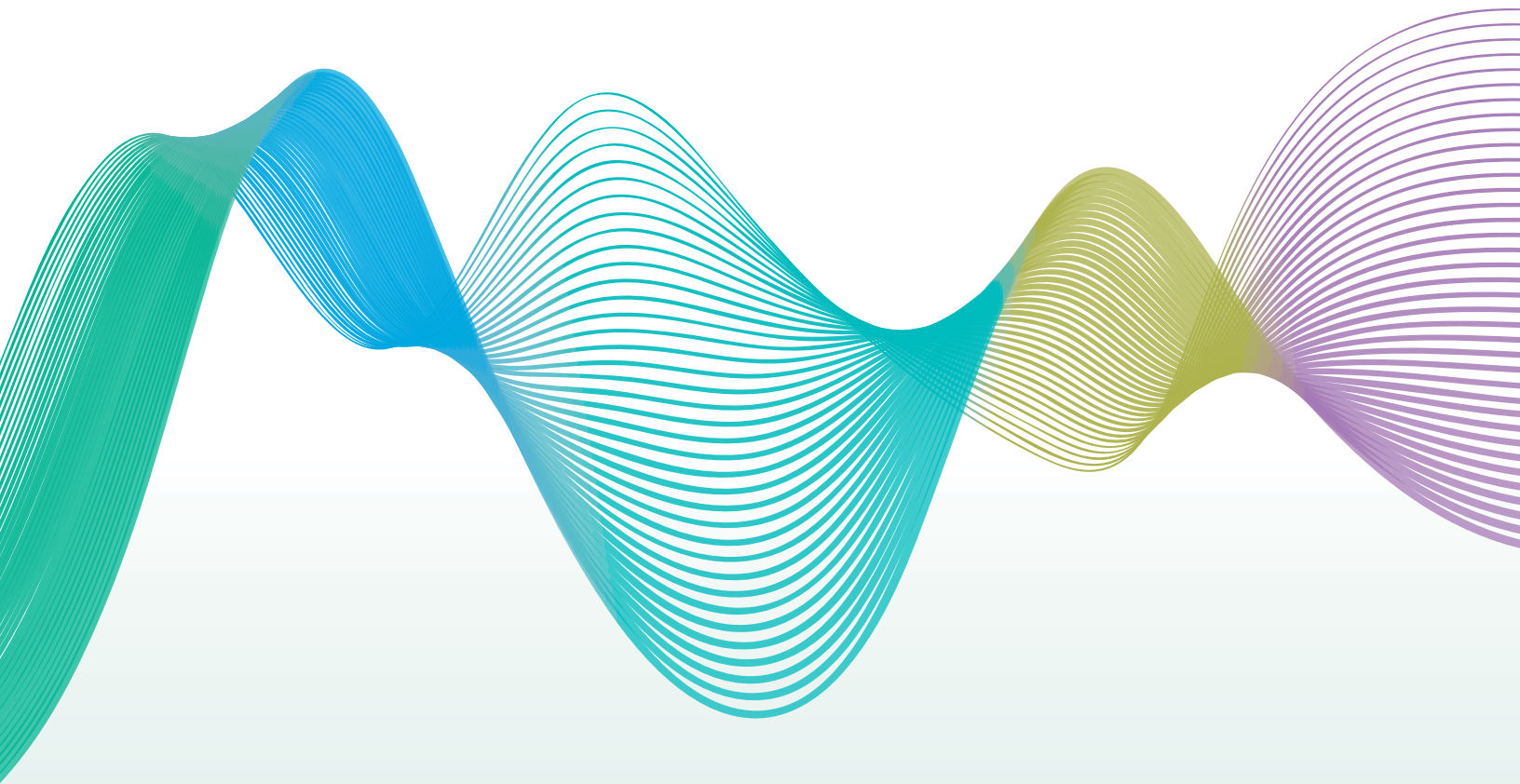


The
Research
Institute
of St. Joe's Hamilton



2019

Annual Report

Introduction

The Research Institute of St. Joe's – Hamilton oversees the work of over 700 researchers, staff members, learners, and fellows as they carry out clinical, translational, evaluative, and fundamental research. Our Hospital has a long and celebrated history of impactful research, which continues to improve diagnostics, care, and treatment for patients in our community and across the globe.



