

A SPECIAL TRIBUTE

# Peter Munk Cardiac Centre

UNIVERSITY HEALTH NETWORK • WINTER 2019

## ONE SIZE DOES NOT FIT ALL

*How precision medicine is transforming cardiovascular care*

## PUSHING THE BOUNDARIES OF SCIENTIFIC DISCOVERY

*World-class researchers probe the mysteries of the heart*

## GAME-CHANGING DEVICES

*An artificial heart the size of a AA battery*

*the life & legacy of*

# PETER MUNK

1927 – 2018

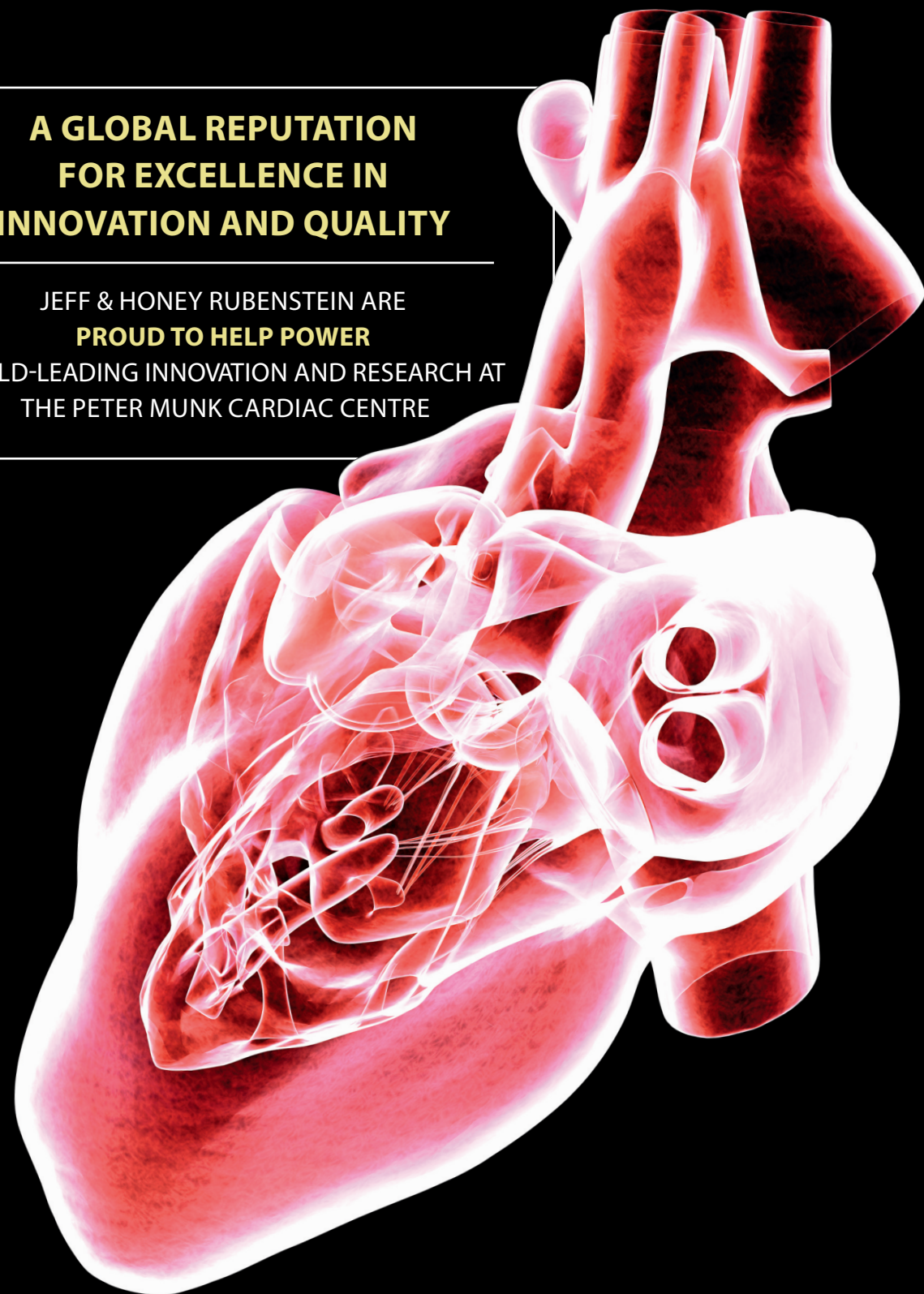


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WINTER 2019

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Peter Munk  
Cardiac Centre 



**4 REMEMBERING  
PETER MUNK**

Peter Munk arrived penniless in Canada from war-torn Europe. But he brought giant ambitions and a grateful heart, as he began a remarkable journey toward becoming one of this country's greatest business leaders and philanthropists

**10 SURVIVOR STORIES**

The stories of four individuals who are grateful recipients of the centre's world-class cardiovascular care. They each faced the fear, pain and uncertainty of heart disease, and came out the other side with a new lease on life

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It takes more than world-class surgeons and researchers to create a centre of exemplary patient care. Behind the scenes and on the front lines are medical professionals striving every day to ensure an exceptional patient experience

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**GOODLIFE  
FITNESS  
GIVES  
CARDIAC  
REHAB A  
BOOST**

Physical activity plays a critical role when patients are living with heart disease. “People who exercise have a much higher chance of successful recovery and improved long-term outcomes than those who don’t,” says Dr. Paul Oh, Medical Director of UHN’s Cardiovascular Prevention and Rehabilitation Program and GoodLife Fitness Chair in Cardiovascular Rehabilitation and Prevention. To help aid Peter Munk Cardiac Centre

patients in their recovery, GoodLife Fitness recently donated more than \$330,000 in fitness equipment to Toronto Western Hospital and Toronto Rehab’s Rumsey Centre (adding to an earlier donation worth \$143,000). These two locations provide rehab services to more than 2,500 patients each year. The new treadmills, exercise bikes and elliptical machines will help cardiac patients make physical activity a part of their recovery regime. In 2012, GoodLife donated \$5-million to the centre’s Cardiovascular Prevention and Rehabilitation Program, with the goal of creating the best possible cardiac rehab program and supporting further research in this field. ■



**PETER MUNK CARDIAC CENTRE  
DOCTORS CELEBRATED  
WITH AWARDS**

World-renowned cardiac surgeon **Dr. Tirone David** has been bestowed the Honorary Fellowship of the Royal College of Surgeons of Edinburgh. It’s the highest accolade granted by the college, one of the oldest of its kind in the world. The honour is well-deserved. Since moving to Toronto in 1975, Dr. David has performed more than 15,000 open heart surgeries, published more than 350 scientific papers and demonstrated complex surgical procedures around the world. (Read more about the life and career of Dr. David on page 29.)



**Dr. John Byrne**, a vascular surgeon at the Peter Munk Cardiac Centre, is the 21st Wylie Scholar. The Wylie Scholar Program awards one outstanding surgeon-scientist annually in North America. Dr. Barry Rubin, Medical Director and Chair of the Peter Munk Cardiac Centre, was the first Canadian to win this award; Dr. Byrne is the second. Dr. Byrne’s research will study how abdominal aortic aneurysms develop and become inflamed, which could improve how physicians predict and treat those at high risk of a fatal rupture.

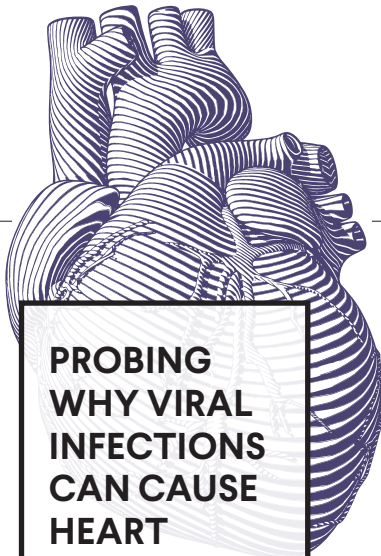
For more than 40 years, **Dr. Wayne Johnston** has trained generations of physicians and saved countless lives. Yet when he received a call from Canada’s Governor-General’s office earlier this year, he was surprised to learn he would be receiving one of the country’s highest civilian honours: becoming a recipient of the Order of Canada. “This is an honour that goes beyond the medical community and speaks to one’s impact as a Canadian citizen,” says Dr. Johnston, Medical Director of the Vascular Lab at the Peter Munk Cardiac Centre. According to the Order of Canada website, Dr. Johnston receives his honour “for his foundational leadership as a surgeon, researcher and educator in the field of vascular surgery in Canada.” ■



**PROBING  
WHY VIRAL  
INFECTIONS  
CAN CAUSE  
HEART  
FAILURE**

Heart failure is commonly caused by heart attacks, but did you know that viral infections can lead to the condition too? Even a harmless common cold virus can do damage. While most colds clear up in a few weeks, in some people they persist and cause risky infections in other organs. Dr. Slava Epelman, a clinician-scientist with the Peter Munk Cardiac Centre and the Loretta Rogers Chair in Immunobiotechnology at the Ted Rogers Centre for Heart Research, is examining which specific types of immune cells actually help prevent an infection from wreaking havoc on the heart. The findings so far? Some cardiac immune cells generate antiviral T cells, which prevent long-term damage. The absence of these cells not only suppresses the anti-virus response, but can also lead to heart damage that weakens the organ’s ability to pump. The results may eventually lead to new understanding about why only some people who contract viral infections of the heart go on to develop heart failure. ■

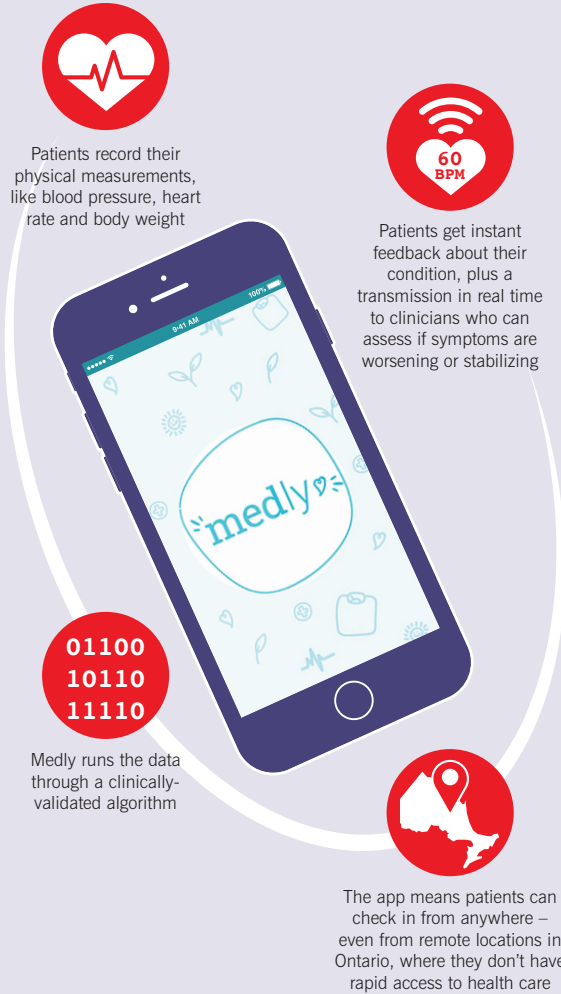
All stories written by Kira Vermond



**APP HELPS  
PATIENTS MANAGE  
SYMPTOMS  
FROM HOME**

After spending time in a hospital for heart failure, patients may have concerns about their condition between their six-month follow-up visits. They wonder: Is that heart flutter dangerous or benign? Is feeling dizzy a symptom of worsening cardiovascular disease or simply due to skipping breakfast? Many Canadians may head back to the hospital’s emergency room, just in case. But a new app called Medly is changing how heart failure patients at the Peter Munk Cardiac Centre manage their symptoms. Developed at University Health Network, Medly can also help patients keep in contact with their health teams without leaving their homes.

**HERE’S HOW IT WORKS:**



Infographic by Trevor Johnston

**NORTHERN EXPOSURE**

*Thunder Bay hospital and the Peter Munk Cardiac Centre partner in innovative program: one program, two sites*

Not long ago, when people living in Thunder Bay and northwestern Ontario experienced cardiovascular problems requiring surgery, their lives were turned upside down – again and again. Not only were they required to travel to southern Ontario for face time with a cardiovascular diagnostic team in Toronto, Hamilton or London, but preoperative testing required travelling south too. Then, of course, there was another gruelling trip for the surgery. Multiple journeys not only created a financial burden, but they placed undue stress on patients and families. But now that’s changing, because of an innovative program in partnership with the Peter Munk Cardiac Centre. “Our motto is, ‘one program, two sites,’” explains Helen Storey, the Thunder Bay Nurse Co-ordinator at the Peter Munk Cardiac Centre. “We’re committed to providing the same level of care regardless of where the patient lives.” The “one program, two sites” program helps northwestern patients receive care closer to home, says Ms. Storey. There are two Peter Munk Cardiac Centre-trained vascular surgeons currently working at the Thunder Bay Regional Health Sciences Centre. On the cardiovascular side, two perfusionists – healthcare professionals who use the cardiopulmonary bypass machine during cardiac surgery – are now training at Toronto General Hospital, so they’ll be ready to head north soon. What’s more, four cardiovascular surgeons from the Peter Munk Cardiac Centre are already on rotation to travel to Thunder Bay and handle 12 clinics per year. The surgeons see patients preoperatively and then follow up with them in the months after their Toronto surgeries. Because of this pioneering partnership between medical institutions, more people in Thunder Bay are getting cardiovascular care at home. Medical professionals like Ms. Storey, a 35-year nursing veteran, help to bridge the two communities by offering attention and support. “Nobody is getting lost in the shuffle,” says Ms. Storey. ■

**“We’re committed to providing the same type and level of care regardless of where the patient lives.”**

**Helen Storey,**  
Thunder Bay Nurse Co-ordinator at  
the Peter Munk Cardiac Centre



Peter Munk arrived penniless in Canada from war-torn Europe. But he brought giant ambitions and a grateful heart, as he began a remarkable journey toward becoming one of this country's greatest business leaders and philanthropists

A DEBT  
REPAID  
IN FULL

By Simon Avery



TOP:  
Peter Munk's 1948  
Hungarian passport.

BOTTOM:  
Peter Munk, age 20,  
aboard an ocean  
liner on which he  
sailed from Liverpool,  
England, to Halifax  
when immigrating to  
Canada in 1948.  
PETER MUNK ARCHIVES

**Peter Munk had an uncanny ability to spot opportunities, the drive to pursue grand visions and the courage to create.**

When Mr. Munk died in March 2018, at the age of 90, he left a sweeping legacy – as founder of the world's largest gold producer, financial saviour of one of the largest international property developers, builder of Porto Montenegro (a superyacht marina on the Adriatic coast dubbed “the new Monaco” by *Forbes*), and a prominent philanthropist who helped make Canada a global leader in cardiovascular care and research.

***A SIXTH SENSE***

Unlike many billionaires who make their wealth in a single industry, Mr. Munk pursued disparate ventures in numerous countries and succeeded across multiple sectors.

In the early eighties, when he founded what would become Barrick Gold Corp., he made a point of letting people know that, in contrast to most executives in the field, he wasn't a “gold bug.” He looked at the gold-mining business with an outsider's clarity and decided the best way to attract investors to the notoriously volatile sector was to limit both risk and upside by hedging against the future price of gold. Other producers thought he was crazy. Why would you build a gold business and then bet against the precious metal? But the market had the answer: In Barrick's first 10 years as a public company, its valuation soared. By 1993, 10 years after Barrick's initial public offering on the Toronto Stock Exchange (TSE), \$1 initially invested in the company was worth \$158.

When his holding company acquired real-estate giant Trizec Corp. in 1994, he was, by his own admission, “not a real estate guy.” Nevertheless, the firm, renamed TrizecHahn, quickly acquired an expansive portfolio of such iconic properties as Chicago's Sears Tower, the Watergate Office Building in Washington, D.C., and management of Toronto's CN Tower.

