, then what we're doing is fantastic!"

Hykawy and Korol concur. By performing less-intrusive angioplasties that don't require a hospital stay, Dr. Papia's work is more than a lifesaver – it's also a money saver. The Canadian Diabetes Association (CDA) estimates that diabetic foot ulcers currently cost our health-care system more than $150-million annually. Eighty-five per cent of all leg amputations, says the CDA, are the result of non-healing foot ulcers.

"If you look at the explosion of diabetes worldwide and in Ontario, I think there's a good argument for a project here that's more than a demonstration project. I can't remember the last time I did an amputation, but I do remember the last two patients that I sent for an amputation. And I remember them because that doesn't really happen any more."

*A recent emergency preparedness exercise at Sunnybrook's St. John's Rehab.*

# In case of emergency

*From SARS to the G20 to next year's Pan Am Games, Sunnybrook experts help lead the response to actual and potential crises*

**BY ALEXIS DOBRANOWSKI**

Trevor Hall is always planning for the worst. Floods, global infectious disease outbreaks, chemical spills. You name it, he's considered it.

But Hall is no pessimist. He is Sunnybrook's patient safety specialist and emergency preparedness leader, and he knows that good planning could make the world of difference to Ontario's health system should one of these disasters occur.

Hall is in the midst of planning a mock chemical decontamination exercise for Sunnybrook's emergency department. First, the participants will learn what is involved in a chemical response and how to properly put their protective suits on. Then they'll practise.

"It's giving staff the experience in a safe environment and making it as realistic as possible for them," he says. "We also look at it from the patient side: What does it feel like to be brought into a room where people are in these suits? Imagine being that patient. You are contaminated, you are not feeling well, you have to take your clothes off and get water all over you. It's scary. How can we improve this experience for you?"

Simulated emergencies like decontaminations allow the emergency preparedness team and staff to have a better understanding of the steps they will undertake during a crisis, and to see where things might go wrong and how it may impact the health system.

Emergency preparedness planning often begins with more questions than answers, according to Hall.

"Based on the feedback we receive through actual incidents and response, or preventive analysis, we find out where the gaps are and try to address those," he explains. "It may be as simple as bringing people together in the room to ask, 'How would we deal with this?' or it could involve building a simulation – like the decontamination exercise or an evacuation – to see the response."

A former firefighter and business school graduate, Hall says he fell in love with emergency response and hospital management. He became a nurse with a focus on quality improvement before taking on his current role.

"It's fascinating to see how, by designing health-care systems, you can really impact the response," he says. "It all comes down to the system. We use prospective analysis: How can things fail? And then we really tailor exercises, plans and protocols for those responses."

"At Sunnybrook, we take a leadership position by saying, 'This is the question, this is our hypothesis and let's test it out.' It's a scientific approach."

### THE SUNNYBROOK EFFECT

Dr. Laurie Mazurik, a Sunnybrook emergency physician and emergency preparedness strategic lead, says as Canada's largest trauma hospital, Sunnybrook's processes and expertise can be used to inform plans across the health system.

"If there's a mass casualty event tomorrow, how can we ensure that all of our pre-hospital services and hospital services are working together to ensure the best care?" Dr. Mazurik asks. "It used to be a crisis management strategy to have 20 per cent of your beds open. But that's just not possible in Toronto these days."

The only way to add capacity is to work

as a system of hospitals and community partners, says Dr. Mazurik.

"Crises tend to be a very good catalyst for communications and collaboration," she adds. "Toronto has been lucky and unlucky. Major event planning for events like the G20, exercises – over 30 in the past 10 years – and actual crises like SARS, the blackout of 2003 and ice storms have galvanized the community, but decreasing health-care capacity continues to increase our vulnerability."

Both Hall and Dr. Mazurik routinely take Sunnybrook's expertise in this area beyond its walls. Hall works with the province's Emergency Management Assistance Team, and Dr. Mazurik is leading an international team to develop an emergency preparedness curriculum on behalf of the Public Health Agency of Canada.

Along with a team of Sunnybrook trauma surgeons, and health and safety leaders, they are also involved in emergency preparedness planning for the 2015 Pan Am Games to be held in Toronto and the GTA. Medical leaders will look at the health system as a whole, and how surges of patients will be managed in the event of an infectious disease outbreak or a CBRNE event (chemical, biological, radiological-nuclear, nuclear or explosive/extreme weather) resulting in mass casualties during the games, which is expected to bring about two million extra people to the city.

"We have to think about our health services as a system, and we need to ensure that our health system is there for each Ontarian and our welcomed guests," Hall says. "The influx of people alone will increase the amount of care that could be needed. And we need to make sure that we can effectively respond to that demand." They will look at a wide range of potential issues, from a chemical attack to heat-related incidents to transportation.

"How do we make sure an ambulance can get to a routine event, like a crash on the highway? How can we ensure that the same consistent standard of care would be available to that person? How do you get the ambulance onto the Don Valley Parkway when there are two million extra people in the region?"

Dr. Mazurik was part of the SARS Operation Centre in 2003 and was the Toronto Central LHIN G20 planning lead. She has conducted multiple multiagency exercises in Toronto since 2003 and will draw on her experience during those events to help prepare for the Pan Am Games. As the games approach, she'll work with external partners, like EMS and police, to plan simulated crises.

"The easiest time to discuss what you should do is not at the time of a crisis," Dr. Mazurik says. "Having stakeholders review their disaster plans simultaneously in preparation for a planned event or exercise creates readiness. The unexpected byproduct of this process is revealing innovative ways to deliver health care more efficiently now."

She worked with a team in the lead-up to the G20 to create an electronic dashboard that could provide an at-a-glance look at the capacity of the critical services of 20 hospitals in Toronto. Hospitals uploaded their capacity data. A green icon meant all was well. Red triggered a teleconference. The system proved extremely useful, she says.

