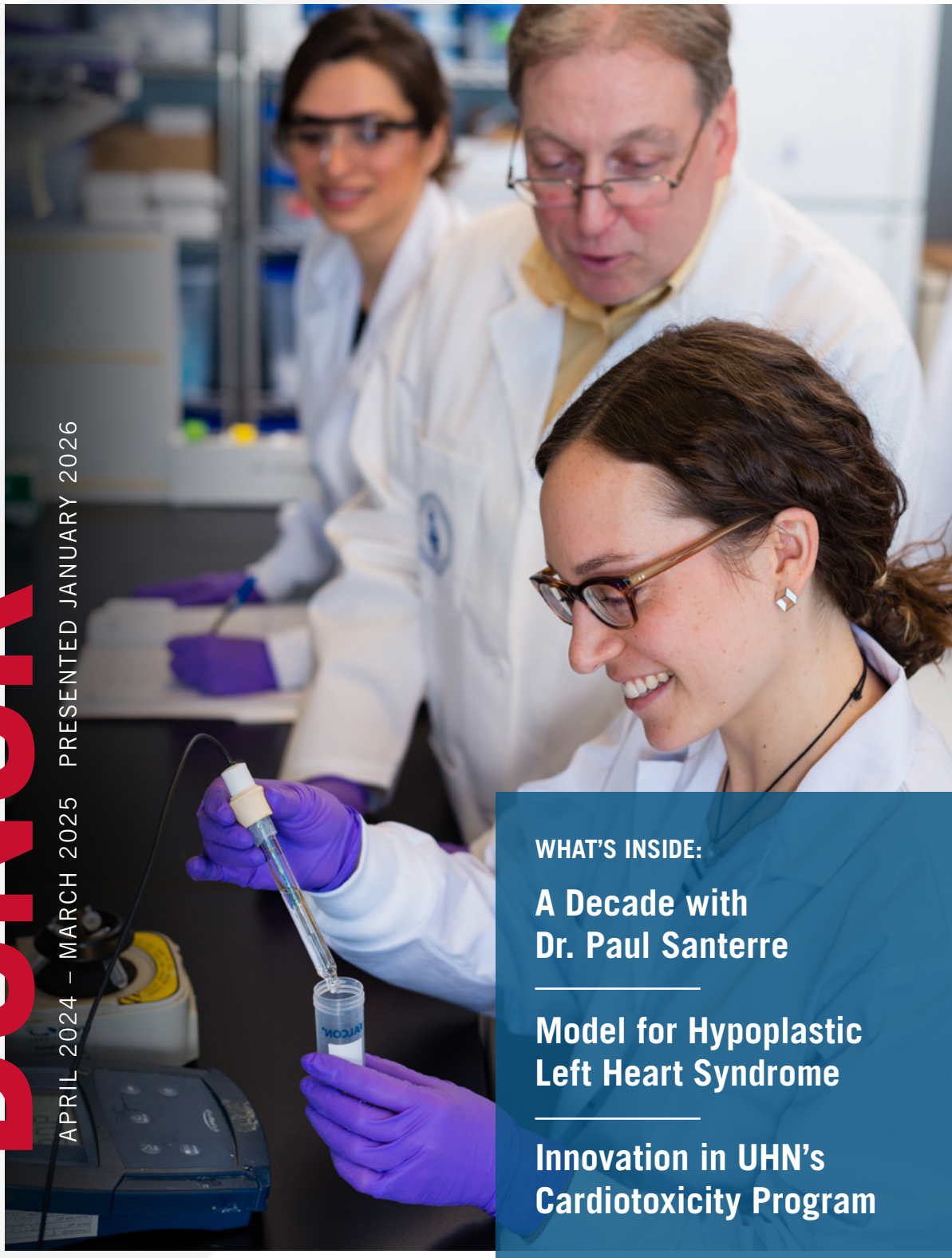
DONOR Stewardship Report

APRIL 2024 – MARCH 2025 PRESENTED JANUARY 2026



WHAT'S INSIDE:

A Decade with Dr. Paul Santerre

Model for Hypoplastic Left Heart Syndrome

Innovation in UHN's Cardiotoxicity Program

TED ROGERS CENTRE FOR HEART RESEARCH
10 years of Healthier Hearts

DONOR Stewardship Report

Table of Contents

5 Presidents' Message

7 Letter from the Executive Director

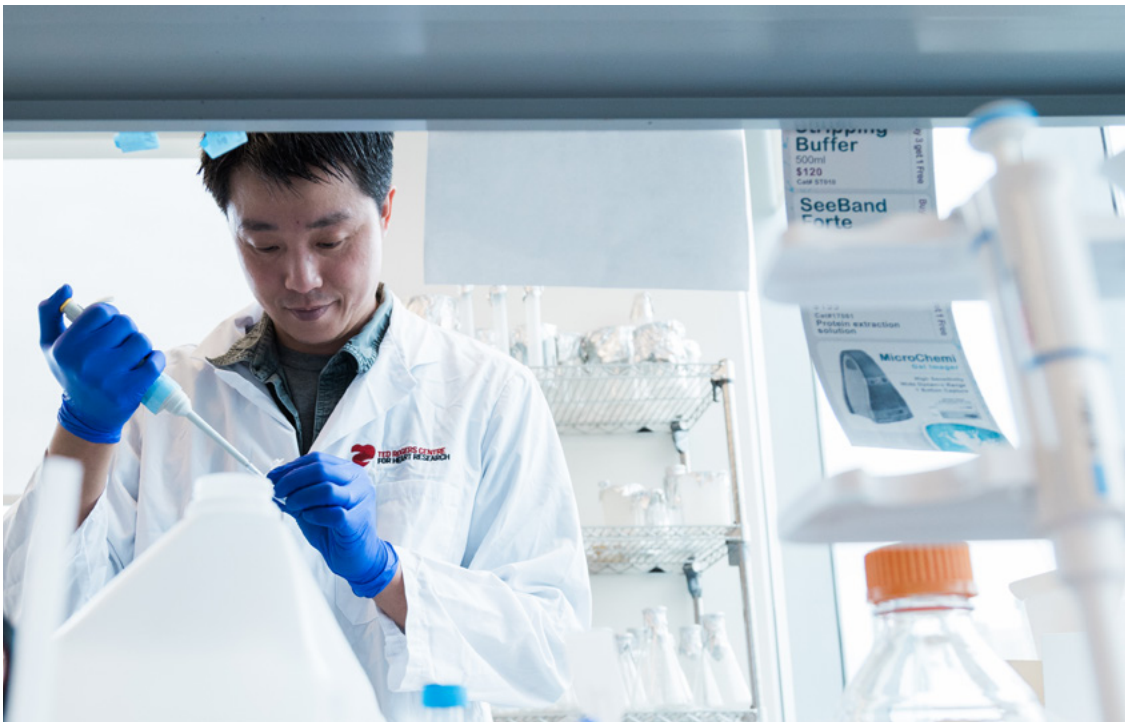
8 Strategic Goal 1: Foster and Promote Our World-Class Talent

10 **Feature Story** - Dr. Paul Santerre: A Decade of Collaboration and Innovation

14 Education Fund Award Recipients

18 Strategic Goal 2: Target the Causes and Progression of Heart Failure

22 **Feature Story** - Protecting Hearts: TRCHR Cardiotoxicity Program's Innovation in Cardio-Oncology



24 Strategic Goal 3: Create Precise and Predictive Digital Health Solutions

27 **Feature Story** - A New Model for Understanding Hypoplastic Left Heart Syndrome and Brain Health

30 Strategic Goal 4: Enable Equitable Access to High-Quality Person-Centred Care

32 Strategic Goal 5: Accelerate the Application of Discovery and Innovation

35 Community Awards

42 Research Productivity

45 Financial Reporting – Overview

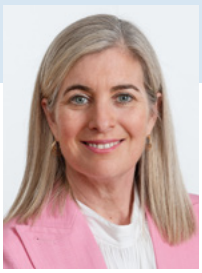


“The Ted Rogers Centre for Heart Research’s legacy as a global leader in the cardiac field is powering a future where fewer patients will succumb to heart failure.”

Presidents' Message







Dr. Ronald Cohn
President and CEO,
The Hospital for Sick Children

Dr. Kevin Smith
President and CEO,
University Health Network

Professor Melanie A. Woodin
President,
University of Toronto

We are honoured to present the 2024/25 impact report for the Ted Rogers Centre for Heart Research (TRCHR). These pages highlight the extraordinary impact made possible by your generosity over the past year and the past decade.

Thanks to your renewed commitment to 'Rogers 2.0' – the second phase of your landmark gift to advance precision cardiac care for children and adults across Canada and beyond – we are forging ahead towards our shared vision of transforming the future of heart health.

This past year saw many achievements that are improving health outcomes for those affected by heart disease. We are continuing to leverage the unique strengths of our three partner institutions – The Hospital for Sick Children, University Health Network and the University of Toronto – to create smarter, data-driven innovations that enhance the delivery of equitable, high-quality care.

At SickKids, Dr. Rajiv Chaturvedi, Rogers Innovator in Congenital Heart Disease, and his team are advancing transformative research into hypoplastic left heart syndrome (HLHS), a life-threatening congenital defect. Building on his ongoing work with the TRCHR, Dr. Chaturvedi has secured a grant from the Swiss National Science Foundation to develop a fetal lamb model of HLHS, aiming to pinpoint critical windows for intervention in affected pediatric patients.