Mr. Munk was a risk-taker, but his keen eye for opportunity seldom let him down.

“Peter Munk is in the business business,” Canadian corporate chronicler Peter C. Newman wrote in 1996. “[He has] a sixth sense of knowing when and where and how to move.”

***FINDING ‘PARADISE’***

Mr. Munk was a man blessed with eternal optimism and charm, and the traits of a natural salesman. Underneath it all, he was a man galvanized to succeed, driven by what he called an “immense debt” to the country that had welcomed him and his family from war-ravaged Europe. His intense patriotism ensured that Barrick, through all its ups and downs, remained a Canadian-based global mining company, and, for the most part, he directed his philanthropy to causes he believed would strengthen his country.



Born into a wealthy Jewish family in Budapest on Nov. 8, 1927, he was 16 years old when, in the the spring of 1944, Hitler ordered Nazi troops to occupy Hungary. Mr. Munk's paternal grandfather, Gabor, arranged for the escape of 14 immediate family members on a train to Switzerland. The small group included Peter Munk, his father, Lajos, and his grandfather – but, because his parents were divorced, his mother was left behind in Budapest and deported to Auschwitz. The family would survive the Holocaust, including his mother, but it would cost them everything they owned.

In 1948, at the age of 20, Peter Munk arrived in Canada with a student visa. He spent his first year as a Grade 13 student at Toronto's Lawrence Park Collegiate Institute learning English, then enrolled at the University of Toronto (U of T). He spent his summers working on a tobacco farm in Delhi, Ont. Back on campus, he began his first business by recruiting fellow students to sell Christmas trees. He graduated from U of T in 1952 with a degree in electrical engineering and a love of his newly adopted country. After the dehumanizing regime in Nazi-occupied Europe, he could only describe Canada as “paradise.”

Again and again, he would gently chide native-born Canadians for taking their country for granted. “You will never appreciate the immense debt I have,” Mr. Munk told an audience gathered at Toronto General Hospital in September 2017. He was at the hospital to announce the \$100-million gift that he and his wife, Melanie, had made to the Peter Munk Cardiac Centre – the largest donation to a Canadian hospital – but

his speech that day centred on his love for his adopted homeland. “To do what I can to help this country, to help repay this country, is never enough.”

Seventy years later, Mr. Munk would still be talking about those formative years with a sense of wonder and gratitude for the generosity of his Canadian classmates. “They were there to show me what a hot dog is, because





I'd never heard of a hot dog. They showed me how to eat doughnuts at the University of Toronto, which made me Canadian," he said in his speech at Toronto General Hospital. "They treated me like a brother."

#### PURSUING EXCELLENCE

By the time of Mr. Munk's death last spring, the Peter and Melanie Munk Charitable Foundation had donated almost \$300-million to health care and education. Having promised to leave most of his fortune to his foundation, Mr. Munk's philanthropy will continue well into the future with the guidance of his wife.

Mr. Munk always dreamed big, unwilling to settle for half measures. In his philanthropic efforts, that meant a strategy to enhance Canada's stature as a global leader. In today's world of volatility and conflict, the country's open-mindedness and diversity is a beacon, he told the crowd during the Toronto General Hospital speech. "Canada must become the moral guidance for the whole world."

He believed that improving health care provided one more testament to the world that it should aspire to Canadian values and accomplishments. But the country's national healthcare system could only provide the framework, he noted. It could not "play favourites." Pursuing the highest levels of excellence falls to philanthropists, he said.

"Excellence means [having] that extra heft, which comes from the top people," he said. "But the top people will only come here...if you give them the tools to achieve their breakthroughs; if you give them the diagnostic and technological means to excel and to come up with breakthroughs." That's where philanthropists can come in, continued Mr. Munk. "We can provide the extra funding that the government cannot. And that extra funding can make the difference."

His gifts to the Peter Munk Cardiac Centre have indeed made a difference in cardiac care in Canada and around the world, and they have helped the centre become a pioneering, world-leading institution on the cutting edge of cardiac care. All told, since 1993, the Munks have donated \$177-million to Toronto General & Western Hospital Foundation. A \$37-million gift in 2006 transformed the Peter Munk Cardiac Centre into a state-of-the-art facility with advanced techniques and procedures. Another \$19.5-million gift in 2011 was used to establish four chairs in advanced cardiac therapeutics, aortic disease research, cardiovascular molecular medicine and multinational clinical trials – all four chairs now occupied by some of the country's most innovative researchers, leading the charge to improve



ABOVE: In 1958, Peter Munk and David Gilmour founded Clairtone Sound Corp., manufacturing high-end stereo consoles with modern Scandinavian design.  
PETER MUNK ARCHIVES

OPPOSITE PAGE  
TOP: Dr. Robert Bell (left), former President and CEO of University Health Network, with Melanie and Peter Munk in 2006, when the Munks donated \$37-million to the Peter Munk Cardiac Centre.

BOTTOM: Melanie and Peter Munk at the 2017 event celebrating their landmark \$100-million donation to the Peter Munk Cardiac Centre.

treatments for heart patients and develop entirely new, life-saving therapies.

Separately, at his alma mater, Mr. Munk and his wife, Melanie, donated \$47-million to create the Munk School of Global Affairs and Public Policy at U of T. Another \$12-million was given to fund the semi-annual Munk Debates, which have achieved international recognition by bringing public intellectuals and thought leaders to Toronto to debate major policy issues. Separately, the Munks have given \$40-million to the Technion – Israel Institute of Technology in Haifa, Israel.

#### FIRST LOVE

Mr. Munk's business ventures matched his philanthropic projects in ambition. After graduating from U of T, he teamed up with David Gilmour, a furniture importer, to blend high-fidelity sound equipment and modern Scandinavian design. Armed with this novel idea and \$2,800 from the father of Mr. Munk's first wife, Linda Gutterson, the pair of charismatic self-promoters founded Clairtone Sound

Corp. to manufacture high-end stereo consoles in a small factory in a Toronto suburb. They hired the political strategist Dalton Camp to create smart advertising, as well as future presidential speechwriter and columnist William Safire to promote the company in the United States. Then they began winning endorsements from celebrities who fell in love with their product, including Oscar Peterson, Frank Sinatra and Dizzy Gillespie.

Clairtone went public on the TSE in 1963, and the two entrepreneurs were celebrated as Canadian visionaries. "Nothing at all thrilled my father so much as seeing his upstart company listed alongside Canada's old guard," Mr. Munk's daughter Nina Munk wrote in her 2008 book *The Art of Clairtone: The Making of a Design Icon*. She recalled her father telling her: "In those days, the TSE was as WASP a club as you can get. I was not only not WASP – I was Jewish, I was an immigrant, and I had an accent."

But for once in his life, Mr. Munk's big dreams got too far ahead of him. Lured by financial incentives from the Nova Scotia government, Clairtone moved its manufacturing operations to Stellarton, a remote coal-mining town. The move was disastrous, creating both supply-chain and labour problems for the young company. At the same time, Mr. Munk was distracted by an opportunity to buy the exclusive assembly rights of Toyota and Isuzu vehicles in Canada, a move that was both prescient and ill-timed.

In 1967, as Clairtone unravelled, Mr. Munk and Mr. Gilmour lost control of the company to the Nova Scotia government. "My father remembers it as the worst year of his life," Nina Munk wrote in her book. Clairtone was

Mr. Munk's first business and his "first love," she added: "Measured coldly in dollars and cents, it was his smallest and least-successful company; yet nothing my father has done since then has affected him the way Clairtone did."

Years later, Mr. Munk spoke about the collapse of the company in a *New York Times* interview, describing how the ordeal had taught him to be more cautious. "Clairtone was the single most formative experience in my life because it was so traumatic," he said. The greatest takeaway from the experience was that it gave him "self-confidence" as he set Barrick to go up against mining competitors Newmont Mining Co. and Placer Dome.

Mr. Munk and Mr. Gilmour headed to London to embark on their next venture – building a resort in Fiji that would grow into Southern Pacific Properties, a chain of more than 50 hotels around the Pacific Basin.

#### A GOLDEN LEGACY

Mr. Munk returned to Canada in 1979, and, two years later, sold Southern Pacific Properties, netting himself some \$100-million, out of which came the seed money for Barrick.

If Clairtone was his first love, Barrick was to become his corporate legacy. The company started as a small oil-and-gas concern called Barrick Petroleum. Before long, however, he saw that gold offered far more opportunity; it was out of favour, prices had tumbled, and South African output was declining.

He transformed his new company into Barrick Resources, a low-cost North American gold producer that grew quickly by making one opportunistic acquisition after another, yet limited its risk by hedging against the future price of gold. The company's \$62-million (US) purchase of Nevada's Goldstrike mine in 1986 proved to be not only shrewd, but legendary. The mine was valued in expectation of holdings of 600,000 ounces. But actual holdings turned out to be more than 35 times greater, giving Barrick one of the richest known deposits on Earth. Suddenly, the company and its founder vaulted into the big leagues.

With Mr. Munk at the helm, Barrick continued to acquire. In 2006, it spent an industry record of about \$10-billion (including debt) to purchase British Columbia-based Placer Dome. Barrick's market value peaked in 2011, but when the company paid \$7.3-billion that year to acquire the copper company Equinox Minerals, investors balked and the share price began a long slide from which it has yet to recover.



On the eve of his departure from Barrick at the age of 86, Mr. Munk gave an interview with *The Economist*, offering some closing thoughts on his business career: "How else can you build a company unless you believe in your views, unless you articulate those views, and unless you are prepared to live and die by those views?" he asked rhetorically.

#### END OF AN ERA

Mr. Munk's passing on March 28, 2018, at the age of 90, was keenly felt – in the Canadian business community, in the philanthropic community and at his namesake centre, the Peter Munk Cardiac Centre.

Writing on Twitter, Prime Minister Justin Trudeau said of Mr. Munk: "He was an immigrant who came to Canada with big dreams, surpassed them beyond any imagination, and shared his good fortune through historic philanthropy. Thank you, Peter Munk, for your enormous contributions to our country. You will be missed."

Toronto mayor John Tory said, "Peter Munk was a business legend. But more importantly, he was a legendary good citizen." And former Prime Minister Stephen Harper said, "His life serves as an inspiration for us all."

At the Peter Munk Cardiac Centre, messages of condolences poured in from employees and patients. Messages such as these: "My husband has had two major heart surgeries. This place has saved his life."

"Thank you for giving our mother a new lease on life. Without your generosity, that may not have been possible."

"My brother is here today thanks to the amazing care he received at the Peter Munk Cardiac Centre. Thank you so much, Peter Munk, for your contributions. You have helped the lives of so many."

At Toronto General Hospital in September 2017, giving what

would be his closing public remarks on his philanthropic career, Mr. Munk echoed the same fierce resolve that characterized his entire life. "Please remember, we are not talking about charity," he said, referring to his many gifts to the Peter Munk Cardiac Centre. "We're talking about repaying a debt. That debt comes from the 14 people, including me, [who were] needy, with zero to offer, no skills, no money, nothing to contribute but with our hands out [asking] 'Please help us, please take us in, please look at us as human beings.' That was me, my father, my 87-year-old grandfather...."

"How can you thank me? It is for me to thank you. Every dollar I give, everything I have been able to offer, has been because I was taken into this country." ▲



# A LEGACY OF GIVING

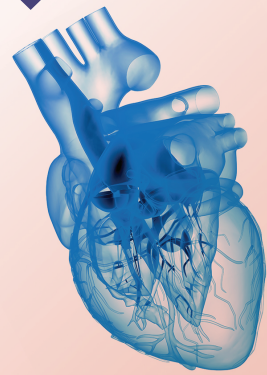
For more than 25 years, Peter and Melanie Munk's generosity helped the Peter Munk Cardiac Centre become the pre-eminent hub for cardiovascular care and research in Canada. From their first donation in 1993 to their historic \$100-million gift in 2017, the Munks continually stoked the fires of innovation at this remarkable institution

1993



◀ Peter and Melanie Munk gave their first gift to establish the Peter Munk Cardiac Centre. Though neither was a heart patient, they clearly identified the need to improve the lives of Canadians living with cardiovascular disease.

2006



◀ Donated \$37-million, which was then the largest-ever gift to a Canadian hospital, to transform the Peter Munk Cardiac Centre into a state-of-the-art facility with the world's most advanced diagnostic and interventional techniques, medical imaging and cardiac procedures.

1996



▲ Established the Melanie Munk Chair in Cardiovascular Surgery, which allowed the centre to retain the renowned cardiac surgeon Dr. Tirone David, and hire and retain a growing number of the world's most highly-skilled doctors.

1997



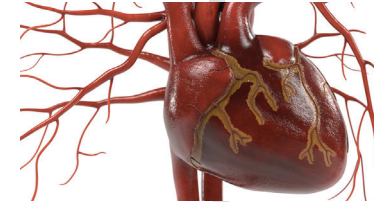
2008



◀ The Peter Munk Cardiac Centre officially opens, becoming a leading global cardiovascular care and research facility.

2011

► Funded four new Chairs and Centres of Excellence at the Peter Munk Cardiac Centre. The Centres of Excellence are multi-disciplinary, breaking down silos and encouraging teams to collaborate.



**Peter Munk Chair and Centre of Excellence in Aortic Disease Research**

Gaining an understanding of the biological mechanisms and molecular pathobiology of diseases of the aorta, ranging from basic lab research to clinical research involving patients.



**Peter Munk Chair and Centre of Excellence in Advanced Cardiac Therapeutics**

Seeking new cardiovascular therapies, whether drug-based therapies or first-in-human devices.



**Peter Munk Chair and Centre of Excellence in Multinational Clinical Trials**

Providing leading cardiovascular scientists with the infrastructure and resources needed to evaluate the efficacy and safety of new devices and therapies, this Chair establishes the centre as one of the world's pre-eminent centres for pivotal clinical trials. Because Toronto is a multicultural hub, it serves as an ideal location to run "real-world" trials that can identify solutions for people with cardiovascular disease.



**Peter Munk Chair and Centre of Excellence in Cardiovascular Molecular Medicine**

Establishing a large cardiovascular biobank of patient data, which is an invaluable resource for turning research into gene discovery. This Chair set the foundation for delivering precision medicine, allowing researchers to use the biobank to inform and improve patient care.

2014



▲ Established the Peter Munk Chair in Structural Heart Disease Intervention, which uses minimally-invasive techniques to repair heart defects. Like others funded by the Munks, this chair seeks to discover, develop and implement the world's most innovative procedures, particularly for patients who have few other options.

2017

\$100-million



◀ This landmark gift from Peter and Melanie Munk will fund and shape the future of cardiovascular care, not only in Canada, but globally. By investing in precision medicine, molecular medicine, genomics and the world's most forward-thinking therapies, this unprecedented donation will transform how people with heart disease are diagnosed and treated. Above all, it will ensure that the Peter Munk Cardiac Centre continues to lead the world in discovery, innovation and patient care.



# A HEARTFELT THANK YOU

*Peter Munk said it meant a great deal to him when family members of patients at the Peter Munk Cardiac Centre approached him out of the blue to share how the hospital had saved a loved one's life. Here are the stories of four individuals who are grateful recipients of the centre's world-class cardiovascular care. They each faced the fear, pain and uncertainty of heart disease, and came out the other side with a new lease on life*

BY JORDANA FELDMAN



## HEART OF A SUPERHERO

John Dickhout is a 55-year-old man with the energy of someone several decades younger. The Burlington, Ont., resident speaks with the projection of a stage actor, apt for a man who decided to plunge full-time into acting two years ago. His eyes well up with tears when discussing emotional subjects, and he has a range of unconscious habits – like angling sideways when engaging in conversation and twisting the silver Superman insignia ring on his left pinky.

