THE FUTURE IS DIGITAL

ARTIFICIAL INTELLIGENCE
Transforming the way heart disease is diagnosed and treated

FROM FAR AND WIDE
Creativity and a multidisciplinary approach lure top-flight talent

THE EVOLUTION OF CARDIAC IMPLANTS
Harnessing the power of mechanical hearts and stem cells
When Drs. Harry Rakowski and Barry Rubin created the PMCC Innovation Committee, they hoped it would become a major influence on health care in Ontario. With over 40 projects approved, their dream of impact is being realized—and then some.

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48 Drawing inspiration from his mother-in-law and his dog, Dr. Kieran Murphy came up with the idea of harnessing antioxidants to reduce the harmful effects of life-saving radiation for patients, doctors and others exposed to work, such as flight crews.

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The Peter Munk Cardiac Centre
Innovation Committee

More than 40 projects have been launched so far and some of these projects, all funded by philanthropy, have significantly changed and influenced the way health care is delivered in Ontario and across Canada

by Shelley White

William Charnetski is a big believer in “celebrating our champions” here in Ontario. But touting our homegrown accomplishments is something we, as Canadians, don’t always do well enough, says Ontario’s chief health innovation strategist. “It feels like with anything other than hockey, we seem to require that people go elsewhere and establish themselves, [to] gain the inherent credibility that makes them more popular at home,” he says.
We're going to look at your research project and improve the design.

"It is saving blood product consumption by about 40 per cent," he says. Addition seed funding resulted in additional multicenter trials, additional funding, and an additional generation of studies, says Dr. Rakowski.

"It is saving blood product consumption by about 40 per cent, which translates into fewer complications of blood product delivery and health-care cost savings," he says.

Another example is an “anti-oxidant cocktail” created by UHN interventional neuroradiology Dr. Kieran Murphy that reduces the negative effects of X-rays on DNA (see story on page 44). Like Dr. Karkouti’s project, that initial seed funding resulted in additional research studies, says Dr. Rakowski. Now, Dr. Murphy has produced a product with “commercial potential and tremendous health benefit for low cost.”

The PMCC’s Innovation Committee is a model that can be replicated elsewhere because it runs on philanthropy, says Ms. Weber. Interest has been coming in from government and other health-care institutions, as well as elsewhere in the UHN.

"Other programs within the UHN have said, ‘If cardiac can do it, we should have something similar, too,’” she says.

Talking up the province’s health-care success stories has been a priority for Dr. Charzemski since he took on the newly created position in Ontario's Ministry of Health and Long-Term Care in 2015. So when he attended the launch of the Peter Munk Cardiac Centre (PMCC) Innovation Committee, Mr. Charzemski knew he was witnessing an exciting Ottawa-health-care-story worth telling.

“We love the stories,” says Mr. Charzemski of the dynamic committee that’s been called the Dragons’ Den of health care. “It’s obviously [conceived of] smart, passionate, hard-working people. The notion that the hospital’s doing it this way is important, and it’s important for us to showcase the work that’s being done.”

Created in 2012 by Dr. Barry Rubin, Medical Director of the PMCC, and cardiologist Dr. Harry Rakowski, E.D. Wigle Chair as Hypertrophic Cardiomyopathy Research, the PMCC’s Innovation Committee reinvented the wheel when it comes to funding health-care projects. Instead of small groups of doctors making funding decisions, the committee is made up of more than a dozen people of diverse backgrounds and skill sets to consider proposals from outside of the medical field entirely. Surgeons, scientists and cardiologists work with hospital administrators, entrepreneurs and business leaders on the committee, and everyone has an equal vote.

Submissions are accepted quarterly instead of annually, and over 1,000 employees at the PMCC can submit a proposal, from nurses to radiologists to anesthesiologists.

The PMCC’s Innovation Committee is an exciting concept that could provide a model for other health-care organizations to follow, says Mr. Charzemski.

“To have it organized in the way that the committee is organized is potentially really powerful, when you’re one of Canada’s biggest hospitals,” he says.

He applauds the fact that the PMCC’s Innovation Committee combines the expertise of those in the health-care realm with those in the business world.

“I truly believe that the optimal solutions to the challenges that face the health-care system will come from the collaboration of the public sector and private sector,” says Mr. Charzemski. “That’s a critical success factor for me.”

A ‘UNIQUE AND NIMBLE PROCESS’

When Drs. Rakowsk and Rubin came up with the idea for the PMCC’s Innovation Committee, they were looking for a “unique and nimble process,” says Dr. Rakowski.

“The idea was to get not just physicians, but [also] other people who were non-physicians — allied health-care professionals and business leaders — to really look at medical innovation,” he says. “The key things are: It is going to have [an] impact? Is that impact measurable? And is it cost-effective?”

While traditional grant-writing requires pages and pages of detailed proposals, applicants to the PMCC’s Innovation Committee must only answer 30 questions, plus commit to a cost-effectiveness study. And while most funding organizations are proud of the fact that they reject 85 per cent of proposals, says Dr. Rakowski, he and Dr. Rubin wanted to buck that trend.

Instead of simply turning away unsuccessful applicants, the committee provides constructive input and guidance, helping them improve their proposal and possibly submitting again a few months later.

“Our goal is to fund as many good ideas as we can,” he says. “So we’re going to help you improve your proposal, we’re going to work with you.

Helping the recipients be self-sufficient.

The PMCC’s Innovation Committee is funded in its entirety by generous philanthropic donors who put their trust in the panel to direct funding to projects with opportunities for greatest impact.

More than 40 projects have been funded by the PMCC’s Innovation Committee so far, some of which have gone on to influence and even change practice in Ontario. One example is a blood conservation project pioneered by anesthesiologist Dr. Kayvon Karkouti (see story on page 46). An initial seed investment of $80,000 resulted in multinational, multicenter trials, additional funding and an additional generation of studies, says Dr. Rakowski.

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"Other programs within the UHN have said, ‘If cardiac can do it, we should have something similar, too,’” she says.

Regardless of these moves forward, Dr. Rakowski says the committee will remain true to its original vision. It’s important for the committee to retain its independence, he says. “Not being beholden to anybody or having institutional bias or favoritism to anybody.” Dr. Rakowski notes that even committee co-founder Dr. Rubin is treated the same as everyone else – one he proposals was recently sent back to the drawing board.

“We have a vision, and we are committed to it,” says Dr. Rakowski. “If you lose that intimacy or the nimbleness, then you simply become an administered bureaucracy. And [what helps to make] this committee unique are those qualities, which we obviously don’t want to lose.”
A diagnosis of coronary artery disease usually comes after a series of procedures, including blood tests, exams to reproduce symptoms, an electrocardiogram, a chest X-ray, and finally, cardiac catheterization, where a thin tube is inserted through the heart’s blood vessels to check blood flow and function in various parts of the organ.

It can take weeks, even months, for each patient to go through these gold-standard procedures and then bring to the hospital those who are identified as at risk for heart disease.

The ability to instantly recognize patterns and make sense of data from electrocardiograms is one of the great promises of artificial intelligence.

The researchers found that the AI algorithms did significantly better in predicting heart attacks than assessments based on the commonly used American College of Cardiology/American Heart Association guidelines.

The researchers then used a hand-held, battery-operated device, cloud storage and artificial intelligence to capture and analyze electrocardiogram signals for specific heart conditions.

“The possibilities with artificial intelligence are truly exciting,” says Brian Golden, Sandra Rotman Chair in Health Sector Strategy at the University of Toronto (U of T) and the University Health Network (UHN) and dean of professional programs at U of T’s Rotman School of Management. “The ability to instantly recognize patterns and make sense of data from these patterns will improve diagnosis speed and quality, reduce wait times, improve health outcomes and reduce costs.”

It Canada, the stage is set for AI to transform the way heart disease is diagnosed, treated and managed. And the Peter Munk Cardiac Centre (PMCC) is right in the centre of this exciting transformation, powered by digital data, ubiquitous connectivity and intelligent machines.

Armed with a $100 million donation from the Peter and Melanie Munk Charitable Foundation, the centre has forged a partnership with U of T’s Vector Institute for Artificial Intelligence, which was launched last March to advance deep learning research and develop leading talent.

“This is the first formal health-care partnership that the Vector Institute has engaged in, and we anticipate that what we do with the Vector [Institute] will be the model for what it does subsequently with cancer, neurosciences and other health disciplines,” says Dr. Barry Rubin, Chair and Program Medical Director, Peter Munk Cardiac Centre.

Together, the PMCC and the Vector Institute will build an AI team that includes a lead computer scientist, other recognize and PMCC clinicians. The team will work to identify heart problems that can be solved through AI and machine learning.

“We will use predictive models and decision support to tailor patients' care to their unique clinical and genomic traits,” says Dr. Rubin. “We will use natural language processing to communicate with patients in real time, no matter what language they are speaking. Taken together, this will improve the efficiency of health-care delivery, outcomes and patient satisfaction.”

What will AI-supported cardiac care look like to patients and health-care professionals? Dr. Rubin paints a sample scenario, where doctors can remotely monitor patients with conditions such as abnormal heart rhythms and then bring to the hospital those who are identified as at risk of death or serious heart damage, based on AI algorithms that can analyze billions of biological and research data points.

“People will use the AI approach to pinpoint which patients face potentially lethal events, and bring them to the hospital before that happens,” says Dr. Rubin. “So you’re managing patients outside the hospital and using the real value of AI to predict and prevent these lethal events.”

Nevertheless, AI solutions have already been proven in other areas in health care. Dr. David Jaffray, Senior Scientist at Princess Margaret Cancer Centre in Toronto, points to the use of algorithms at the hospital to automate the difficult decision for patients.

“The technology is very attractive because it allows us to design the treatment course, treat patients sooner and even ensure that the treatment regimen needs to be changed after the fact. We are in the process of testing algorithms that will provide the treatment plan based on patient responses in real time, and in fact have the ability to change the treatment plan on the fly.”

While AI champions continue to innovate in health care, it will likely take years before many of these new technologies are adopted in clinical practice, says Mr. Tam. “Regulations that govern medical technology are complicated, says Mr. Tam, and could work against the very nature of artificial intelligence. For instance, when an organization such as the U.S. Food and Drug Administration approves a medical solution, it does so based on a specific information package. With AI, information continues to change as the underlying algorithm learns from existing and new data.

“What we do with the Vector [Institute] will be the model for what it does subsequently with cancer, neurosciences and other health disciplines.”