The Research Institute is a proud member of St. Joseph's Health System.

Since its inception in 2014, the Research Institute has become a leader in collaborative, translational research. Known as the bench-to-bedside approach, this innovative method of conducting research allows scientists working in our labs to make the latest advancements available to clinicians for patient care, all within the walls of our Hospital.

St. Joe's researchers are helping to improve patient quality of life and the quality of care provided by health care professionals. We are an integral partner within Hamilton's growing health innovation community, where we are working to transform the way medicine is practiced.

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@ResearchStJoes

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A word from Dr. Gail Martin

Executive Director, The Research Institute of St. Joe's – Hamilton

The
Research
Institute
of St. Joe's Hamilton



It has been a consistently exciting year for the Research Institute. We've recognized several major milestones, proudly disseminated landmark publications, and are looking towards a bold new initiative for increasing access to research studies for patients at St. Joe's.

Celebrating its fifth anniversary, the Peter Boris Centre for Addictions Research has experienced incredible growth since its launch, quickly becoming an international leader through its diverse, multidisciplinary research portfolio. The Centre has exceeded any of our expectations for its first 5 years. As well, the world-renowned Firestone Institute for Respiratory Health at St. Joe's celebrated an incredible 40 years of clinical and basic research excellence in respiratory medicine, showing no signs of slowing down. On the contrary – researchers in our Lungs & Chest program are ensuring the Firestone legacy continues, with international partnerships, state-of-the-art research infrastructure, and an exceptional mentoring tradition.

On April 1, 2019, we also recognized another milestone – the Research Institute's fifth anniversary. The move to become an independent research institution allowed us to secure new funding opportunities, paving the way for immense growth of our research enterprise. It has since allowed us to develop highly specialized services for our affiliates, including contract negotiation, information technology, financial management, quality assurance, and much more.

Our researchers have led large, multi-centre studies and published in high-impact journals. These projects have directly affected clinical care, shaping new standards that will help patients everywhere.

Research is constantly evolving, bringing new challenges and opportunities to the fore. To that end, our Hospital has made research and learning a key strategic priority. Our goal is to empower our researchers with the tools, knowledge, and support they need to cultivate excellence in discovery and innovation. I am thrilled to share this report, providing just a glimpse of the excitement that 2019 has meant for us.

A word from Dr. Jack Gauldie

Vice President, Research, St. Joseph's Healthcare Hamilton



St. Joe's is a teaching hospital, affiliated with the world-renowned McMaster University, where life-changing research and innovation benefits patients, where we educate the world's best and create a healthier community.

Under the leadership of our new president, Melissa Farrell, we launched our 5-year Strategic Plan in November 2019. This vision for the future of our Hospital has 4 pillars: Leading, Learning, Building, and Caring.

Key to the plan's Learning pillar is our goal of strengthening research leadership across the board, with a particular focus in mental health and addiction, urology, respiratory health, and Integrated Comprehensive Care. This pillar also speaks to our Hospital's commitment to our learners – medical residents and trainees, research students, post-doctoral fellows – St. Joe's academic ties are a key part of our success.

As part of our Strategic Plan, we will continue to be an industry leader in adopting new technologies to improve medicine. Big data and artificial intelligence are playing a key role as we move towards the future of digital health care.

St. Joe's is committed to excellence. Our researchers are dedicated to discovery. Together, we will continue to build internationally-recognized research that influences the provision of care for health care providers everywhere.

I hope that you will take some inspiration from the stories contained in these pages. They are just a small sample of the amazing work occurring at our Hospital throughout 2019 and beyond.