"The riots downtown meant that dialysis patients couldn't get to appointments. There were burning cars; the TTC wasn't running," Dr. Mazurik says, adding they worked closely with police and military. "It triggered a response via the dashboard. All the other hospitals that had dialysis that weren't in that zone of terror were ready and willing to take those patients. It was unprecedented. In the past, we would not have been aware there was a problem, let alone be able solve it."

Dr. Mazurik is in talks to update the dashboard to be used during the Pan Am Games. And, better yet, all the time.

"There are certain kinds of situations that we hope aren't going to come again," Dr. Mazurik says. "But, as they say, there is no such thing as luck; there's just working hard to be prepared."

## WHEN THE LIGHTS WENT OUT

When ice and wind took out power lines and left much of Toronto in the dark on December 21, 2013, Sunnybrook's emergency response principles were put to the test.

Emergency generators immediately kicked in, providing critical areas with power and keeping patients safe.

And the emergency operations centre – bringing together staff leads from power plant, risk and patient safety, administration and units across the hospital – was up and running soon after the lights went out.

"I think it's human behaviour to hear the word 'emergency' and think the worst," says Trevor Hall, Sunnybrook's patient safety specialist and emergency preparedness leader. "Sunnybrook's response proved that an emergency can be controlled. People came to work. We had great communications, which is something that often fails. Most patient service wasn't interrupted. I think all of Sunnybrook and our external partners did a great job working as a team and maintaining the patient experience."

Because it was unclear how long Sunnybrook would be off the grid, a decision was made to transfer six babies out of the Neonatal Intensive Care Unit (NICU) to neighbouring hospitals. The NICU had undergone mock Code Green (evacuation) exercises to practise these scenarios.

Sunnybrook's power was restored within two days. But as power outages around the city continued into the third day, a concern arose among Toronto hospitals, the local health integration network and community partners, as well as the Ministry of Health and Long-Term Care, that the emergency departments across the city could see a surge in patients due to the extreme cold.

The province's Emergency Medical Assistance Team was deployed and set up a field hospital in Sunnybrook's McLaughlin Auditorium within nine hours. The field hospital saw patients not sick enough for a medical bed, but who had other issues preventing them from being released to a warming centre or home.

"This demonstrated great leadership and enhanced patient safety," Hall says. "It also proved that Sunnybrook can provide surge capacity for the city and the GTA when it matters most."





*Dr. Sophie Grigoriadis*

# Beyond the baby blues

*Do antidepressants in pregnancy pose a real risk to the fetus? A Sunnybrook psychiatrist is researching this and other issues*

**BY CHANTAL BRAGANZA**

The patient is newly pregnant and feeling restless or moody. She may be sleeping more, her appetite has changed and she has been feeling exhausted more often. Unexplained aches and pains start to appear in various places.

In the past, these typical symptoms may have been written off as simply the "baby blues." But while they are all common symptoms of the first few months of pregnancy, they are also possible indicators of antenatal depression.

"It's often difficult to diagnose depression during pregnancy because many of the physical symptoms often mimic pregnancy itself," says Dr. Sophie Grigoriadis, a psychiatrist at Sunnybrook's Women's Mood and Anxiety Clinic: Reproductive Transitions.

It's also more common than is generally thought. Nearly 13 per cent of women experience major depression while pregnant, and up to 18 per cent experience a depressive disorder of some kind. While public awareness about postpartum depression has made gains in the past few years, says Dr. Grigoriadis, achieving the same for mood disorders during pregnancy – and easing the stigma that surrounds it – still has a way to go.

"People often think that pregnancy is a great time of excitement and joy, and a large number of women do experience that," she says. "But, for some women, it's not, and it's important to acknowledge it. It can be confusing for them, because they start to worry even more that they're not loving this the way they're told they should."

She recounts the experience of one patient, a high-functioning lawyer who had developed some symptoms of depression early on during a pregnancy, but decided not to pursue treatment. "When she had the baby, she just hit rock-bottom. She didn't want to take care of herself … had no interest in the baby. At the same time, she thought herself a horrific mother," says Dr. Grigoriadis, describing the cyclical feelings of apathy and guilt that often present themselves in antenatal and postpartum depression. Eventually realizing she needed help, she sought out Dr. Grigoriadis. Through a combination

of psychotherapy and medication, she improved over time, though there were post-pregnancy issues that still had to be dealt with: Had leaving her depression untreated negatively affected the early development of her child? Might things have been different had she taken medication during her pregnancy?

### SAFETY FIRST

It's questions like these that prompted Sunnybrook to establish the Women's Mood and Anxiety Clinic: Reproductive Transitions in 2011. While the clinic acts as a resource centre and research program for mood disorders across a woman's reproductive life span, much of its research is focused on pregnancy and the complex decisions that arise around the treatment of mood disorders before and after childbirth. One of Dr. Grigoriadis's primary research interests, for example, has been the complex – and controversial – question around the safety of taking antidepressant medications while pregnant.

In 2005 the drug manufacturer GlaxoSmithKline published a study on the effects of taking Paxil during pregnancy, concluding that infants exposed to the antidepressant medication were at risk of congenital heart defects. The U.S. Food and Drug Administration and Health Canada followed suit with public warnings about the drug soon after, along with a few other selective serotonin reuptake inhibitor (SSRI) medications, sparking concern among the medical community and its patients about the safety of taking antidepressants during pregnancy.

"It was difficult to tease apart the literature, because there was contradictory evidence," says Dr. Grigoriadis, who notes that similar studies published since 2005 offered wildly conflicting conclusions, making treatment decisions for doctors difficult. Part of the reason for this is that clinical trials of such drugs aren't performed on pregnant women for ethical reasons. They're often population studies and surveys conducted after birth.