Dr. Barry Rubin, Chair and Program Medical Director, PMCC

By Marjo Johnne

From diagnostics to therapeutics, artificial intelligence is set to change the way cardiovascular diseases are identified and treated.
Transcatheter Aortic Valve Implantation (TAVI) has changed the game in heart valve care and saved the lives of patients who were considered too-risky for surgery. With TAVI now well-entrenched in clinical practice, cardiac doctors are looking out for the next big thing in heart valve repair and replacement.

Transcatheter Aortic Valve Implantation (TAVI) has changed the game in heart valve care and saved the lives of patients who were considered too-risky for surgery.

"We will be looking for specific patient groups who will benefit from a single valve replacement approach, including the addition of calcium in the valve leaflets, and whether the opening and the geometry of the valve and surrounding structures are optimal," she says. "Right now, there really isn’t anyone in the world with enough experience in this type of procedure, and it is still extremely low compared to how many can be at home, recovering in 24 hours." 

In search of the next big thing
What could be the next game-changer after TAVI? Dr. Paul Fedak, a researcher for the Heart and Stroke Foundation of Canada and a professor at the University of Calgary, says the next big breakthrough in valve care is likely to come from tissue engineering innovations.

"I think in the future, we will have replacement valves that are designed for each patient out of their own cells and tissues," he says. "These will be real game-changers because we’ll be less prone to infection and won’t need blood thinners; the valves will never break down and when they’re used in a younger patient, they’ll have the potential to grow as the patient grows, which is a huge deal."

In the meantime, the research and clinical teams at the PMCC continue to examine new and emerging technologies in heart valve care. Dr. Eric Horlick, a cardiologist at the PMCC, is part of a team at the Peter Munk Cardiac Centre in Toronto that will be part of a project to evaluate the new mitral valve replacement system – which is still an investigational therapy and not available for use outside a trial setting – could be one way to do this.

"Up to 80% of patients who are at high-risk for surgery and who have been referred to us as a ‘space’ – is implanted through a vein in the upper chest using a catheter – a similar technique to implanting a pacemaker."

"Will it work? I think it will help to reduce the problem, but I’m sure we will not see it completely in one year,“ says Dr. Robert James Cusimano, a cardiac surgeon and the head of the PMCC’s valve program. “We are looking at this as a new way to perform surgery in the very high-risk patients."

"It can become very dangerous when you wait too long in patients who are not waiting for surgery," she says. "That’s important to companies that are looking at new treatments for the mitral valve replacement."
Subcutaneous ICD

S-ICD | Protection without touching the heart

An S-ICD is a subcutaneous implantable cardioverter defibrillator. It is designed to provide protection against Sudden Cardiac Death, without a lead in the heart.

The lead that transfers the impulse from the device to the heart is not implanted into the heart through the blood vessel, like with the transvenous ICD. The lead of the S-ICD sits just under the skin, leaving the heart and blood vessels untouched and intact.

ICD therapy is a very trustworthy therapy that has prolonged hundreds of thousands of lives. When ICD devices were first introduced in the 1980s, they were implanted in the abdomen. Later came the transvenous ICD, which is implanted in the shoulder area. The less invasive subcutaneous ICD (S-ICD) is the latest type of ICD device, introduced in 2008, which delivers protection against Sudden Cardiac Death, without touching the heart.

International fellows come to learn the ‘PMCC Way’

Hundreds of national and international physicians apply each year to train with Peter Munk Cardiac Centre specialists in a unique program.

by Shelley White

At the Peter Munk Cardiac Centre (PMCC), the world’s best and brightest come together for a common cause: to save lives. Walking through the halls of the PMCC, it’s not uncommon to encounter groups of international fellows intensely discussing a complex case with staff physicians. These fellows hail from all over the globe – Asia, South America, the U.S., Europe, Africa – bringing knowledge with them and then taking what they’ve learned back to their home institutions.

Each year, hundreds of national and international physicians apply to obtain post-certification training with experienced specialists at the PMCC in areas such as: adult congenital heart disease, cardiovascular surgery, vascular surgery and heart failure and transplantation. While they learn, the fellows provide much-needed manpower to help PMCC staff with the day-to-day work of treating patients.

The PMCC’s fellowship program attracts international physicians because of its excellent worldwide reputation, says Dr. Barry Rubin, Medical Director of the PMCC. “We are a growing, expanding, international brand,” he says.

“Lots of people talk about this, but we actually walk the walk,” he says. Dr. Rubin says that one of the goals of the international fellowship program is to touch the PMCC Way in the hope that they will bring it back to their home institution in Tokyo or Buenos Aires or Bangalore. “The real mark of success: Did that person succeed to a leadership position and then start training other people locally, the way they were trained at the PMCC?,” says Dr. Rubin. “That’s when you know you’ve really had an impact.”

Meet four physicians who have had that impact since their time as international fellows at the PMCC.

Dr. Diego Delgado
Cardiologist, Reuben and Florence Firestone Family Professorship in the Medical Management of Heart Failure

“I was already trained in advanced heart failure and transplant mechanical devices, so for me it was going to be more of a challenge to help build a program from scratch, versus going somewhere that was already established,” he says. After his fellowship, Dr. Diego Delgado was a cardiologist in his native Argentina where he decided to further his training internationally. He says he was drawn to the PMCC because the transplant program was new, and he was looking for a challenge. "I was already trained in advanced heart failure and transplant mechanical devices, so for me it was going to be more of a challenge to help build a program from scratch, versus going somewhere that was already established," he says. After his fellowship, Dr.
Delgado, who holds the Reuben and Florence Fenwick Family Professorship in the Medical Management of Heart Failure, was invited to stay on at the PMCC, and in the years since, he has become an integral part of the institution. As a cardiologist and heart failure specialist, Dr. Delgado says he is a big proponent of the PMCC’s multidisciplinary approach.

“Because these patients are very complex and they are critical in many cases, you need a collaborative team,” he says. That team can involve nurses, nurse practitioners, social workers, psychiatrists and physiotherapists, along with surgeons, cardiologists and radiologists.

“That’s how the outcomes in patients with heart failure have improved over the last 10 years, because of this concept of the multidisciplinary team.”

Two years ago, Dr. Delgado helped create a fellowship to bring in more fellows from Latin American countries. He hopes to continue to build the fellowship program, focusing on bringing up in talented people who may lack resources in their home countries.

“I value bringing in physicians from the Middle East, South Asia or Central and South America because I know that we can create a huge global impact by training these people and having them go back to their own country,” he says. “I’ve seen it.”

Dr. Sathya Nambala
Chief cardiac surgeon, Apollo Hospitals, Bangalore

COUNTRY OF ORIGIN: India

Dr. Sathya Nambala had two goals in mind when he applied to be an international fellow at the PMCC to train with Dr. Tirone David and learn to do one particular operation. It was the “David Operation” (which is named after Dr. David) – a valve-sparing aortic root replacement.

“I was fascinated by that operation,” says Dr. Nambala. “During my training, I always wanted to do this. So I would say if there’s one chance to work with this man, I would want it.”

Dr. Nambala was at Manipal Hospitals in Bangalore at the time and had a colleague who had trained with Dr. David. The colleague was going to an international conference in Barcelona, Spain, so Dr. Nambala gave him his CV in the hopes he could pass it on to Dr. David. Two months later, Dr. Nambala was on his way to Toronto to be an international fellow at the PMCC.

“I actually landed in December,” he says. “I’d never seen snow in my life before.”

During his time at the PMCC from 2006–07, Dr. Nambala had the chance to work with Dr. David and see the “David Operation” first-hand. “He’s probably the best surgeon I’ve worked with in my life so far, and that experience is something I don’t think I’ll ever forget,” he says.

Now, Dr. Nambala is passing along what he learned at the PMCC to surgeons from India and other parts of Asia. “People now come and watch what we do here,” he says. “Many times when I get observed, I say ‘I learned this in Toronto.’”

Dr. Carolina Alba
Cardiologist, former LaSorda Family Fellow

COUNTRY OF ORIGIN: Argentina

Like Dr. Delgado, Dr. Carolina Alba began her medical career in her homeland of Argentina. Also like Dr. Delgado, her positive experiences in the PMCC’s international fellowship program convinced her to stay on after her fellowship was over.

“One important aspect of the fellowship program at the PMCC is that all are treated with respect,” says Dr. Alba. “Fellows and other team members no matter what their position at the hospital – can give an opinion,” she says. “Everybody is heard here.”

Dr. Alba says she also felt supported as a female physician and a mother. “You feel like there is some flexibility to balance your work and family life (e.g., leaving work to pick up your sick child from school).” And that’s so very important as well – to work happier and reduce the stress.”

As someone who now works with international fellows (and was once in their shoes), Dr. Alba says the bonds formed through the fellowship program are lasting ones.

“We establish very good relationships with everybody who comes here, so everybody feels engaged,” she says. “I am able to tell my family that because I have been a fellow until recently, I know very well the intimate feeling of all the fellows. And when they move back to their countries, we keep the connections, which turn into opportunities to collaborate with patient care and research.”

Dr. Matthias Greutmann
Director of the Congenital Heart Disease Unit, University Hospital Zurich

COUNTRY OF ORIGIN: Switzerland

As a resident at University Hospital Zurich, Dr. Matthias Greutmann developed an interest in adult congenital heart disease and decided to look for some international training in the area. Two of his colleagues had been fellows at the PMCC, so he also applied.

“It was well-known that Toronto is the place to be for congenital heart disease,” he says. “It was well-known that Toronto is the place to be for congenital heart disease,” he says. Dr. Greutmann was a fellow at the PMCC from 2006–07, and says he was struck by the “openness” and “spirit” at the hospital.

“I always felt extremely comfortable, and felt like there was an openness there to discuss issues. I think that was something that I brought back to Switzerland.”

Connecting with other international fellows from around the world while at the PMCC has also been a bonus, says Dr. Greutmann.

“If a patient comes to me and tells me, ‘I am going to travel here or there,’ I’ll say, ‘I know someone,’ and I’ll refer them,” he says. “I am still connected all over the world.”

And he is always pleased to see his former PMCC colleagues at international conferences, such as the recent World Congress of Pediatric Cardiology and Cardiac Surgery in Singapore.

“The whole Toronto group met here, and it was very nice,” he says. “It’s like my Toronto family.”