In that last detail, there's a profound link between subject and object. The ring once belonged to Adam Prashaw, a 22-year-old man from Kanata, Ont. And the heart giving Mr. Dickhout his high colour and boundless energy once belonged to Mr. Prashaw, too.

"I wear this to remind me that he's my superhero," Mr. Dickhout says.

Mr. Prashaw passed away in 2015 after suffering an epileptic seizure and drowning in a hot tub. Described as kind, generous and deeply loved, he had signed on as an organ donor to ensure he would continue his spirit of giving back to others. Mr. Prashaw's thoughtfulness would end up saving Mr. Dickhout's life.

In 2013, Mr. Dickhout suffered a heart attack as a result of sarcoidosis, a rare disease that causes the immune system to turn on the body's internal organs.

"The whole thing was surreal, because I went from what I thought was completely healthy to completely a mess overnight, with no explanation and no understanding," he says.

At the time of his heart attack, Mr. Dickhout, a call centre executive, was living in the Philippines. He had relocated there from Welland, Ont., with his wife, Lynn, when an opportunity arose to help get a new satellite location off the ground. The Dickhouts made the most of their new adventure, exploring their surroundings and playing golf with other ex-pat friends on Sundays.

One Saturday, Mr. Dickhout woke up in the middle of the night with a racing heart. He tried to control his breathing and eventually went back to sleep.

"Old depictions of heart attacks have people clutching their chest in agony and falling over, and that's part of the challenge, because that's what you expect. [But] that's not what happened to me," he recalls of the heart attack that nearly killed him that day.

Mr. Dickhout was immediately admitted to intensive care in the Philippines. His condition confounded his doctors, but they were clear about one thing: the otherwise perfectly healthy middle-aged man would need a heart transplant. With costly private health care their only option in the Philippines, Mr. Dickhout and his wife moved back to Ontario, where he was referred to the Peter Munk Cardiac Centre. There, he was "extraordinarily fortunate" to land in the office of cardiologist Dr. Heather Ross, he says. Dr. Ross is Director of the Ted Rogers and Family Centre of Excellence in Heart Function and the Cardiac Transplant Program at the Peter Munk Cardiac Centre.

"The first time I met her, I felt I'd known her my whole life," Mr. Dickhout says of Dr. Ross. "She wasn't so much focused on the event, or the 'why.' Her focus was on getting better and, 'What do we do now?'"

In 2016, Mr. Dickhout received a call from the Peter Munk Cardiac Centre informing him they'd found a match. At the time, as per custom, he was given no information about his donor's identity in order to protect the family's privacy. The heart was a

fit, and thanks to the great work of Peter Munk Cardiac Centre cardiovascular surgeon Dr. Terry Yau, the transplant operation was a success.

"The whole thing was extraordinary," he says of his medical team at the Peter Munk Cardiac Centre. "I am overwhelmed with gratitude to everyone involved in my care and recovery."

Several months post-op, Mr. Dickhout felt compelled to write a letter to his donor's family through the Ontario Trillium Foundation, who removed markers of identification before passing it on. When he received a reply from the family, he realized he wanted to know his donor's identity. He plugged five or six "clues" from the letter into Google and pulled up an obituary for Mr. Prashaw. "I was sure it was him," he says.

Taking a risk, Mr. Dickhout set up a social media account and contacted the father of the man whose heart he believed had ended up in his chest. Once again, it was a match.

He's since developed a "special friendship" with Mr. Prashaw's family, culminating in the clan travelling from all over the East Coast to cheer for Mr. Dickhout as he competed in the 2016 Canadian Transplant Games in Toronto. (He took the gold medal in golf and finished fourth in his age category for the 5K run.)

In addition to gaining a heart and a new family, Mr. Dickhout remains awed by the luck that led him to be the "caretaker of Adam's heart" and to the Peter Munk Cardiac Centre.

Struggling to speak through tears, Mr. Dickhout recalls what Mr. Prashaw's father wrote to him during their early correspondence.

"Based on your enthusiasm and zest for life, we know our son's heart is also the perfect match for you." ■





## UNCOMMON RESILIENCE

From the very start, it was going to be a bumpy ride. Keri-Lynn Kasaboski entered the world in a Brampton, Ont., hospital in 1971 as a blue baby. She had a medical condition called transposition of the great arteries, which meant her newborn arteries weren't properly connected. The congenital heart defect was further complicated by a silver-dollar-sized hole between the two ventricles (pumping chambers).

Surgeons at Toronto's Hospital for Sick Children (SickKids) were able to "patch up" her heart, says Ms. Kasaboski. But she wasn't expected to survive for long. "My right-sided pumping chamber must work much harder than the left," explains Ms. Kasaboski, now 47 and living with Adult Congenital Heart Disease (ACHD). "The problem with that is because of all the extra work, if my right ventricle fails, I can go into right ventricular heart failure."

The self-described "old punk rocker" has made a habit of defying the odds since day one.

Ms. Kasaboski says her biological mother, then a high-school student, was strong-armed into giving her baby up for adoption, a far-too-frequent occurrence of the time. Ken and Barbara Threlfall, an expat British couple with two adopted teenagers at home, took up the challenge.

"My parents were in their 50s and, at the time, they exceeded the legal age to adopt," says Ms. Kasaboski. "[I think] they only allowed them to adopt me because they thought I was going to die."

At four and still very much alive, Ms. Kasaboski returned to SickKids for a

seven-hour operation called a Mustard procedure (developed in 1963 by Dr. William Mustard of SickKids), where doctors stop the heart and redirect the venous blood returning to the heart at the level of the atria to the opposite ventricles. They also closed the hole between the two ventricles. This operation allowed her to survive until adulthood.

Despite these early surgeries, Ms. Kasaboski says she never felt different from other kids growing up.

"My parents never kept me in a bubble because I have a congenital heart defect. I did horseback riding, dancing, all the school sports," she says.

But her uncommon resilience did have one drawback. She developed what she describes as a "careless" attitude toward her condition.

"Because everything worked, I figured I was fine," she says. So, when Ms. Kasaboski found herself pregnant at 28, she was shocked back into reality. Well into her pregnancy, she had a cardiac event that caused her to lose consciousness.

Now a patient at the Peter Munk Cardiac Centre, Ms. Kasaboski delivered safely – a healthy son born in 1999. But her joy was short-lived. Realizing the vulnerability of her situation, Ms. Kasaboski developed postpartum anxiety and returned to the centre for support.

That's when she met Dr. Erwin Oechslin, a man who would become instrumental in her recovery. Dr. Oechslin, Director of the Adult Congenital Heart Disease Program at the Peter Munk Cardiac Centre, immediately got her in to see one of the hospital's clinical psychologists with expertise in congenital heart disease, a resource that she says saved her life again.

"They had a program at the time that helped me, and it was the spark that started turning my mind from the dark place with all the things that had gone on in my life," Ms. Kasaboski says.

But circumstances led to more challenges, both psychological and physical, at the age of 42. A combination of family and work stresses exacerbated her depression. She was overweight, unhappy and inactive, and says her heart began to "give way." Dr. Oechslin put her on heart failure medication to stabilize her heart, and let her know she would also need a pacemaker/defibrillator and an inevitable heart transplant.

The idea of additional surgeries shocked Ms.

Kasaboski into taking control of her lifestyle. After education about healthy diet and exercise by Dr. Oechslin, she began with slow lunchtime walks alongside her "incredibly supportive" manager at department store company TJX, where she currently works in operations. She soon added a second walk after work with her husband.

Ms. Kasaboski worked with Dr. Oechslin to monitor her physical exertion rates safely. Within a year, she'd lost 67 pounds and was exercising with weights, yoga and running for two hours a day. The former rebel had turned into the model cardiac patient – another turn of events that defied the odds.

"Ms. Kasaboski has a very strong mind and personality," says Dr. Oechslin. "She took ownership of her health and became her own health advocate. She was very determined to change her lifestyle and to [reverse] the slippery slope of her health. Her lifestyle changes and medications improved her condition and quality of life dramatically. She is a role model as a patient; I admire her."

At 47, Ms. Kasaboski hopes to keep playing the odds in her favour. Last October, her test results began to indicate recurrence of severe heart failure. She's now on the list for a transplant. Instead of dreading the inevitable, Ms. Kasaboski's experience at the Peter Munk Cardiac Centre has given her a more hopeful perspective.

"I used to give [my doctors] a hard time because I was scared," she admits. "But this is the place to be if you need to be here. I get really emotional when I talk about them, because I love them so much." ■

## SAVED BY THE BARK



The most critical countdown of Matthew Church's life began on an otherwise unmemorable December night in 2014.

The 55-year-old editor went for a two-hour bike ride, as was his habit, then returned to his home in downtown Toronto. He greeted his wife, Patricia, and chocolate labradoodle, Zola, who was keeping warm by the fire. But something felt off.

"I apparently said to Patricia, 'My elbows are sore,'" says Mr. Church, who has no memory of what transpired that night. His wife, a physician, "told me to take Aspirin before heading upstairs, just in case it was heart-related," he says. That was the beginning of a series of extraordinary life-saving interventions.

Within minutes of sitting down on the third floor to watch television, Mr. Church thudded to the ground. His heart had stopped.

An athletic man with no medical history of heart problems, Mr. Church had suffered an ST-elevation myocardial infarction (STEMI), a heart attack where one of the major arteries that supplies blood to the heart gets blocked.

Unwitnessed heart attacks of this kind outside the hospital typically result in death. In North America alone, 15,000 people are killed this way each month. But if the right medical steps are taken within a critical 90-minute window, the victim has a shot at survival and recovery.

In Mr. Church's case, the interventions continued with a series of hysterical barks. With his wife oblivious to his condition two storeys away, it was Zola whose doggy instincts kicked into high gear.

"She wouldn't stop barking until Patricia got up. Zola made her go upstairs,"

says Mr. Church. Trained in CPR, Patricia jumped into immediate action until the ambulance arrived nearly 10 minutes later.

Paramedics used a defibrillator to restart the heart, and recognizing the signs of a STEMI, notified the hospital. Mr. Church was rushed through emergency to Dr. Chris Overgaard's cardiac catheterization laboratory, or cath lab, at the Peter Munk Cardiac Centre. A cath lab is a specialized examination room with imaging equipment where doctors can diagnose and treat cardiac abnormalities or disease.

Back in 2014, the cath lab was cutting-edge, and it has recently become even more so. Through philanthropic support, the centre has become the first hospital in Canada to add new equipment focused on radiation safety, boasting the lowest radiation emission per procedure.

But on that fateful December night, Mr. Church had arrived with no time to spare. By the 88-minute mark, Dr. Overgaard had removed a clot from Mr. Church's blocked artery and inserted a stent.

"I'm incredibly lucky to be living where I am," says Mr. Church. "My proximity to the Peter Munk Cardiac Centre saved my life."

Since his heart attack, Mr. Church has modified his exercise regimen and discovered the benefits of meditation. He is now part of a mindfulness-based stress-reduction workshop at Toronto General Hospital.

He says that on the surface, his life hasn't changed very much. "But really, everything is different. Everything changed that night."

Zola's life has also changed. The heroic pup is now a proud member of the Purina Pet Hall of Fame. ■



## POWER OF POSITIVITY



Sharon Greer was in her 60s when her family doctor retired and was replaced by an enthusiastic young upstart near her North York, Ont., home.

Although she complained of no medical ailments, the doctor wanted to make sure he was doing his job.

"He said, 'I don't know you, so let me run a whole bunch of tests so I can be familiar with what your problems are,'" recalls Ms. Greer, who is now in her early 80s.

When he summoned the grandmother of two back into his office, her doctor didn't mince words. "He said, 'You're a mess,'" says Ms. Greer. He immediately sent her to the Peter Munk Cardiac Centre.

Ms. Greer would spend more than a decade and 10 major surgeries sorting out that "mess."

Tests revealed Ms. Greer initially had a thoracic aneurysm, which had presented in her chest. Aneurysms of this type are a degenerative condition of the aorta that cause the artery to enlarge due to a weakness in the arterial wall. A ruptured aneurysm causes internal bleeding and can be fatal if blood leaks into the chest.

Ms. Greer was referred to Dr. Thomas Lindsay, vascular surgeon at the Peter Munk Cardiac Centre. He quickly assessed a series of complications in Ms. Greer's case that would require him to assemble a team of fellow experts.

"The problem is she also had a symptomatic hardening of the arteries in her neck, so before we could get to the main procedure, I had to clean the artery that goes to her brain to prevent a stroke and make sure the brain had maximal blood flow," Dr. Lindsay says, noting she would also present with a thoracoabdominal aneurysm in her abdomen over the course of her treatment.

With a two-month recovery window, Ms. Greer returned to the Peter Munk Cardiac Centre for the next round. She would need an aneurysm repair, or a TEVAR. This is a spring-like device that's inserted into the artery in a collapsed position and, once successfully positioned, gets expanded via X-ray control in order to cover over the aneurysm.

While her body recovered from multiple serious operations, Ms. Greer recalls feeling nothing but optimism.

"I didn't go into one surgery being frightened, because I knew who was doing it and I had such confidence in them," she says. "Everyone was so kind and good, and no one ever put me under stress."

Dr. Lindsay returns the compliment, saying Ms. Greer's sunny attitude made treating her a pleasure. "When patients are positive, it makes them easier to look after, it makes the whole process a whole lot smoother," he says. "She's a very delightful individual." ■

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# A DAY IN THE LIFE OF THE PETER MUNK CARDIAC CENTRE

*It takes more than world-class surgeons and researchers to create a centre of exemplary patient care. Behind the scenes and on the front lines are medical professionals striving every day to ensure an exceptional patient experience. Working early in the morning and late into the night, here are some of the many dedicated individuals who make up the Peter Munk Cardiac Centre family*

BY MIRJAM GUESGEN



## STARTING THE DAY WITH A PLAN

It's 9 a.m. at the Peter Munk Cardiac Centre, and close to 25 people are crowded into a room not much bigger than most office break rooms. They wear the uniforms affiliated with the many different roles at the hospital: nursing, housekeeping, medical residents, physiotherapy and social work. Standing in one corner overseeing it all is Linda Flockhart, Clinical Director at the Peter Munk Cardiac Centre.

The hospital implemented these daily "huddles" a little over a year ago. It is a chance for all the staff working in a particular unit to come together and plan for the next 24 hours and anticipate any issues that may arise. The huddles happen throughout the centre each morning, with the manager of each unit feeding the most vital information to Ms. Flockhart on a 9:30 a.m. phone call.

Put simply, Ms. Flockhart's job is to realize the organizational goals and vision of the Peter Munk Cardiac Centre. As Clinical Director, she is tasked with managing the centre's \$100-million budget, making sure her staff has the tools to do their job and working with physicians to support their initiatives. "Within reason," she says with a laugh.

Before stepping into management roles, Ms. Flockhart was a critical care nurse on the front lines of patient care. Her passion for her patients never waned – she's just able to influence patient care in a different way now. "I think I always was vocal in wanting to change the system and speak up, so this role gives me that opportunity," she says.







## THE GUARDIAN ANGEL

Titi Manning-Atwell is nimbly working on patient Jason Sun's foot wounds – wiping the foot with iodine, cutting up a specialized fabric embedded with silver and shaping dressings to perfectly fit the contours of his arch. "This is the part where he's looking good and he can go away into the sunset," she says.

Ms. Manning-Atwell is a chiropodist, a medical professional who works on all aspects of foot health, from gait analysis to orthotics to treating diseases or ulcers of the foot. The majority of her patients have issues with their vascular system, the blood vessels outside the heart. When blockages occur in the vessels of the body, wounds

farthest away from the heart, like the foot, may not heal as quickly because they are not supplied with enough blood. The Peter Munk Cardiac Centre Vascular Program is a one-stop shop for patients to have their condition diagnosed, be seen by a surgeon, be given a treatment plan and have their wounds healed.