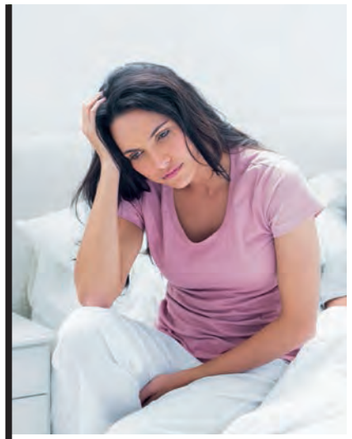
Since then, Dr. Grigoriadis has set out to sift the results. She has been collating the outcomes of a wide range of antidepressant and pregnancy studies and assessing the quality of the studies themselves, along with colleagues from a range of institutions such as the University Health Network, Women's College Hospital, Centre for Addiction and Mental Health and the University of Toronto (where she also teaches).

> *"People often think that pregnancy is a great time of excitement and joy, and a large number of women do experience that. But, for some women, it's not, and it's important to acknowledge it."*

"We wanted to see if they used randomized methods or not, or control groups or not. For example, a lot of papers did not control for things like other psychotropic medications, alcohol, cigarettes or drugs. When you do that, you can't tease apart A from B."

Her recent efforts, published in the *Journal of Clinical Psychiatry* in April 2013 and the *British Medical Journal* last January, found cases for both sides of the debate. SSRI medications did pose slight risks of cardiovascular malformations, or pulmonary hypertension (a lung condition) to the fetus if taken late-term, but it was also found that untreated depression had effects on pregnancy, too, from premature delivery to problems with breastfeeding initiation.

"We embarked on this to make sense of the data," says Dr. Grigoriadis, "but we're also making a reference guide that highlights key findings for doctors to use when talking to their patients. These papers were the preliminary steps – ultimately it's important to ensure women have access to all the relevant information." Her team is currently piloting a version of it with local physicians. They hope to have it ready for nationwide use by next year.



## RECOGNIZING THE SYMPTOMS

The Women's Mood and Anxiety Clinic: Reproductive Transitions is one of a small network of centres that specialize in the diagnosis and treatment of depression in pregnancy. "Starting out with your family doctor is great, but if something is not working, it helps to have our expertise," says Dr. Sophie Grigoriadis, a psychiatrist at the clinic. "We can tease apart what is expected from what is not expected in pregnancy." According to Health Canada, you should speak with a doctor if you experience any or some of these symptoms for two weeks straight or longer:

- Feelings of restlessness and a lack of energy
- Difficulty concentrating
- Changes in sleep or appetite, from sleeping and/or eating too little or too much
- Withdrawing from other people
- Guilty thoughts or feelings of worthlessness
- Crying spells
- Depressed moods and/or extreme sadness.


*New mom Daniela LaFace with little Samantha and NICU nurse Julia Kim.*

# A move in the right direction

*A new study shows the positive impact of private rooms and other transformations at the Sunnybrook NICU*

**BY KATIE ROOK**

For the first weeks of her life, Liliana LaFace was so tiny her father's wedding ring fit over her wrist like a bracelet.

Weighing only 630 grams at birth, Liliana's chances of survival improved exponentially through every minute of care she received at Sunnybrook. She is one of hundreds of prematurely born babies whom Sunnybrook doctors and nurses have shepherded to health each year at a world-class neonatal intensive care unit (NICU) that was recently transformed so that each family can have its own room. The hospital moved the NICU from Women's College Hospital to a newly constructed perinatal centre at Sunnybrook in September 2010.

The overall effect of providing families with private rooms has been positive for everyone, according to Jo Watson, a Sunnybrook administrator who co-authored a study on the outcome of the move to private rooms and away from an open bay-style care model. Over a 12-month period, the impact of the change on babies, their parents and the staff supporting both was tracked.

"We've discovered something here that leaves babies healthier, leaves parents healthier, costs the system less money and improves staff satisfaction, safety and quality of care," she says. "Other centres can learn from this."

Liliana overcame the health challenges that follow when birth precedes the full development of lungs and a heart. She was a healthy 21-month-old who was keeping her parents very busy last December when her mother, Daniela, went into labour at 26 weeks with Liliana's sister Samantha.

"The thought that Samantha would come early was in my head. People kept reassuring me, but when the same stomach pain started, I knew what to expect," she says.

The birth was less fraught than Liliana's, but was still enormously stressful. Whereas Liliana had been cared for in an open bay-style room, with Samantha, the LaFace family benefited from the advantages of a private room.

"It was huge for us to be able to have privacy. I could bond in whatever way I wanted to. It was just me in my room, just like it would be at home," says Daniela. "We're very happy to be here. It's like having family watch her."

Moving the NICU to a specially designed space that affords each family a private room where they can work with and oversee their child's care has reduced some of the stress and anxiety known to plague the parents of preemies.

In considering the experience of 85 families, the majority of parents reported feeling more comfortable spending time with their baby. They were better able to understand their infant's signals and as a result became more confident feeding and comforting them.

Staff noted improved job satisfaction: Concentrating was easier, noise levels more manageable and overall communication and productivity improved.

The study also revealed a significant reduction in hospital-acquired infections and in medical errors. At the same time, the private room care model decreased the cost per patient per day from $1,500 to $1,100.

> *"It was huge for us to be able to have privacy. I could bond in whatever way I wanted to."*
>
> Daniela LaFace
> maternity patient

The benefits of private rooms stand in relief to the realities of open bay-style units typically found in NICUs throughout North America, where up to 12 babies are cared for in a large room. While each baby and the equipment needed for their care are allotted ample space, the amounts of noise and light the baby is exposed to cannot be regulated.

In open bay-style units, some families long for privacy – their stress amplified by easy exposure to the germs from surrounding people and the changes in health of nearby babies. The constant buzz and hum of equipment is known to wear down staff who are already managing the pressure of visually monitoring a number of babies despite the array of technological tools now available to do so.

The new private rooms at the Sunnybrook NICU provide a modest bed for parents who stay overnight. There is also room for a second cot. An entrance corridor for family members is separate from that which staff use. Each private room opens into a central space out of which staff work. Whiteboards are posted in each room to help facilitate easy communication between parents, nurses and doctors.