PMCC FELLOWS FROM AROUND THE GLOBE

COUNTRY OF ORIGIN: Switzerland

PMCC fellows from around the globe

COUNTRY OF ORIGIN: Argentina

Argentina 1

Brazil 1

Canada 1

China 1

Colombia 1

Czech Republic 1

Denmark 1

England 4

France 3

Germany 17

India 2

Iran 1

Ireland 7

Italy 1

Japan 1

Korea 1

Lebanon 1

Netherlands 1

South Africa 4

Spain 5

Sweden 1

Switzerland 1

Turkey 1

U.S. 6

U.K. 11

U.S.A. 1

Total 13
A steady stream of innovations point to the day when electronic pacemakers may be obsolete

Development and advancements on the heart-regulating apparatus over the past decade have been phenomenal

By Chris Atchison

DR. GORDON CHONG MAY HAVE DEDICATED HIS CAREER TO FIXING TEETH, but his golden years have included an unexpected education in cardiac care – specifically, his own. A retired dentist, Dr. Chong has been the recipient of four pacemakers since being diagnosed with congestive heart failure in 2011. His pacemaker has since been fitted with a defibrillator to keep his heart functioning in the event of a major cardiac incident.

“It seems to be working well, but the condition I have is still deteriorating,” says Dr. Chong. “I’m being assessed for a heart transplant or a mechanical device that will get me over the hump for a while.”

Dr. Chong, a patient of the Peter Munk Cardiac Centre (PMCC), is one of more than 10,000 Canadians who receive electronic pacemakers each year and one of more than 120,000 Canadians currently living with the life-saving technology.

The tiny devices treat arrhythmias – abnormal heart rhythms – and help the heart beat at a steady, normal pace. Pacemakers average about a seven-year lifespan before their batteries need replacing.

Dr. Chong has a unique perspective on the evolution of the heart-regulating apparatus, thanks to his medical background.

“I spent two years [studying] at the Hospital for Sick Children when I graduated and have been following (pacemaker development) for the past few years...and in the last decade, the amount of knowledge and technology, and bringing together of biometrics and biology, has been phenomenal,” the 73-year-old says.

Indeed, the devices have come a long way since the invention of an external, toaster-sized pacemaker in 1950 by Canadian engineer John Hopp, in conjunction with researchers from the University of Toronto. Despite its many shortcomings – the device required an AC power source, creating obvious mobility challenges for patients – Hopp’s pacemaker was regarded as a drastic improvement over previous rudimentary devices.

That was until a team in Minnesota developed a battery-powered, belt-worn pacemaker later that same decade. Fully implantable devices...
In many patients because the regions causing atrial fibrillation are not apparent with current technology. This is where University Health Networks Thomas J. (Toby) Hall Centre of Excellence in Heart Rhythm Disease program aims to be innovative. Consider the work of Dr. Vijay Chauhan, a cardiologist at the PMCC who is developing new technology to localize atrial fibrillation electrical drivers in order to improve catheter ablation for patients with atrial fibrillation. Dr. Chauhan and his team have set out to find what he calls “the flashing beacon in the heart” that may sometimes trigger and sustain the condition. To curb atrial fibrillation, doctors often begin with drug treatments, and if unsuccessful, they will then perform a catheter ablation around the pulmonary veins to normalize the patient’s heart rhythm. But catheter ablations have only a 50 per cent success rate, particularly in patients whose atrial fibrillation persists all the time, due largely to the fact that atrial fibrillation in these patients often stems from abnormal electrical areas in the heart outside the pulmonary veins that doctors can’t see or treat. “That brings in the notion of finding and ablating electrical drivers that can be outside pulmonary veins,” Dr. Chauhan says. But without an effective tool to do exactly that, Dr. Chauhan and his team developed a mapping technology which systematically analyzes the atrial fibrillation electrical signals from hundreds of regions in the heart. With a study currently underway, researchers should know in a year whether the new treatment does, indeed, improve catheter ablation success rates. Other researchers, including Dr. Gordon Keller, Director of the University Health Network’s McEwen Centre for Regenerative Medicine in Toronto, are using trailblazing biological innovations to improve heart health and potentially mitigate the use of pacemakers. In 2016, Dr. Keller and his team announced that they had produced sinoatrial node pacemaker cells—which regulate the heart’s rhythm with electrical impulses—from human pluripotent stem cells. The pacemaker cells were injected into rat hearts and assumed a biological pacemaker function, exactly as planned. “The groundbreaking advancement could lead to the development of a biological pacemaker for humans that would offer immediate benefits over current electronic pacemaker devices, which have limited battery lives and are unable to adapt to changes in heart sizes in pediatric patients. The team’s long-term goal is to produce the human heart cells that make up the heart’s chambers, including the ventricles and atria. The goal is to use these ventricular cells to create new muscle in the hearts of patients who have experienced a heart attack. The whole idea of using cells we make in a lab to treat patients may be closer than we thought,” Dr. Keller says.

Dr. Vijay Chauhan and Andrew Ha, cardiologists at the PMCC, has had multiple consultations with patients who have a 50-75% chance of needing an MRI over the lifetime of their device.1

If you, your loved one, or your patient has a pacemaker, they have a 50-75% chance of needing an MRI over the lifetime of their device.2

In 2011, Medtronic launched the first pacemaker in Canada that was safe to use in an MRI.3 We didn’t stop there. We did the same with our:

• Neurostimulator for Parkinson’s in 2013.
• Insertable cardiac monitor for unexplained fainting or stroke in 2014.
• Implantable cardioverter defibrillator (ICD) for heart failure in 2015.
• Spinal cord stimulator (SCS) for chronic pain4 in 2016, and
• Cardiac resynchronization therapy-defibrillator (CRT-D) for heart failure in 2017.

Now, more Canadians with these medical devices can safely access an MRI.

3. Consult the conditions of use with your physician.
4. Chronic, intractable back/leg pain.

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IN TORONTO, transplant was achieved three decades after the

By advanced stem cell treatments and repairs to a patient’s own heart and scientists could lead to more donor hearts, fewer rejections, heart in the future
to truly mend a

Paving the way

the miracles keep multiplying.

mysteries keep unravelling, and

“We have done more than 700

Family Centre of Excellence in

world-renowned cardiologist and

on 500,” says Dr. Heather Ross,

remarkable all the time. Doctors

and scientists are on the verge of breakthroughs that promise to increase the success of heart transplants and which may vastly expand the number of patients who can receive the life-saving treatment.

The first successful heart transplant in Toronto took place on November 17, 1968, at St. Michael’s Hospital, performed by Dr. Clare Baker on Charles Perrin Johnston, who lived until 1975. It took place after two earlier transplants in Toronto in which patients died within a week of surgery, as well as less than a year after the world’s first heart-to-heart transplant was performed in South Africa by Dr. Christian Barnard.

In the next 30 years, the possibilities for innovation range from incremental improvements in technology and medicine to the miraculous. Doctors and scientists are on the verge of breakthroughs that promise to increase the success of heart transplants and which may vastly expand the number of patients who can receive the life-saving treatment.

The use of donor hearts that were previously considered too damaged to transplant, making transplants available to many more people;

the possibility of stem cell treatment to repair damaged hearts;

and 

taking a patient’s own heart and putting it “on the hoist” — removing it temporarily for repairs and then reinstating it, rather than replacing it with a donor’s heart.

In the next 30 years, nothing has really changed in terms of the surgery itself — until recently,” says Dr. Mittesh Badwala, a cardiac surgeon at the PMCC.

“We’d take a donor’s heart, flush it and package it in a cooler full of ice.” Donors are always those who have been declared brain-dead, with no hope of recovery. Brain death is declared when it is clearly irreversible, and it is a legally accepted concept of death in virtually every country in the world. Still, even when a donor has been declared brain-dead, doctors can use hearts that are damaged. So, many people who need transplants are placed on waiting lists.

“We’re probably taking only up to 35 per cent of the hearts from donors. The rest are turned down, sometimes because the donors are really old or have heart disease,” Dr. Badwala explains.

At some time, “there are hearts out there that we know have only temporary damage, and even though the donor is brain-dead, the heart has the potential to recover,” he says. Understandably, grieving families want a donor’s heart to be used quickly to save someone, so Dr. Badwala and his team are working on technology that can repair temporary heart damage as fast as possible.

“We’re testing the machine in the lab now. We hope that later this year, we’ll be able to use human hearts that have been discarded as too damaged for transplants and see how many we can bring back,” Dr. Badwala says.

“At some point, when we’re confident that the surgery is working well, we’ll be able to take them off the machine and use them for transplants.”

Perhaps an even more exciting aspect of this research into correcting damage is that it may make it literally possible to fit a broken heart. “It gives us an opportunity to potentially repair hearts, with new strategies that are being used in other labs,” Dr. Badwala says. New medications can be used experimentally without putting patients at risk, as heading-edge heartbiology such as gene or stem cell therapy are developed.

This goes beyond fixing the temporary damage that sometimes shows up in donors’ hearts.

“We may be able to repair hearts that right now are not useable,” Dr. Badwala says. “Our team is also about to begin clinical trials with DCD — donation after circulatory death — hearts. Unlike hearts that come from donors who are brain-dead, DCD hearts have been considered unreliable for transplants because they stopped beating when the donor died.

Hospitals in Britain and Australia are now using DCD hearts.

“They’ve done this in those two centres nearly 50 times. My team and I visited the facility in Papworth, England (near Cambridge), and we were impressed. They were able to increase their volume of transplantation by more than 50 per cent,” Dr. Badwala says.

“We hope to increase the incidence of patients who die while on waiting lists.”

Donors’ and families’ wishes must be respected, including when it is appropriate to withdraw life support for a patient who will not recover. The legal definition of a circulatory death in Canada is when a person’s heart has stopped beating for five minutes. Dr. Badwala notes, which leads to a dream for the future. “We can dream of the devices we’ve working on to repair hearts becoming a device not just to repair hearts for transplant, but also to repair your own heart.”

Dr. Badwala says. “Take it out, put it on the machine and transplant it right back into you.”

This is not as far-fetched as it sounds. He points out that patients on waiting lists already survive for short periods, even months sometimes, with mechanical heart devices. Maybe they can be repaired so while their own hearts are on the hoist.

Yet as promising as the future may be, the present at the PMCC is pretty amazing, too. Dr. Ross says. “I’ve been working in this area for 25 years, and every time we do a transplant it seems like the first time, in terms of miraculous and life-saving potential.”
Banking on the future

A massive biospecimen and data repository at the Peter Munk Cardiac Centre holds the promise of more precise, personalized medicine.

By Marjo Johne

**“Our goal is to create a large consortium of cardiovascular researchers in the GTA who would have access to this incredible resource.”**

Dr. Richard Weisel, Cardiovascular Surgeon, PMCC, Senior Scientist, Toronto General Research Institute

There are over 50,000 outpatient visits to the Peter Munk Cardiac Centre (PMCC) each year, where cardiovascular diseases that range from arrhythmia to heart failure are treated. Over the last three years, a growing number of these patients have also become contributors to the centre’s biobank— an ambitious research infrastructure project that’s opening the way to a deeper understanding of cardiovascular diseases and the treatments that work best for each patient.