The French Connection: Forging new partnerships in neuroscience

“The Pasteur Institute is a world-renowned institution, and a full partnership would be very beneficial to all parties. Our efforts in collaborating closely with research units such as ‘Perception and Memory’ and ‘Microenvironment and Immunity’ led by Drs. Lledo and Eberl, respectively, are demonstrating to the Pasteur Institute that **St. Joe’s and McMaster are fully devoted to this partnership.**”

Dr. Florence Roulet

Manager of Franco-Canadian Relations for St. Joe’s and McMaster University

Mood disorders, such as depression and bipolar disorder, are common and frequently associated with disability. Nearly 1 in 5 adults will experience symptoms of a mood disorder at some point in their lives. These illnesses can have a profound effect on the mind and the body.

Dr. Flavio Kapczinski is a Professor in the Department of Psychiatry and Behavioural Neurosciences at McMaster University and a psychiatrist at St. Joseph’s Healthcare Hamilton. He studies the cellular and immunological aspects of mood disorders, including depression.

Dr. Kapczinski and his colleagues are pursuing research to explain why mood disorders are associated with accelerated aging and increased rates of mortality.

“There has been interest in the research community to identify the causes of why people with depression present with cognitive impairment, poor health, and higher risk of cardiovascular mortality,” says Dr. Kapczinski. “Our team at St. Joe’s has recently begun collaboration with the world-renowned Pasteur Institute in Paris, France, to understand more about the relationship of depression and poor health outcomes.”

To further study the cellular and immunological mechanisms related to depression and overall health, researchers at St. Joe’s and McMaster are creating a new Centre for Clinical Neuroscience – the first step towards the shared goal of a permanent partnership with the Pasteur Institute. A vital component to the creation of this Centre is a new wet lab, located at St. Joe’s West 5th campus.

In February 2019, representatives of the Pasteur Institute, McMaster University, and St. Joseph’s Healthcare Hamilton agreed to collaborate on neuroscience research, connecting leading French laboratories with St.



St. Joseph’s
Healthcare  Hamilton

McMaster
University 

Psychiatry &
Behavioural
Neurosciences



Researchers at St. Joe's hosted a French delegation and toured the new wet lab

Joe's clinical populations. In order to attain a full partnership with the Pasteur Institute, St. Joe's researchers have been branching out in collaboration with various French organizations. Plans for a resident exchange program between McMaster's Psychiatry Residency Program and Sainte-Anne Hospital in Paris are underway.

In addition, an agreement for a joint PhD program between McMaster and the Neurocampus at the University of Bordeaux in southern France is in development. The team is also developing open-access online courses with their French colleagues at the Pasteur Institute.

The French Embassy has been very helpful in facilitating these collaborations, notably by providing guidance and funds to support the various exchanges across the Atlantic. In addition to the budding research on the biology of mood disorders, these cooperative efforts are consolidating St. Joe's preeminence in the field of neuroscience.

St. Joe's new wet lab, which opened in 2019 at the West 5th Campus, features 4,059 ft² of research space available to investigators. Expanding St. Joe's capacity to conduct basic science bolsters the possibilities for collaboration and discovery.



Moral injury in servicewomen and female veterans

“The Research Institute recognizes the importance of nurturing the next generation of investigators. Our Studentship Awards support the work of graduate students as they undertake critical research projects and expand the state of knowledge in their respective fields.”

Dr. Gail Martin

Executive Director,
The Research Institute of St. Joe's

There are stress-inducing aspects of most occupations, and often the best remedy involves a little time off to rest. However, the circumstances of some career paths in particular may lead to greater psychological harm. For instance, those on active duty and veterans of the armed forces, emergency first-responders, and front-line medical staff all face unique demands and experiences in their workplace environments that may make them more susceptible to moral injury.

Moral injury is psychological distress that may arise in response to perpetrating, observing, or failing to prevent acts that violate one's deeply held moral codes. It may also arise from the perception of betrayal by a trusted figure, such as a commanding officer or fellow service members.

The experience of moral injury itself can be a normal human reaction to a traumatic event. However, the consequences of moral injury can include severe anxiety, major depressive disorder, post-traumatic stress disorder, and in extreme cases, suicide ideation. Thus, a greater understanding of moral injury will aid in the diagnosis and treatment of mental health disorders that may arise.