Sunnybrook's success with private rooms can also be attributed to the contributions of a parent co-ordinator, Kate Robson, who is herself the mother of preemies. Robson has been instrumental in mitigating parent stress and anxiety. In addition to building a rapport with each family within the NICU, she encourages participation in programmed group activities, including educational and holiday events.

Sunnybrook's NICU move was planned for many years. It resulted from extensive and careful research, as well as close consultation with staff, families and design experts.

Alongside Watson, study co-authors Marion De Land, Sharyn Gibbins, Elizabeth MacMillan York and Kate Robson hope that other facilities will benefit from their experience designing, moving to and working within the private room care model. Through their study, they aim to demonstrate that "research is an arena where Sunnybrook is building capacity in transforming the future of health care," Watson says.

"When you're caring for sick preemies, you have an obligation to do things right."

*Dr. Krista Lanctôt (left) and Sarah Chau analyze eye-scan images.*

# The eyes have it

*Researchers are working on eye-scan technology to peer into the inner workings of the minds of Alzheimer's patients*

**BY JUNE ROGERS**

Families can feel helpless as they watch their loved ones with Alzheimer's disease (AD) become withdrawn, no longer caring to get dressed in the morning or taking any pleasure in their favourite pastimes. It's difficult to tell whether they are depressed or are simply sinking faster than expected into the ravages of the disease.

But a new eye-scan technique being tested at Sunnybrook promises to take the guesswork out of an AD patient's prognosis. Early results of the eye-scan study, led by Dr. Krista Lanctôt, Dr. Nathan Herrmann and PhD candidate Sarah Chau, are revealing that what is commonly thought to be depression may actually be apathy, which is treatable. When some of the AD patients in the study diagnosed with apathy received the proper medication, they responded positively and took more interest in the world around them.

Even though AD affects memory, retention and recognition, some 65 per cent of caregivers cite apathy as more distressing than memory loss in their loved ones, says Dr. Lanctôt, a neuropsychopharmacologist and senior scientist, evaluative clinical sciences Brain Sciences Research Program at Sunnybrook Research Institute. The signs of apathy, says Dr. Lanctôt, include decreased initiative – AD patients often have difficulty starting anything on their own – and emotional indifference. "Nothing seems to make them happy, not even the sight of their own grandchildren," she says.

Apathy is the most common symptom associated with Alzheimer's disease, says Dr. Herrmann, head of geriatric psychiatry at Sunnybrook. It is estimated that 40 to 90 per cent of AD patients experience apathy at some point in the disease's trajectory, which can last anywhere from two to 15 years. Apathy may be due to the part of the brain that may be degenerating the most, Dr. Herrmann adds.

Because AD patients often have difficulty describing how they feel, health-care professionals tend to rely on their caregivers to assess their patients' emotional well-being, which can be subjective or unreliable. "It's very hard for someone to know what's going on inside an AD patient's mind," says Chau, a PhD student in pharmacology and toxicology at the University of Toronto. "It's important to make sure we diagnose our patients properly because we may be giving them medication that either doesn't help at all or may make their mental health even worse."

## EYE SPY

To that end, the research team is testing an eye-scan technique to find out whether a patient with mild to moderate AD is experiencing depression or apathy and measure memory and attention span. Each participant is placed in front of a computer screen that projects 16 different images and tracks their eye movements. For example, a screen may contain four slides of neutral objects such as apples, oranges, seascapes and flowers. In the next screen, two of the images will be repeated and two new ones will be added, say, of candy and ice cream.

"We test to see if the patients tend to be more interested in the new images and if they have already seen the repeated images, if their eyes move on. In other words, we want to know if they are paying attention and how well their memories are working" says Chau.

The second set of slides is full of emotional content. For example, they may look at a war scene or people crying. Alternatively, the images may contain happy people at a party or other social gatherings. "We measure how long they spend looking at the sad images versus the happier ones," says Chau. If they concentrate on the sad content, they may be depressed. But if they don't dwell on either the sad or the happy images, they may simply be feeling apathetic, she adds.

"We're excited because if the eye scan can help in mild to moderate cases of AD, it will be even more helpful in severe cases, where patients may not even be able to tell you what they had for breakfast," says Dr. Lanctôt.

The aim is to treat those exhibiting apathy with methylphenidate, also known as Ritalin, instead of antidepressants, which may increase apathy. Methylphenidate has been shown to improve attention span, memory, language, learning, problem-solving and decision-making.

The study will continue for at least another year before the researchers will likely share the new eye-scan technique with other researchers. "We've already had interest in our study from our Canadian and American colleagues," says Dr. Lanctôt.

## THE SILVER TSUNAMI

As Canada's population grows older, improving quality of life for Alzheimer's disease (AD) patients will make an enormous difference to the growing number of families being impacted by the disease, says Dr. Krista Lanctôt, a neuropsychopharmacologist and co-investigator of the eye-scan study.

Based on the *Rising Tide*, from the Alzheimer Society of Canada:

- Age is the number one risk factor for AD
- 1 per cent of the population between 65 and 75 have AD
- 26 per cent of the population 85 and older have AD
- 1.1 million Canadians will be living with AD by 2038.

*In the eye-scan test, Alzheimer's patients are shown slides that have four images: one is dysphoric (exhibiting anxiety or unease), one is social and the other two neutral. Researchers measure how the participants scan each slide and which theme they prefer to look at over others.*

*Dr. Lorne Zinman monitors the condition of ALS patient Lucia Corapi.*

# On the trail of a mysterious killer

*Dr. Lorne Zinman and fellow researchers are determined to unlock the secrets of ALS, a terminal disease that shows no mercy*

**BY WENDY GLAUSER**

It's a rare disease with no effective treatment and no cure. It usually kills within three to five years of diagnosis. There is little funding available, and little known about why it happens. But at Sunnybrook, a dedicated team of health workers and researchers are determined to solve the mystery of one of the most horrific diseases.