“What we have at the PMCC is a unique opportunity to examine specimens from thousands of patients (in order) to look for biological markers and novel pathways of cardiovascular disease,” explains Dr. Phyllis Billia, a scientist and Co-director of the Peter Munk Cardiac Centre Cardiovascular Biobank. “The goal ultimately is to use this information to discover potential new treatments for the various types of cardiovascular disease.”

Housed in a secured facility at the PMCC, the biobank is a massive repository containing more than 25,000 blood and tissue samples. The recent acceleration of blood and tissue sample collection has led to the discovery of new treatments for various types of cardiovascular disease.

1. Dr. Phyllis Billia, left, Dr. Michael Gollob and Dr. Richard Weisel spearhead work at the Biobank, which stores more than 25,000 blood and tissue samples.
2. Dr. Billia says the goal of the Biobank is to discover new treatments for various types of cardiovascular disease.
3. Patients’ clinical data, including MRI and other imaging.

“This is one of the largest biobanks of its kind in Canada, representing a full gamut of cardiovascular diseases,” says Dr. Billia, who notes that all samples and data are scrubbed of any details that could identify their source.

The PMCC Biobank, enabled through the efforts of the Ted Rogers Centre for Heart Research, holds out the promise of more precise, personalized medicine. With its large—and still-growing—collection of samples and data, the biobank gives scientists access to research material with much greater depth and breadth than what they would find in their own laboratory biobanks.

The value of biobanks to researchers is underscored by numerous success stories in various fields. In cancer research, the ability to screen banked tissue samples led to the discovery of an antibody—which was subsequently developed into a drug called Herceptin— that targets HER2-positive breast cancer cell receptors.

“The biobank is useful for those of us who do research on biological markers that we can measure from blood serum,” says Dr. Michael Gollob, Chair of the Centre of Excellence in Molecular Medicine, a research program within the PMCC that’s advancing personalized patient care by combining traditional clinical information with genetic, molecular, cellular and physiological data. “Having the blood or tissue samples from the biobank also enables us to extract DNA from those samples and conduct DNA-based research.”

For patients, this translates into a future where therapies are fine-tuned to match each person’s genetic makeup. Dr. Billia, for instance, is leading a study that uses blood from patients with hypertrophic cardiomyopathy—an inherited heart condition—to create laboratory models of the disease that are then used to test a range of treatments.

“This is a genetic condition with a 50 per cent chance of getting passed on to your children, and each child could potentially have different manifestations of the condition. One could have a long life expectancy, while another could just die suddenly from cardiac arrest,” explains Dr. Billia. “By using a patient’s blood sample to model the disease in the lab, we can test a library of drugs to see how the patient is likely to respond to each drug, allowing us to tailor treatment for each individual.”

Dr. Gollob says the PMCC Biobank will also allow researchers to genetically model the different types of cardiovascular disease in various ways. For example, by identifying a specific DNA alteration of a particular heart cell leading to disease, scientists may be able to intervene on the pathway of the disease.

“From genetic discovery, we can then consider or create potential treatments targeting the disease-causing gene and its protein,” says Dr. Gollob.

Dr. Richard Weisel, a cardiovascular surgeon at the PMCC and Co-director of the Biobank, says the biobank has already had an impact in cardiac surgery. “As an example, he cites cases involving patients with dilated aortas, which would normally be removed and replaced once the affected blood vessels have grown to a radius of at least five centimeters.

“But some surgeons wondered if that’s the right cut-off in deciding whether that blood vessel should be removed or not, mostly because we don’t understand the mechanisms in which the dilation occurs,” says Dr. Weisel, who is one of the scientists leading the PMCC Biobank. “So we took samples from the biobank and were able to look at patients who seem to have progression of the disease, versus those who did not.”

This large-scale comparison gave doctors a better understanding of the disease and revealed certain genetic abnormalities associated with dilated aorta—a fine-tuned knowledge that has since led to new therapies for the condition, he says.

The PMCC Biobank continues to be a work in progress. A key goal, says Dr. Weisel, is to combine this project with other cardiovascular biobanks in Toronto and make the aggregate samples and data available to all researchers in the city.

“One goal is to create a large consortium of cardiovascular researchers in the Greater Toronto Area who would have access to this incredible resource,” says Dr. Weisel. “We also hope to expand our capabilities to the extent where we’ll have samples from all patients at the PMCC, something that’s done as routine in some places in the United States and Europe.”
Mechanical hearts are buying time for patients and groundbreaking research

Combined with stem cell technology, a patient’s own heart can start pumping again* By Bryan Bozykowski

Over the next three years, the damage worsened to the point where, in 2010, her heart essentially stopped working on its own. Doctors had to implant a left ventricular assist device (LVAD) – a battery-powered mechanical heart that pumps blood through the body.

While Ms. Lorde had to plug it in every night, and she had to be mindful of the power cord sticking out of her chest, it helped improve her life. “I had to be careful, but I got around to do a lot of things, like my cooking and washing,” she says. “I didn’t feel sorry for myself.”

Ms. Lorde received her mechanical heart (called a Duraheart) at the Peter Munk Cardiac Centre (PMCC), which, over the last 16 years, has developed a robust mechanical circulatory support program – it installed its 200th LVAD in late 2016.

In 2001, Dr. Vivek Rao, Division Head of Cardiovascular Surgery at PMCC and the Peter Munk Cardiac Centre Chair in Advanced Cardiac Therapeutics, launched the LVAD program in Toronto after working under Dr. Mehmet Oz at Columbia University, Department of Surgery, in New York, which has one of the world’s largest mechanical heart programs.

These first few years were challenging, as the program was exclusively funded by donors, which meant only about five to 10 devices a year were paid for.

In 2012, though, the government began covering LVADs for use in patients on the heart transplant list, and the number of people receiving the device rose. Now, Dr. Rao and his team install about 30 annually.

MORE LVADS NEEDED

However, it’s still not enough, says Dr. Rao. Most people with heart failure aren’t candidates for heart transplants. They might have a history of cancer or lung problems that make them ineligible for a new transplant. LVADs, though, can help them live long and fulfilling lives.

“Patients with heart failure who are not transplant candidates are given a death sentence,” says Dr. Rao. “They have one or two years to live, and it's not a great life. But those who get these devices do live active lives. They’re not restricted by heart failure anymore.”

Now that funding has been extended to non-transplant patients, the number of LVADs installed should triple – from 30 to 90. That number could grow even more, as technology continues to improve. It may not be long before Dr. Rao is installing LVAD devices that charge without needing to be plugged in. “We’ll get to the point where devices are completely implantable, and they charge like a watch battery,’ he says. “It won’t impact life in any way, and you won’t have to worry about your heart failing.”

MAKING BAD HEARTS GOOD AGAIN

While the PMCC’s mechanical heart program is mostly focused on implanting LVADs, it’s also doing groundbreaking research around stem cell technology, says Dr. Terrence Yan, cardiovascular surgeon and Angelo & Lorelza DeGasperis Chair in Cardiovascular Surgery Research. He’s currently trying to see if stem cells injected into the heart can help the patient’s heart work on its own again.

Dr. Yan is taking patients with LVADs, putting stem cells into their heart and then turning down the LVADs to reduce their pumping function. Normally, if an LVAD is turned off or down, the patient’s heart almost instantly fails. However, in the first phase of testing, Dr. Yan found that half of the patients who received stem cell injections could tolerate a reduction in the LVADs’ power, compared to only 20 per cent of those patients who did not receive stem cells.

The second phase of the trials are now underway, which will see even more stem cells injected into LVAD patient hearts. The goal? To get people’s hearts pumping again. “We want to be able to take the LVAD out and leave the patient with their own heart,” says Dr. Yan. “There’s nothing better than having your own well-functioning heart.”

Ms. Lorde knows that better than most. In 2012, she received a heart transplant, which meant she no longer needed the LVAD. Now she can do everything she used to do, including going to exercise classes. “I’ve never felt better,” says Ms. Lorde. “And that LVAD really helped me as I was waiting for a transplant.”

*By a patient’s own heart can start pumping again

The look and function of LVADs

The look and function of Left Ventricular Assist Devices (LVADs) have evolved over the years and are now being combined with other treatments, such as stem cell technology, to restore function to a patient’s own heart:

- 2001 Heartmate I (1,225 g)
- 2004 Novacore (550 g)
- 2006 Heartmate II (450 g)
- 2010 Duraheart (540 g)
- 2014 Heartmate III (200 g)

- 2010 Heartware (190 g)
A cutting-edge PET-MRI machine has enabled doctors to find new, less-invasive ways to improve the lives of patients and conduct new research

By Kira Vermond

A PET-MRI should give you the best of both worlds, says Dr. Michael Domanski, a cardiac surgeon who specializes in aortic disease at the Peter Munk Cardiac Centre (PMCC), and a German radiologist and nuclear medicine physician who came to Canada from Switzerland in April 2016. “A PET-MRI should give you the best of both worlds,” he says.

**WHY USE A PET-MRI?**

- It combines the spectacular structural imaging of an MRI with the ability to detect physiological changes in real time.
- Images are taken simultaneously — quicker than using two separate imaging machines.
- A small amount of ionizing radiation is a real boon, particularly for pediatric patients who must be monitored through their entire lives.

Anyone who has ever slid through the tunnel of a magnetic resonance imaging (MRI) machine likely remembers its numbing whirring and knocking, not to mention the squeeze of a snug 70-centimetre-wide hole.

But for some patients undergoing procedures at the Peter Munk Cardiac Centre (PMCC), the time spent in the life-saving imaging machine will result in something even more — Positron Emission Tomography (PET) images.

Back in April 2016, the centre acquired and installed one of only about 160 PET-MRI combination machines in the world, giving cardiology researchers access to the cutting-edge, hybrid technology.

While MRI uses strong magnetic fields to generate hyper-detailed images of the body’s organs, a PET scan offers information about metabolic changes happening in organs or tissues. The images are generated simultaneously.

It’s the best of both worlds, explains Dr. Patrick Veit-Habach, Clinical Director of the PET-MRI, Joint Department of Medical Imaging (JDMI), and a German radiologist and nuclear medicine physician who came to Canada from Switzerland in April 2017. “A PET-MRI should give you complementary information about the disease,” he says.