A veteran in the field of chiropody for more than 42 years, Ms. Manning-Atwell gets the most difficult cases. "I tend to get them when they've been everywhere else and they're told they have to have their leg amputated and there's nothing anybody else can do," she says. "I always tell my boss, 'This is the limb salvage clinic.'" Her patients call her their guardian angel.



## 'CHOOSING LIFE OVER LEG'

In a nearby, dimly-lit room, ultrasound technologist Susan Ungaro is skillfully manoeuvring a transducer probe over patient Jerry Paquet's leg. Mr. Paquet's heart beat pulses on the screen, making a "wowwow" sound with every beat and a rushing, river-like sound when Ms. Ungaro moves the probe to a vein.

Cindy Dickson, the Vascular Clinic's sole nurse, explains that Mr. Paquet is being checked into the centre's Vascular Unit today, a process that involves checking his arteries and veins for any blockages. Fortunately, he is in the clear.

Ms. Dickson joined the foot and wound clinic 12 years ago, so she has seen people from all walks of life at all stages of their disease. Treatment could mean a change of lifestyle (like quitting smoking), vascular surgery or, in rare cases, amputation. Ms. Dickson admits no one wants to have their limb removed, but this option can result in patients feeling markedly better after months of excruciating pain.

"It's like a new outlook on life. They're choosing life over leg," she says.



## LEARNING THE ROPES

When a new treatment or procedure is introduced to the hospital, most people only see the final result: the patient success stories. What is often invisible are the hours of training that nurses and surgeons do to prepare.

Outside the operating room, Rebecca Collier-Doyle is already in her scrubs, wearing a cap with blue and green mandala designs. Ms. Collier-Doyle has been tasked with bringing cardiac nurses up to speed with the transcatheter aortic valve implantation, or TAVI, procedure.

TAVI allows high-risk patients to undergo valve replacement surgery without opening up their chest. A replacement valve is inserted through a small incision in the leg and guided up to the heart through a main artery. It can cut operating time from six hours down to 90 minutes and speeds up recovery time because the incisions are so small, and the patient can remain awake. That by no means makes it a simple procedure to learn, says Ms. Collier-Doyle. "It's intense in a different way [than open heart surgery]."

Today, she is training operating room nurse Haniely Pableo to set up for a TAVI procedure. To the untrained eye, many of the instruments laid out for the procedure look the same. Part of Ms. Collier-Doyle's role as a clinical support nurse is to create resources to assist the nurses in their learning. One of those resources is a binder containing each of the main pieces of equipment used in the TAVI procedure, so her nurses can see, touch and manipulate them before entering the operating room.

Learning how TAVI works and the instruments needed make up only a small part of the training. Up to four patients are wheeled in and out of the operating room in a single day. That leaves little time for cleaning and setting up between procedures, and even less time for breaks.

"It's a push," Ms. Pableo says with a sigh. Knowing what to prioritize, like having the equipment laid out and counted, is key. A sip of coffee at the beginning of a sometimes 12-hour day also helps.





SAVING LIVES TO CREATE NEW ONES

Addy Murchie is having a mid-pregnancy checkup for her third child at the Peter Munk Cardiac Centre’s Adult Congenital Heart Disease Pregnancy Clinic, a program that runs in partnership with the Mount Sinai Hospital Prenatal Care Program. As Ms. Murchie discusses her health with her physician, Dr. Rachel Wald, the conversation is punctuated with laughter from her healthy son and daughter, and toys being boisterously thrown around the room. “Sometimes it’s a little crazy coming in,” she admits.

Ms. Murchie is a clinic success story. She was born with a coarctation of the aorta, or a narrowing of the main artery that pumps blood from the heart to the rest of the body. She says all her pregnancies have gone smoothly and she credits the clinic for that.

Ms. Murchie’s husband, Nick, notes that although they live in Port Hope, Ont., which is over an hour from Toronto, “it’s worth it for the help we get here. You never know what can happen.”



BUILDING BRIDGES OF TRUST

It’s nearing the end of the day, and Jessica Pereira is at the Peter Munk Cardiac Centre for a checkup. Ms. Pereira is engrossed in a music video by Selena Gomez, her favourite singer. The annual visits are sometimes tedious for Ms. Pereira, so her mother carries a smartphone with her favourite shows and music on it.

Ms. Pereira has Down syndrome and an atrioventricular septal defect, or holes in the heart. She attends the Dalglish Family 22q Clinic, a specialized clinic geared toward patients with special needs. The clinic is about trying to alleviate the anxiety patients feel coming to the hospital or undergoing multiple diagnostic and surgical procedures. Ms. Pereira is due for a pulmonary valve replacement later this year.

Distraction, like watching a favourite television show,

often helps ease tensions, but the key is “building a bridge of trust,” says Ms. Pereira’s anesthesiologist, Dr. Jane Heggie.

Anesthesia assistant Joanne Bosche says giving patients some control back, like letting them pick which arm the blood pressure cuff goes on or getting them to hold the anesthesia mask, is also effective. But helping patients become comfortable with the surroundings takes some time and patience.

“I mean, everyone’s a little afraid when they come into hospital,” she says.

For Ms. Pereira’s mother, Maria, it is comforting to know that her daughter is looked after by experts who care. “It’s a very positive feeling when she comes,” she says. “If I know she’s comfortable, then I know they’re treating her [well] and they’re looking after her the best they can.”



DR. BARRY RUBIN

Leaving no stone unturned

Meet Dr. Barry Rubin, Medical Director at the Peter Munk Cardiac Centre. He’s a celebrated vascular surgeon, a champion of innovation and a visionary leader dedicated to honouring the legacy of his mentor, Peter Munk

David Israelson

Ask Dr. Barry Rubin about the future of the Peter Munk Cardiac Centre, and it quickly becomes clear he has big plans. As the institution’s visionary Medical Director and Chair, Dr. Rubin is dedicated to helping the Peter Munk Cardiac Centre become the world’s leading cardiovascular centre in all aspects, from patient care to technology to research.

But spend a few minutes speaking with Dr. Rubin about his unrelenting drive toward excellence, and it also becomes clear where he gets his vision. The answer is simple, says Dr. Rubin – from Peter Munk.

He speaks with fond reflection about the man he considers one of his most important mentors.

“I realize how integrated Peter’s thinking has become in the way we run the heart centre,” Dr. Rubin says. “Peter was phenomenal at identifying elements of proposals that resonated with him. He could see the long-term value in particular things.”

One time, for example, Dr. Rubin says he was explaining how sensors can be used to probe deep into arteries – a concept that immediately intrigued the mining titan.

“Peter was fascinated. He said, ‘That’s exactly the kind of technology we’re using to go deep into our mines.’ He made the connection instantly and he understood how you can apply a technology or an idea to look at a completely different issue,” Dr. Rubin says.

In both his broader thinking about heart disease and his day-to-day work running the Peter Munk Cardiac Centre, Dr. Rubin says he thinks constantly of the legacy of his mentor. He and his colleagues have organized the centre to ensure that everything, from fundraising to research to clinical care, meet the standards that were set by Peter Munk.

“A big part of what we do to honour Peter’s legacy is delivering on the promises we made to him on how we would improve the lives of patients with heart and blood vessel disease,” he says. “Peter wanted us to build this centre to generate new knowledge that would translate everywhere around the world.”



As the Peter Munk Cardiac Centre’s top administrator and leading visionary, Dr. Rubin is determined to see Mr. Munk’s vision come to fruition. And while world-leading excellence might seem like a lofty goal, it’s an ambition in line with a vascular surgeon who’s made striving to be the best a priority throughout his career.

INTENSE AND INCISIVE

In an institution and a field of medicine that is dominated by titans, Dr. Rubin seems to stand taller than most. “One of the giants” is how one colleague referred to him.

He’s one of only two Canadians to be named a Wylie Scholar, which is awarded to vascular surgeon-scientists in North America who have demonstrated promise for innovative research. His research has been funded continuously by CIHR (Canadian Institute for Health Research) for the last 19 years. And under his leadership, the Peter Munk Cardiac Centre has become a world leader in the diagnosis, care and treatment of cardiovascular disease, attracting the best in surgical and research talent from around the globe.

Beyond the centre, he’s involved in several other healthcare industry organizations. For example, he’s served as Chair and CEO of the Mount Sinai Hospital University Health Network Academic Medical



Organization since 2003 – an organization that supports teaching, research and innovation by doctors at these hospitals. He’s also the elected representative of more than 7,000 academic physicians for an initiative funded by the Ministry of Health that is designed to ensure that teaching hospitals train enough physicians to meet the healthcare needs of Ontario’s growing and aging population.

Dr. Rubin’s peers describe him as driven, focused, intense and incisive.

“I’m so glad that Barry Rubin is leading the [Peter Munk Cardiac Centre],” says Dr. Victor Dzau, a cardiologist and president of the U.S. National Academy of Medicine. Dr. Dzau is also chair of the external board that reviews research proposals for the centre.

“The vision that he developed and Mr. Munk endorsed is transformative,” says Dr. Dzau. “He knows how to assure success by creating goals and setting targets. He clearly wants to take the centre to the highest level – and that’s good for Toronto, it’s good for Canada and it’s good for the world.”

Dr. Richard Reznick is dean of health sciences at Queen’s University in Kingston. He says he and Dr. Rubin have been colleagues for years, both as surgeons and as co-members of the Ontario Medical Association panel that negotiates doctors’ fees with the Ontario government.

“He’s so dedicated,” Dr. Reznick says of his long-time friend. Dr. Reznick says he appreciates that he never has to wonder if it’s a good time to call Dr. Rubin or not when there’s a work problem to discuss.

“We talk more often on Saturday evenings than we do on Monday afternoons,” Dr. Reznick says.

“What strikes me most though is how he is so meticulous. I guess that’s not unusual for a surgeon, but with Barry you always know where you stand. He knows the facts and cuts to the chase.”

Dr. Reznick adds: “If he were not a vascular surgeon, I think he would have made a great criminal lawyer.”

JOURNEY TO THE OPERATING ROOM

Dr. Rubin says he ended up in vascular surgery via a slight detour.

Born and raised in Montreal, he did his undergraduate work at McGill University, originally studying physics and physiology. Nobody in his family was in medicine, he says, and he didn’t necessarily think it would be the right fit for him.

“I did not have a burning desire to be a doctor,” says Dr. Rubin. “But after undergrad, a lot of my friends were going to medical school. I saw what happened to a lot of people in business, and medicine intrigued me then.”

After graduating from McGill Medical School, Dr. Rubin came to Toronto to intern, expecting to stay for a year.

“I was young and naïve,” he says. “I had no idea of how hard it was to get into surgery in Toronto.”

Fortunately for him, Dr. Rubin’s natural talent with the scalpel gave him a leg up. He remembers working at Mount Sinai Hospital with one of his mentors, the late Dr. Robert Ginsberg. A thoracic surgeon, Dr. Ginsberg was a former Surgeon-in-Chief at Mount Sinai and a former Chief Surgeon at Memorial Sloan Kettering Cancer Center in New York City. One evening, Dr. Rubin resuscitated two patients in the same



Dr. Barry Rubin (left) about his mentor, Peter Munk (right): “Peter wanted us to build this centre to generate new knowledge that would translate everywhere around the world.”

inpatient ward room who had both gone into cardiac arrest at the same time.

The next day, he had a meeting scheduled with Dr. Ginsberg and the Chief Resident in thoracic surgery at the hospital.

“Dr. Ginsberg asked the Chief Resident, ‘Is this guy any good?’” Dr. Rubin recalls.

“He said, ‘Well, he saved two of your patients last night.’ Dr. Ginsberg [asked me], ‘So, what do you want to do?’ I babbled out the word surgery, and here we are.”

ONE FOOT IN THE SURGERY WORLD

Although he now devotes most of his time to the leadership and administration of the Peter Munk Cardiac Centre, Dr. Rubin likes to keep one foot in the vascular surgery world. He’s repaired arteries and veins as one of the country’s leading vascular surgeons for more than two decades, and it’s clear that patient care is still, well, close to his heart.

He remembers being called upon to operate on a 14-month-old girl who had an aneurysm.

“We think she was the youngest patient ever to have this type of surgery,” he says.

A couple of months ago, this same patient turned up in his clinic, now an 18-year-old. She was sitting down, so Dr. Rubin asked her to stand up.

“She was a baby when we fixed her,” he says. “And I said to her, ‘Now you’re taller than I am.’”

Although not all surgery is successful, Dr. Rubin says it’s moments like these that can be so rewarding.

“There is no feeling like performing surgery on someone and then later seeing them walk out of the hospital with their family,” he says.

Sharon Ungerman experienced Dr. Rubin’s surgical skills first-hand last year, when she underwent a successful aortic bypass performed by him.

“I just can’t say enough about him,” says the Toronto resident, who first saw Dr. Rubin seven years earlier about severe pain in her left leg. “It took a while to warm up to him, but I knew I was in good hands. He followed through with me all the way.”

Ms. Ungerman says what she appreciates most about Dr. Rubin is how focused he is on putting the patient’s care before everything else.

“In recovery, he visited me every day, including weekends,” she says. “I had thought of him as a suit-and-tie-and-white-shirt kind of guy, yet he showed up on the weekend in a baseball cap. I almost didn’t recognize him.”

She was so moved by Dr. Rubin’s care that she donated to the Peter Munk Cardiac Centre.

“I have donated to causes before, but never on this level. But I’m glad I did,” Ms. Ungerman says. “Thanks to him, I don’t have to look back. I can look forward.”

A CHAMPION OF INNOVATION

While his work with patients is important to him, Dr. Rubin says he gets a “different satisfaction from working on healthcare policy that will impact the lives of thousands of people, and from research that might affect the lives of millions.”

As Medical Director at the Peter Munk Cardiac Centre, Dr. Rubin leads a staff of more than 1,000 people, who see some 163,000 patients a year. A tireless supporter of the institution’s top-notch researchers, he also created the centre’s Innovation Committee – a panel that evaluates and reviews the pioneering research proposals that may lead to new breakthroughs in treating heart disease. The funding comes from donors, who have entrusted the Innovation Committee to direct the funds to projects appropriately.

The Innovation Committee, chaired by cardiologist Dr. Harry Rakowski since 2012, is made up of more than a dozen members. This includes nurses,

“[Barry] knows the facts and cuts to the chase. If he were not a vascular surgeon, I think he would have made a great criminal lawyer.”

Dr. Richard Reznick, dean of health sciences, Queen’s University

Dr. Barry Rubin (right) with patient Morris Clarfield (left). Mr. Clarfield had an aortic aneurysm repair at 97 years old and was able to leave the Peter Munk Cardiac Centre the next day.



doctors and hospital administrators, as well as a CEO of a major corporation and real estate developers.

It is sometimes referred to as the *Dragons’ Den* of healthcare innovation (referring to the CBC TV show where entrepreneurs pitch to venture capitalists). The committee reviews submissions from staff seeking research grants every quarter, spending \$1-million per year on projects it considers promising.

Of all the research projects currently brewing at the Peter Munk Cardiac Centre, Dr. Rubin is perhaps most passionate about the new Digital Cardiovascular Health Platform. It’s a database that consolidates all the health information about every patient the centre sees, from those who come for routine checkups to the 12,000 people who undergo heart or blood vessel procedures every year. (You can read more about the digital health platform on page 24.)

“I’m tremendously excited about how we’re generating a personalized approach to patients with heart or blood vessel disease. You’ll be able to press a button and have 95 per cent of the information we need about a patient come up instantly. It will save time and be more accurate,” he says. “That’s cool stuff.”

DEDICATION IN THE DNA

Though unfailingly dedicated to his job, Dr. Rubin spends as much time outside work with his family as he can. When it comes to interests, he lists “family and vacations” as top pursuits.