Attacking the motor neurons in the brain and spinal cord, amyotrophic lateral sclerosis (ALS) often starts with impaired function – a person may frequently trip or drop things – and gets worse and worse over time. Patients gradually lose the ability to walk, feed themselves, swallow, speak and, eventually, to breathe. In 10 per cent of cases, it's inherited; 90 per cent of the time ALS hits randomly.

In most cases, the degenerative process does not stop until a person dies. "You're witness to your motor function decay and you eventually become locked in," says Dr. Lorne Zinman, medical director of the ALS/Neuromuscular Clinic at Sunnybrook. Every week, approximately two to three Canadians die of ALS, also known as Lou Gehrig's disease, after the famous Major League Baseball player who died of ALS in 1941. Although ALS is nearly as common as multiple sclerosis (MS), it doesn't receive near the same attention or funding. Due to the disability caused by the disease, and, with it, the financial and logistical demands of home care and equipment, it's difficult for patients and families to mobilize for more research funding.

## A NATIONWIDE RESPONSE

Determined to do better for the ALS patients he sees, in 2008 Dr. Zinman formed the Canadian ALS Research Network, which he currently chairs. His "energy and enthusiasm" for a nationwide response has allowed Canadian ALS researchers to embark on larger, more far-reaching studies, says Dr. Janice Robertson of the Centre for Research in Neurodegenerative Diseases at the University of Toronto and a close collaborator.

Dr. Zinman, Dr. Robertson and Dr. Ekaterina Rogaeva, a genetics researcher and associate professor, University of Toronto, have together set up a blood and tissue collection site, where patients can donate blood and, after death, their brain and spinal cord to aid researchers in finding new genes associated with ALS.

Blood samples from Sunnybrook patients have contributed to finding three novel mutations in ALS, one of which is the most common mutation found in familial cases. Abnormal genes result in misfolded proteins which clog up and eventually kill motor neurons. Now, researchers are honing in on an antibody that has the potential to eliminate the misfolded protein. "If you could remove the misfolded protein, you could stop the propagation of the disease," says Dr. Zinman.

In addition, Dr. Zinman and his team are participating in a study in six sites across Canada, including Sunnybrook, to test another antibody, called ozanezumab, which showed promising results in pre-clinical trials and may shut down a protein that blocks neuron growth and repair. The compound could, therefore, regenerate motor neurons and slow the progression of the disease.

But the more researchers learn about the disease, the more they realize how complicated it is – rather than being caused by one gene, dozens may be involved. Future treatment lies in the identification and targeting of the particular genes involved, which will be different for individual patients. "If you look at the cancer field, it's really getting into personalized medicine, and I think ALS will be treated that way, too," says Dr. Robertson.

> *"First, we've got to find something that can slow the disease down and then hopefully one day actually stop it. That would be the greatest day of my life."*
>
> Dr. Lorne Zinman
> ALS/Neuromuscular Clinic

But Dr. Zinman and his colleagues recognize that a cure will likely come too late for those currently living with ALS. That's why he also spends his time caring for ALS patients along with the multidisciplinary team at Sunnybrook, which hosts the largest treatment centre for ALS patients in Canada. The team includes nurses, occupational therapists, a speech language pathologist, a respirologist, a physiatrist and a dietitian. Here, patients get outfitted with technologies that help them live their final years with as much comfort and independence as possible, including a keyboard that responds to a patient's eye movements and power wheelchairs that can be controlled with only a flicker of movement.

As Melanie York, an ALS patient currently being treated at Sunnybrook, explains, the one-stop clinic is critical. "Because of the continual loss of function and ability, and no specific timeline as to how the disease will progress, all aspects need to be monitored. You access the clinic for all of your needs, including your technological needs, your physiotherapy needs and your breathing needs," she says.

But it's the fellow patients who help her the most. Sunnybrook has established a peer support group so that people with ALS can talk about their challenges and the "emotional and spiritual aspects" of living with the illness, Melanie says. "We have to live fully … for ALS patients, it's about quality not quantity."

## A POTENTIAL WEAPON?

When patients with ALS die, researchers examine the proteins in their motor neurons. Different proteins are involved, depending on the genetic mutation that led to ALS. One that's found in large amounts not seen in non-ALS patients is a DNA-binding protein known as TDP-43. And these errant masses of TDP-43 have been found in the motor neurons in patients with both familial and sporadic ALS (though not all cases). "Now we're saying, 'Aha!'" says Dr. Zinman. "It's a bit of a smoking gun."

But researchers have struggled with how to target the misbehaving TDP-43. Dr. Zinman thinks the solution might be to instead target its "partner in crime," known as NF-kB. When TDP-43 starts behaving abnormally, it associates with the NF-kB pathway, something it wouldn't normally interact with.

This fall, Dr. Zinman will be leading a study to see whether a naturopathic compound called Withaferin A delays the disease in humans. Withaferin A blocks NF-kB and has been found to reduce ALS symptoms in pre-clinical trial. One hundred patients across Canada will be randomized to take either Withaferin A, which comes from a plant in India, or a placebo.

"It's like you walk into a room and you see a guy covered in blood and you have to figure out what caused the blood," explains Dr. Zinman. "We see the aftereffects of ALS but we're still trying to figure out what the causes are, and what the right targets are."

PHOTOGRAPHY BY JENNIFER ROBERTS

*The Family Navigation Project "was born out of trauma, but it was a brilliant development," says Rhonda Myers, shown with her son Jason.*

# Steering through rough waters

*Sunnybrook's Family Navigation Project is launching with a view to helping troubled young people get the help they need*

**BY MARLENE HABIB**

Jason Myers is enthusiastic, energetic and ambitious – like any twentysomething with career and personal goals – but the Toronto university student also shares something deeply personal with many other young people.