Evidence suggests that military members who have experienced potentially morally injurious events are more likely to develop mental health disorders as a result. Yet, there is a knowledge gap when it comes to the effects of moral injury among Canadian servicewomen and female veterans. Key details on the incidence, prevalence, knowledge of and access to care, and prevention of moral injury remain unknown within this population.

Bethany Easterbrook, a PhD student working under the supervision of Dr. Margaret McKinnon, aims to tackle this knowledge gap. She is conducting a research project that seeks to understand more about moral injury in Canadian servicewomen and female veterans. Previous work from Dr. McKinnon's lab has already pointed to important treatment targets, such as emotional regulation, that may reduce the mental health consequences of moral injury. However, these targets have yet to be precisely understood among a female service member population.





Bethany Easterbrook is pursuing a PhD in Neuroscience at McMaster University

Easterbrook's research project has support from multiple partnering institutions through the Homewood-McMaster Trauma Research Network, which includes St. Joseph's Healthcare Hamilton, Homewood Health in Guelph, and the Post-traumatic Stress Disorder Research Unit at Western University, London.

This resourceful network is bolstered by connections to further stakeholders, including the Canadian Institute for Military and Veterans Health Research (CIMVHR), Servicewomen's Salute, Veterans Affairs Canada, and Project Trauma. As well, Dr. McKinnon holds the Homewood-McMaster Research Chair in Mental Health and Trauma, which was established in 2018 to address the need for more translational research in post-traumatic stress disorder, and to explore how emotional trauma can have physical impacts on the brain. As a nexus of trauma research, working in McKinnon's lab will have a significant impact on Easterbrook's success.

To further support her work on moral injury, Easterbrook was the recipient of the 2019 Research Institute Studentship Award, a grant intended to bolster the work of graduate students studying under the supervision of a St. Joe's affiliated researcher.

"There is a need to investigate how potentially morally injurious events may be further complicated through intersections of gender. Much of the current literature focuses on the effects on moral injury among men, which while important, leaves many unanswered questions when it comes to women," says Easterbrook. "Just as the symptoms of a heart attack are different between men and women, there may be key differences when it comes to moral injury. Until we work to understand them, those differences will remain unknown."

Whose guideline is it anyway?

“Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.”

Dr. David Sackett
1934-2015

Professor and Pioneer in
Evidence-Based Medicine

Founder of the First Department of
Clinical Epidemiology in Canada
at McMaster University



Scientists and clinicians from all over the world are expanding medical knowledge and understanding of different diseases. They are making new discoveries through intensive research, engaging in peer review, and publishing in scientific journals. Their work can inform clinical practice guidelines that physicians, nurses, and other allied health professionals rely on for effective care – but who makes these guidelines, and how are they disseminated to the medical community? Perhaps more importantly – how is the evidence that supports new recommendations assessed?

In the health sciences, the term “evidence-based medicine” describes efforts to optimize medical decisions by emphasizing the best available evidence. Rigorous scientific techniques are employed to assess the certainty of evidence, including the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach, a global standard that was developed at McMaster University.

With the evolution of evidence-based medicine, clinical practice guidelines have changed dramatically over the last decade. Guidelines now require more time, resources, and expertise to produce. Fortunately, St. Joe’s is home to the Guidelines in Intensive Care, Development, and Evaluation (GUIDE) Group, comprised of an interdisciplinary team of physicians who are experts in guideline development and GRADE methodology. The GUIDE Group is co-chaired by Dr. Waleed Alhazzani and Dr. Emilie Belley-Côté, who each have extensive training from the Department of Health Research Methods, Evidence, and Impact at McMaster.

The GUIDE Group aims to advance the development of clinical practice guidelines in critical care medicine. The Group is working to improve the outcomes for critically-ill patients, to identify knowledge gaps in critical care and high priority clinical areas, and to mentor junior colleagues.