At UHN, Dr. Paaladinesh Thavendiranathan's cardiotoxicity program is revolutionizing cancer survivorship care. By combining cutting-edge tools, like advanced imaging, biomarker profiling, and digital rehabilitation, the program enables earlier intervention, dramatically reducing long-term heart-failure risk in cancer patients. This work is setting a new global standard for proactive, precision cardio-oncology that ensures every survivor maintains lifelong heart health.

Moreover, U of T's Professor Craig Simmons and his team at TRCHR's Translational Biology and Engineering Program have overcome a major barrier in regenerative medicine. They have developed a specialized medium that helps lab-grown heart cells mature and function like adult cells, improving their integration into damaged heart tissue and enhancing the effectiveness of cell-based therapies.

We are so proud of all we are accomplishing together and the many scientific breakthroughs that lie ahead. The Ted Rogers Centre for Heart Research's legacy as a global leader in the cardiac field is powering a future where fewer patients will succumb to heart failure. We look forward to sustaining, advancing and expanding the centre's reach in the years to come.

DONOR Stewardship Report



Letter from the Executive Director
Dr. Mansoor Husain



Dr. Mansoor Husain

As we mark another year at the Ted Rogers Centre for Heart Research (TRCHR), I am deeply grateful for the collective efforts of our community of scientists, clinicians, trainees, and patient partners who continue to advance our mission and vision. Over the past year, this shared commitment has not only driven meaningful progress in cardiovascular discovery, but has also strengthened the impact of our partner institutions across research, education, and care.

Together, these collective efforts have contributed to the University of Toronto's position as Canada's top-ranked university, reinforced The Hospital for Sick Children's standing among North America's best pediatric hospitals, and supported the University Health Network's continued recognition as Canada's #1 research hospital. These achievements reflect the power of an integrated partnership where our collaboration strengthens and amplifies impact across each institution.

Building on last year's new format, we are pleased once again to highlight the achievements of our community and the collaborations unfolding across our partner institutions through the lens of our five strategic goals. Some of the 2024/25 milestones include:

Foster and Promote Our World-Class Talent

We are proud of the progress we have made building this community over the past ten years, boasting 185 trainees and 90 research staff across our programs. To date, we have awarded over $2.7M in funding through trainee scholarships, seed grants, and awards across the Centre.

Target the Causes and Progression of Heart Failure

Dr. Rebekah Jobling's work on *NOTCH1* variants has unveiled a spectrum of congenital heart and multisystem presentations, urging comprehensive clinical testing to improve family care. In addition, Dr. Michelle Bendeck's team has engineered N-cadherin–coated nanoparticles that, when delivered via balloon catheter, promote healthy vessel healing in preclinical models.

Create Precise & Predictive Digital Health Solutions

A precision robotic platform developed by Drs. Jason Maynes and Yu Sun enables high-speed, high-precision delivery of fluorescent tracers into beating heart muscle cell layers, identifying new therapeutic leads that may one day reduce the need for transplants for patients with Arrhythmogenic cardiomyopathy (ACM).

Enable Equitable Access to High-Quality, Person-Centred Care

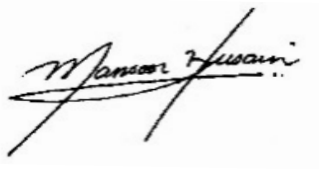
In partnership with the Weeneebayko Area Health Authority and TRANSFORM HF, Medly's remote-monitoring program developed by Dr. Heather Ross earned the Ontario Health Quality & Innovation Award for improving cardiac care in James and Hudson Bay communities and inspired an animated short that premiered at the Toronto Shorts International Film Festival.

Accelerating the Application of Discovery and Innovation

TRUE-HF (Ted Rogers Understanding of Exacerbations in Heart Failure) researchers have filed a patent for an algorithm that leverages Apple Watch™ metrics to detect early decompensation in heart failure, translating costly tests into accessible, scalable monitoring. Moreover, Dr. Cedric Manlhiot is leading a unified AI-powered analytics system for the SickKids Labatt Family Heart Centre, breaking down data silos to accelerate model development and clinical insights.

These are just a few of this year's achievements that reflect the unwavering dedication of the TRCHR community, and the true spirit of collaboration. With the Rogers Foundation's continued support, we will keep pushing scientific boundaries, translating innovations into equitable care models, and nurturing the next generation of cardiovascular leaders.

As we celebrate a decade of healthier hearts, we extend our deep gratitude for your ongoing support. We look forward to making extraordinary strides in cardiovascular research for the next decade – and more.



Dr. Mansoor Husain
Executive Director, Ted Rogers Centre for Heart Research
Professor of Medicine, University of Toronto



STRATEGIC GOAL 1

Foster and Promote Our World-Class Talent

Training, developing, and promoting a diverse leadership of scientists, cardiologists, and members of the TRCHR is at the core of the Centre's mission. Within this strategic goal, we strive to:

- Deliver coordinated training and mentorship programs that integrate with career pathways, and span disciplines and sectors
- Implement a recruitment strategy for trainees and faculty that embraces underrepresented groups to attract top talent from across the world
- Grow the Centre's international presence and engagement through existing faculty, trainees, patients, and alumni to amplify our knowledge translation strategies

STRATEGIC GOAL 1

Foster and Promote Our World-Class Talent



185

TRAINEES



90

RESEARCH STAFF



42M

AWARDED FOR FUNDING

(Internal and External Sources)



45

EVENTS



FEATURE STORY

Dr. Paul Santerre: A Decade of Collaboration and Innovation

CELEBRATING TEN YEARS OF COLLABORATION ACROSS U OF T, SICKKIDS, AND UHN AS DR. SANTERRE PREPARES TO RETIRE

When the Ted Rogers Centre for Heart Research (TRCHR) was officially established at the end of 2014, it was the combination of years of advocacy, a clear vision, and careful planning. Central to that effort was Dr. Paul Santerre. As a professor of Dentistry and Biomedical Engineering at the University of Toronto (U of T), he joined the task force assembled to champion the proposal that united The Hospital for Sick Children (SickKids), University Health Network (UHN), and U of T under the umbrella of heart failure research. As he approaches retirement, the Centre reflects on a decade defined by his innovative biomaterials research, his transformative leadership in entrepreneurship, and his global commitments to equitable health innovation.

Translational Biology & Engineering: Building Bridges Across Disciplines

Shortly after the Centre opened, under the joint efforts of Dr. Santerre and collaborators, led by Dr. Craig Simmons, the Translational Biology and Engineering Program (TBEP) was launched as a unique interdisciplinary incubator within TRCHR. Ten researchers from U of T and their graduate students from Engineering, Dentistry, and Medicine began working side-by-side in an open lab environment to accelerate clinical applications in genomic and regenerative medicine, tissue engineering, and advanced cardiac care. The development of this collaborative space laid the groundwork for numerous joint projects.

Dr. Santerre's grant funding and productivity tripled overnight from the richness and ease of collaboration that this unique environment provided, resulting in new intellectual property for cardiac nanomedicine, which has fuelled both Heart and Stroke Foundation and Canadian Institutes of Health Research (CIHR) funding with collaborative initiatives from the three TRCHR partner institutions.

Driving Innovation in Cardiac Care

Before the establishment of the Centre, Dr. Santerre was already reimagining how polymeric biomaterials interact with biological systems in the life sciences. His early work on surface-modifying macromolecules (SMMs) provided the first tools to tailor implant surfaces for controlled protein adsorption and minimal immune interference. This created a foundation that has contributed to several interventional devices used in today's cardiac care, including stent and balloon interventional cardiology, heart-valve technologies, cardiac catheters, and others.

Over the past ten years at TRCHR, his lab has advanced the concept of cell and blood contact interfaces in close collaboration with SickKids pediatric surgeons and Peter Munk Cardiac Centre's interventional cardiologists to develop biodegradable polyurethane scaffolds that guide new tissue formation from host cells. Collaborating with Drs. Jason Maynes and Mark Friedberg (SickKids) and Stefan Hofer (UHN), Santerre's team fine-tuned tissue scaffold stiffness, pore architecture, and degradation rates to match the dynamic conditions of natural valves, coronary arteries, and cardiac muscle. Early tissue engineering prototypes, tested in piglet models with Dr. Simmons (TBEP) and Dr. Maynes, have demonstrated excellent biocompatibility, while work with Drs. Gramolini, Bendeck, and Simmons (TBEP) along with Dr. Friedberg has yielded fully engineered blood vessels, generated using host fat-derived cells. The latter are now undergoing animal testing and could one day offer repair strategies to pulmonary and coronary arteries, where these diseased vessels are often early precursors to heart failure over the long-term.

Building on this immune-modulating biomaterial work, the Santerre lab has collaborated with Dr. Slava Epelman (UHN) to create nanofibers and nanoparticles that deliver anti-inflammatory and tissue-regenerating agents directly to injured heart muscle. In animal studies, these biomaterials show promise in promoting blood vessel growth into heart muscle, which is required to support heart muscle cell survival and regeneration.

These findings highlight that overcoming complex biomedical challenges depends on the integration of a diverse scientific expertise and clinical research – a testament to the power of collaboration.

Building the Health Innovation Hub (H2i) and Empowering Entrepreneurs

Beyond the bench, Dr. Santerre has been a firm advocate for translating discovery into real-world impact. In 2014, he co-founded the Health Innovation Hub (H2i) at U of T, a one-stop accelerator for health-tech entrepreneurs.

With a $3 million budget over ten years, H2i has supported 850 entrepreneurs, guiding them through hands-on workshops, mentorship, and access to prototyping facilities. Over this period, these ventures have collectively generated $660 million in revenue, proof of H2i's ability to turn early-stage ideas into thriving companies.