“At least for certain research questions, it’s very important to have real-time simultaneous imaging, so you don’t have a delay between one image and another.”

Now, the machine is being used to conduct new research, determining everything from low heart and brain health to connecting specific metabolic changes with the disease.

**IMAGING... WITH HEART AND INNOVATION**

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**HEART AND BRAIN LINK**

Take the work being done by Dr. Michael Domanski, Division Head, Cardiology. He’s studying the link between aging arteries and neurological disorders such as Alzheimer’s, which causes memory loss and cognitive decline.

As people age, their arteries stiffen, which exposes them to dangerous aortic aneurysms. “That’s the grand scheme,” he says.

**AVOIDING THE WORST**

Meanwhile, Dr. Maral Ouzounian, a cardiac-surgeon who specializes in aortic disease at the PMCC, has a grand vision of her own. After moving to Toronto from Houston in 2014, she has performed many surgeries on patients with aneurysm or dissection in their aorta.

The aorta is the main artery that carries blood away from the heart to the rest of the body. If an aneurysm forms there — the artery wall weakens, so that it balloons out — it can quickly become a serious, life-threatening medical emergency if the aneurysm tears or bursts.

“If you tear your aorta at home, most of the time you don’t even make it to the hospital; it’s a fatal event,” she cautions.

Most people don’t even realize they’re living with an aneurysm until it shows up on an unrelated echocardiogram or CT scan. Then the surgeon has a decision to make: operate to remove it or take a wait-and-see approach. Some aneurysms are stable and unlikely to rupture. But others are far more dangerous. The problem is, it’s not easy to tell one from the other, so physicians depend on their size as a guide. In the part of the aorta that is close to the heart (root or ascending), aneurysms are repaired if they are larger than 5.5 centimetres.

Yet size can be misleading, says Dr. Ouzounian. Some will rupture or dissect when they’re smaller, while others remain stable even as they hit the six-centimetre threshold.

But her new research could change that and how surgeons decide to operate. By using the hybrid PET-MRI machine, Dr. Ouzounian is looking at novel ways that imaging can help predict which patients have vulnerable aortas. Not only does it allow her team to examine inflammation of the aortic wall, which can’t be completed with a CT scan or an ultrasound, but she can also look at the biomechanical properties of the wall. How stiff or compliant is it? How is the wall handling the pressure? Once patients have their PET-MRI scan, they’re whisked to surgery, where Dr. Ouzounian removes the aorta and replaces it with graft material. The patient’s aortic tissue is then taken to the lab, where it is examined under the microscope and tested for tensile strength. There, she can determine if the aortic wall was, in fact, weak and prone to rupture.

“It’s early days for Dr. Ouzounian’s research, but she hopes the PET-MRI results will give surgeons a new, less-invasive diagnostic tool that will tell them which aortas are vulnerable,” she says. “If we do find parameters that are predictive, we could tailor our therapies more to the individual,” she says. “The PET-MRI gives us a much more in-depth look at somebody’s aorta and allows more personalized decision making.”

Considering the risk of death is only less than 1 per cent for elective surgery, it’s no wonder Dr. Ouzounian is looking for novel ways to avoid risky emergency surgeries.

She’s pleased she’s been able to conduct her potentially life-saving research at the PMCC, where she works daily alongside vascular surgeons, interventional radiologists, cardiology partners and even geneticists.

“My goal to be an academic aorta surgeon — and this is the best place to do it.”

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**WHY USE A PET-MRI?**

- It combines the spectacular structural imaging of an MRI with the ability to detect physiological changes in real time.
- Images are taken simultaneously — quicker than using two separate imaging machines.
- A small amount of ionizing radiation is a real boon, particularly for pediatric patients who must be monitored through their entire lives.
MORE THAN ONE MILLION CANADIANS CURRENTLY LIVE WITH HEART FAILURE, and 50,000 new cases are diagnosed each year. These numbers cost the Canadian health-care system more than $3-billion annually, according to the Heart Research Institute (Canada).

“We have an epidemic of heart disease, more specifically heart failure. And we can’t keep doing big-box medicine,” says Dr. Heather Ross, Director of the Ted Rogers and Family Centre of Excellence in Heart Function and a cardiologist at the Peter Munk Cardiac Centre (PMCC).

While medical advances in Canada are helping to treat those with heart disease, there are new systems that put the onus, as well as the power to drive an individual’s health, back in the hands of the patient.

Innovations in heart failure research are spearheaded at the University Health Network (UHN) site of the Ted Rogers Centre for Heart Research, which is an integral program of the PMCC. Here, Dr. Ross and her team are using smartphone apps, digital platforms and even a Bluetooth-enabled monitor implanted into a patient’s lungs to help manage symptoms and triggers of heart failure, educate patients and limit hospital trips.

Cardiovascular disease is one of this country’s largest killers. Someone in Canada dies every seven minutes from a heart attack or stroke, according to the Heart and Stroke Foundation of Canada.

But this advanced technology helps health-care providers offer timely, optimal and efficient patient care with real-time patient data in the hopes of reducing the strain on Canada’s health-care system.

“Virtual care has been a term that has been thrown around, but I think this is virtual care on steroids,” says Dr. Ross. “What we have is a set of virtual tools to enhance self-care and to enlist patients in their own care, because patients are the largest equipment the patients use at home is fairly simple.

Patients don’t need to come into a clinic for a weigh-in. They can simply stand on a scale hooked up to an app on their smartphone, and the details are sent digitally to a Bluetooth-enabled monitor implanted into a patient’s lungs for real-time monitoring methods, such as CardioMEMS, must be developed.

Dr. Ross Practitioner Meredith Linghorne shows a patient how to use CardioMEMS, a mobile application system that allows real-time measurement of a patient’s fluid status. The PMCC was the first health-care centre in Canada to implant a CardioMEMS device.

Medly is a nurse practitioner at the PMCC and she is on the receiving end of Medly’s patient data.

“Medly allows us to see key clinical data, such as changes in weight and patient’s symptoms, without having them come into the clinic,” says Ms. Linghorne. She says that patients are asked to monitor their blood pressure, heart rate, weight and simple symptoms on a daily basis – something that would have been impossible before without daily trips to a clinic or a hospital.

“We know when they are getting into trouble. And this particular app is designed so they will get immediate feedback from us after taking their measurements.”

or the app tells them to contact us to discuss the problem.”

For the clinicians, this advanced technology marries the vital components of self-management and education in cardiac health care.

Dr. Jane MacIver, nursing professor in cardiovascular research for the Ted Rogers Centre for Heart Research, says it’s about the teachable moments that this type of technology provides. A large part of cardiac health is providing patients with information about low lifestyle choices affect one’s heart health.

Her work is focused around CardioMEMS, a system designed in the U.S. and only used on two patients in Canada so far, as approval is pending.

CardioMEMS is a heart monitor that is inserted into a person’s lung artery and gives real-time blood pressure readings back to the clinician, allowing for more immediate lifestyle or medication adjustments.

For instance, if a person has been neglecting a healthy diet and reaching for sodium-rich snacks, CardioMEMS will pick up on the effects. “For the patient, it allows them to see how the changes they make in their life can affect their reading,” says Dr. MacIver.

“It’s more impactful than saying, ’Don’t take any more than 1,500 milligrams of salt. It doesn’t mean anything to them, but they can see (a salty) buffet is bad because it causes weight gain.’”

As part of Dr. MacIver’s research, her team will measure the out-of-pocket expenses associated with the CardioMEMS device. It’s true there is no direct cost to the patient for the device itself, but Dr. MacIver explains there can be extra costs, such as increasing the bandwidth on an individual’s Internet to accommodate the device and its Bluetooth readings. There will also be home visits to CardioMEMS patients to study ease of use.

“I think it’s one thing the technology makes sense to a clinician, but if we find out it is really ineffective for the patient, then are they really going to use it,” says Dr. MacIver. “It’s taking it one step further and saying, ‘Yes, we have this technology, but let’s look at how it’s actually picked up in the real world.”
Solving the complex puzzle of aortic disease

A team approach allows doctors to offer solutions, and quality care, to patients like Nazmoon Griffith

By Judy Gerstel
Chair in Vascular Surgery, to be “more approachable. I didn’t feel nervous about asking questions. He was very reassuring, and he was really involved, checking on her every day.”

Dr. Lindsay, in turn, appreciated Ms. Rahaman. “Sometimes the patient is blatantly unaware,” he says. “Her niece was invaluable. When problems were arising, we made sure to talk to the niece, as well.”

Even the fact that the case was one of the first of its kind in Canada and involved a large, highly skilled and creative team meeting and planning six months in advance of the first operation was of no great relevance to Mrs. Griffith.

What does impress her, though, is how she was cared for. “They treated me so well,” she says. “I was almost like family.”

Mrs. Griffith’s aorta was so extensive and damaged from top to bottom that it required total reconstructive surgery. “It was a huge operation,” says Dr. Lindsay. “We切除 the whole aorta.”

She pointed to her head and said, “Here.”

A normal aorta is less than three centimetres. Two different aortic surgical teams used different approaches and techniques for patients with aortic disease. Mrs. Griffith’s was more than six centimetres.

Aortic aneurysms and dissections are estimated to cause almost 3,000 deaths annually in Canada.

People with aortic aneurysms rarely have symptoms. The bulging of the aorta and other signs and symptoms usually appear during imaging or during surgery. Any sudden, severe, sharp pain in your chest, back, or abdomen should be evaluated immediately. These symptoms may indicate an aortic aneurysm or dissection. Pain in your head, shoulders, arms, or legs can signify a ruptured aortic aneurysm. Pain in your legs can indicate intermittent claudication.

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Growing into adulthood when you are born with heart disease

Specialized medical teams at the Peter Munk Cardiac Centre and the Toronto Congenital Cardiac Centre work to provide lifelong care for adults born with heart defects.

By Daina Lawrence

FIFTY YEARS AGO, BABIES BORN WITH COMPLEX CONGENITAL HEART DEFECTS had a less than 5 per cent rate of survival to adulthood, as surgical strategies that would eventually treat many of these patients were still in their infancy or not available.

Today, more than 90 per cent of these babies make it into adulthood, creating a whole new patient demographic where there are currently more adult patients living with congenital heart disease than children—and medicine must now do its best to treat many of these patients to adulthood.