As leaders in evidence-based medicine, members of the GUIDE Group have contributed to dozens of clinical practice guidelines. These include updates for the management of pediatric and adult sepsis as part of the Surviving Sepsis Campaign, a joint effort between the Society of Critical



Dr. Alhazzani (left) hosted the Children Surviving Sepsis group in Hamilton

Care Medicine and the European Society of Intensive Care Medicine, of which Dr. Alhazzani was the Methods Chair. The Surviving Sepsis Campaign remains the most cited and read guideline in critical care medicine.

Through its work globally, the GUIDE Group has impacted patient care in areas including transfusion practices in the critically ill, optimization of the management of liver disease, use of non-invasive ventilation, organ donation, fever management, and toxicology. The Group has also built rapid practice guidelines, which are smaller updates to existing clinical practice guidelines. Since most guidelines are only updated every 3 to 5 years, rapid practice guidelines provide timely amendments to existing guidelines when new evidence impacting patient care becomes available.

“We are looking towards the future of health care delivery, including the enormous potential of digital knowledge translation and the use of machine learning to optimize patient outcomes,” says Dr. Alhazzani. “For example, we aim to use digital tools to enhance decision support for patients with life-threatening conditions, so that all factors that may affect the outcome – genetics, drug therapies, social and behavioural circumstances – are considered.”

By expanding the capability of existing digital tools, particularly with electronic medical record systems that have been adopted in hospitals across the globe, patient-tailored clinical guidelines are within reach. The GUIDE Group is working with partners at St. Joseph’s Healthcare Hamilton, Mohawk College, McMaster University, and other local health care stakeholders to build and implement clinical practice guideline recommendations into electronic medical records. This is an enormous task, but one with the potential to enhance patient care, tremendously.

Every day, the GUIDE Group is closer to its ultimate goal: improving patient care by generating rigorous and clinically relevant guidelines that lead to optimal clinical outcomes. **Learn more about the GUIDE Group at www.guidecanada.org**

Holding Steady: Limiting the progression of pulmonary fibrosis

“The INBUILD trial is arguably one of the most important and impactful studies of interstitial lung diseases in the last ten years. Hamilton is fortunate to have world-class clinical research of this sort happening right in our own backyard. It is a testament to the importance of the relationship between the Hospital and the University.”

Dr. Paul O’Byrne

Dean & Vice President,
Faculty of Health Sciences,
McMaster University



Melissa Sulpher and her husband have four children whose activities include baseball, hockey, ringette, and volleyball. Keeping up with active children can be difficult for many parents, but it is particularly challenging for Melissa because she is living with a complex airway disease.

Ten years ago, Melissa was diagnosed with pulmonary fibrosis (PF), one of several interstitial lung diseases characterized by scarring of the lung tissue between the alveoli – the air sacs of the lungs. This scarring makes it more difficult for oxygen to pass into the bloodstream. People affected by PF experience consistent shortness of breath, cough, fatigue, and general weakness. As the disease progresses, it may lead to further complications like hypoxia and pulmonary hypertension.

“My lungs aren’t strong enough to get me through daily activities anymore,” says Melissa. “Two years ago I could walk up the stairs and sort of keep going, and now I can’t. I have to pause. Running around with my kids is harder. They know there are things Mom just can’t do.”

Pharmacological treatments for PF are limited, and include corticosteroids to reduce inflammation. If the disease progresses far enough, a lung transplant may be necessary. Melissa’s doctors could only offer her medication to control her symptoms, but none that worked to slow the progression of the disease. Her condition was slowly worsening.

Melissa’s outlook began to change when she was referred to the Firestone Institute for Respiratory Health at St. Joe’s. There, she became a patient of Dr. Martin Kolb, an expert in the field of interstitial lung diseases.

At the time, Dr. Kolb was recruiting participants for the INBUILD trial, which was evaluating a drug called nintedanib used to slow the progression of interstitial lung diseases. Since nintedanib was not approved by Health Canada, it was only available through a clinical trial. Melissa decided to participate in the trial.