During Dr. Santerre's leadership, H2i has become a cornerstone to TRCHR's own entrepreneurship ecosystem, complementing the Entrepreneurship for Commercialization of Health Opportunities (ECHO) and ECHO Discovery programs. By connecting over 150 mentors with early-stage ventures, and directing more than $300,000 in pitch funding, he has helped catalyze start-ups exploring everything from remote-monitoring patches to fibrosis-reducing hydrogels. As Chair of TRCHR's Translational & Commercialization Committee (TCC), he continues to convene researchers and clinicians across U of T, SickKids, and UHN, ensuring promising innovations are on track to find the path from lab to patient.

Global Partnerships for Health Equity

In 2021, the success of H2i captured the Mastercard Foundation's attention, leading to an invitation for Dr. Santerre and his team to replicate their accelerator model across Africa. Today, eight new H2i-style hubs support ventures from 14 countries, and in just three years, 80 ventures have been trained, each tackling pressing public-health challenges in their own communities.

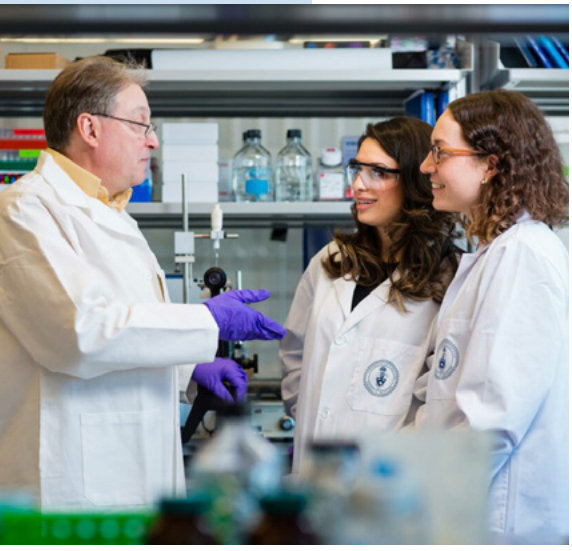
This work embodies Dr. Santerre's view that "true impact emerges when local problems are approached with the expertise and mindset of a global community that purposefully shares knowledge." By fostering international collaborations, H2i is contributing to the Centre's innovations to address real-world needs across the globe.

Shaping Leaders, Celebrating Excellence

Dr. Santerre's influence extends beyond patents and start-ups: he has shaped the careers of a generation of innovators. Over 100 graduate students, postdoctoral fellows, and clinical trainees have passed through his lab. His passion for entrepreneurship and emphasis on interdisciplinary research teamwork have inspired alumni now leading research groups across North America, Europe, and Africa.

His contributions to science and health entrepreneurship have earned him many prestigious honours and awards. He is a fellow of both the American Institute for Medical and Biological Engineering and the American Association for the Advancement of Science. He has also received the NSERC Synergy Award for technology transfer, a lifetime achievement award from both the Canadian and USA Biomaterials Societies, and the Governor General's Innovation Award, to name a few. His induction into McMaster University's Alumni Gallery in 2024 and honorary doctorate degree perfectly capped a career that began with a post-doctoral fellowship working on artificial-heart engineering at the University of Ottawa Heart Institute – a collaboration with the Salt Lake City team that developed and implanted the Jarvik heart in the mid-80's.

Each achievement reflects not only his hard work and dedication to collaboration, but also the sense of importance to bringing together engineers, clinicians, entrepreneurs, and community partners to solve pressing health challenges.



LOOKING FORWARD: SUSTAINING A LEGACY OF COLLABORATION

As Dr. Santerre embarks on a phased retirement in 2026, he leaves us with a clear call for the future of heart research: the importance of collaboration.

"The challenges ahead – developing regenerative patches, smart diagnostics, and AI-driven therapies – will demand even more meaningful collaboration among engineers, clinicians, and entrepreneurs. Our three institutions each bring unique strengths; and together, a tremendous force to transform heart care faster than ever, for everyone."

His retirement is a moment of reflection for the Centre and for U of T, SickKids, and UHN to carry on the essence of partnership that he helped instill. In celebrating Dr. Paul Santerre's ten-year journey with the Centre, we honour a legacy built on innovation and unwavering collaboration.



"The challenges ahead – developing regenerative patches, smart diagnostics, and AI-driven therapies – will demand even more meaningful collaboration among engineers, clinicians, and entrepreneurs. Our three institutions each bring unique strengths; and together, a tremendous force to transform heart care faster than ever, for everyone."

– Professor Paul Santerre

2024/25 **Education Fund Award Recipients**

Post-Doctoral Fellowship (4)

Trainee:	**Christopher Yu***
Project:	Multi-Centre Non-Inferiority Randomized Controlled Trial of STOPping Cardiac MEDications in Patients with Normalized Cancer Therapy Related Cardiac Dysfunction – The STOP-MED CTRCD Trial
Supervisor(s):	Dr. Paaladinesh Thavendiranathan
Institution(s):	UHN
Collaborator(s):	Raymond Kim, Husam Abdel-Qadir, Eitan Amir, Kate Hanneman, Steve Fan, Coleen Power
Trainee:	**Amin Motamed Ektesabi**
Project:	miRNA-based therapeutics for infection-associated left ventricular dysfunction
Supervisor(s):	Dr. Claudia Dos Santos
Institution(s):	U of T
Collaborator(s):	Howard Leong-Poi, Kim Connelly, Phyllis Billia
Trainee:	**Cristine Reitz**
Project:	Investigating the role of key membrane-shaping proteins in the formation and maturation of the cardiomyocyte sarco(endo)plasmic reticulum
Supervisor(s):	Dr. Anthony Gramolini
Institution(s):	U of T
Collaborator(s):	Michael Laflamme, Chris Yip
Trainee:	**Aleksandra Mitina**
Project:	Integrative multiomic analysis of tandem repeat expansions in congenital heart disease
Supervisor(s):	Dr. Ryan Yuen
Institution(s):	SickKids, U of T
Collaborator(s):	Erwin Oechslin, Seema Mital

*Applicant received renewal of Education Fund award.

PhD (10)

Trainee:	**Ting Xiong**
Project:	Medly Caretown: Building an Equitable Family-Centered Digital Health Intervention to Support Patient-Caregiver Dyads Living with Heart Failure
Supervisor(s):	Dr. Quynh Pham
Institution(s):	UHN
Collaborator(s):	Lindsay Jibb, Jill Cameron
Trainee:	**Coulter Montague**
Project:	Enhancing the Force Generation of Human Pluripotent Stem Cell-Derived Cardiomyocytes Using Genome Engineering
Supervisor(s):	Dr. Michael Alan Laflamme
Institution(s):	UHN
Collaborator(s):	Craig Simmons, Sara Vasconcelos, Christoph Haller, Kumaraswamy Nanthakumar, Michael Garton
Trainee:	**Crizza Ching***
Project:	Endothelial-derived extracellular vesicles: a new paradigm in cancer therapy-related cardiac dysfunction
Supervisor(s):	Dr. Jason Fish
Institution(s):	UHN
Collaborator(s):	Seema Mital, Milica Radisic, Paaladinesh Thavendiranathan, Elana Aikawa
Trainee:	**Doris Adao***
Project:	Investigating the role of miR-9-5p in hypercontractility using a human induced pluripotent stem cell cardiomyocyte model of hypertrophic cardiomyopathy
Supervisor(s):	Dr. Phyllis Billia
Institution(s):	UHN
Collaborator(s):	Craig Simmons
Trainee:	**Luxcia Kugathasan**
Project:	Cardioprotective responses to SGLT2 inhibition in patients at high cardiovascular risk
Supervisor(s):	Dr. David Cherney
Institution(s):	UHN, U of T
Collaborator(s):	Vikas Sridhar, Bruce Perkins, Yuliya Lytvyn, Julie Lovshin

*Applicant received renewal of Education Fund award.

Trainee:	**Kate MacQuarrie***
Project:	Endothelization and perfusion of a tubular D-PHI/PCNU vascular construct using patient-derived HAMVECs supported by VSMCs and monocytes
Supervisor(s):	Dr. Paul Santerre
Institution(s):	U of T
Collaborator(s):	Stefan Hofer, Anthony Gramolini, Michelle Bendeck, Craig Simmons, Mark Friedberg, Heyu Ni
Trainee:	**Megh Rathod***
Project:	Development of Accurate and Equitable Wearable Non-Invasive Optical Devices for Continuous Hemodynamic Monitoring
Supervisor(s):	Dr. Daniel Franklin
Institution(s):	U of T
Collaborator(s):	Daniel Franklin, Heather Ross
Trainee:	**Mimi Deng**
Project:	Evaluating the impact of extended warm ischemic time using ex-vivo heart perfusion in juvenile porcine models of circulatory death
Supervisor(s):	Dr. Osami Honjo
Institution(s):	SickKids
Collaborator(s):	Osami Honjo, Phyllis Billia
Trainee:	**Karem Abdul-Samad**
Project:	Novel Approaches to Enhancing the EHMRG for Mortality Risk Prediction in Acute Heart Failure
Supervisor(s):	Dr. Douglas S. Lee
Institution(s):	UHN
Collaborator(s):	Husam Abdel-Qadir, Chris McIntosh
Trainee:	**Zhiyue Zhu***
Project:	Fabrication and preclinical testing of engineered heart valve tissue
Supervisor(s):	Dr. Craig Simmons
Institution(s):	U of T
Collaborator(s):	Jason Maynes, Matteo Ponzoni

*Applicant received renewal of Education Fund award.