For several years, Jason struggled with mental health, as well as substance use, issues. It was only after an exhaustive search that his parents finally found the right support and programs that would kick-start their son's recovery.

After spending a total of nearly a year at two Utah treatment centres, Jason, now 21, is blossoming as a third-year student in the psychology program at Toronto's Ryerson University, where he's also passionately involved in an entrepreneurship program. As well, his mother, Rhonda Myers, turned her son's negative experiences into a positive: She's among the parents who were instrumental in the formation of the Family Navigation Project (FNP) – a Sunnybrook initiative that connects young people aged 14 to 24 struggling with mental health and/or substance abuse problems, as well as their families, with appropriate and timely help.

While the FNP has been in development for some time, it will officially launch in June 2014, boosted by $1.2-million raised through the inaugural RBC Run for the Kids™. As well as a parents' council of dedicated volunteers like Rhonda, there are staff health system "navigators," other volunteers and a medical director, Sunnybrook's Dr. Anthony Levitt.

In many ways, Jason wishes the FNP was around when he began struggling in middle school.

"Before I went away [to the American treatment centres], I went to a number of different therapists, tried a number of different programs – nothing really worked for me," says Jason. "But it's very different when you find the right groups and therapists."

Dr. Levitt, Sunnybrook's director of research in psychiatry, says an estimated two million youth in Canada have mental health and/or addiction problems, and only one in five gets specialized treatment.

"Mental illness and addictions know no social barriers – they occur across socioeconomic class, and employment and housing status," says Dr. Levitt, also a professor in the University of Toronto's psychiatry department. "The truth is, it can affect anybody, and it does.

"What we have discovered is even those 20 per cent of kids who get the specialized treatment, a lot don't complete it – then they have to go back and get treatment again, and even then that doesn't necessarily work. Families are going through the system and can't find the right door."

Jason and his family had the door slammed shut on them many times while seeking help.

"I started struggling with anxiety and depression, and it got progressively worse to the point that, in Grade 11, I was unable to sleep, really had no motivation to get out of bed and go to school or do anything," recalls Jason, the youngest of three children. "My mindset was, 'Why bother going to school when I was going to be dead anyway,' which was pretty grim, but that was my overriding thought."

That dark period finally saw some light, however, in the summer of Grade 11 after he entered a 10-week program called Second Nature: Wilderness Therapy for Troubled Teens and Families located in a mountainous area of Utah. Jason says, in his first few days in the program, he wrote his life story while in isolation – an important eye-opener.

"Reading my life story was what really made it click that, 'Wow, I'm wrong – nowhere did I mention friends and family – it was more about myself, and drugs and being cool. Before that, I was convinced I didn't need help because no one understands me and it wasn't my fault – it was everyone else's." Today, the sports-loving student is working part-time at a venture capital firm with the goal of a career in marketing and business development and shares a downtown apartment with two buddies.

## SEARCHING FOR ANSWERS

Rhonda says the FNP "was born out of trauma, but it was a brilliant development." When she and her husband first started trying to navigate the mental health system, "nobody we called had any answers… . We were lost, absolutely lost, terrified."

While attending a lecture by another Sunnybrook psychiatrist, Rhonda met Dr. Levitt and they discussed the harrowing road that parents like her often have to take to get help. From there, Dr. Levitt met with Rhonda and other parents to conceive the FNP "around the kitchen table."

Jeanne Foot, chair of the FNP parents' council, who has two children who overcame problems, says meeting other parents with troubled kids showed her she wasn't alone.

"For all of us [on the council], we had exhausted every situation, but for these families who are now being helped by the FNP, they will get a lifeline right away," says Foot.

That lifeline can come in various forms, say Kailey Patterson and Naomi Algate, who are the FNP's first staff navigators. Working in a large office in Sunnybrook's psychiatry department building, both have extensive education and experience in the field of youth mental health and addiction and in supporting parents and families of these youth.

In just the first couple of months of getting underway in November, the FNP had helped some 60 families, mostly from the Toronto area, but also from other parts of Ontario and as far away as British Columbia and Newfoundland.

"I've seen a lot of families dealing with anxiety and depression, and we've seen some with kids with bipolar or borderline personality disorder, accompanied by substance use," says Patterson. "Many of the parents have taken on the full-time job of calling around to see if a certain program fits with their child's needs and doing that runaround game. So we make the calls and do that for them sometimes."

Algate says one of the biggest concerns of parents is the long wait lists for publicly funded help, the reason the FNP also serves as an advocacy group. But the navigators guide families through their options.

Dr. Levitt adds: "The majority of resources we find are publicly funded, while a significant minority are privately funded because those resources simply don't exist in the public system or the waits are terribly long … . But even for those resources that are privately funded, there may be circumstances where government agencies may help cover them."

Jason found salvation in private treatment – at Second Nature, as well as at Gateway Academy, a Salt Lake City residential treatment centre for adolescent boys, where he spent about nine months from 2008-09. But Jason stresses: "There are good programs in Canada that can help kids quite a bit – not every kid needs to go to Utah – but what is needed is a resource where you can find the connections you need."

## BANKING ON PARTNERSHIP

Since 2008, the RBC Children's Mental Health Project has provided more than $20-million to support over 350 organizations dedicated to providing early intervention, increasing public awareness and reducing stigma of mental illness. Recognizing the need for a program to help youth more readily access mental health care, in 2013, the RBC partnered with Sunnybrook to establish the RBC Run for the Kids™ as a method to raise funds and awareness for the Family Navigation Project. Held in the Sunnybrook neighbourhood, the event attracted about 4,400 participants – nearly doubling expectations, says Jessica Diniz, Sunnybrook Foundation's director of marketing and communications, who also oversees the RBC run event. "RBC was looking for a way to further their commitment to youth mental health and to engage employees in a cause that touches all families."