“The rapidly growing field of congenital heart disease was not available until the 1990s. “Within ACHD, the ties to the pediatric world are exceptionally strong because congenital heart disease was once strictly a pediatric condition,” explains Dr. Wald, originally a pediatric cardiologist before joining the Peter Munk Cardiac Centre (PMCC)’s adult congenital heart disease (ACHD) team. "Initially, these children simply didn’t survive, and that’s one of the reasons why the rapid growth of this field is happening now. We have a large number of these babies make it into adulthood, creating a whole new patient demographic where there are currently more adult patients living with congenital heart disease than children—and medicine must now do its best to treat many of these patients to adulthood.

For instance, a surgical technique to help treat babies born with hypoplastic left heart syndrome—which occurs when the heart’s left side isn’t able to effectively pump blood, forcing the right side of the heart to pump blood to the entire body—wasn’t available until the 1980s. Before then, this birth defect was fatal.

“Now we’re seeing our first wave of adults surviving in their 20s and we don’t really know what’s going to happen when this cohort survives another 10 years (and more),” into their 30s, 40s and 50s,” explains Dr. Wald. "We’re trying to come up with an educated guess of which complications might happen, and how these can be prevented, however management is very much an evolving process, as our patients teach us what we need to be aware of."

The specialties of the team members make the treatment at the centre truly unique. Not only are there the congenital heart surgeons and ACHD cardiologists who are experts in ACHD, but the team also consists of cardiac interventionalists (specialists trained in catheter-based treatment), electrophysiologists with expertise in heart rhythm problems, cardiac imaging specialists and several others with congenital heart disease expertise to help provide the most balanced patient care."Each colleague contributes his or her expertise to find the best treatment option for the individual patient,” says Dr. Erwin Oechslin, an ACHD cardiologist, Director of the Adult Congenital Heart Disease program at the PMCC and Distinguished Professor in Adult Congenital Heart Disease at the University of Toronto. "These patients are born with an abnormal heart from the very beginning, and after the surgeon remodels the heart, they end up with a very complex anatomy,” says Dr. Oechslin. "What’s important to remember is that these patients are not fixed, they’re not cured,” he adds. "They’ll never be cured, only repaired. Most patients with a scar in their chest need lifelong medical care,” explains Dr. Oechslin. "This team of specialists in these areas, as well,” explains Dr. Oechslin. "Together, the ACHD team is recognized for its long-term outcome studies, care of pregnant women with heart disease, attention to psychosocial aspects and end-of-life issues."

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For Dr. Oechslin, “it’s this team of medical specialists and nurses providing comprehensive care to adults with ACHD.”

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Dr. Erwin Oechslin, Director, Adult Congenital Heart Disease program, the Peter Munk Cardiac Centre
THE MECHANICAL HEART

WHAT DR. JAGDISH BUTANY HOLDS IN HIS HANDS

Looks surprisingly unremarkable, about the size of a dime. Yet as director of cardiovascular pathology at the Peter Munk Cardiac Centre (PMCC), this particular valve took him on a mission around the world. The mystery was the silver coating of heart valves that were implanted into patients, leading to infections in heart patients, and forcing the devices to be replaced, within months the device and in some cases death.

The mystery started unfolding some 20 years ago, Dr. Butany explains. “Now, about 2 per cent of prosthetic heart valves that are implanted get infected. You make something by hand or with machinery, and somewhere along the line, the sterilization is not adequate, you can get bugs coming in,” he says.

In the late 1990s, one of the manufacturers brought out a new model. It was offered to leading heart institutes at no cost and led to only a small improvement – a coating of silver along its edge that was intended to prevent infection.

Trouble is, more patients than usual actually had infections after receiving this device. Instead of the normal percentage of patients whose valves had to be replaced, within months the numbers kept going up. “When we had eight (uninfected), I said, ‘This is too much.’ Unfortunately, prosthetic heart valves behave differently in different people,” Dr. Butany says.

With Dr. Butany knowing the problem needed attention, he didn’t think dealing with this valve would become the cornerstone of his life’s work. There was a great deal at stake, though, not only for some of the over 25,000 people who have heart valves implanted every year, but also for the hospitals that need to make sure the devices work and the companies that invest time and even hundreds of millions of dollars in developing valves. Costing at least $4,000 each in Canada, synthetic heart valve looks deceptively simple. It’s an outer ring with a disc or a membrane that opens and closes to let in blood and prevent it from flowing back.

As a pathologist, Dr. Butany looks at tissues, biopsies, lab results and even autopsies to determine what went wrong. He works closely in evaluating and reviewing new devices with cardiovascular surgeon Dr. Tirone Davila, Melanie Munk, Chair in Cardiovascular Surgery, and Dr. Christopher Feindel, Antonio & Helga DeGasperis Chair in Clinical Trials and Outcomes Research at University Health Network (UHN) and across the city.

Many people believe that doctors are highly influenced by drug and health-care companies, “but those days are gone,” Dr. Butany says. “We meet several times per year, to discuss procedures of the U.S. Food and Drug Administration. (Health Canada) tends to adopt the same testing process that all medical devices must undergo, in many cases following the procedures of the U.S. Food and Drug Administration. (Health Canada) tends to adopt the same standards.”

Pathology is at one end of situations in 30 years where someone has died, and the other end, “It’s a fine line between allowing a device to market and then we talk about the problem being critical when it’s necessary,” Dr. Butany says.

“One day, about three years after I had my first concerns, I got a call from the medical device people regarding a valve, I got a call from the manufacturer saying that the device was about to be withdrawn. They made the public announcement half an hour later, that morning,” Dr. Butany says.

The process for reviewing devices is always itself being reviewed and fine-tuned, Dr. Butany says. “It’s a fine line between allowing people to use new devices and being cautious,” he explains. For the future, “I think there are probably ways you could tighten the follow-up. There have been subtle changes in new transcatheter valves [implanted into aortic valves], for example,” Dr. Butany says.

“We’ve learned a lot over the last few years, so if there’s an issue with one, we need to know if it’s a one-off situation, or are there more cases like it?”

Pathologists’ puzzle: mystery of the silver-coated heart valve

Dr. Jagdish Butany and the Peter Munk Cardiac Centre’s determined team of detectives work to ensure the safety of novel cardiovascular devices

By David Israelson

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Discovering the problem with this mechanical heart valve is part of the PMCC’s dedication to rigorous testing protocols.

From left: Drs. Tirone Davila, Jagdish Butany and Christopher Feindel drive to fine-tune the process for reviewing new devices.
“The one thing I like most about [the PIE website] is that it’s very democratic. Every country in the world, no matter how well off they are, has access to the Internet…it's very democratic. Every country in the world, no matter how well off they are, has access to the Internet...”

Dr. Gordon Tait, Manager, Perioperative Interactive Education, Toronto General Hospital

Dr. Gordon Tait, Annette Vegas, Massimiliano Memmi and Wendy Tsang involving PIE fills a major gap in helping doctors and students learn new technologies and techniques.

The work of Dr. Gordon Tait, Annette Vegas, Massimiliano Memmi and Wendy Tsang involving PIE fills a major gap in helping doctors and students learn new technologies and techniques.

“...the soon-to-be obsolete multimedia software for viewing rich media on the Web...”

Dr. Tsang — who was a contributor to a 3-D TEE imaging suite with anesthesiologist Dr. Massimiliano Memmi — says the website helps standardize TEE instruction and student experiences. And that includes showing students of all skill levels the process in major detail, down to buttons being pushed and adjustments being made to the virtual TEE equipment in order to simulate a real-world experience.

Previously, she says, anesthesiologists or cardiologists learning TEE, or any diagnostic procedure, would be limited to the knowledge and experience of the doctor providing the instruction. The PIE website removes potential variance in the education process.

To find the time to learn new technologies or techniques is difficult, especially once physicians have finished their training,” she says. “Trainees in smaller centres and individuals practising in the community may not be able to go or have access to a centre willing to offer them the time to learn and practise. There was a major gap that needed to be filled.”

From Dr. Tsang’s perspective, upgrading the technology is essential at a time when even the most complex medical instruction is migrating into the digital realm. She points to the plethora of detailed YouTube videos demonstrating echocardiography that are free to the public as just one example. “This is a step forward from seeing thinking they have an interesting video and uploading it to YouTube,” she says of the PIE website. “This has a different educational component. It also demonstrates how you can reach out to people who can’t come to your hospital or university for training. It’s free for anyone and has quality behind it. You can’t necessarily guarantee that when you go online.”
Recruiting and retaining the best and the brightest
Multidisciplinary research and creative thinking aid the Peter Munk Cardiac Centre in its relentless search for top talent

By Mary Gooderham

THE PETER MUNK CARDIAC CENTRE (PMCC) HAS BECOME A POWERFUL CENTRE FOR INNOVATIVE MEDICAL RESEARCH that attracts scientists from all over the world. "The multidisciplinary environment allows cross fertilization of ideas by stimulating interaction across various medical specialties and scientific disciplines. This feature of our environment is attractive to bright, creative people," says Dr. Michael Domanski, Cardiology Division Director at University Health Network (UHN) and Mount Sinai Hospital.

Dr. Domanski, a specialist in advanced heart failure and transplant cardiology, made the move from the Icahn School of Medicine at Mount Sinai Hospital in New York to the PMCC "because it looked like a chance to make a difference in terms of research and also in patient care and teaching," he says. "The commitment of the organization to innovation is expressed by its leadership."

Dr. Patrick Lawler, a cardiologist who joined the PMCC’s emerging cardiovascular clinical research group in April, was attracted from his position at Brigham and Women’s Hospital and Boston Children’s Hospital, as well as Harvard Medical School in Boston, because the centre encouraged creative thinking and encouraged taking scientific risks. "It seemed like there was a spirit of wanting to do different things and trying different approaches to a disease that we’ve been treating for some time," he says, noting that a good deal of research "has plateaued" in cardiovascular disease. "It’s time for a fresh look and a fresh perspective, and I thought that the people here were the ones who might be able to do that."

Dr. Lawler, a Boston native who attended medical school and completed his residency at McGill University in Montreal, was impressed with the diverse group of people at the PMCC who have expertise in clinical trials, including epidemiologists, biostatisticians, regulatory scientists and administrators. "Lots of aspects of science are a team sport, but having the right team is really essential to doing these large clinical trials and translational studies," he says, adding that international recruitment is part of an overall trend to "break down the borders" in medicine. "One of the richness of the medical community here is the diversity of backgrounds that people bring from across the world," Dr. Lawler says. "It’s important to continue that."