DREMEL



STRATEGIC GOAL 2

Target the Causes and Progression of Heart Failure

Addressing the causes and progression of heart failure is key to the mission of the TRCHR and is an integral part of each program and initiative. Within this strategic goal, we strive to:

- Identify the biological, social, and environmental factors contributing to the onset and development of heart failure
- Develop practical frameworks for precision diagnosis and staging, allowing for tailored treatments for individual patients
- Establish and refine models of heart failure to deepen our understanding of the disease and create new treatments aimed at prevention and reversal
- Ensure streamlined access to catalogued data sets, facilities, and resources for all partners involved in research

STRATEGIC GOAL 2

Target the Causes and Progression of Heart Failure



ADVANCING VASCULAR REPAIR WITH TARGETED PEPTIDE THERAPIES

Restenosis, which is the re-narrowing or blockage of blood vessels after procedures like angioplasty, remains a major challenge in cardiovascular care, particularly in patients with heart failure or diabetes. Dr. Michelle Bendeck and her team are working on a new approach to reduce this risk using targeted nanotechnology, a method that uses tiny particles to deliver therapeutic agents to specific cells, tissues, or organs within the body.

In recent work, the team developed nanoparticles coated with an adhesive molecule (N-cadherin peptide) designed to promote healthy vessel healing and prevent excessive cell growth that leads to restenosis. Delivered directly to the blood vessel wall using a balloon catheter, the nanoparticles stay confined within the location of injury and help modulate cell behaviour in real time. Preclinical studies have shown that this strategy significantly reduces restenosis while supporting endothelial recovery. This finding marks a potential breakthrough in minimally invasive cardiovascular therapies.

A champion of research translation, Dr. Bendeck led a winning team in the 2025 Entrepreneurship for Cardiovascular Health Opportunities (ECHO) Discovery Pitch Competition, showcasing a commercialization pathway for this technology.

IMMUNE CELLS POWER NEXT-GENERATION ENGINEERED HEART TISSUES

Dr. Slava Epelman, Loretta Rogers Chair in Immunobioengineering, continues to push the boundaries of cardiac tissue engineering with two major innovations that redefine the role of immune cells in heart development and regeneration.

In a study published in *Nature Cardiovascular Research*, Dr. Epelman's lab successfully integrated human immune cells, specifically primitive macrophages, into engineered heart tissues. These macrophages, derived from human embryonic stem cells, play a critical role in guiding cardiac development. Their presence in engineered microtissues enhanced the protein maturation of muscular contractile units (sarcomeres), increased contractile strength, and improved relaxation dynamics, bringing lab-grown heart tissue closer than ever to natural fetal heart muscle.

In a separate, collaborative study led by Dr. Milica Radisic's lab and published in *Cell Stem Cell*, researchers showed that macrophages also support long-term vascularization in human lab-grown heart models. This study, in which Dr. Epelman was a collaborator, showed that incorporating macrophages into these engineered models not only kept the tissues healthy, but also improved blood flow, reduced cell stress, and supported blood vessel growth and heart protection. These findings indicate a use for immune cells in heart repair and regeneration, suggesting new possibilities for therapies that prevent further damage and help the heart heal itself.

These studies reflect the uniquely collaborative research ecosystem within the TRCHR. By working across disciplines and laboratories, researchers like Dr. Epelman are building next-generation platforms to study heart development, model disease, and one day, regenerate damaged cardiac tissue.

PETER MUNK CARDIOVASCULAR BIOBANK IDENTIFIES EMERGING RISK FACTOR IN HEREDITARY HEART DISEASE

Supported by a Peter Munk Cardiac Centre Innovation Fund Precision Medicine Grant, Dr. Phyllis Billia, Ted Rogers and Family Chair in Heart Function, is leading *PREDICT-HF,* a cutting-edge initiative aimed at predicting disease progression in heart failure patients using molecular signatures and clinical data. Through *PREDICT-HF,* Dr. Billia's group continues to lead collaborative efforts that bring us closer to truly personalized heart failure care, where genetic and inflammatory profiles guide early intervention and improved outcomes.

In a study published in the *European Journal of Heart Failure*, Dr. Billia and her team uncovered a significant new risk factor in individuals living with hypertrophic cardiomyopathy (HCM): clonal hematopoiesis (CH), an age-related condition where blood cells develop mutations linked to inflammation and cardiovascular risk. The team of researchers analyzed biospecimens from 799 HCM patients enrolled in the Peter Munk Cardiovascular Biobank. They found that nearly one in four patients with gene mutations affecting the heart's mechanics also carried CH.

Importantly, HCM patients with CH had more severe symptoms, increased scar tissue on the heart muscle, and significantly higher rates of major adverse cardiovascular events – such as stroke, cardiac arrest, and death. The risk was particularly elevated among those with mutations in genes *DNMT3A*, *TET2*, and *ASXL1*. This group's increased cytokines and cardiac markers indicate inflammation that could drive disease severity. These findings mark a pivotal step in understanding HCM and point to CH as a critical biomarker for identifying patients who are at greater risk of serious complications.

UNCOVERING THE CELLULAR CHOREOGRAPHY BEHIND HEART DEVELOPMENT

Understanding how the heart forms in the earliest stages of life is essential to uncovering the root causes of congenital heart disease (CHD). New research from Dr. Rodrigo Fernandez-Gonzalez's lab is shedding some light on this process and revealing how cells coordinate their movement to form the developing heart.

In a recent study, Dr. Fernandez-Gonzalez and his team used high-resolution live imaging to observe how developing heart cells, called cardiac progenitor cells, move and organize in the embryo to form the heart tube, which is the foundational structure of the heart. Their work revealed that instead of a constant migration, cells move in a sequence of steps driven by internal contractile waves and supported by protein (actin) "cables" that perform like a cellular spine. Disruption of these mechanisms impaired the ability of cells to reach their destination, highlighting how accurate and harmonious these early movements must be.

By mapping these collective behaviours, the Fernandez-Gonzalez lab is building a detailed blueprint of how the heart first takes shape – work that could one day help identify the origins of congenital heart disease (CHD) and open new doors to early interventions.

SIMMONS LAB DRIVES COMMERCIALIZATION OF HEART CELL MATURATION TECHNOLOGY

A long-standing challenge in regenerative medicine has been maturing stem cell-derived heart muscle cells to resemble, more closely, their adult counterparts. Dr. Craig Simmons and his team at TBEP developed a new solution: a defined nutrient cocktail that significantly enhances the maturity of lab-grown heart muscle cells, known as induced pluripotent stem cell-derived cardiomyocytes (iPSC-CMs).

To bring this innovation beyond the lab, Dr. Simmons co-founded *boutIQ Solutions*, a TBEP and University of Toronto (U of T) spin-off company. Since winning the 2021 ECHO PITCH competition, boutIQ has secured over $1.5 million in non-dilutive funding, filed multiple patents, and in 2023, successfully licensed the medium to Axol Bioscience, a stem cell biotechnology company.

Now commercially available, the medium is being used worldwide to advance cardiac disease modeling and drug discovery. The Simmons lab is also expanding the approach to support cell therapy applications and sustainable technologies like lab-grown meat, demonstrating how innovations in heart research can drive impact across disciplines.

REVEALING THE FULL PICTURE OF A HIGH-RISK HEART GENE

In the largest study to date of its kind, Dr. Rebekah Jobling and her team at SickKids have uncovered new insights into *NOTCH1*, a gene previously linked to CHD and Adams-Oliver syndrome (AOS). The study evaluated 33 individuals across 11 families, all carrying damaging *NOTCH1* variants, and revealed a wide range of heart defects and related health issues.

While the most common heart defect was tetralogy of Fallot (a heart condition that makes it hard to get enough oxygen to the body because of four issues within the heart's structure), researchers also found left- and right-sided lesions, septal defects, and other abnormalities outside of the heart. Surprisingly, while only a small number of individuals met the full criteria for AOS, individuals presenting with apparently isolated CHD were found to have AOS-related health issues outside of the heart. This suggests that *NOTCH1*-related conditions exist along a broader spectrum than previously thought, and that *NOTCH1*-related disease cannot be clearly divided into AOS and isolated CHD.

This research supports broader clinical testing for *NOTCH1*, especially in families with inherited CHD, and highlights the importance of testing and comprehensive assessments, including imaging of the heart, brain, and eyes, for individuals with known variants.

By capturing the full picture of how *NOTCH1* affects the body, this work lays the foundation for improved diagnosis, monitoring, and care for families impacted by inherited heart conditions.

FRIEDBERG LAB UNCOVERS EARLY DRIVERS OF RIGHT VENTRICULAR FIBROSIS

Right ventricular (RV) fibrosis is a known contributor to RV dysfunction in conditions like pulmonary hypertension, yet the mechanisms driving this process need further understanding. Recent work led by Dr. Friedberg and his team sheds new light on how pressure overload affects the RV, using a mouse model to mimic conditions such as pulmonary hypertension. Their studies identified early fibrosis and structural remodeling as key contributors to RV dysfunction, even before major functional decline occurs. Importantly, their findings suggest that targeting fibrotic pathways (particularly the MRTF-A signaling pathway) at an early stage may help prevent or reduce RV deterioration in pressure-overloaded hearts.