Diniz says the second RBC Run for the Kids™ has been set for September 20, 2014, and will start at North York's Mel Lastman Square, given that it's expected to attract upward of 5,000 participants to the 5-kilometre, 15-kilometre and 25-kilometre events.

"We are very proud of our partnership with RBC. They are a true partner in every sense of the word, working hand in hand with us on this project." says Diniz. "The money [from the inaugural run] is being put to use immediately and already it's had an impact."

*To contact the FNP:*
*E-mail: intake@navigatingfamilies.com or call 416-480-4444*

## SPOTTING THE RED FLAGS

Knowing the signs of a young person facing a mental health problem is important in getting early help. Here are some symptoms to watch for:

- Abuse of drugs and/or alcohol
- Problems at school like skipping classes, stealing, damaging property, dropping grades
- Inability to deal with daily problems and activities
- Changes in sleeping and/or eating habits
- Experiencing a lot of physical problems
- Self-esteem and/or body image issues
- Angry outbursts
- Unhappy much of the time, thinking of self-harm or suicide.

*Source: Canadian Mental Health Association*

*Kumar Punithavel on his fundraising odyssey to Mount Kilimanjaro.*

# Climbing over cancer

*A punishing four-day trek to the top of an iconic mountain didn't deter Kumar Punithavel in his quest to honour his late wife's memory*

**BY DAN BIRCH**

Kumar Punithavel's quest to hike Mount Kilimanjaro last June began ominously. His checked baggage arrived in Tanzania days after he did, and the day before he set out on the climb his horoscope was discouraging.

"You may have to tell someone that you cannot deliver on what you promised. Chances are they won't mind in the slightest. It seems like they didn't want you to do it," the horoscope read.

"I thought, 'OK, now what should I do? Should I give up?'" recalls Mr. Punithavel, a 68-year-old Scarborough, Ont., resident.

But, in this case, giving up wasn't really an option, and chances were that people would be disappointed if he didn't deliver. Mr. Punithavel was not only hiking for pleasure, but also to raise money for the innovative care and research at Sunnybrook's Louise Temerty Breast Cancer Centre, the largest and most advanced in Canada.

He was hiking in memory of his wife, Chandra, who had succumbed to cancer in 2007, two years after diagnosis. Despite surgery, chemotherapy and radiation, the aggressive breast cancer spread to Chandra's brain. Mr. Punithavel's older sister, Nageswary, who lived in New Zealand, had also lost her life to breast cancer.

Mr. Punithavel's aim was to "climb over cancer" by raising funds to support the discovery of new and better breast cancer treatments. It was also to show his gratitude for the skilled care that Chandra, an early childhood educator, received at Sunnybrook.

Mount Kilimanjaro was Mr. Punithavel's second big adventure to benefit Sunnybrook's breast cancer program. In 2011, he skydived for the first time in his life. As of early 2014, he had raised $42,000 for Sunnybrook through both events.

Mr. Punithavel's full set of gear finally reached him on the third day of his four-and-a-half day climb up the nearly six-kilometre-tall mountain, the highest peak in Africa and the tallest free-standing mountain in the world. The first three days of hiking were gentle.

That changed on day four. Starting out in the middle of the night, Mr. Punithavel and his guides began the final push to the top, which quickly became very steep. The trail turned into a series of short switchbacks – 10 steps this way, 10 the other way.

As he grew more tired from the decreasing oxygen, he became less discerning about his choice of resting spots. Rather than searching out a nice boulder to sit on, he would simply drop to the ground and sprawl out. During one of these breaks another team passed him and, concerned about the risk of altitude sickness, suggested he should head back down the mountain.

His lead guide, Simon, encouraged him to continue, pointing out how close they were to the top. About 30 minutes later Mr. Punithavel was again on the ground, flat on his back. His thoughts turned to what his daughter told him before he began the adventure: "Do whatever you like, but don't make me come to Africa to claim your body," she said. "I'm laughing now, but I know how scared I was at the time," Mr. Punithavel says.

He told Simon it was probably best that he give up, but Simon wouldn't have it and remained encouraging. "That made a big difference. I thought, 'OK, let me give anything and everything I have in me.'"

It was characteristic of the tenacity Mr. Punithavel and Chandra had shown throughout their lives. Born in Sri Lanka, they emigrated with their son and daughter to Nigeria, then to Toronto in 1986. They operated a Sri Lankan grocery story in the gritty neighbourhood of Parliament and Wellesley streets before moving to Scarborough, where he began an insurance agency and Chandra worked as an educator.

With Simon's steady support, Mr. Punithavel pushed to the top of Mount Kilimanjaro in time to see the sunrise. He says words cannot describe the sense of accomplishment. Standing at the top, he thought about the loved ones he had lost, but also about how fortunate he was to have his health.

"Life is a journey. Despite the challenges, we must keep striving forward," he says.

# RESEARCH & INNOVATION

*the latest in leading-edge developments at Sunnybrook*

## WHICH COMES FIRST: SLEEP PROBLEMS OR STROKE?

It's scientifically established that people who have had a stroke have a propensity toward sleep disorders. New research at Sunnybrook is finding a sinister two-way link: Sleep problems such as sleep apnea and periodic limb movements – the nighttime leg kicking common in restless leg syndrome – may be harbingers of serious health problems such as heart attack and stroke.

"There is pretty solid evidence that sleep apnea is associated with cardiovascular disease, stroke and death," says Dr. Mark Boulos, a Sunnybrook neurologist and expert in sleep and stroke. "Now research is demonstrating that periodic limb movements may be associated with future cardiovascular disease and possibly stroke."

The usual culprits that cause clogged arteries – high blood pressure, high cholesterol, inflammation, diabetes, obesity, elevated heart rate – can also result in limited blood flow to the brain. Sleep disorders can exacerbate those risk factors.