Dr. Rubin says Penny, his wife of 28 years, is “an honorary doctor” because she has had to listen to him talk about his work so much. His kids, Chelsea, Blake and Shelby, all in their 20s, used to repeat the names of operations when they overheard his work talk as children.

But they have no interest in medical careers themselves, he says.

“Given the hours they saw me come home late, working nights and weekends, I think that went into their decision.”

So why does he work so hard? “It’s in my DNA. I like things to be perfect,” Dr. Rubin says.

He’s so dedicated that years ago, he gave up one of his few outside hobbies, karate. He had studied the martial art for seven years and achieved a second-level brown belt. But one day during a sparring match, he punched an opponent in the face (who had a full face protector on) and broke a knuckle.

“I thought it wouldn’t be good to be a surgeon with mangled hands,” he says.

In reflecting back on his career, Dr. Rubin again cites Peter Munk. He shares one of the lessons learned from his mentor: “He said we should be bold, but to also use a gift that is recognized by everyone, but frequently underused: moral integrity.”

And when asked what he hopes his legacy will be as a surgeon and hospital administrator at the Peter Munk Cardiac Centre, Dr. Rubin pauses.

“I hope it will be that I gave every single ounce that was available to the Peter Munk Cardiac Centre to make it the best that it could possibly be; that I left no stone unturned and paid attention to detail. I hope people will say that I made a difference.”



PRECISION MEDICINE

# One size does not fit all

*What if your health care could be tailored to your own biology and lifestyle? That's precision medicine.*

*Through the development of a massive data 'lake,' the Peter Munk Cardiac Centre is aggregating the health information of thousands of patients across Ontario and taking the first step in making precision cardiac medicine a reality*

Mirjam Guesgen



DR. HEATHER ROSS

DR. PATRICK LAWLER

DR. BARRY RUBIN

**D**r. Barry Rubin has a vision. The Medical Director and Chair of the Peter Munk Cardiac Centre imagines a day when a patient comes in, has an oral swab taken and has their entire genome sequenced in an hour. That, together with data about their lifestyle, weight and blood pressure, is integrated into a complete patient profile, along with all of their imaging studies, such as ultrasounds and CT scans. The profile is then used to create a personalized treatment plan, and a computer algorithm automatically predicts treatment success and chances of readmission.

It may sound too good to be true, but Dr. Rubin says it's coming.

"It will be totally different," he says of patient care in the future. "In 10 years, I think we'll be unrecognizable in [comparison to] our current approach."

Dr. Rubin's vision is part of a wider initiative at the Peter Munk Cardiac Centre – one based on the principle of precision medicine. It's an approach that can be described as: the right treatment for the right patient at the right time.

Instead of a "one-treatment-fits-all" approach – the current standard in medicine – precision medicine looks to break up the wider population into smaller subgroups

based on characteristics such as the genetic or molecular mechanisms underlying the disease, the patient's lifestyle or the patient's unique physiology.

Then, instead of basing treatment on the average results of a randomized controlled trial, which targets that wider population, treatment is personalized to each subpopulation of patients.

"Currently, if two people come to the hospital – same age, same sex, same risk factors – and have narrowed heart arteries, we tend to treat them the same. But the cause of the narrowed heart arteries or the optimal treatment may be totally different," Dr. Rubin explains. "Everybody gets grouped the same, but the diseases aren't likely the same."

The precision medicine approach has been applied primarily in the field of oncology, but Dr. Rubin and others at the Peter Munk Cardiac Centre see heart disease as its next frontier. As part of the strategic vision for the centre, doctors and data scientists are coming together to realize the possibility of one day providing individualized care for their patients. Their efforts will not only mean a better match between patient and treatment, but also the potential to detect problems before they arise or even redefine particular diseases altogether.

## CREATING A 'LAKE' OF DATA

Big data and artificial intelligence (AI) are the scalpel and stent in precision medicine.

The combination of complex AI algorithms and massive amounts of data can reveal subpopulations of individuals with a particular gene or molecular pathway. In cardiology, having genetic sequence data, heart ultrasounds, X-rays,

blood work, tissue samples, treatment outcomes and lifestyle information for every patient is crucial. To see any trends requires thousands upon thousands of patients. The spreadsheet quickly fills up.

"That information for just one person generates a lot of data, so imagine doing that for every one of the 163,000 people we see every year," Dr. Rubin says.

For that reason, much of the effort in bringing precision medicine to cardiology has focused on developing a way to bring all available data for many patients together in one place at one time. Thanks to generous support from the Rogers family and from the Peter and Melanie Munk Charitable Foundation, doctors at the Peter Munk Cardiac Centre have developed a Digital Cardiovascular Health Platform. This platform – a digital storage repository that holds a vast amount of data until needed – draws together more than 40 databases with information from thousands of patients across Ontario, in real time.

Some of those databases include the Ontario Laboratories Information System, which tracks patients' blood test results, the Canadian Institute for Health Information Database, which tracks patient outcomes, and data from the Peter Munk Cardiac Centre's own Cardiovascular Biobank, a physical repository containing more than 50,000 blood and tissue samples. After they provide consent, each new patient admitted to the centre will automatically have their data added to the data lake.

To ensure patient privacy, the digital platform was developed in consultation with the Privacy Office at University Health Network and the Information and Privacy Commissioner of Ontario.

"We think we're as secure as we can possibly be because we've integrated

privacy considerations into the actual construction of the platform," Dr. Rubin says.

## A TRIP INTO THE MATRIX

Dr. Heather Ross, cardiologist and Director of the Ted Rogers and Family Centre of Excellence in Heart Function and the Cardiac Transplant Program at the Peter Munk Cardiac Centre, led the development of the digital platform alongside her colleague Dr. Cedric Manlhiot, Director of the Cardiovascular Data Management Centre at the Ted Rogers Centre. Dr. Ross, who holds the Loretta A. Rogers Chair in Heart Function, says the first time data streamed into the lake was a real "wow" moment.

"It was like *The Matrix*," she recalls, referring to the futuristic 1999 sci-fi film. "All this information was coming in, but you had to know how to read it. That's when I knew [precision cardiac medicine] was possible."

Dr. Ross is involved in many of the Peter Munk Cardiac Centre's research projects, which aim to harness the power of artificial intelligence to "find patterns in the chaos," as she puts it. The centre has already partnered with one of Canada's AI leaders, the Vector Institute for Artificial Intelligence, a Toronto-based, independent, not-for-profit corporation dedicated to excellence in this area. The Peter Munk Cardiac Centre is planning to hire a team of AI specialists in-house, in collaboration with the Vector Institute.

The hope is that any physician or surgeon at the Peter Munk Cardiac Centre will be able to access the expertise of the AI group to investigate factors they think could make a difference in the efficacy of patient treatment.

## PREDICTING THE BEST TREATMENT FOR EACH PATIENT

Genetics have played a prominent role in oncology in the quest for subpopulations, but Dr. Patrick Lawler, a cardiologist who leads the Molecular Epidemiology and Precision Medicine Group at the Peter Munk Cardiac Centre, says biomarkers may be better indicators in cardiology.

Biomarkers are measurable substances or characteristics in the body that may indicate disease, such as proteins or enzymes. For example, blood cholesterol is a well-known biomarker of risk for heart disease.

"I think everyone is interested in the concept of genetics, but there's a lot that happens between the genome and what we see it manifesting as [in the body]," Dr. Lawler says.

Using powerful computers, scientists can comb through thousands of biomarkers to see which ones may be associated with a disease.

"There might not be a single perfect marker, but a compilation of markers," says Dr. Slava Epelman, a clinician-scientist with the Peter Munk Cardiac Centre and the Loretta Rogers Chair in Immunobioengineering at the Ted Rogers Centre for Heart Research.

Once subpopulations of patients with these biomarkers have been identified, researchers could then conduct clinical trials to determine if particular treatments are more effective for particular groups, a technique known as predictive enrichment.

Machine learning could also be used to predict the success of that treatment for a particular patient. Machine learning is an application of AI that allows computers to learn and improve without being explicitly programmed.

The machine learning program would be fed patient, treatment and outcome data from previous cases, then it would build a predictive model to be used in new cases. Knowing the chances of success for specific sub-



sets of patients could help doctors decide which treatment option is best. Alternatively, computer models could predict which patients are likely to be readmitted to hospital after their procedure, allowing physicians to step in early and prevent cardiac complications.

#### 'A BIG PARADIGM CHANGE'

Perhaps the most fascinating aspect of the precision medicine approach is that it has the power to redefine diseases altogether. That is because instead of diseases being classified according to their symptoms, as they currently are, they could be classified according to the molecular pathways underlying them.

Dr. Lawler explains this is the cardiac equivalent of cancers being classified and treated not based on where in the body they occur (like bowels, skin or lungs), but by the genetic pathway driving them.

"The whole precision medicine initiative offers us an opportunity to look fresh at the way we've traditionally defined diseases," says Dr. Lawler. "It's a big paradigm change. It's rethinking a lot of things that are quite ingrained in how we do things."

Ultimately, the hope is that precision medicine will pave the way for the Peter Munk Cardiac Centre to create a learning health system – one that bridges the gap between research and practice. This learning system would automatically evolve as new data is fed into it, thereby providing doctors with the most up-to-date, effective treatments for their patients.

In this way, "patients truly become partners in their care, because they're helping us generate data that lets us improve their care," Dr. Rubin says.

But it is a stepwise process. Currently, there is enough data to begin to identify, or stratify, broad subpopulations, but not all patients pooled into the data lake have their genomic or blood work information available – at least not yet – limiting how precise the stratification can be.

Dr. Vivek Rao, head of the division of cardiovascular surgery at the Peter Munk Cardiac Centre and the Peter Munk Cardiac Centre Chair in Advanced Cardiac Therapeutics, says the way forward is to emphasize how astonishingly powerful the precision medicine approach is and ask patients to contribute their biological samples to help build the databases further.

"The more patients that we treat, the more data that we'll have, the more we can fine-tune the algorithms to appropriately treat the patients," he says.

Precision cardiac medicine is a goal that the Peter Munk Cardiac Centre's best and brightest believe in. After all, the field of oncology has seen marked changes in how cancer is understood and treated, and cardiology is catching up fast.

"The time it will take until that becomes a reality is rapidly shortening, thanks to the global collective work of many, including quite a few here," Dr. Lawler says. ■

"The whole precision medicine initiative offers us an opportunity to look fresh at the way we've traditionally defined diseases."

Dr. Patrick Lawler, cardiologist, Peter Munk Cardiac Centre

DR. BILLIA



DR. RAO



DR. FORBES



DR. LEE



DR. THAVENDIRANATHAN



DR. ALBA



## THE BENEFITS OF PRECISION MEDICINE

### Understanding the mechanisms of disease

Although cardiologists have a good understanding of how cardiac diseases or disorders manifest themselves and how to treat them, the genetic or molecular mechanisms underlying those diseases aren't as clearly understood. Having the ability to analyze large amounts of data using artificial intelligence is a step toward a better understanding.

**DR. PHYLLIS BILLIA**, cardiologist, Peter Munk Cardiac Centre Research Lead and Co-Director of the Peter Munk Cardiac Centre Cardiovascular Biobank, explains: "Disease modelling will [enable us] to develop a better understanding of pathogenesis, or what underlies the disease process. Until we have a better understanding of the heart disease process, we are unable to target the genetic problem."

### Finding or developing the right treatments

Once cardiologists know the underlying cause of a disease, they are better able to target treatments to subpopulations based on their disease profile or lifestyle attributes.

**DR. VIVEK RAO**, head of the division of cardiovascular surgery at the Peter Munk Cardiac Centre and the Peter Munk Cardiac Centre Chair in Advanced Cardiac Therapeutics, hopes to use precision medicine to tailor blood-thinning medication doses for his patients after surgery. Those medications are given at a low dosage after surgery, and that dosage is gradually increased over time until the medication has the desired effect. But some people are sensitive to the medication and can have a bad reaction, while others are more resistant and it takes a long time to get to a dosage that works. Dr. Rao hopes to find the genes associated with sensitivity and resistance, so that his patients can get the right dose right away.

**DR. THOMAS FORBES**, division head of vascular surgery and the R. Fraser Elliott Chair in Vascular Surgery at UHN, wants to get to the point of predicting a patient's individual outcome following endovascular aneurysm repair. According to Dr. Forbes, the standard, quoted risk of complication following surgery is approximately 1.6 per cent, but this number fluctuates greatly between patients. "Just like not all patients [respond to Aspirin] because of their genome, not all patients respond

to endovascular aneurysm repair," he says. Dr. Forbes also notes that some patients may be able to avoid surgery altogether if pharmacological treatments could be tailored to individuals based on their biology.

### Predicting future cardiac events

Cardiac researchers from the Peter Munk Cardiac Centre have several studies underway investigating how they can use clinical data, proteomics (the characterization of proteins), biomarkers, the cardiopulmonary exercise test (CPET) or cardio-linguistics to predict which patients may be at risk of heart failure. The aim is to anticipate cardiac events before they happen, rather than just responding to them when they do.

In a paper due to be published later this year, Dr. Heather Ross and her team show how the use of artificial intelligence, more specifically called neural networks, allows them to more accurately predict heart failure risk. A neural network is a computer program that works like a human brain, enabling a computer to learn from observational data. For example, neural networks allow Peter Munk Cardiac Centre researchers to analyze all variables of CPET data with every breath the patient takes, giving them a more accurate picture of heart failure risk.

**DR. DOUGLAS LEE**, the Ted Rogers Chair in Heart Function Outcomes at the Peter Munk Cardiac Centre, is working to predict the chances of readmission to hospital following treatment by analyzing patients' perspectives in addition traditional medical and biological data. His team will utilize patient-reported outcomes and the language patients use during conversational exchange with their healthcare professional (called cardio-linguistics). Combined with other measures, such as new biomarkers and machine learning, this could be a better predictor than what's currently available. "Ultimately it's patients who decide they're going to come back to hospital," he explains. "If a patient is not feeling well at home, and we're able to identify that earlier using data collected and entered by the patient, then we're probably better able to anticipate that this person might end up in the hospital. That's a missing link that hasn't been there before."

### Better risk assessment

**DR. DINESH THAVENDIRANATHAN**, cardiologist and Director of the Cardiotoxicity Prevention Program at the Ted Rogers Centre for Heart Research, says risk assessment is particularly important in his field, cardio-oncology, because they are in the unique situation of dealing with two competing problems – heart issues and cancer. Dr. Thavendiranathan believes precision medicine could play a major role in helping balance the two. "[We need] to make sure we're not undertreating our patients from a cancer perspective, and to make sure that we're not missing [an] opportunity to prevent cardiovascular disease in these patients."

**DR. CAROLINA ALBA**, cardiologist at the Peter Munk Cardiac Centre and scientist at Toronto General Hospital Research Institute, hopes to use the data platform to assess which patients are good candidates for advanced heart therapies, such as heart transplants or a mechanical heart. She also hopes to give family doctors the tools to identify high-risk patients, so they can refer them in a timely manner to a cardiologist. "Some patients are referred to us too late, or maybe not referred at all," she says. ■

## MANY CLUES ON THE ROAD TO BETTER CARE

The Peter Munk Cardiac Centre's Digital Cardiovascular Health Platform will contain vast amounts of data from thousands of patients. Here are some of the types of data that will contribute to the precision medicine paradigm:

### CARDIO-LINGUISTICS

How a patient talks about their health to their doctor could provide clues about whether they will be readmitted to hospital.

### CLINICAL MEASURES

Measures like blood pressure, X-rays or heart ultrasounds are collected from the patient in the clinic. They can help doctors diagnose disorders and keep a record of how that disorder affects that individual.

### PATIENT OUTCOMES

Patients who have experienced cardiac issues in the past are often asked to record their recovery after treatment. This allows cardiologists to determine how effective their treatment was.