Ongoing research is also exploring the therapeutic potential of induced pluripotent stem cell (iPSC)–derived treatments, which use adult cells reprogrammed into versatile stem cells that can become heart cells, to regenerate or stabilize RV function under chronic stress. They are also working with engineers who have created tiny particles to deliver special molecules to the heart. They discovered that these molecules, which help reduce scarring in the normal heart, are depleted in the RV of people with pulmonary hypertension. This growing body of work is helping to identify early interventions that could transform care for patients living with pulmonary hypertension and related conditions leading to right heart failure.



Dr. Raymond Kim and Dr. Rebekah Jobling of the SickKids Cardiac Genome Clinic



Photo credit: Tim Fraser

FEATURE STORY

Protecting Hearts: TRCHR Cardiotoxicity Program's Innovation in Cardio-Oncology

In 2017, Dr. Paaladinesh Thavendiranathan was appointed to lead the TRCHR's new Cardiotoxicity Program at the Peter Munk Cardiac Centre. His program set out to tackle a pressing challenge: how to detect, prevent, and treat early cardiac injury in cancer patients so that survivors not only beat their disease but also maintain lifelong heart health. The program has grown rapidly over the past 8 years to now include 5 dedicated cardiologists (including Drs. Husam Abdel-Qadir, Fernando Rivera-Theurel, Amna Zafar, Christopher Yu) and one Nurse Practitioner (Coleen Power).

Since joining TRCHR, Dr. Thavendiranathan has quickly become a leader in the emerging field of precision cardio-oncology. He has published in top journals, shaped new Cardio-Oncology guidelines, led international committees and education programs, and forged national clinical trials all while collaborating across Centre initiatives such as TRANSFORM HF and the *Cardiovascular Remote Diagnostic & Monitoring Technologies for Health Equity* (CaRDM Eq) program. His leadership has transformed how cancer patients are monitored during their treatment at the Peter Munk Cardiac Centre, with early screening, ongoing monitoring, and precision health strategies coming together to protect their heart function or act early in cases of cardiac injury.

Early ECHO clues could help prevent heart failure in cancer survivors

Cancer therapies that save lives can also harm the heart, and standard echocardiograms may miss the earliest signs. As cancer survival rates continue to rise, so too does the need to address long-term side effects of treatment. In a recent publication in the *Journal of the American College of Cardiology (JACC): Cardiovascular Imaging*, Dr. Paaladinesh Thavendiranathan and his team highlight the importance of comprehensive echocardiographic assessments to detect early signs of cardiac injury in cancer patients.

The study shows that a limited approach to imaging can overlook key structural and functional changes in the heart – changes that, if identified early, could signal increased long-term risk of heart failure. Dr. Thavendiranathan's group makes the case for an expanded echocardiography protocol that looks beyond ejection fraction to assess tissue strain and diastolic function, and cardiac MRI-based detection of subtle heart muscle changes throughout the course of cancer therapy.

Reflecting on the impact of this study, Dr.Thavendiranathan remarked, "When we first expanded our echo protocol beyond

ejection fraction, I knew we were uncovering something powerful. Seeing significant strain changes means we can intervene earlier and truly protect patients' hearts as they focus on fighting cancer." By helping to refine and standardize cardiac imaging protocols, Dr. Thavendiranathan's research is protecting hearts during and after cancer treatment.

Novel screening strategy helps protect hearts during cancer treatment

By the time heart function decreases, cardiotoxicity is often advanced and harder to reverse. In a recent study published in the *European Heart Journal*, Dr. Thavendiranathan and his team demonstrated preserved heart function during cancer therapy using a proactive, strain-based screening strategy.

The study evaluated the use of advanced echocardiographic strain imaging to detect subtle signs of cardiac injury before traditional measures, like ejection fraction, begin to decline. Patients flagged by this approach were started on cardioprotective therapies early, and were significantly less likely to experience worsening heart function.

This work provides compelling evidence for integrating strain-based screening into routine cancer care, offering a pathway to protect the heart without interrupting life-saving cancer treatment. By combining precision imaging with preventative care, this strategy marks a new chapter in protecting patients' long-term health, one heartbeat at a time.

Advancing cardiotoxicity care with biomarkers

Imaging alone cannot catch every at-risk patient. To address this, Dr. Thavendiranathan and collaborator Dr. Jason Fish have filed a patent for a novel combination of blood biomarkers that can help identify patients at risk of cardiotoxicity early in their cancer therapy. This innovation has the potential to guide more personalized monitoring and intervention strategies, minimizing long-term cardiac damage.

Empowering young cancer survivors to protect their hearts

Adolescent and young adult cancer survivors face decades of elevated heart-failure risk after therapy. With support from the Canadian Institutes of Health Research (CIHR) and the Canadian Cancer Society, TRCHR's Cardiotoxicity Program is leading a new clinical trial aimed at improving cardiovascular outcomes in adolescent and young adult cancer survivors.

The HIMALAYAS Trial *(Harmonized Interventions to Maintain health via Appropriate risk factor modification & Lifestyle changes in Adolescent & Young Adult cancer Survivors)* focuses on patients who show early signs of cardiac injury after their cancer therapy but have not yet developed symptoms. The study evaluates whether exercise-based rehabilitation, supported by wearable technology like Fitbit devices, can improve heart function, cardiopulmonary fitness, and improve quality of life. Early participants have shown improved strain measurements, greater exercise capacity, and higher quality-of-life scores after a 12-week program.

HIMALAYAS is one of the first precision cardio-oncology trials to marry lifestyle intervention with digital health, offering a new blueprint for long-term wellness in adolescent and young adult cancer survivors.

LOOKING AHEAD

Dr. Thavendiranathan's program has grown to include 5 cardiologists, 1 nurse practitioner, 2 research sonographers, 1 kinesiologist, 3 research coordinators, 2 active graduate students, 3 postdoctoral fellows, and several rotating clinical research trainees. To date, his program has trained over 30 highly qualified personnel, secured over $12 million in direct funding and has contributed to various other collaborative grants across cardio-oncology and digital health.

Building on this growth, the program has welcomed a new recruit: Dr. Christopher Yu, a clinician-scientist with an interest in artificial intelligence and cardiac imaging. Dr. Yu's work will focus on leveraging AI to enhance early detection and develop remote monitoring solutions that bring heart failure care directly to patients—no matter where they live.

Dr. Thavendiranathan reflected, "Looking ahead, our goal is to transform precision cardio-oncology from a centre of excellence into a global model of care. By combining these innovations with robust training and digital monitoring, we aim to ensure that every cancer survivor has the best chance at a strong, healthy heart."

Over the coming year, the team will validate the biomarker panel in a multicentre study, refine AI-enabled echo analytics for real-time risk scoring, and expand the HIMALAYAS Trial into additional provinces. The program will also continue to lead other CIHR-funded trials and will transform cardio-oncology care around the world. As a mentor in TRANSFORM HF and a key educator in CaRDM Eq, Dr. Thavendiranathan is training the next generation of cardio-oncology innovators—ensuring that every cancer survivor's heartbeat remains strong.



STRATEGIC GOAL 3

Create Precise and Predictive Digital Health Solutions

Advancing personalized healthcare through innovative technologies and data integration is the core focus of our third strategic pillar. In line with this objective, we are committed to:

- Developing wearable sensors for both pediatric and adult patients to enable personalized care
- Refining predictive algorithms for risk stratification and management
- Deploying person-centered diagnostic and therapeutic innovations
- Facilitating streamlined access to comprehensive data sets, facilities, and resources across all partners to support and enhance research efforts

STRATEGIC GOAL 3

Create Precise and Predictive Digital Health Solutions



ROBOTIC BREAKTHROUGH OFFERS NEW HOPE FOR ARRHYTHMOGENIC CARDIOMYOPATHY

Arrhythmogenic cardiomyopathy (ACM) is a life-threatening inherited condition and one of the leading causes of sudden cardiac death in young adults. For patients with severe forms of ACM, heart transplantation has long been the only definitive therapeutic option. However, new research led by Dr. Jason Maynes at The Hospital for Sick Children (SickKids) and Dr. Yu Sun at the University of Toronto's Robotics Institute is changing that outlook.

In an innovative study, the team developed a precision robotic platform capable of injecting fluorescent tracing molecules into functional, beating cardiomyocyte layers, using the system to screen the effects of therapeutic drug candidates at once. Traditional methods struggle with the dynamic motion of these cells, but this new system, which features a tiny robotic arm and 3D imaging, enables high-speed, high-precision delivery without damaging the cells.

Already, the team has identified promising therapeutic leads that may one day eliminate the need for heart transplants in ACM patients. Beyond ACM, this platform has the potential to revolutionize drug discovery for a wide range of cardiovascular conditions, bringing personalized, less invasive treatments closer to reality.

DIGITALLY ENABLED CARE PATHWAY EXPANDS TO GENERAL INTERNAL MEDICINE

Building on the success of the Medly remote management program in cardiology, a new digitally enabled care pathway has launched in the General Internal Medicine (GIM) program at Toronto Western Hospital. Developed by the University Health Network (UHN) team with support from the Ted Rogers Centre for Heart Research, this pathway brings Medly's proven benefits, including real-time patient monitoring, tailored treatment adjustments, and reduced hospitalizations, to a broader population of patients with complex, chronic conditions.

Patients admitted to GIM with heart failure can now be enrolled in the Medly program prior to discharge, allowing their care teams to remotely monitor symptoms, track daily health data, and adjust treatments as needed. A successful pilot in winter 2025 saw nearly 40 patients enrolled in three months. The initiative not only helps decrease the number of readmissions, it also empowers patients to take an active role in managing their own health at home.