Dr. Barry Rubin, Medical Director of the PMCC, says that recruiting is among the stated goals of the Peter and Melanie Munk Charitable Foundation’s third donation to the PMCC in 2011, along with retaining the best and the brightest. "We’ve been unbelievably successful at doing that," he says, noting that key elements of the strategy have included establishing five new chairs and four centres of excellence. "Our vision is to be the best heart centre in the world, and you can’t do that without having the best people." Dr. Rubin says the new recruits in turn are attracted by the PMCC’s vision, its multidisciplinary approach, its cohesive program and a "constant and unremitting focus on innovation." He calls the substantial number of recruits from the U.S. "the reverse of the brain drain," made possible with substantial funds from donors to the PMCC, including the Munks. He says, for example, that Dr. Lawler is "truly at the cutting edge," and "every major heart centre" tried to lure him. "For somebody with his pedigree to look out over the landscape and choose the PMCC tells you about the draw that we have. He could have gone anywhere."

Another new recruit, Dr. Patrick Veit-Haibach, a radiologist and nuclear medicine physician, came to the PMCC’s joint Department of Medical Imaging in April from the University of Zurich. As director of Positron Emission Tomography/Magnetic Resonance imaging (PET-MRI), his clinical research focus is combining molecular imaging in all sorts of diseases, he says. "It’s time for a fresh look and open to new ideas; that’s not always the case in places where the single most important thing is how to intervene successfully to bring relief to patients."

Dr. Veit-Haibach is excited to be at the PMCC, given its "patient population with all sorts of cardiovascular indications," as well as its enthusiasm for using molecular imaging in all sorts of trials. "It makes it interesting," he says, noting that he’s pleased to get a good deal of academic time at the PMCC, which has a strong focus on translating basic science to clinical science. "There’s something to build up here, so we can understand disease, where it comes from and how to intervene successfully to bring relief to patients."

Interdisciplinary exchange is "very much encouraged" in his field, Dr. Veit-Haibach says, and the PMCC inspires teamwork. "Everybody’s really collaborative and open to new ideas; that’s not always the case in places where you’ve been," he says. "It can be more political."

Dr. Rubin says that the new recruits at the PMCC have associations with institutions outside of Canada "will benefit research there," says Dr. Veit-Haibach, who expects to connect with research fellows at the University of Zurich. Dr. Domanski says that multidisciplinary research is "implicit" and "critical to success that are made and all the science, with heart disease," Dr. Rubin products. "For all the investments that are made and all the science, the single most important thing here is the people we recruit – no question."
Thorsteinssons is proud to support the Peter Munk Cardiac Centre and to share in their vision of integrating excellence into every aspect of client care.

The right test, at the right time

As the appetite grows for medical testing, a palatable app is feeding physicians timely information

By Shannon Moneo

Cardiologist Dr. Sacha Bhatia and his team led the Echo Wisely trial, which examined ways to reduce the number of unnecessary echocardiograms being performed. The initiative was funded by the PMCC Innovation Committee.
When Dr. Barry Rubin was asked in 2012 by the Government of Ontario to examine the appropriate use of imaging tests, such as echocardiography and magnetic resonance imaging, he wanted no outside interference and the freedom to produce an honest report. The stakes were rather high because Canada spends more than $2.2 billion annually on such diagnostic imaging. Just a 10 per cent decrease in unnecessary testing would save $220 million each year. What Dr. Rubin, the PMCC’s Medical Director, and his Expert Panel on Appropriation Utilization of Diagnostic and Imaging Studies found is that 10 per cent to 50 per cent of imaging tests are done for inappropriate reasons. “When you focus on echocardiography, it’s a $10-million enterprise in Ontario annually. If one-quarter of those tests were not carried out, it would produce savings of $3.5 million each year,” says Dr. Rubin, a vascular surgeon and also a Professor of Surgery at the University of Toronto. “The goal is to control costs by ensuring tests are done only on the right patients, in a safe environment, by individuals who are trained to carry out and interpret the tests.” So the problem then becomes: “What is the appropriate use criteria?” Enter Dr. Sacha Bhatia, a cardiologist at Women’s College Hospital and University Health Network. “One thing we know is that some people get care they probably don’t need,” he says. The danger then becomes that patients will not get false positive results or benign conditions will be missed and left untreated. “The basic premise becomes: ‘How do we make sure the patient gets the tests they need?’” Dr. Bhatia asks.

Echocardiography uses ultrasound to create images of the heart in order to examine its blood supply. Determine how large the heart is, how well it contracts and how the valves function. The test, using an ultrasound probe and electrodes attached to the skin, is done when people are concerned about, for example, heart disease, dizziness, irregular heartbeat or shortness of breath. It costs approximately $100 for the physician to read the test results, plus another $100 for the actual test, Dr. Bhatia notes. While a research fellow in cardiology at Massachusetts General Hospital and a research fellow at Harvard University from 2015-13, Dr. Bhatia learned of an “appropriate use criteria” guideline that he combined with a pocket card that described the criteria in the context of common clinical scenarios and twice-monthly e-mail feedback on the appropriateness of test orders. When used by a study group, there was a 26 per cent reduction in echocardiography orders. In 2013, Dr. Bhatia was awarded the Arthur E. Weyman Young Investigator’s Award by the American Society of Echocardiography and the Young Investigator Award from the American College of Cardiology for his work. “We used very simple educational material, looked at their order patterns and examined the appropriateness,” he says. Physicians were provided with clear guidelines on recommendations, based on key indicators. But more importantly, the e-mail feedback informed the physicians how their peers were doing and which physicians were ordering fewer tests. “Doctors often don’t get feedback on how they’re doing,” Dr. Bhatia notes. That information became significant because the doctors became more aware of how their patients were later doing and how much treatment cost. In 2013, a University of Toronto study found that between 2001 and 2009, the rate of echocardiography increased by 5.5 per cent over the eight years, a rate that was adjusted for the rising number of older citizens and accelerating rates of disease. Dr. Bhatia attributes the rather high growth rate to patients’ requests for tests and how physicians practise, meaning they don’t refrain from ordering tests. After returning to Canada, Dr. Bhatia began a similar 18-month study in 2014 at nine hospitals in Toronto, Kingston and Boston, involving almost 180 clinicians who were broken into two groups. One group had no contact with Dr. Bhatia and his team. The second group got a YouTube video outlining the appropriate use of echocardiography and was given access to an online appropriate use criteria application for their phone. Research co-ordinators would record how often and why they ordered echocardiograms, and the data would be delivered to Dr. Bhatia. His team would input the information, and each month the physicians would receive an e-mail telling them whether the ordered test was appropriate or why it wasn’t necessary. As the trial proceeded, there was a 25 per cent drop in the proportion of unnecessary echocardiograms. “There were no incentives. We just gave them data in a very thoughtful way,” Dr. Bhatia says. “By giving doctors information, we significantly changed their behaviour. It’s about showing doctors how they practise in a way that’s easy to digest, changing their practice for the better and improving their performance.” Or as Dr. Rubin says, “It’s one thing to put together a recipe and another thing to follow it.” He adds that Dr. Bhatia is putting into practice the recommendations from his 2013 report. “He’s a superstar,” Dr. Rubin says. “He’s working and the recommendations my report panel made align. The problem had been that there were guidelines out there, but no mechanism to put them into action. He used technology to deliver a solution in a very effective way.” The upshot is that doctors will order fewer tests, saving money, increasing access and reducing wait times for patients who require a heart ultrasound. Dr. Bhatia, who also earned an Innovation in Quality Award set you would like to apply the process to other tests. “It doesn’t have to be limited to echocardiograms. It could be used for stress tests, CTs, MRIs, even for the prescription of drugs.” And as in the earlier U.S. study, Canadian physicians appreciate the approach because “there’s a real appetite to give doctors their performance data and how they can improve,” Dr. Bhatia says. “No one wants to be mediocre.”

**‘One thing we know is that some people get care they probably don’t need...’**

Dr. Sacha Bhatia, Cardiologist, Women’s College Hospital and University Health Network

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A breakthrough in lowering systolic blood pressure

A new e-counselling program is proving that with the right self-help support and education, people can make healthier lifestyle choices and – hopefully – live longer.

By Bryan Borzykowski

EVERYONE KNOWS THAT A HEALTHY DIET AND REGULAR EXERCISE CAN LEAD TO A LONGER LIFE, but for most people, it’s nearly impossible to break bad lifestyle habits. In 2010, Dr. Robert Nolan, Director of the Cardiac-Education and Behavioral Cardiology Research Unit at Peter Munk Cardiac Centre (PMCC), set out to change that by helping patients connect heart-healthy lifestyle change to their personal goals for living.

Over the last seven years, Dr. Nolan has been devising ways to help patients with hypertension create meaningful and long-term changes to their lifestyle. In the past, people would have consultations with a specialist and then be left to fend for themselves. Some might change their behaviours for a short time, made a huge difference.”

For Toronto IT worker Virpi Kononen, a Toronto-based self-care expert give step-by-step instructions on how to set up a plan.

“Your goal is to look for partners who want to work with us, who can offer this on a population-wide basis,” he says: “We want to continue making sure that we can demonstrate the effectiveness of this for not just reducing risk factors for heart disease, but also that we can help improve everyone’s quality of life.”

01 Dr. Robert Nolan, second from left, and his team at the PMCC, work to find ways for patients to deal with hypertension by creating important and long-lasting lifestyle changes.

02 For Toronto IT worker Virpi Kononen, regular sessions were the key to success in managing her high blood pressure.
The algorithm allows us, early at the bedside, to identify why patients are bleeding, and once that is identified, to find therapies to target abnormalities we identified,” says Dr. Keyvan Karkouti, who is keenly aware of the algorithm’s value. Between October 2014 and May 2015, a randomized controlled trial of the point-of-care-based transfusion algorithm was tested at 12 Canadian hospitals. None of the sites previously used point-of-care testing for bleeding management during cardiac surgery. During the seven months, the algorithm was used for 7,405 patients having coronary bypass surgery. Overall, the point-of-care algorithm reduced red blood cell transfusions, platelet transfusions and major bleeding following cardiac surgery.

For Dr. Michael Farkouh, the “out-of-box” thinking that led to this valuable algorithm is truly innovation in action. “It’s a novel, very cost-effective way of improving outcomes,” says the Chair of the Peter Munk Centre of Excellence in Multinational Clinical Trials. With a limited blood supply and a push to minimize blood resources throughout the health-care system, Dr. Farkouh, a cardiologist, former perpetual blood donor and big proponent for the algorithm, says, “We have the ability to tailor transfusions in patients.”