### GENOME SEQUENCING

Some diseases are caused by changes in how the body's building blocks, or DNA, are ordered. By working out the precise order of DNA in both healthy and sick patients, scientists can figure out if there is a particular gene causing a disease and diagnose patients by sequencing their genes.

### BLOOD SAMPLES AND BIOMARKERS

Biomarkers are proteins or other molecules that are made by different biochemical processes in the body. Having abnormal levels of those molecules could indicate the presence of a disease, predict how a patient will respond to therapy or provide doctors information about prognosis.

### CARDIOPULMONARY EXERCISE TEST (CPET)

CPET allows cardiologists to see how fit a patient is following heart failure and determine how they are recovering. Information, such as how much oxygen a person is taking in, is recorded with every breath while a patient runs on a treadmill or pedals a bike.



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DR. TIRONE DAVID

## A legend in the operating room

*In his 40-year career, Dr. Tirone David has performed thousands of surgeries, developed pioneering surgical procedures and saved countless lives. He's one of the most influential cardiac surgeons in the world — and he's not done yet*

Chris Atchison

**I** imagine holding a person's broken heart in your hand, then being forced to improvise an unprecedented technique for its repair. For most cardiac surgeons, this would be a non-starter. For Dr. Tirone David, overcoming seemingly impossible surgical hurdles became his clinical calling card.

"I find the challenge never dies," the renowned cardiac surgeon says from behind the desk of his office at the Peter Munk Cardiac Centre at Toronto General Hospital. "I'm fighting a disease that never dies. I'm trying to resolve a problem."

Over the course of a more than 40-year career, Dr. David, who holds the Melanie Munk Chair in Cardiovascular Surgery, has contributed more to the resolution of deadly heart conditions than almost any other cardiac surgeon in the world. By his own estimate, he has performed open-heart surgeries on more than 15,000 patients, with a success rate of close to 100 per cent. Dr. David has

published more than 350 scientific papers and when pressed, humbly allows that he has developed approximately 16 or 17 life-saving surgical procedures to treat heart disease — some perfected from other surgeon's innovations, but mostly his own.

Of his earliest days in the operating room, the 73-year-old says, "The passion was incredible. I could do an operation much faster than my peers."

Instead of doing two surgeries in a single day, as would be standard for most surgeons, Dr. David was able to perform four or five. In his prime, he says he was able to manage about 500 patient cases per year, or about double his current workload.

"He's had probably the biggest influence in cardiac surgery around the world for the last 30 years," explains Dr. Michael Borger, Director of Cardiac Surgery at the Leipzig Heart Center in Leipzig, Germany. Dr. Borger studied and worked under Dr. David in Toronto at the start of his career, and credits that time with helping to advance his own understanding of complex surgical procedures.

Dr. Borger points to procedures such as the pioneering David Operation — also known as aortic valve-sparing operation — as an example of Dr. David's surgical prowess at work. The procedure was developed to overcome challenges stemming from aortic root aneurysms that are common in younger patients with genetic ailments, such as Marfan syndrome, but without the use of artificial aortic valves.

"Basically, through Dr. David's operation, you can get these people back on a life expectancy comparable to other people their own age without worrying about the long-term consequences of an artificial valve," Dr. Borger says. "He





has directly or indirectly helped tens of thousands of patients around the world with this one operation.”

Indeed, crowning Dr. Tirone David a legend in his field would still understate his achievements. His operating room innovations, teaching and research have advanced the field of cardiac surgery in countless ways – and his work is far from over. He mentions that the next day alone he will see some 28 patients during his clinic hours. His staff is continually fielding requests for his services from around the world, as well as countless calls to speak at conferences and events.

And to think Canada came close to losing this remarkable talent to deeper-pocketed hospitals south of the border.

#### THE RELUCTANT SURGEON

Born in Ribeirão Claro, Brazil, in 1944, Dr. David graduated from Universidade Federal do Paraná in 1968. His father, a Syrian Jew, and his Italian mother moved to Brazil during the Great Depression and would go on to launch a successful construction supply company. His youngest brother would eventually take over the family business, while another brother pursued a law career. The elder David had different plans for young Tirone.

“When my time came, he said I was going to be a doctor,” Dr. David recalls. “I was reluctant, but I was 18, and in those days we had to decide either to go into mathematical sciences, biological sciences or the arts.” Unsure of his path, yet determined to succeed, he would quickly discover a lifelong passion for surgery.

Upon graduating with his MD in Brazil, Dr. David emigrated to the United States to further study medicine. But his socialist political leanings would soon steer his career northward.

Dr. David landed at King’s County Hospital Center in New York, where he mainly treated poor patients whose care was often dictated by the quality of their health insurance (or lack thereof). He came to resent the for-profit system, believing that there must be a better way to provide medical care to the masses. He worked for a time at the renowned Cleveland Clinic – which catered to the wealthiest of the country’s 1 per cent – where he met his wife, Jacqueline. Then he made his way to Toronto in 1975 to train in cardiac and thoracic surgery at Toronto General Hospital.

“I came to Canada as a student and they said, ‘We don’t worry about insurance. A patient comes in and we treat them.’ For a socialist kid in 1975, that was heaven. It was paradise for a doctor.”

As Dr. David’s reputation grew and word of his surgical prowess spread, offers poured in from across the U.S. In 1978, he was earning \$15,000 a year when he was presented with an opportunity to continue at Toronto General Hospital for triple the salary. The young doctor was elated with the pay raise. That was until a contact at the Cleveland Clinic offered him a salary of \$125,000 to move south. Yet another offer came from St. Vincent Mercy Medical Center in Toledo, Ohio, to partner with a top cardiac surgeon for a whopping annual paycheck



Dr. Tirone David (right) formed a strong friendship over the years with Peter Munk (left).

of \$500,000. In 1978, this was a staggering amount of money for any doctor. Dr. David recalls being so conflicted that he couldn’t sleep at night as he laboured over his next move. He called an old mentor in search of advice.

“He asked me how much I was earning, and I said \$15,000. He said, ‘Are you guys hungry? Can you live on that?’ I said, ‘Of course I can.’ He said that if I moved to Cleveland I’d become a money collector. He said, ‘Do what’s in your heart, do whatever you like, but forget about money.’ So, I stayed here.”

Others were not as impressed by his decision to practise in Canada and forego a life of wealth stateside.

“My father-in-law said to my wife jokingly, ‘You didn’t marry well; your husband is not very smart.’”

#### A CAREER OF CREATIVITY

A defining characteristic of Dr. David’s approach to surgery was – and still is – his willingness to take on cases that seem impossible, all while prioritizing his patients’ quality of life. That focus earned him a reputation as a risk-taker and operating room maverick, but he notes that there was often little choice. “For all the things I developed, the alternative was [the patient’s] death,” he says.

A willingness to try new methods when others failed often put the surgeon in operating room situations where he was literally forced to develop new techniques in real time.

“The first time he did [aortic valve-sparing] surgery, you’re talking about a real technical challenge with nobody to guide you through it,” says Dr. Borger. “At the end, if it didn’t work, there was a reasonable chance you’d have a young, dead patient on the operating table, compared to using the more established and better-known method of just replacing the valve.”

Dr. Borger points out that Dr. David took the risks he did in order to get the best long-term outcome for the patient.

“Not only is he a technical genius, but he was also one of the first people I ever heard talk about what the long-term consequences are of what you do in the operating room, and not just thinking about the short-term consequences to get the patient out of the hospital alive,” he says.

Other Dr. David-developed procedures include the first patch reconstruction of a damaged mitral annulus – a problem common in patients with compromised kidney function – and the use of the first stentless aortic valve

during an aortic valve replacement. According to Dr. Borger, Dr. David also perfected the use of Gore-Tex sutures in mitral valve reconstruction, a technique he says is used by cardiac surgeons virtually every day around the world.

“We’re talking for sure more than 100,000 people worldwide,” he says of the number of patients who have benefited from that innovation alone.

#### PETER MUNK: SUPPORTER AND FRIEND

It takes the right research and academic environment to foster the kind of creativity that Dr. David has continued to display throughout his career. Enter the late entrepreneur Peter Munk and his wife, Melanie, who gave the first of many gifts in 1993 to help establish the Peter Munk Cardiac Centre.

As it turns out, the inspiration for that donation came during an earlier meeting between Dr. David and Mr. Munk. In 1988, the renowned surgeon presented ideas to Mr. Munk to bolster Toronto General Hospital’s cardiac program and solidify its position as a global leader in the field. The idea excited the visionary business magnate, and it was there that the foundation for a transformative philanthropic legacy – not to mention a lifelong friendship – was laid.

“He allowed us to compete academically,” Dr. David says when asked to reflect on Peter Munk’s commitment to advancing cardiac research in Canada.

“He allowed us to develop a collaborative practice model where cardiologists, surgeons and other cardiovascular specialists worked together and developed several academic programs focused on innovation and research. If you look at our contribution to academic medicine, it’s as good as any large U.S. university, if not better.”

The Munk family’s gifts to Toronto General & Western Hospital Foundation – now topping \$177-million – have also helped to keep leading surgeons such as Dr. David (who in 1989 briefly contemplated returning to the U.S.) working in Canada.

“He was one of the reasons I didn’t [move back],” Dr. David recalls.

“Although he was a billionaire and I was a heart surgeon, we had a lot of things in common. He supported me tremendously throughout my career and treated me as a friend over the years. That was a man who came from nothing. He became a billionaire, but never changed. He loved the simple things of life.”

That relationship carries on with the strong friendship that Dr. David and his family maintain with Mrs. Munk. When Mr. Munk passed away last March, the Munk family arranged a private funeral for invited guests only. Dr. David and his wife were two of them.

#### THE SEARCH FOR BALANCE

As any specialist physician in this country can attest, the demand on a clinician’s time is daunting. Dr. David reflects on his tenure at Toronto Western Hospital early in his career. Hospital administrators custom-built a bedroom for him in the building’s atrium where he lived six days a week, so he could tend to patients around the clock. His wife would visit with his three daughters from time to time, and he would return home on Sundays for a partial day off.

He would maintain a similarly exhausting pace throughout his career.

“It was a massive workload. I worked a lot,” says Susan Peters, Dr. David’s long-time clinical administrative assistant, who recently retired from the practice. Ms. Peters was the one tasked with managing Dr. David’s schedule, booking clinics and patient surgeries, as well as liaising with patients or visiting physicians from around the globe.

“Sometimes you had to collaborate with no notice, switch cases and know what’s

“Although [Peter Munk] was a billionaire and I was a heart surgeon, we had a lot of things in common. He supported me tremendously throughout my career and treated me as a friend.”

Dr. Tirone David on Peter Munk

going to work in the operating room right now. But I think once you learned your craft as an employee, [Dr. David] was really great at letting you run with it. He needed you to [run with it].”

Dr. Borger – who spent countless hours watching and learning from his mentor in the operating room – says the two now enjoy a strong, “father-son” relationship. But it wasn’t always so. Dr. David was demanding of his colleagues and didn’t suffer fools lightly.

“He’s a challenging guy to work for. Somebody who can perform at that level also has expectations that are difficult to live up to,” Dr. Borger says.

“We get along great now, but at the time I was like a teenager. And you’re not always happy with your father’s decisions, or what your father wants you to do, when you’re a teenager.”

A commitment to perfection and innovation meant sacrifice for Dr. David away from the hospital. When asked how he maintained work-life balance throughout his career, Dr. David admits it was an area where he fell short. How, for example, did he manage to spend time with his daughters?

At this, his eyes drop.

“They don’t know me,” he says softly. “Luckily, my wife quit her career and became a full-time mother, so the girls are all good people, good citizens, thanks to my wife.”

He recalls a time when he came home one Sunday morning, and his two-year-old daughter was in the window. He walked in and began speaking with her, and she replied, “My mom told me not to speak to strangers.” She had no idea who he was.

“Hard,” he says, his voice cracking with emotion. “It’s a choice you make. They are three wonderful women, but they don’t know me, which is sad.”

When it’s suggested that his daughters must understand the immense impact of his work, he allows that they admire his dedication, but resent the fact that they grew up mostly without a father. Dr. David now spends at least one afternoon a week with his two young grandsons. The eldest, at three years old, enjoys demonstrating his cycling prowess for his grandpa.

“I don’t know why I did this with such conviction and passion,” says Dr. David. “I don’t know if it’s personality, addiction, because surgery is addictive. If I could do it differently, I’d try to balance it more. And I’m not the only one.”

#### A LEGACY OF COMPASSION

Having devoted his life to the care of others, Dr. David acknowledges that the time will come when he will retire.

“I know one day I’ll begin to fail, but nobody else will know but me. I’ll walk away,” he says.

Such talk begs the question of his legacy. How best to encapsulate the career of one of Canada’s pre-eminent cardiac surgeons, an officer of the Order of Canada and a literal saviour to hundreds of thousands of people? The answer can be found in an anecdote he shares about hiring his new assistant when Ms. Peters retired.

“I interviewed about 20 people. What I tried to impress upon them is that the most important things in a doctor’s office are kindness, sympathy and caring. When the telephone rings, don’t ignore it. The reason I chose my new person is that she came across as very sympathetic,” he says.

“When I see patients, I try to be reassuring. Not to paint a rosy picture, but show the positive side and serve them in the best way I can.”

And with that, Dr. David rises from behind his desk and excuses himself as he sets out to prepare for yet another long day of patient appointments. ■

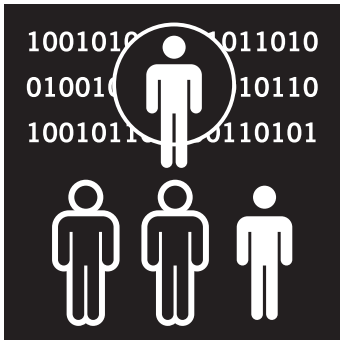




WHAT'S NEXT

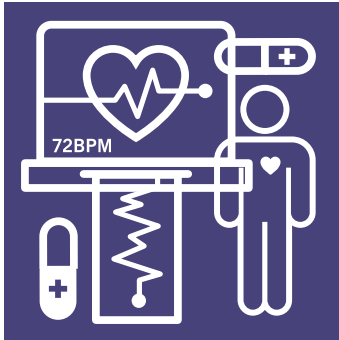
# The next evolution of the Peter Munk Cardiac Centre

*Home to many world firsts, the Peter Munk Cardiac Centre has changed the way patients with heart and vascular diseases are treated here in Canada and around the globe. But they're far from done. In the next stage of evolution, the aim is to become the world's leading heart and vascular centre. Here's how the Peter Munk Cardiac Centre is going to get there:*



DEVELOP A WORLD-CLASS DIGITAL CARDIOVASCULAR HEALTH PLATFORM

All patient information will be securely integrated under a single digital platform, or “data lake.” The platform will include clinical notes, blood tests, pathology results, imaging studies, genetic information and more – all while maintaining the highest degree of data security – and will build on work initiated through the Ted Rogers Centre for Heart Research. Worldwide, the healthcare industry is significantly behind in digitizing information, and the Peter Munk Cardiac Centre is beginning the evolution of digitizing patient information to inform patient care.



GENERATE NEW KNOWLEDGE THROUGH MORE FIRST-IN-HUMAN STUDIES AND CLINICAL TRIALS

Clinical trials are crucial to the development of new therapies for cardiovascular disease. They provide the real-world evidence needed to determine how successful therapies will be outside of the lab. A new Clinical Trials and Translation Unit will dramatically increase the number of clinical trials that are led by the Peter Munk Cardiac Centre. Research will focus on areas of strength, such as heart failure, adult congenital heart disease (patients born with structural heart disease), cardiovascular imaging and novel device evaluation.