This expansion marks an important milestone in bringing person-centered, technological care to more patients across UHN, and represents another step forward in achieving the Centre's goal of delivering equitable, high-quality care through innovation.

HARNESSING MACHINE LEARNING TO PREDICT HOSPITAL READMISSIONS

Hospital readmissions are a major challenge for patients with heart failure and can often lead to worse outcomes and health-associated costs. With support from a Heart & Stroke Foundation Grant-in-Aid, researchers have launched the PROBE-ML study (Predicting Readmission Outcomes using Biostatistical Evaluation and Machine Learning) to better understand and anticipate which patients are most at risk of readmission after a hospital stay.

This study, led by Dr. Douglas Lee, Ted Rogers Chair in Heart Function Outcomes, and researchers across UHN and partner institutions, is using advanced machine learning algorithms and clinical data to create more accurate prediction tools for early intervention. By identifying high-risk patients before discharge, the PROBE-ML model aims to support more personalized, proactive care plans and reduce preventable readmissions.

PROBE-ML is part of a growing suite of precision tools supported by the Ted Rogers Centre for Heart Research that are transforming how we deliver care by making it smarter, more responsive, and tailored to each patient's unique needs.





FEATURE STORY

A New Model for Understanding Hypoplastic Left Heart Syndrome and Brain Health

Professor Rajiv Chaturvedi is a Paediatric Interventional Cardiologist and Section Head of the Cardiac Catheterization Laboratory of The Hospital for Sick Children (SickKids). He joined the TRCHR in 2019, as the Rogers Innovator in Congenital Heart Disease at the SickKids' Cardiac Genome Clinic (CGC). Led by Drs. Raymond Kim and Rebekah Jobling, the CGC is a multidisciplinary team of medical geneticists, clinicians, researchers, and bioinformaticians who perform genome sequencing and deep phenotyping to identify the genetic causes of congenital heart diseases (CHD).

Leveraging the clinic's strengths in genetics and pharmacogenomics, Prof. Chaturvedi focuses his research on how congenital heart defects shape development before and immediately after birth. In 2023, his team developed an in vivo animal model system that mirrors human physiology, creating a perinatal fetal lamb model of hypoplastic left heart syndrome (HLHS), a congenital defect characterized by the underdevelopment of left heart structures.

The Critical Window: Heart Development in Utero

"I first met a smiling, slightly blue neonate years ago," Prof. Chaturvedi reflected, "Seventeen years later, that child is in our ICU after their fifth open-heart operation, yelling 'I'm not a baby!' at the nurses. They can't wait to get back to independence, friends, and life."

The child's left ventricle, the heart's main pumping chamber, is too small to circulate adequate blood to the body. Reconstructive surgery for HLHS can rearrange the circulation to enable survival, but currently about 50% of children born with HLHS reach 18 years of age while still facing overt or incipient heart failure and multiple medical morbidities.

In many severe forms of CHD, cardiac development looks chaotic: chambers are misplaced, valves fail, and vessel connections are abnormal. HLHS is different. The heart typically has four chambers and four valves, but the left-heart structures are small, almost as if they froze at different stages of growth (Figure 1). Left-heart flow is particularly vulnerable after the ventricular septum closes at 9.5 weeks gestation. During fetal life, oxygen-rich blood returns from the placenta and only about one-third of that flow passes through the left heart to the developing brain. A sustained reduction in this already limited left-heart flow may turn off the growth signals in the left ventricle and alter brain development. Understanding this mechanism reveals actionable windows when intervention may make the greatest difference.

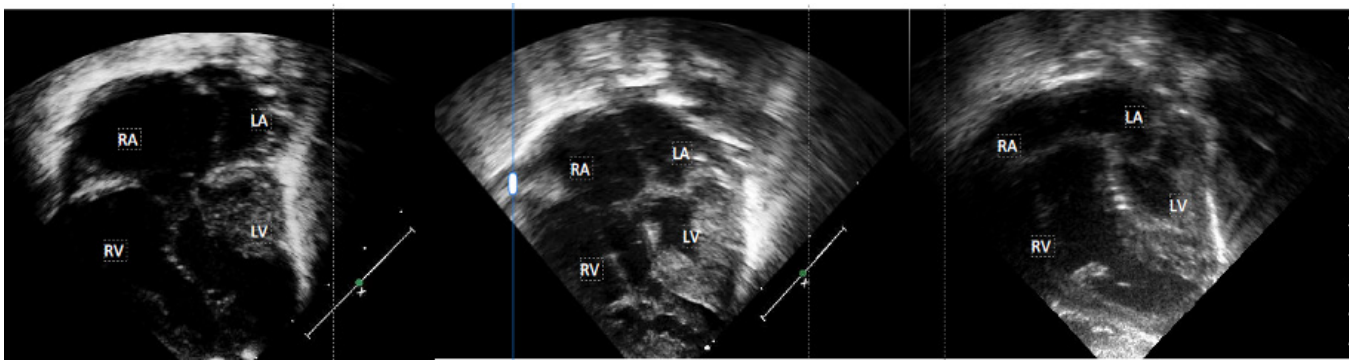


Figure 1. Three different hearts with HLHS. The left ventricle (LV) varies in size, it should be the same size as the right ventricle (RV). In these hearts, the RV is enlarged compared to normal. RA, right atrium; LA, left atrium.

Modeling HLHS in a Living System

Using the fetal lamb model, Prof. Chaturvedi and colleagues recently showed that a prolonged period of severely decreased left-heart flow produces left-heart growth failure and recreates the flow patterns seen in human fetuses with HLHS. Histology and genomic tests showed fewer heart muscle cells (cardiomyocytes), more fibroblasts, and signs of scarring. Because the heart grows before birth by making new cardiomyocytes and most of those cells stop dividing after birth, the team believes that missed growth in utero cannot be made up later, and scarring may block any "catch-up" growth by cardiomyocyte enlargement. These findings provide the biological rationale needed to test targeted therapies in the model.

These fetal lamb experiments were technically demanding and only feasible because of more than 15 years of experience with human fetal cardiac interventions in Toronto. The Toronto group, including Professor Mike Seed (SickKids), recently collaborated with Professor Walter Knirsch (Children's Hospital, Zurich) to recreate the fetal lamb HLHS model in Zurich and use Magnetic Resonance Imaging (MRI) to measure fetal blood flows and cardiac volumes. This work was combined with ex vivo, high-resolution MRI studies of how altered flows affect brain structure. The project has been awarded a Swiss National Foundation grant of CHF 1.1EU (approximately CAD 1.89M) to support the study for the next four years. This multi-year support will allow the team to test treatments that improve blood flow and, in turn, protect and improve brain development in infants with HLHS.

From the outset, this has been a novel, high-risk project supported by funding from SickKids and the Ted Rogers Centre for Heart Research. Without that steadfast encouragement, the model would not have reached a level of maturity sufficient to tackle clinically relevant problems. Prof. Chaturvedi expressed his hopes for the future: "We cannot offer children with HLHS anything tangible yet, but now we can move faster and evaluate novel therapies in the animal model before embarking on clinical trials in children."

LOOKING AHEAD

By combining his unique fetal lamb model with insights from other collaborative studies, and by bringing together diverse expertise in engineering, imaging science, and genetics, Prof. Chaturvedi is poised to drive forward innovations in diagnostics, surgery, and personalized care for patients born with complex heart conditions. His work not only exemplifies the importance of early heart and brain development but also informs the design of next-generation therapies and imaging techniques tailored for CHD patients.

With the Swiss-funded model now operational, Prof. Chaturvedi's team will evaluate treatments aimed at improving blood flow, potentially reducing the risk of brain injury. Through his collaborative spirit and innovative approach, Professor Rajiv Chaturvedi continues to chart a path toward healthier hearts and better life-long outcomes for the Centre's most vulnerable patients.



"We cannot offer children with HLHS anything tangible yet, but now we can move faster and evaluate novel therapies in the animal model before embarking on clinical trials in children."

– Professor Rajiv Chaturvedi



STRATEGIC GOAL 4

Enable Equitable Access to High-Quality Person-Centred Care

Enabling access to high-quality person-centered care is the focus of our fourth strategic pillar. Our aim is to ensure that everyone who needs care can receive it. We are committed to addressing disparities in heart failure care through collaboration, partnership, and co-creation. By 2027, we strive to:

- Form and deepen partnerships to better understand and tackle inequities in heart failure care
- Develop and implement new care models with input from the community, patients, and providers to enhance local capacity and access to quality care
- Build infrastructure to integrate equity into operations

STRATEGIC GOAL 4

Enable Equitable Access to High-Quality Person-Centred Care

AWARD-WINNING PARTNERSHIP IMPROVES CARDIAC CARE IN INDIGENOUS COMMUNITIES

The Medly digital therapeutic program has been adapted to serve First Nations communities in the James and Hudson Bay region through a unique partnership between Weeneebayko Area Health Authority (WAHA) and UHN. This WAHA/UHN Medly model of care won the 2024 Ontario Health System Quality & Innovation Award for Improved Indigenous Health. This honour celebrates the collaborative work bringing equitable, responsive cardiac care to remote communities in the James and Hudson Bay region where access to specialized services is limited.