State-of-the-art brain imaging at Sunnybrook is showing the world how important it is to keep blood vessels clear in both the body and the brain: In the aging brain, especially with vascular risk factors, white spots show up deep inside; what neurologists call "white matter hyperintensities." These hyperintensities reflect small vessel disease and are associated with stroke, dementia and earlier death.

Dr. Boulos's research has found that people who kick while they sleep also have greater incidence of small-vessel disease of the brain.

"This is an important area of study," says Dr. Sandra Black, director of Sunnybrook's Brain Sciences Research Program. "The link between sleep disorders, vascular disease and dementia is becoming increasingly more established, through imaging technology and careful clinical observation."

The good news is that sleep disorders may be reversible. "If you have a sleep disorder, see a doctor," says Dr. Boulos. "There may be a treatment that will make you feel better and may reduce your risk of heart attack and stroke."

## A PROMISING TREATMENT

"Gold nanobombs to treat breast cancer" sounds like science fiction, but promising research is already underway. Researchers at Sunnybrook's Odette Cancer Centre and the University of Toronto have developed an assembly of tiny gold particles (nanoparticles) and antibodies that attach to cancer cells, and a radioisotope, which, upon decay, provides a highly efficient radiation treatment.

Nanobombs would be injected into and around the tumour using brachytherapy, a technique where a tiny radioactive source is inserted into a cancer growth. The hope is that nanobombs will better target treatment for early stage and locally advanced breast cancers.

"The technology would allow us to focus the radiation killing effect into the cancer cells by implanting them with nanobombs and trapping cancer's spread, as nanobombs follow the same route as the cancer. That could be a much more efficient treatment," says Dr. Jean-Philippe Pignol, Sunnybrook radiation oncologist and scientist, who is leading this research, working with Dr. Raymond Reilly, a radiopharmaceutical scientist at the University of Toronto.

Dr. Pignol, an expert on brachytherapy, pioneered the one-day radiation treatment for early stage breast cancer using tiny, permanent radioactive seeds implanted after a lumpectomy. Combining nanotechnology and brachytherapy, he is developing a new form of implantable seeds to encase the nanobombs. The seeds would be readily absorbed by the body, after treatment.

"Treatments must adapt to the patient," he says. "Nanobomb seeds would be simple, portable and could be used in remote communities where it is difficult to access high-tech radiation treatment facilities."

## 3-D SURGICAL GAME-CHANGER

Enhanced precision in the operating room is something that every surgeon wants, especially during a brain or spine operation. Surgical navigation uses 3-D imaging to accurately track surgical instruments and a patient's anatomy, providing real-time information. Dr. Victor Yang, a Sunnybrook neurosurgeon and Ryerson University engineering professor, is poised to place made-in-Ontario technology on the international medical scene by creating a solution that is easier to use, faster and more cost-effective than current options.

Using surface imaging, Dr. Yang and his team have designed a solution that aligns the patient's anatomy with preoperative images. Registration takes only seconds for the surgical team, a radical improvement in speed. Not only that, the solution is inexpensive, making it an appealing option for developed countries, and the developing world.

"By decreasing surgical time and maintaining accuracy, there is an absolute improvement in patient safety and also a reduction in surgical complications," says Dr. Yang, whose team has started a company called 7D Surgical Inc. to commercialize the surgical navigation solution.

## A CLEAR CASE FOR A BETTER VIEW

When it comes to rebuilding a patient's injured face, surgeons turn to screws, plates and wires. Often there's a high post-surgery complication rate, and often the need for one or more follow-up operations. Drs. Cari Whyne, Jeff Fialkov and their team in the Holland Musculoskeletal Research Program at Sunnybrook set out to discover why.

"Dr. Fialkov wondered if the reason for these high complication rates is over-engineering – we are putting many plates and screws into very thin bones, but we don't really know how loads travel through the complex craniofacial structure," says Dr. Whyne. "If we better understand how loads from activities like chewing travel through these bones, we could do a better job of designing and placing implants and performing the surgeries."

When they began investigating, one thing became clear right away: Clinical CT scans aren't clear enough. "Even very good patient CT scans give blurry images of the craniofacial bones, and that changes the geometry and intensity of the bone structure. It doesn't allow us to accurately model what is going on in the face," says Dr. Whyne.

So the researchers designed a way to make regular CT images much clearer and offer more accurate representations of the skull. This is done using new image-processing software that deblurs the images based on known properties of thin bone. These images show the location of the thin bones that don't always appear on a regular CT. Patients don't need extra or more powerful scans. It's all left to this new postimaging technology. •

*In* Decoding Annie Parker, *Helen Hunt plays Dr. Mary-Claire King, while Samantha Morton (inset, with Aaron Paul) takes the role of Annie Parker.*

# The tale of Annie and Mary-Claire

*A new film tells the story behind a breakthrough in breast cancer treatment that had its origins in Toronto*

Annie Parker was only 29 years old when she was diagnosed with breast cancer, a disease that had taken the life of her mother and her sister. She endured and survived. Nine years later, Annie, a patient at Sunnybrook, was diagnosed with third-stage ovarian cancer. Again, she beat the odds. A third strike with cancer hit when doctors found a tumour on her liver. Each diagnosis fuelled her with an anger and determination to beat what she describes as a "hideous disease."

Annie had a suspicion that the risk of developing cancer was more than by chance. Driven by the need for answers, her path led her to geneticist Mary-Claire King, who at the time was pioneering DNA research on breast and ovarian cancers.

Their real-life story is the inspiration behind a touching film (and related book), *Decoding Annie Parker*. Portrayed by Samantha Morton and Helen Hunt, Annie and Mary-Claire's journey through the lab and life shows that art is often inspired by true events. Directed by Steven Bernstein, the film, due for release in May, follows the growing bond these women share on the road to the discovery of the BRCA1 and BRCA2 genes. This breakthrough would forever change the understanding of breast and ovarian cancer risk internationally.

*Decoding Annie Parker* is a moving tribute to the power of two women: one hoping to change her life, and the other hoping to change the world.

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