EXPAND AND STRENGTHEN THE PETER MUNK CARDIAC CENTRE'S PRECISION CARDIOVASCULAR MEDICINE PROGRAM

Precision medicine is the key to finding the right treatments for the right people. By harnessing the valuable information in the “data lake,” researchers can identify similarities between patients and tailor treatment like never before. Predictive modelling will improve the early detection of heart disease, increase the accuracy of diagnoses and tailor treatments to patients' individual characteristics. To lead this precision medicine revolution into the future, the centre will build a top-flight team of clinician scientists to solve the mysteries of genetics and heart disease.



DRIVE MEDICAL INNOVATION AND QUALITY

At the root of all initiatives at the Peter Munk Cardiac Centre is a commitment to constantly improve diagnoses, care and outcomes for patients. One important initiative is participation in international quality assessment databases to benchmark the centre's performance against leading cardiac centres across North America. The Peter Munk Cardiac Centre will be the first in Canada to participate in the National Cardiovascular Data Registry, the Vascular Quality Initiative and the Society for Thoracic Surgery databases, allowing the centre to compare the outcomes of the 163,000 patients they treat every year with millions of patients in the United States.



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GAME-CHANGING DEVICES

# A proving ground for game-changing devices

*From valve replacements that are a perfect fit to the smallest possible artificial heart, the Peter Munk Cardiac Centre is where industry partners go to test trailblazing – and life-saving – medical devices*

Joel Schlesinger

“We pride ourselves on being the hospital that introduces new technologies to the country’s healthcare system,” says Dr. Vivek Rao, head of the division of cardiovascular surgery at the Peter Munk Cardiac Centre and the Peter Munk Cardiac Centre Chair in Advanced Cardiac Therapeutics.

When it comes to bringing broken hearts back from the brink, the Peter Munk Cardiac Centre is a global leader.

The Peter Munk Cardiac Centre is a go-to proving ground for the latest devices that are rapidly changing the treatment of heart disease. It’s often on the short list when industry partners seek to test new devices on patients who often have no other safe, viable therapy alternatives.

Call it the cutting-edge technology that can reduce the “cutting” involved in surgery.

“The device field is rapidly evolving as the technology improves, and every three to four years a new device is introduced into the market,” says Dr. Rao.

New devices tested at the centre save lives. They also transform what were once major surgeries into much safer procedures, involving smaller incisions and less recovery time.

These game-changing devices are welcome additions to health providers’ toolkits across many disciplines of acute cardiovascular care, including these three key areas:

## VALVE REPLACEMENTS

Size matters when it comes to getting the latest technologies to treat valvular problems.

In the case of the Peter Munk Cardiac Centre, it helps to be big.

“Because of our size and volume – being in Toronto – we have access to a lot of technologies before they are ready for prime time and widely available,” says Dr. Eric Horlick, a cardiologist, professor of medicine at the University of Toronto and the Peter Munk Chair in Structural Heart Interventions at the Peter Munk Cardiac Centre.

Further to that point, the Peter Munk Cardiac Centre has established connections with industry leaders, who recognize the centre’s skilled teams and their ability to

integrate new technologies into care models.

Yet size is also an important aspect of the new devices themselves. They often treat conditions involving leaky, malfunctioning valves controlling blood flow within the heart and to the rest of the body. Dr. Horlick points to a current study underway at the Peter Munk Cardiac Centre involving next generation replacement valves used to treat aortic stenosis – the narrowing of the valve of the main artery exiting the heart.

“It’s a common problem we see as people get older,” Dr. Horlick says. In the past, valve replacements would involve major surgery, and were often not a good option for elderly patients.

But the latest heart valve to treat this condition can fit through all but the smallest arteries using a catheterization procedure. Catheterization means inserting the device through a vessel in the neck or leg to gain access to the heart.

“When we started this 10 years ago, we were one of the first centres in the country doing catheterization procedures,” he says. “At the time, it was so unthinkable to shove a rather large valve up someone’s leg, so it was only done in the highest risk people with no other options.”

Now, new devices can not only travel up a blood vessel into the heart, they also fit more perfectly within the heart, like a bespoke suit, resulting in less leakage and a longer lifespan.

Dr. Horlick points to new imaging technologies combining magnetic resonance imaging (MRI) and computed tomography (CT) scan modalities that create three-dimensional, highly accurate copies of a patient’s heart. Using 3D printing technology in a facility at the Peter Munk Cardiac Centre, cardiac teams can construct an exact, life-sized model of a patient’s heart that they can hold in their hands.

“This allows us to ensure the replacement valve is a perfect fit,” he says, adding they can literally place the valve within the model. “Our team of cardiologists and surgeons have carefully and meticulously refined the process of choosing the right size and type of valve for the right patient, and that gives me confidence and piece of mind when we offer TAVI [transcatheter aortic valve implantation] to our patients.”

Altogether, these advances have made procedures safer and more effective, Dr. Horlick says.

What used to involve a large incision in the chest, splitting open the rib cage, five to 10 days in hospital and about six weeks of recovery can now be done in about half an hour. And the patient can often go home the next day.

“Think of it from the patient’s perspective,” Dr. Horlick adds. “Who would want to have surgery if this alternative is available?”

## TREATING AORTIC ANEURYSMS

For more than a decade, the Peter Munk Cardiac Centre has been revolutionizing treatment for aortic aneurysms. Essentially a thinning of a section of the wall of the aorta, an aneurysm can

burst without treatment leading to fatal hemorrhaging, says Dr. Thomas Forbes, division head of vascular surgery and the R. Fraser Elliott Chair in Vascular Surgery at UHN.

“Up until about 15 years ago, when someone had an aneurysm of their aorta, the only way to fix that would be to do a large cut and replace it with a man-made tube,” Dr. Forbes says.

“Correspondingly, the procedure was a large operation, and these are often elderly people, so the cure could be worse than the disease.”

Simply put, many would not survive the procedure.

Enter fenestrated (or branched) stent grafts that can be personalized to fit the vessel structure of the individual patient. Similar to stents used in catheterization procedures to unblock coronary arteries in heart attacks, these devices are made from stainless steel mesh frameworks. Only aortic stent grafts are larger, about two to three centimetres in diameter, as opposed to a few millimetres. And unlike coronary artery stents, aortic stent grafts’ metal framework has a fabric cover, serving as a new lining for the weakened sections of the aorta.

“Rather than holding open a narrowing vessel, it relines the aorta to protect against rupture and bleeding,” Dr. Forbes says.

The procedure has been fine-tuned by the centre over several years, and the stents themselves have improved as a result. Today, they are more reliable, more customizable to the patient and, perhaps most importantly, smaller. Again, the move toward greater miniaturization has opened the procedure up to more patients, especially women.

“In the past, we were not able to repair aneurysms in women with this therapy, because they had smaller blood vessels,” Dr. Forbes says.

Surgery still occurs to treat aneurysms today, he adds, but it is much rarer. Of course, notes Dr. Forbes, “the least invasive procedure is prevention.”

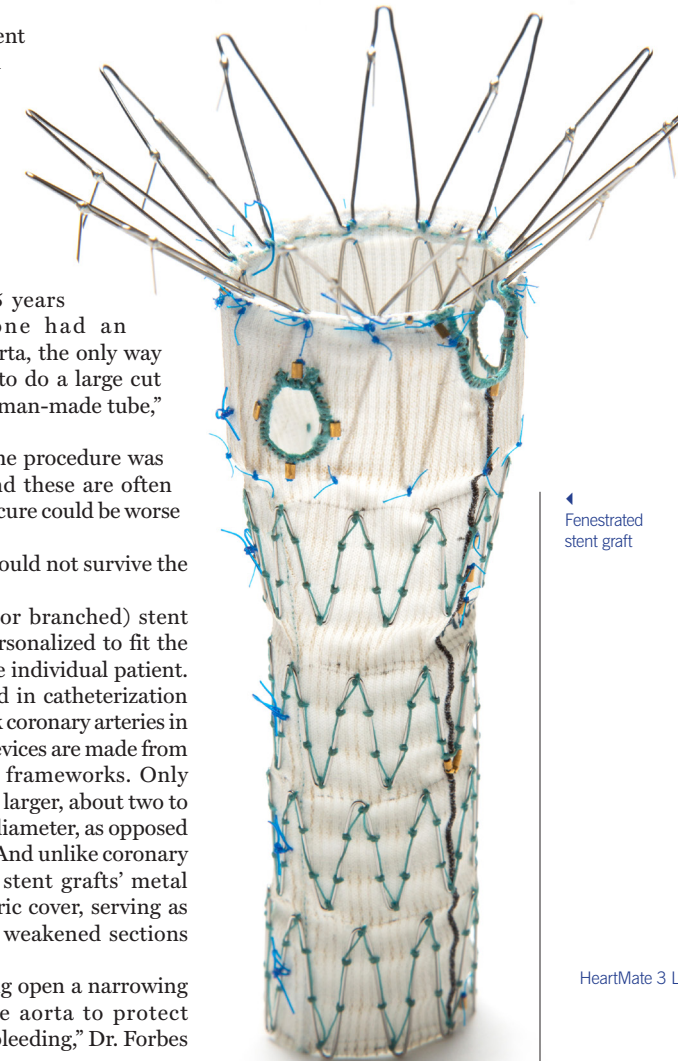
The Peter Munk Cardiac Centre is involved in groundbreaking research on this front too, carrying out basic research to understand how aneurysms form so that one day, pharmacological therapies could treat them rather than more invasive options.

“We’re a ways off,” Dr. Forbes says. “But we’re always looking at different ways to transform the treatment paradigm.”

## ARTIFICIAL HEARTS

The Peter Munk Cardiac Centre is one of Canada’s top centres for heart transplants – a last-line option for patients with severe heart failure. But many can wait for long periods for a donor heart. As well, others may not be suitable for the most invasive of cardiac procedures.

That’s why since the early 2000s, the centre has been at the forefront of procedures involving left ventricular assist devices (LVADs) – essentially the technical term for an artificial heart.



Fenestrated stent graft

HeartMate 3 LVAD



Working with industry leaders, the centre was among the first hospitals in the world to implant the earliest version of the device in a patient with heart failure – whose organ could no longer adequately pump blood throughout the body.

After years of testing and implanting new-and-improved iterations of LVAD technology, another new device is on the horizon, called a miniaturized ventricular assisted device. The size of a AA battery, it will be the smallest artificial heart device yet.

“This will allow us to do the surgery in a much more rapid fashion, and with a less invasive procedure so that people who are elderly, frail and may not tolerate an operation to implant an [LVAD] may now have a viable option,” Dr. Rao says.

Only time will tell if the next generation of devices improves outcomes and expands care options for patients who may not be good candidates for other therapies.

And that’s just fine with Dr. Rao and the clinical care team at the Peter Munk Cardiac Centre. After all, they see themselves as the gatekeepers for new innovations, helping to determine whether they increase safety and efficacy of treatment. “Or are they very expensive toys you would like to have on your shelf, but they don’t provide a cost-effective solution?” Dr. Rao says.

“In that respect, we’re not just clinical implanters of the latest devices; we’re scientists evaluating the benefits of new technology.” ▲

SAPIEN 3 valve  
by Edwards  
Lifesciences Canada

HeartMate 3 LVAD photo courtesy of Abbott Medical Devices



# Pushing the boundaries of scientific discovery

*Philosophers and poets will muse about the human heart; at the Peter Munk Cardiac Centre, world-class researchers are coming closer to discovering what makes it tick*

David Israelson

**C**an a damaged heart learn to fix itself? There's the question Dr. Phyllis Billia is looking to answer through her pioneering research at the Peter Munk Cardiac Centre. Dr. Billia, cardiologist, Peter Munk Cardiac Centre Research Lead and Co-Director of the Peter Munk Cardiac Centre Cardiovascular Biobank, says part of the answer may rest in how hearts develop in the first place.

When a baby is born, the heart “proliferates,” or grows, for a period of time. Then it stabilizes and stops growing, she explains.

But what if a damaged heart could regrow?

“How can we coax it back?” Dr. Billia asks.

The problem is that the heart is “not really a great regeneration organ,” she notes. When a surgeon opens up an artery that caused a heart attack, there is usually irreparable damage. But Dr. Billia is investigating whether the heart could be altered so that it's able to regenerate.

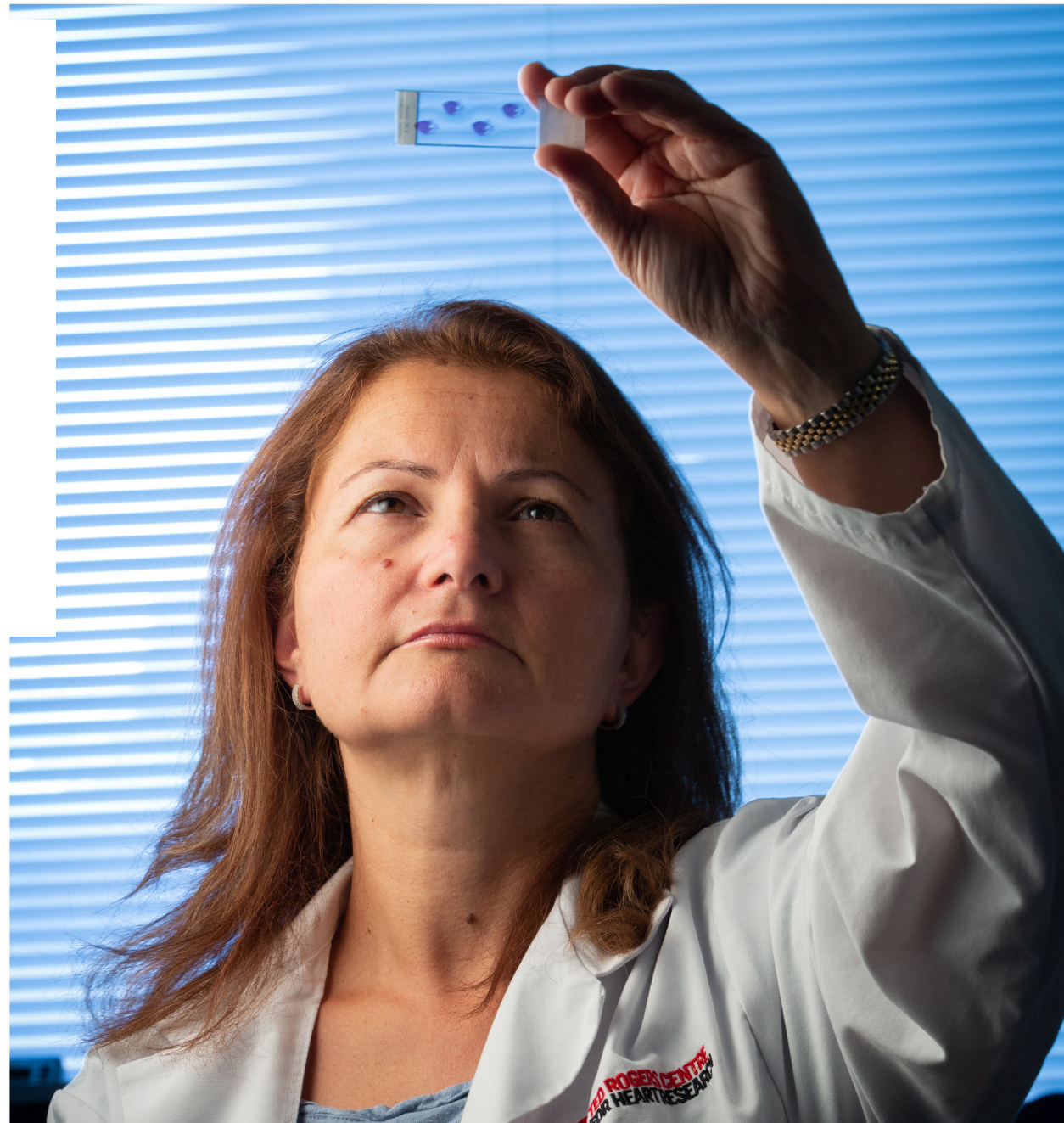
“If we could get viable heart tissue to repair the damage, then we could prevent heart failure in the kinds of patients I see all the time,” she says.