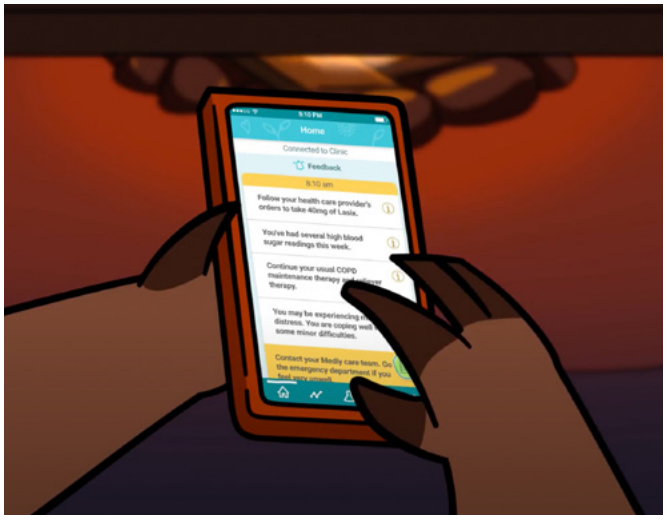
To help build understanding and foster trust, the collaborative team also co-created a short, animated film with community members and Indigenous artists, *Strengthening our Hearts through a River of Possibilities.* It highlights the importance of local context, of multifaceted definitions of heart health and how tools like Medly can support wellness close to home. The film premiered at the 2024 Toronto Shorts International Film Festival and has been shared across Northern Ontario.

$11.7 MILLION INVESTMENT FUELS INNOVATION IN PRECISION CHILD HEALTH AT SICKKIDS

This year, SickKids received a significant breakthrough in pediatric research with an $11.7M award from Genome Canada. As part of the Canadian Precision Health Initiative, a total of $81M in Government of Canada funding was awarded through Genome Canada to create a coordinated, large-scale, diverse genomic data asset of 100,000 genomes that reflects Canada's population.

With this investment, SickKids will sequence the genomes of 10,000 children and drive forward innovations that tailor treatments to a child's individual genetics, providing more effective and personalized care. This is an initiative that aligns closely with the TRCHR mission to transform cardiac care through precision medicine, data-driven approaches, and innovative research.

For children with heart disease, precision medicine holds transformative potential. This funding will allow SickKids researchers, through the TRCHR Cardiac Precision Medicine Program (Scientific lead, Seema Mital), and the TRCHR Cardiac Genome Clinic (Scientific lead, Raymond Kim) to improve their understanding of the genetic causes of pediatric cardiac conditions, accelerating the discovery of novel biomarkers and targeted therapies. By combining these insights with cardiovascular genomics and digital health, we are poised to create more predictive, preventative, and personalized interventions to improve the lives of children living with heart disease.



An animation from *Strengthening our Hearts through a River of Possibilities.*



STRATEGIC GOAL 5

Accelerate the Application of Discovery and Innovation

The final goal of the strategic framework aims to expedite the translation of research discoveries into practical applications. This goal prioritizes active engagement with patients and caregivers, effective knowledge mobilization, technology development, policy changes in health, and commercialization. To achieve this, we strive to:

- Develop a comprehensive roadmap for supporting and tracking projects through their various stages
- Strengthen external relationships and pathways for quicker implementation of innovations
- Foster a dynamic culture of co-development to ensure discoveries and innovations are accessible to our diverse community

STRATEGIC GOAL 5

Accelerate the Application of Discovery and Innovation

BUILDING A NEXT-GENERATION DATA PLATFORM FOR PEDIATRIC HEART CARE

Dr. Cedric Manlhiot, Rogers Innovator in Cardiovascular Precision Medicine, is leading the development of an innovative data integration and analytics platform for the SickKids Labatt Family Heart Centre. This new system will bring together clinical data from across hospital systems into a single, streamlined platform, making it easier for researchers and care teams to access the information they need, when they need it.

Aligned with the strategic priorities of the SickKids Heart Centre and the Rogers 2.0 vision to harness the power of AI and Big Data, the platform will support the training and validation of prediction and generative models and tools designed to improve care. By transforming how pediatric heart data is managed and analyzed, this initiative will enable faster clinical insights, strengthen research efforts, and ultimately improve outcomes for children living with heart disease.

WEARABLE TECH AND AI JOIN FORCES TO PREDICT HEART FAILURE EVENTS

In a powerful example of digital innovation in cardiovascular care, Dr. Heather Ross, Loretta A. Rogers Heart Function Chair, Drs. Yasbanoo Moayedi, Christopher McIntosh, and a team of researchers have filed a patent for a new algorithm that uses wearable technology, specifically Apple Watch data, to detect early signs of worsening heart failure by way of significant reductions in cardiopulmonary fitness capacity. This innovative system could help clinicians intervene sooner, preventing hospitalizations and improving patient outcomes.



The algorithm, developed as part of the Ted Rogers Understanding of Exacerbations in Heart Failure (TRUE-HF) study, was designed to analyze real-time physiological data from wearable sensors and predict a patient's cardiopulmonary fitness capacity. It takes what used to be an expensive, resource-intensive and time-consuming medical test and distills it down to a far more accessible and scalable smartwatch. The team recently published the first paper from the study in *Circulation: Heart Failure* that outlines how they've been collecting daily smartwatch data, like heart rate, step count, and variability, to offer valuable insights into a patient's clinical journey.

By combining machine learning, remote monitoring, and clinical expertise, this discovery represents a major step forward in the development of scalable, person-centered care models for heart failure. With continued validation, this tool could help transform how we monitor patients in real time, bringing precision heart health into the hands of patients and care teams alike.



INNOVATIVE STRATEGIES TO EXPAND THE DONOR POOL FOR INFANTS IN NEED OF HEART TRANSPLANTS

A third of infants on the heart transplant waitlist die while waiting due to a shortage of donors and a lack of suitable mechanical support devices. To help address this urgent gap, Dr. Osami Honjo and his team at SickKids developed Canada's first pediatric ex-vivo heart perfusion system, a technology that can resuscitate and assess donor hearts outside the body, including those from marginal or circulatory death.

Adding to this innovation, the team is now exploring how to enhance donor heart recovery using exenatide, a cardio-protective medication. In a recent preclinical study, exenatide-treated hearts showed better oxygen efficiency and reduced tissue damage, pointing to improved function and viability during transplant procedures.

Together, these breakthroughs have the potential to increase the number of donor hearts available for pediatric transplant in Canada, offering new hope to the youngest patients awaiting life-saving care.

Community Awards

This list is a non-exhaustive highlight of many of the awards and grants received by our TRCHR community members across 2024/25. Awards $100,000 and above were included.

Investigator Name:	**Dr. Aamir Jeewa**
Grant/Award Title:	A Randomized, Double-blind, Placebo-controlled Clinical Study to Evaluate Mavacamten in Adolescents (age 12 years to < 18 years) with Symptomatic Obstructive Hypertrophic Cardiomyopathy
Funding Agency:	Fortea Inc.
Total Amount Awarded:	$130,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Aamir Jeewa**
Grant/Award Title:	Precision medicine for RASopathies: from molecular mechanisms to allele-specific therapies
Funding Agency:	SickKids Foundation – PHCP Catalyst Grant
Total Amount Awarded:	$150,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Anthony Gramolini**
Grant/Award Title:	Pathological Mitochondrial Respiration in Single Ventricle Disease: The Role of Post-Translational Modifications
Funding Agency:	Heart & Stroke Foundation
Total Amount Awarded:	$250,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Anthony Gramolini**
Grant/Award Title:	The role of reticulon homology domain protein family members in the endo(sarco)plasmic formation and regulation
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$800,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Azadeh Yadollahi**
Grant/Award Title:	Novel algorithms and sensors for accessible and equitable monitoring of the respiratory system
Funding Agency:	NSERC
Total Amount Awarded:	$310,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Christopher McIntosh & Dr. Daniel Franklin**
Grant/Award Title:	Development of Convolutional Neural Network for Motion Artifact Mitigation in Wearable PPG Devices
Funding Agency:	U of T Data Sciences Institute + Tanenbaum Institute — Catalyst Grant
Total Amount Awarded:	$100,000
Grant/Award Type:	Research Grant

Investigator Name:	**Dr. Clint Robbins**
Grant/Award Title:	Notch Signaling Determines Regulatory Plasmocyte (PCreg) Maintenance and Expansion Across Species
Funding Agency:	Canadian Institutes of Health Research
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Craig Simmons & Dr. Lorraine Kalia**
Grant/Award Title:	Blood-Brain Barrier-on-a-chip for Parkinson's Disease Modelling and Therapeutic Testing
Funding Agency:	U of T Joint EMHSeed & XSeed
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Daniel Franklin**
Grant/Award Title:	Advancing Pulse Oximetry Accuracy and Equity through Wearable Spectroscopy Devices
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$875,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Daniel Franklin & Dr. Joseph Cafazzo**
Grant/Award Title:	Development of Smart-Ring and Medly Interface for Continuous, Remote, Vasomodulation Monitoring
Funding Agency:	TRCHR Innovation Award
Total Amount Awarded:	$100,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Douglas Lee**
Grant/Award Title:	BREATHe: B-type natriuretic peptides to reduce events and advance treatment in heart failure
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$660,000 over four years
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Hai Ling Cheng**
Grant/Award Title:	A Novel Targeted MRI Probe for Safe and Early Detection of Fibrosis
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$875,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Heather Ross**
Grant/Award Title:	CHF QBP Heart Failure Pathways at UHN, Sinai Health and Women's College
Funding Agency:	Ontario Health
Total Amount Awarded:	$250,000 over three years
Grant/Award Type:	Research Grant