The algorithm works by determining if red blood cells or plasma are needed via a flow chart. After a blood sample is reviewed, questions are asked, such as: “What are the clotting defects?” or “How much blood loss has occurred,” based on the weight of spongoids used to absorb patient blood? “The questions drill down to appropriate therapies, but no blood products, the use of platelets, plasma or cryoprecipitate, a frozen blood product prepared from plasma. When heart surgery is performed, heavy bleeding can occur. The more blood that is lost during surgery, the worse the outcome for the patient. Conditions that lead to excessive bleeding during surgery include complex heart surgeries, such as transplants, that result in longer times on the heart-lung machine; complicated, emergency heart surgery; and patients who were taking blood-thinner medications,” Dr. Karkouti says. Use of the heart-lung machine plays a significant role in degrading the patient’s blood. “The algorithm has improved the management of bleeding and major bleeding following cardiac surgery,” he says. “The patient did well, Dr. Rao discovered a source of bleeding, which was also controlled. “The patient did well, Dr. Rao discovered a source of bleeding, which was also controlled. “The patient did well, Dr. Rao discovered a source of bleeding, which was also controlled. “The patient did well, Dr. Rao discovered a source of bleeding, which was also controlled. “The patient did well, Dr. Rao discovered a source of bleeding, which was also controlled. “The patient...
A radiologist stirs up a vitamin cocktail to protect against radiation exposure

A chat with his mother-in-law and a walk with his dog gave this neuroradiologist the idea to use anti-oxidants to help lessen the dangerous after-effects from life-saving radiation

By Mary Gooderham

SURGERY PERFORMED UNDER X-RAY GUIDANCE HAS TRANSFORMED MODERN MEDICINE, allowing for minimally-invasive operations (from neurosurgery to gastroenterology procedures), reduced pain and shorter recovery periods for patients. It also means lower costs to the health-care system. But X-rays also subject patients, and especially doctors, nurses and technologists, to emitting radiation, causing molecular changes in the body’s DNA that have been linked to elevated risks for cataracts and cancerous tumours.

“It’s scary; we are exposed to vast amounts of radiation over a career,” says Dr. Kieran Murphy, an interventional radiologist at Toronto’s Western Hospital who has been a neuroradiologist at Vancouver Hospital.

He says that the anti-oxidant cocktail his research, the first clinical trials. After extensive research, the first clinical study was carried out using 10 patients undergoing diagnostic and radiation was funded by donors who supported the Peter Munk Cardiac Centre (PMCC) Innovation Committee. “Without that, we wouldn’t be at this stage; it was a very, very important step for us,” says Dr. Murphy, noting that the trial showed the premedication treatment to be beneficial in reducing DNA breaks in the blood of patients exposed to diagnostic radiation.

The research is being closely watched by clinicians such as Dr. Lindsay Machan, an interventional radiologist at Vancouver Hospital who has experienced occupational radiation-induced cataracts and lost the sight in one eye as a result of cataract surgery. He says that anti-oxidant premedication is an “exciting advance” in the effort to reduce the impact of radiation on imaging-guided surgery.

“She is impressive and encouraging,” Dr. Machan says that minimally-invasive procedures are exploding in fields such as cardiology, orthopaedics, vascular surgery and pain medicine. “The numbers are just increasing every year.”

Patients face little risk from their temporary radiation exposure and “enormous benefits,” indeed a growing number of procedures can only be done by imaging-guided techniques, including delivering chemotherapy agents to parts of the liver.

Meanwhile, medical professionals performing procedures such as fluoroscopy and CT scans are exposed to continual low doses of radiation, yet don’t see the danger, he comments. “No one has invented the perfect protection as yet – that’s for sure.”

The International Commission on Radiological Protection has suggested new exposure limits that are one-seventh of the previous average annual level. But Dr. Machan notes there is “tremendous individual variation in how people respond to radiation, and the idea of a threshold is somewhat arbitrary.” His goals are to reduce the amount of radiation given off by imaging devices, improve radiation shielding and introduce innovative protective measures, such as Dr. Murphy’s premedication treatment.

“It’s one more step,” he says. “There’s no doubt in my mind that it will become a product.”

The next study of Coramed will involve testing it on interventional radiologists, cardiologists and other medical professionals who work in a field of radiation, says Dr. Murphy. He expects one of the largest markets for the product to be airline crews, who are exposed to high levels of solar radiation flying at high altitudes, especially on polar routes.

His research has been recognized by the Society of Interventional Radiology, which gave him its Leaders in Innovation Award in 2015. Murphy has also filed 64 patents on new medical devices and started six companies. He’s grateful to be able to devote two days each week to research, and to be part of a “vibrant, intellectually active and questioning” community at the PMCC.

“We’re not just here to do a job, but to change how the job is done,” says Dr. Murphy, who hopes the premedication anti-oxidant will be on the market within about a year.

A chat with his mother-in-law and a walk with his dog gave this neuroradiologist the idea to use anti-oxidants to help lessen the dangerous after-effects from life-saving radiation.

Dr. Kieran Murphy, an interventional radiologist at Toronto’s Western Hospital, received the Leaders in Innovation Award from the Society of Interventional Radiology.
Finding global solutions to cardiovascular disease

By Kira Vermond

The Peter Munk Centre of Excellence in Multinational Clinical Trials is uniquely positioned to study the world.

The ability to run multinational trials is part of the expertise and experience that cardiologist Dr. Patrick Farkouh and Dr. Jacob Udell bring to the PMCC’s cardiac clinical work and research.

CORONARY HEART DISEASE. It doesn’t care if you’re Canadian, American or living in India, Kenya or Spain. Political boundaries mean nothing to a condition that kills an estimated 3.5 million men and 2.4 million women globally each year. So why shouldn’t cardiac clinical trials and research also break geographic barriers?

That’s part of the thinking behind the Peter Munk Centre of Excellence in Multinational Clinical Trials, launched in 2011 and one of seven Centres of Excellence established by the Peter Munk Cardiac Centre (PMCC) to transform the way patients with cardiovascular diseases are treated around the world.

“We bring innovation and what we call the ‘one-stop-shop’,” says Dr. Michael Farbouh, the Peter Munk Cardiac Centre Chair in Multinational Clinical Trials, who came back to Canada in 2010 after working in the United States for 20 years, including 10 years directing the Mount Sinai Cardiovascular Clinical Trials Unit in New York City.

“When we develop new drugs and new devices, we have the ability that most centres in the world do not have to go from the early concept in innovation all the way to the large-clinical trial,” he says.

That partly due to Dr. Farbouh’s own experience running large multinational trials. While phase one and phase two trials typically involve smaller numbers of people chosen with very specific medical parameters in mind, multinational trials examine outcomes in thousands or even hundreds of thousands of people worldwide.

“Take the FREEDOM Trial, co-led by Mount Sinai Hospital in New York and the Peter Munk Cardiac Centre,” Farbouh says. “It showed that when diabetic patients with multivessel coronary artery disease have bypass surgery, they live longer and are less likely to experience complications than those who undergo angioplasty.”

The Tailored Antiplatelet Initiation to Lessen Outcomes: Due to Increased Clopidogrel Resistance After Percutaneous Coronary Intervention (TAILOR-PCI) study is another large trial the PMCC is currently co-leading with the Mayo Clinic. It’s meant to determine whether patients with stents should receive the drug Plavix or another prescription.

Thirty per cent of people are actually unable to metabolize Plavix. They have a genetic variation in a liver enzyme that prevents it. Ultimately, the drug is next to useless for them.

But what if you could tell through rapid genotyping – who is a good candidate for that standard medication and who should receive an alternate medication that’s more effective for them?

The TAILOR-PCI study team uses genotyping technology – a quick cheek swab – in some of the 6,000 patients enrolled in the trial to use if genetic testing before prescribing medication alters the way physicians lead to better patient outcomes. So far, the team has signed up more than 4,000 patients in Canada, the U.S. and South Korea. “It’s about trying to show that individualizing care is the way to go,” says Dr. Farbouh.

It’s also the first and largest trial of individualized medicine that the U.S. National Institutes of Health (NIH) has sponsored, he explains.

“The beauty of multinational trials is not merely the vast scope, but also how the data is actually collected and analyzed,” says Dr. Patrick Lawler, a cardiologist, Boston native and now recruit to the centre who is a leading expert in preventing adverse outcomes of cardiovascular disease.

Lawler says he was drawn to the PMCC because the centre’s focus is unique: a strong interest in developing pragmatic clinical trials that intersect with real-world evidence by pulling data from actual clinical cases.

In a pragmatic clinical trial, a study could look at how blood in blood banks is used. Are patients being given the newest blood or the stock that has been stored the longest? (Think milk growing nearer to its expiration date.)

Then, when you follow those patients through their electronic health records afterward, what are the outcomes?

“That’s the way to the large clinical trial,” he says.

“The teams participating in the study have already completed one full season. The results will be recorded in 2020. Teamwork and collaboration are obviously paramount if large multinational clinical trials are to succeed. And Dr. Udell says the centre is working with nurses, nurse co-ordinators, health administrators and senior leadership at the PMCC and Toronto General Hospital, as well as teams across the country and beyond.

“This couldn’t have happened without everyone coming to the table,” he says. “It’s going to take work and rolling up our sleeves, but we’re on the precipice of doing something pretty cool that will open the floodgate for many trials to come.”
Accelerating healthcare innovation

Our goal is to improve the lives of three billion people every year by 2025. We are proud to support the Peter Munk Cardiac Centre and committed to lead the way in delivering innovation. Through clinically relevant technology and a unique blend of cardiology solutions, we will contribute to building the healthy society that we all envision.

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By partnering with the Vector Institute, we will use artificial intelligence and machine learning to help guide decisions in the clinic, and to advance biomedical research.

DETERMINING THE BEST TREATMENTS FOR PATIENTS WITH HEART DISEASE
By leading a worldwide clinical research network, we will improve our understanding of heart disease and accelerate the development of new treatments.

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By making treatment decisions based on patients’ individual genetic makeup, we will deliver the right treatment, at the right time, to every patient.

TRAINING FUTURE LEADERS
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|+163,000 OUTPATIENT VISITS
|+10,000 CARDIAC & VASCULAR PROCEDURES
|2,400 PATIENTS IN CARDIAC REHABILITATION
|160 CLINICAL FELLOWS & RESIDENTS FROM AROUND THE WORLD
|67 FUNDED PRINCIPAL INVESTIGATORS
|35 HEART TRANSPLANTS
|34 MECHANICAL HEART PUMPS

*Based on 2016 data

Here's what the future of cardiovascular care looks like:
Rogers is proud to contribute to the Peter Munk Cardiac Centre, and to share its pioneering spirit of pursuing new technology for the betterment of Canadian lives.

“The best is yet to come.”

Ted Rogers