The key to a self-repairing heart may be delivering a drug that could induce neighbouring cells to reduce the damage, Dr. Billia explains. A heart cell's ability to regenerate is suppressed by natural “roadblocks,” so they are seeking a drug that can remove those roadblocks. Dr. Billia's team has figured out the molecular “signatures” in the early stages of what could drive this potential repair. They've also done modelling where they have removed certain genes from the mix, to see what changes.

The team is using cancer research as a model, says Dr. Billia, citing how some stem cell research investigates how to encourage healthy cells to replicate instead of cancerous ones.

“We're looking at how we can push the heart into ‘cell-cycle’ like that. The next stage is to use drugs to target whether we can induce repair after we open an artery,” she says.

“Really, no one else is doing what we're doing in the way that we're looking at regeneration [in cardiovascular research].”



Cardiologist Dr. Phyllis Billia is investigating whether the heart can be altered so it's able to regenerate.

Dr. Billia's work is very much in keeping with the spirit of the centre's founder and benefactor, the late Peter Munk.

“He was incredible – thoughtful and humble, yet quite visionary in terms of knowing what to focus on in offering his support. I consider him a man with a lot of foresight,” she says.

## AN ‘INCREDIBLE, EXCITING’ TIME IN RESEARCH

The Peter Munk Cardiac Centre treats some 163,000 patients a year, performing everything from routine examinations to the most complex surgeries and transplants. That's only part of the job though. While healing present-day patients, the centre is also keenly focused on looking ahead to the future of cardiovascular care.

The physicians and researchers at this world-class institution want to know why: Why are some people born with heart disease? Why do people develop aneurysms? Why do some patients recover from heart attacks while others do not? These researchers are seeking – and finding –new ways to prevent, treat and understand heart disease.

“We have multiple initiatives on the go,” says Dr. Barry Rubin, vascular surgeon and the Peter Munk Cardiac Centre's Medical Director and Chair. “It's an incredible, exciting time.”

The Peter Munk Cardiac Centre is well into what Dr. Rubin calls its Discovery Program – ongoing research and breakthroughs that go back more than 80 years at Toronto General Hospital and University Health Network, before the Peter Munk Cardiac Centre was established in 1993 through donations led by the late Peter Munk and his wife, Melanie.

For example, researchers are mapping single cells in unprecedented detail and exploring the potential of stem cells to support heart repair. They are using ever-more detailed imaging to treat patients with less intervention and more precision. And they're making strides in areas ranging from immunology to genetics.

This is the future of discovery at the Peter Munk Cardiac Centre and the world-class researchers who are driving it.

## PROBING THE MYSTERIES OF GENETICS

Could doctors predict who will develop heart disease and who will not?

While environment and lifestyle are always factors, some heart disease is genetic and inherited, says Dr. Raymond Kim, Scientific Lead of the Cardiac Genome Project at the Ted Rogers Centre for Heart Research, which spans the Peter Munk Cardiac Centre, The Hospital for Sick Children and the University of Toronto.

“Naturally, those families with a history of heart disease would want genetic testing for the one particular gene that may be the cause,” Dr. Kim says.

But up until about five years ago, that kind of genetic testing was not easily available because of a hefty cost. It would cost about \$1,000 per gene and take about three months for the results to come back. An unrealistic proposition, since there are upwards of 25,000 genes in the human genome.

“The breakthrough is that now, testing all 20,000–25,000 genes – not just one – costs just \$2,000 and takes about three months for everything,” Dr. Kim says. “It took 20 years and \$3-billion to map the human genome. Now we have terabytes of information.”

Dr. Kim says he and his team are now using that information, with the goal of finding out more about the relationship between genetic disorders and heart disease. Ultimately, those relationships could lead to doctors being able to gain more insight into who will develop heart disease in future.

The biggest obstacle to the next phase of this discovery breakthrough is not technology, Dr. Kim adds. “It's computational power, and our understanding of the actual biology of the genes.”

Despite the challenges ahead, Dr. Kim has high hopes

for his field.

“Heart disease has one of the highest yields for new discovery, so it's a good place to be,” he says.

## BREAKTHROUGH IN BRUGADA SYNDROME

We've all read the tragic stories about young people who've been struck down suddenly by heart-related events, before anyone knew there was a problem.

Brugada syndrome is a condition that can result in these kinds of tragedies. It's a potentially life-threatening heart rhythm disorder that affects one in 2,000 people and sometimes runs in families. People with the syndrome have an increased risk of abnormal heart rhythms from the lower chambers of the heart, and it's also associated with the risk of sudden arrhythmic death.

When it comes to disorders like this, finding a genetic link could be a crucial step in preventing sudden, life-threatening cardiac events. It's an area of study that Dr. Michael Gollob is passionate about.

Until recently, scientists thought that some 21 genes were connected to Brugada syndrome. But a new study, led by Dr. Gollob, a cardiologist and the Peter Munk Chair in Molecular Medicine, found that only one of these genes – the SCN5A gene – has a definitive association with the syndrome.

The study findings could dramatically alter how Brugada syndrome is

diagnosed and treated in the coming years.

“Remarkably, 20 of 21 genes previously believed to be causes for Brugada syndrome have been shown in our study to lack any evidence to support this belief,” says Dr. Gollob, who published the findings in June in *Circulation*, the journal of the American Heart Association. “This has huge implications to our approach of genetic testing and screening of patients and their families.”

Narrowing in on the exact cause of the condition is important, otherwise there's a risk that some patients may be misdiagnosed or receive unsuitable treatment due to inaccurate genetic diagnosis.

“The knowledge of genetics is important for families who have lost someone suddenly, or who have lost a child to heart disease,” he says.

## UNDERSTANDING ANEURYSMS

An aneurysm – which occurs when an artery wall is weakened and balloons out – can lead to a blood vessel or heart rupture and sudden death.

“If you have an aneurysm, there's a 50 per cent chance you'll be dead before you even reach the hospital,” says Dr. Clinton Robbins, scientist and the Peter Munk Chair in Complex Aortic Therapy.

Dr. Robbins is on the hunt for what causes these frequently fatal occurrences and how to prevent them, including how they might be triggered by cigarette

Scientist Dr. Clinton Robbins is on the hunt for what causes aortic aneurysms.





smoke. He says they know that the majority of aneurysms can't be explained by genetic predisposition, so they're looking at other risk factors, such as the development of plaque buildup in the arteries (atherosclerosis).

"There's a lot of anecdotal information, but we're trying to do better than that," says Dr. Robbins.

Making these kinds of connections could help scientists determine who is at risk for aneurysms and even help prevent them from happening.

Dr. Kong Teng Tan, interventional radiologist and division head of interventional radiology at the Peter Munk Cardiac Centre, says they are also looking at how to minimize invasive treatment for aneurysms.

"We're the largest centre for repair [of aneurysms] in Canada, but treatment can be complicated," he says.

Right now, aneurysms are most commonly treated with stents – tubes reinforced with wire mesh that are inserted into weakened blood vessels. That's current technology. In the future, Dr. Tan expects that his research will lead to smaller and smaller stents – and perhaps no stents at all.

"We've been using stents for years, but there are limits to what they can do. In five or six years, there will be better designs for stents, [but] we're looking at even finer technology. For example, we could use stem cells to rebuild blood vessels, instead of using a stent."

The idea is that blood would be taken from the patient and filtered. Once the specific "signalling factors" that stimulate circulation in the blood vessels were identified, they could be injected back into the patient to help rebuild the artery.

"There are already clinical trials underway," says Dr. Tan of this novel approach.

The centre also has new imaging equipment that will enable them to monitor how blood vessels are behaving, a great benefit to this sort of investigation, he adds.

"PET [positron emission tomography] scanners can let us see whether the stem cells that are injected are stimulating the blood vessels."

#### PREDICTING PATIENTS' CARDIOVASCULAR HEALTH

For Dr. Patrick Veit-Haibach, the future of discovery is in imaging biomarkers.

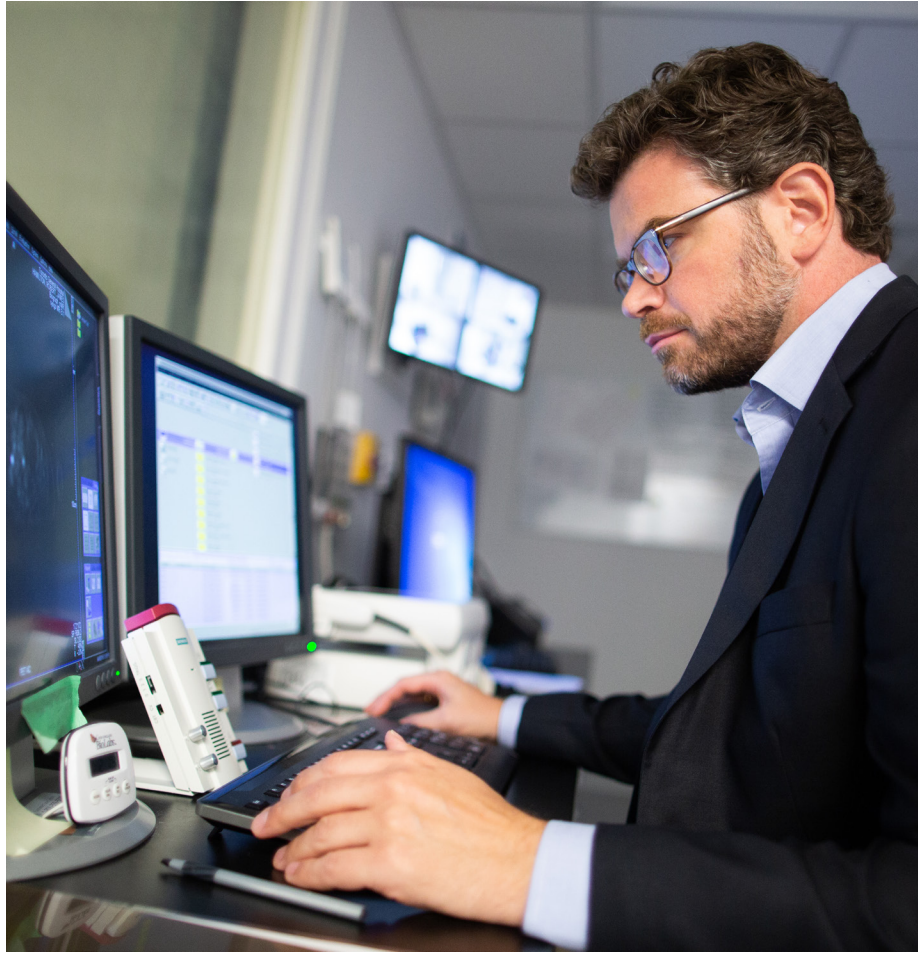
"In five years, I would hope that the projects we're working on will help us and patients make decisions on transplants and treatments," says Dr. Veit-Haibach, a radiologist and nuclear medicine physician who came to the Peter Munk Cardiac Centre from the University of Zurich in 2017. "For example, we could use imaging biomarkers to predict the success of a procedure, as well as when it is important to intervene earlier."

A biomarker is any measurable biological characteristic that can measure a disease state or bodily process. Researchers can use sophisticated imaging tools, such as the centre's cutting-edge PET-MRI (positron emission tomography-magnetic resonance imaging) scanner to identify biomarkers and measure disease activity.

Dr. Veit-Haibach is working on a number of complex projects that involve mapping the heart and how it functions. Ultimately, they all come down to answering simple questions: Why do certain things happen in the heart, and what can be done?

"We'll look at patients with treated cancer, for example, who also have shortness of breath," he says. "We want to try to figure out through imaging what the underlying reasons are. Perhaps it's cardiac dysfunction, perhaps lung hypertension."

Dr. Veit-Haibach and his co-researchers are also looking at the metabolism of heart attacks, using imaging to figure out why some patients who have heart attacks



Radiologist and nuclear medicine physician Dr. Patrick Veit-Haibach uses sophisticated imaging tools to map the heart.

Dr. Patrick Veit-Haibach, radiologist and nuclear medicine physician, the Peter Munk Cardiac Centre

might recover, while others don't survive or have limited recovery. "Another project is with patients [who have received] radiation therapy to the neck," Dr. Veit-Haibach adds. "Those patients are known to have higher risks for cardiovascular events; however, nobody knows the exact reason."

He and other experts suspect that the arteries supplying the brain are altered after the radiation therapy (also called radiotherapy).

PET-MRI scans can look at those vessels in astonishing detail, pinpointing areas of very subtle inflammation that were never detectable before.

"We can compare what we see to 'normal' vessels, because not all vessels [would have been] in the radiotherapy field. We hope to see biomarkers that will determine the difference," Dr. Veit-Haibach says.

The centre's infrastructure and funding enable Dr. Veit-Haibach to work toward the future of discovery with the confidence that there will be more breakthroughs. The PET-MRI equipment is a boon, and so is the positive atmosphere at the Peter Munk Cardiac Centre, he says.

"It's very collaborative," he says. "I have been in places where it's much more complicated." ▲

"In five years, I would hope that the projects we're working on will help us and patients make decisions on transplants and treatments."



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# In his own words

On September 19, 2017, just short of his 90th birthday, Peter Munk made history when he and his wife, Melanie, added to their transformational giving with a new \$100-million gift to the Peter Munk Cardiac Centre. It was the largest gift to a single Canadian hospital in the nation's history – a gift that will forever change the future of cardiovascular care in this country and around the world

Mr. Munk addressed the crowd at Toronto General Hospital to a standing ovation that day with his usual passion, sense of purpose and complete command of the audience. He talked about arriving in Canada as a refugee after the Second World War, the warm welcome he and his family received in this country, and why giving back was for him an attempt to repay his enormous debt to the nation. Here are some condensed and edited excerpts from his speech, giving us insight into why he chose to give, and give so much:



“You know, in life, few people are given real privileges. The ability to give, the ability to donate is truly a rare privilege.

When you thank me for what I've done for Toronto, when you thank me for what I can do for this community, it doesn't begin to express my immense gratitude for what this country has done for me and my family.

My first job was in southern Ontario on a tobacco farm, then as an engineer for Toronto Hydro – and at every job I worked with labourers who invited me to their homes... and would say, 'Make yourself at home, go to the fridge, eat what you wish.' Go to the fridge?! This after coming from a country where you had to save up a month to get a meal! Where people were dying on the streets for food! This was paradise delivered. From then on, in every step in my career – which has been long, boring and full of failures and successes – I felt that enormous desire to become more Canadian, to do more for Canada. The further I went, the more passionate I became.

If you are in the position to give away money, you've got the opportunity to give for education and for arts and for religion and for a million causes, from foreign aid to having more beautiful libraries, and they are all important. But does anything compare to human need? To the human quest for health?

If you want to pick one centre of excellence that can make Toronto and therefore Canada stand out in the world and prove we are number one, there is nothing better than [this] hospital. It's down the street from where I was educated, my grandfather was looked after and passed away here, and the Toronto General Hospital's origins make it an outstanding institution.... The satisfaction you get from being able to contribute to the excellence of health care is immense.

Let me tell you, this was a hell of a trip. When you are reaching 90, you can be allowed the luxury of leaning back a bit and starting to dream. My dream was always about trying to repay Canada.

The world needs more Canada, not less. And if my contribution to the Cardiac Centre, together with all of your contributions, helps achieve that by creating one more building block, one more testament to the world that Canada is indeed a country to follow, I've achieved my dream. And for that, I thank all of you, every one of you in this room. I don't care whether you clean the floor, or whether you're chairman of the bank or whether you run the biggest law firm. We are all together in this because it's the future of our country that will determine the future of your children's children. So thank you.”



## Creating a healthier tomorrow.

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.






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WHAT  
KNOWLEDGE  
CAN DO

Dr. Barry Rubin, Medical Director, Peter Munk Cardiac Centre