Investigator Name:	**Dr. Heather Ross**
Grant/Award Title:	Leveraging a digital health platform to assess attitudes towards clinical trials
Funding Agency:	Astra Zeneca Canada Inc
Total Amount Awarded:	$420,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Heather Ross & Dr. Douglas Lee**
Grant/Award Title:	Early Initiation of Antiplatelet Therapy in Heart Transplantation - AERIAL International Trial
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$2.5M over six years
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Ian Scott**
Grant/Award Title:	Function of an antagonistic Gata5/Tbx1 regulatory loop in establishing the epigenetic framework for cardiopharyngeal development and disease
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$1M
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Joseph Cafazzo**
Grant/Award Title:	A Mobile, Smart device Based Telemonitoring for Pediatric Heart Failure, a Prospective Cohort Study
Funding Agency:	Boehringer Ingelheim Ltd
Total Amount Awarded:	$250,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Joseph Cafazzo**
Grant/Award Title:	MEDLY CRM: Co-Design of a Cardio-Renal-Metabolic Remote Patient Management for UHN
Funding Agency:	Boehringer Ingelheim Ltd
Total Amount Awarded:	$650,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Ka Chun Yuen**
Grant/Award Title:	Development of a tool for discovery and characterization of genome-wide tandem repeats from long-read sequencing data
Funding Agency:	U of T McLaughlin Centre
Total Amount Awarded:	$100,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Luc Mertens**
Grant/Award Title:	PHUR4Life Precision Health for patients with Univentricular HeaRts across the Lifespan (PHUR4Life)
Funding Agency:	Heart & Stroke Foundation
Total Amount Awarded:	$1M
Grant/Award Type:	Research Grant

Investigator Name:	**Dr. Mali Worme**
Grant/Award Title:	AED Access in the Weeneebayko Area
Funding Agency:	TRANSFORM HF – Collaboration Starter Grant
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Mark Friedberg**
Grant/Award Title:	How does the right heart fail under pressure?
Funding Agency:	Heart & Stroke Foundation
Total Amount Awarded:	$250,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Michelle Bendeck & Dr. Rodrigo Fernandez-Gonzalez**
Grant/Award Title:	4D Quantitative Cardiovascular Physiology Centre
Funding Agency:	Ontario Research Fund — Research Excellence
Total Amount Awarded:	$1.5M
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Osami Honjo & Dr. Mansoor Husain**
Grant/Award Title:	Reducing the risk of complex pediatric cardiac surgery through metabolic modulation
Funding Agency:	Heart & Stroke Foundation
Total Amount Awarded:	$300,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Paaladinesh Thavendiranathan & Dr. Jason Fish**
Grant/Award Title:	Tumour-dependent mechanisms of cardiotoxicity during cancer therapy
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$1.1M over five years
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Paul Santerre**
Grant/Award Title:	Advancing Polar/hydrophic/ionomeric polyurethane nano-constructs
Funding Agency:	NSERC
Total Amount Awarded:	$300,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Paul Santerre**
Grant/Award Title:	Mitochondrial Dysfunction in Cyanotic Heart Disease: From Discovery to Mechanism to Personalized Medicine
Funding Agency:	Heart & Stroke Foundation Grant-in-Aid
Grant/Award Type:	Research Grant

Investigator Name:	**Dr. Phyllis Billia & Dr. Anthony Gramolini**
Grant/Award Title:	Cardiac tissue and plasma proteomics to identify biomarkers predicting right ventricular failure
Funding Agency:	Seer Biotechnology
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Philis Billia & Dr. Hai Ling Chengi**
Grant/Award Title:	A Non-Gadolinium Fibrosis-Targeting MRI Contrast Agent
Funding Agency:	U of T Joint EMHSeed & XSeed
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Quynh Pham**
Grant/Award Title:	The Cadre App: Experience-Based Co-Design and Feasibility Evaluation of a Digital Health Intervention to Support Cardiac Arrest Survivorship
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$960,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Quynh Pham**
Grant/Award Title:	TMedly CHAT: Scaling heart failure remote patient management for afterhours care with an AI nurse chatbot
Funding Agency:	University of Toronto
Total Amount Awarded:	$120,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Rachel Dawn Vanderlaan**
Grant/Award Title:	Pulmonary Vein Stenosis: Mechanistic Insights Through Genomic Studies
Funding Agency:	The Thoracic Surgery Foundation
Total Amount Awarded:	$240,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Robin Hayeems & Dr. Wendy Ungar**
Grant/Award Title:	A Canadian knowledge-to-action roadmap for evidence-informed implementation of first-tier clinical genome-wide sequencing for rare disease (K2A-RD)
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$600,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Sahr Wali**
Grant/Award Title:	Bridging our worldviews: Using reflexive innovation strategies to transform culturally safe cardiovascular care with underserved communities in Ontario
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$800,000
Grant/Award Type:	Research Grant

Investigator Name:	**Dr. Sahr Wali**
Grant/Award Title:	Rivers of Plenty: Enabling Heart Healthy Eating in the James and Hudson Bay Region
Funding Agency:	University of Toronto, Connaught Fund
Total Amount Awarded:	$100,000
Grant/Award Type:	Research Grant
Investigator Name:	**Drs. Seema Mital, Rafik Tadros, & Andrew Krahn**
Grant/Award Title:	2023-26 Canadian Heart Function Alliance (CIHR) Award, Canadian Cardiomyopathy Collaborative (C3)
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$300,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Slava Epelman**
Grant/Award Title:	Differential type I interferon responses drive sex-specific vulnerability to viral myocarditis
Funding Agency:	Canadian Institutes of Health Research
Total Amount Awarded:	$900,000
Grant/Award Type:	Research Grant
Investigator Name:	**Dr. Stephen Scherer**
Grant/Award Title:	Precision Child Health - Comprehensive sequencing for childhood life-long disorders
Funding Agency:	Genome Canada
Total Amount Awarded:	$8.4M
Grant/Award Type:	Research Grant





Research Productivity: 2020-2024

106

RESEARCHERS AT THE TED ROGERS CENTRE FOR HEART RESEARCH PUBLISHED



549
IN TOP JOURNAL (IMPACT FACTOR: >10)



866
IN HIGHER IMPACT JOURNALS (IMPACT FACTOR: 5-10)

2,745
PEER-REVIEWED JOURNAL ARTICLES AND REVIEWS

63
CONFERENCE PAPERS



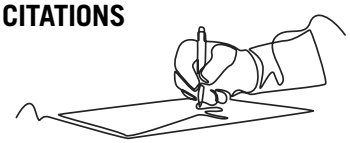
2,808 PUBLICATIONS

~5
AVERAGE PAPERS PER RESEARCHER PER YEAR

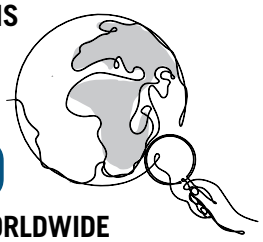


FIRST OR LAST AUTHOR ON
>40%
OF PUBLICATIONS

65,678
CITATIONS



21%
OF PUBLICATIONS WERE IN THE



TOP 10
MOST CITED WORLDWIDE

Productivity and Impact

MEASURING RESEARCH PRODUCTIVITY AND IMPACT

Common measures of productivity and impact for a research centre include a) the number of publications produced and b) the frequency with which these publications are referenced or cited by other researchers. The following seven metrics build upon these measures and provide insight into the Centre's productivity and impact over the past five years (2020-2024).

METRICS

a. Number of researchers

The Centre currently has 106 investigators, including 28 involved in discovery; 2 involved in personalized medicine and 36 involved in heart failure outcomes. 40 investigators were not classified with a theme.

b. Number of publications

Our researchers published a total of 2,808 publications during the five-year period (2020-2024) or nearly 5 papers per researcher per year. Articles, reviews, proceedings papers, indexed in Clarivate's Web of Science with a TRCHR researcher in the author list were included in this count.

c. Number of citations

The Centre's 2,808 publications generated 65,678 citations or over 20 citations per publication on average. This is 1.9x the number of citations of the average paper published globally in the same field and year. Citation metrics are from Clarivate's Web of Science and are current as of October 1, 2025.

d. Number of articles in:

i top journals and

ii higher Impact Factor journals

Journal Impact Factor (JIF) is a numerical score based on the citations of the journal that a paper is published in and has been traditionally used to assess a journal's impact on the research community. JIF is often used as a proxy for the importance of a journal to its field and can range from a high of over 500 to a low of less than 1.

In journals classified as Cardiac & Cardiovascular Systems in *Clarivate's SCIE Journal Citation Report*, journals in the top 10th percentile have a JIF > ~10 ("Top Journals") while journals ranked between the 10th and 30th percentile have a JIF of ~5-10 ("Higher Impact Journals")

i. Number of articles in top journals

Our researchers published 549 articles in journals with an impact factor greater than 10 during 2020-2024. This represents 20% of our total papers and includes papers in *CA-A Cancer Journals for Clinicians* (IF 508.7); Lancet (202.7); *New England Journal of Medicine* (IF 176.1).

ii. Number of articles in higher impact factor journals

Our researchers have published 866 articles in journals with an impact factor between 5-10. This represents 31% of our total papers and includes *Advanced Healthcare Materials* (IF 10.0); Cell Reports (IF 9.99); and *Cardiovascular Diabetology* (IF 9.95).

e. Highly cited publications

Of our 2,808 publications, 21% were in the top 10th percentile of the most cited publications world-wide.

f. Type of publications

The majority of our 2,808 publications were peer-reviewed journal articles or reviews (2,745). The remaining publications were conference papers (63).

g. Senior author publications

In addition, our researchers were either first or last author on 40% of the publications, indicating leadership and/or oversight of the related research.

DONOR Stewardship Report