Melissa Sulpher and Dr. Kolb at St. Joe's Firestone Institute for Respiratory Health

“Our lungs are designed to have extra reserve, and I just don’t have that anymore. As much as I have limitations now, any more progression in my disease – each percentage I lose – is another limitation in my life,” says Melissa. “So I can assure you, it’s a very big deal and reason to celebrate if I can keep my lungs where they’re at right now.”



In September 2019, the results of the INBUILD trial were published in the *New England Journal of Medicine*. The findings indicate that nintedanib slowed lung capacity decline by over 50 percent compared to placebo. As a direct result of the INBUILD trial, Health Canada initiated an expedited review of nintedanib shortly after the study findings were published, and has since approved the drug for the treatment of interstitial lung diseases.

An incredible \$2 million gift from The Boris Family is enabling St. Joe's to recruit a new leader for Firestone, and will also create a new Institute for Chronic Lung Disease. This initiative is supported by the Hospital, Foundation, McMaster University, and multiple Canada Research Chairs. The new Institute will lead in all areas of lung disease research – respiratory, thoracics, pathology, diagnostic imaging, and much more.

Personalizing treatment of severe asthma for better outcomes

“Personalizing treatment moves beyond targeting the symptoms – we are working to address the unique causes of disease that may vary from one person to another. At the Firestone Institute, with researchers like Dr. Svenningsen and Dr. Mukherjee, we are developing novel bioimaging tools and immunoendotyping panels to achieve this goal.”

Dr. Parameswaran Nair

Physician & Researcher,
Firestone Institute for
Respiratory Health



Those living with severe asthma know how daunting it can be at times, both physically and psychologically. Symptoms of a severe asthma attack commonly include shortness of breath, tightness in the chest, coughing, and wheezing. It can also leave one unable to speak in full sentences, and cause breathlessness even when lying down.

Patients are often prescribed a corticosteroid-based inhaler that they take regularly, and a fast-acting rescue inhaler to be used as needed. While these medications can be effective in managing the symptoms of severe asthma, they may not be treating the underlying cause of the condition.

Dr. Sarah Svenningsen is a post-doctoral researcher at the Firestone Institute for Respiratory Health. Together with Dr. Parameswaran Nair, an expert in complex airway diseases, Dr. Svenningsen is conducting asthma research using novel lung imaging techniques. Her goal is to personalize asthma therapies by improving diagnoses of the specific asthma subtype for each patient – a process called endotyping. As researchers have learned, there are multiple underlying causes of severe asthma.

Constriction of the bronchial tubes leads to symptoms of severe asthma, but not all parts of the lungs may constrict to the same degree. Rather, constriction can be localized to specific areas of the lungs. Build-up of excess mucus in the airways is also a major cause of severe asthma symptoms and can be visualized on chest CT scans. Dr. Svenningsen has been developing methods to see the functional consequence of this phenomenon, known as ventilation heterogeneity, through the use of MRI and inhaled hyperpolarized inert gases. This technique allows an image to be generated of the spaces in the lungs that have been filled with the gas.

St. Joe's Imaging Research Centre offers researchers state-of-the-art infrastructure, allowing researchers like Dr. Svenningsen to use advanced imaging techniques in their investigations. This non-clinical MRI allowed Dr. Svenningsen to see fine details of patients' lungs, including identifying areas that the gas cannot reach due to being plugged by excessive mucus. Her research also found that a simple, non-invasive breathing test known



Dr. Nair and Dr. Svenningsen perform an MRI scan using advanced techniques

as Fractional Exhaled Nitric Oxide (FENO) may act as a reliable indicator of severe asthma linked to excessive mucus production.

In June 2019, Dr. Svenningsen's work on airway mucus and pulmonary ventilation was published in the journal *Chest*. It may allow clinicians performing a FENO test to tell whether a patient's airway obstruction is linked to excessive mucus production, representing a major step towards personalizing treatment.

"We already have biologics, such as dupilumab, that could potentially be able to reduce or eliminate excessive mucus build-up in the lungs for this specific asthma subtype," says Dr. Svenningsen. "The next phase of our research is to test which biologics would be most suitable for a specific patient with more mucus or more eosinophils plugging the airways."

Biologics, or biologic drugs, are medicines derived from living cells. Some biologics may prove effective in the treatment of severe asthma, but only if the underlying cause is known. To that end, Drs. Nair and Svenningsen are searching for further diagnostic methods to identify various severe asthma subtypes, including asthma caused by excess mucus, eosinophils, etc.

"When we have a clear idea of the disease subtype, we can hypothesize new biologic treatments and conduct clinical research to test their efficacy," says Dr. Nair.

To learn more about the [Imaging Research Centre](#) and their work with state-of-the-art medical imaging devices, refer to "[Supporting research with leading imaging technology](#)" on page 22.

A year in numbers

195 Total Number of Researchers

+ **548** Research Staff & Learners



4,059 ft²

Wet Lab Space Added in 2019



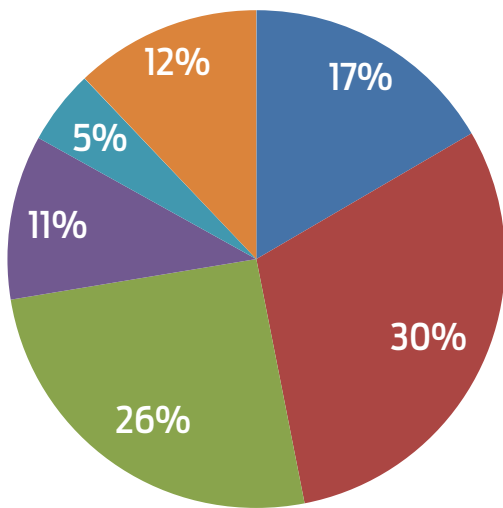
117

New Clinical Research Projects Started

77,040 ft²

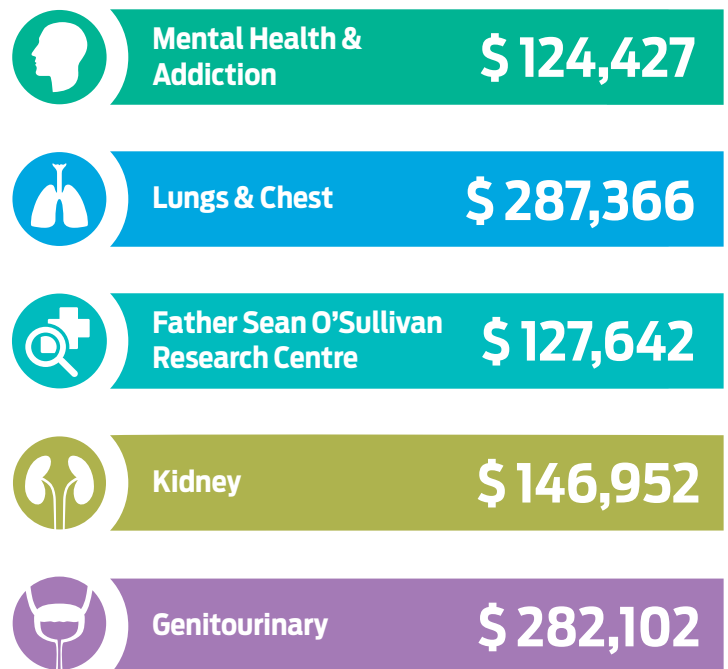
Total Dedicated Research Space

Funding Source by %



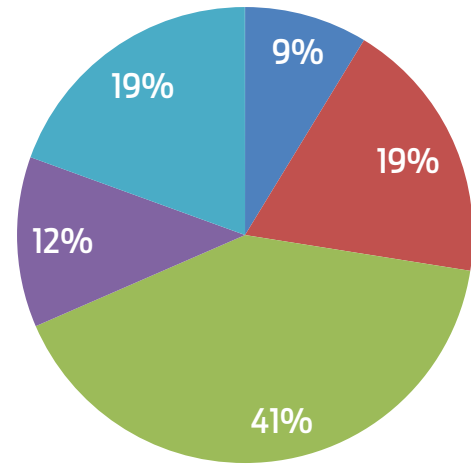
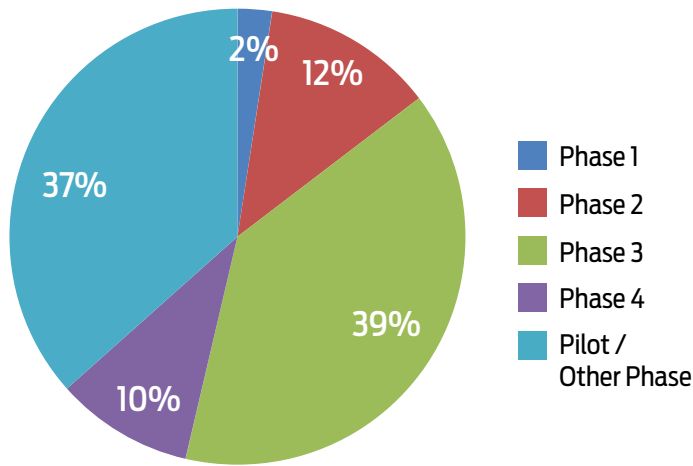
■ Corporate ■ Not for Profit
■ Federal ■ Provincial
■ Internal ■ Regional

Average Research Funding per Investigator by Program



41 New Clinical Trials

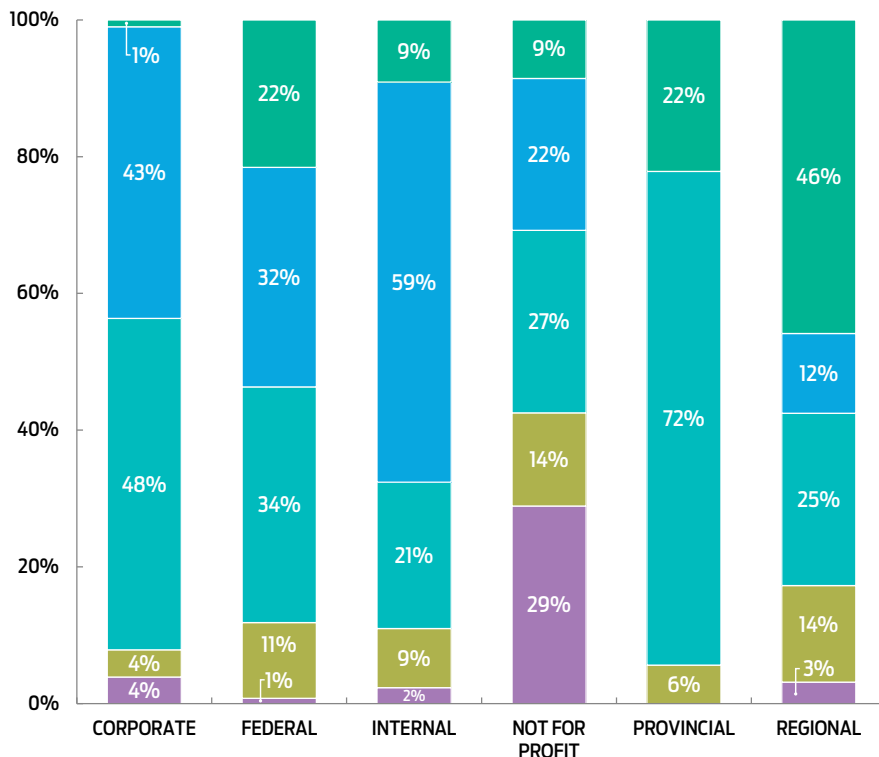
149 Ongoing Clinical Trials



Total Funding

\$25,377,111

Funding Source by % per Program



27

Events

(See Pages 24-25)



1215

Publications

+7% over 2018



Making surgery safer for patients who rely on anticoagulant therapy

“With the widespread use of DOAC therapy, the global significance of the recent PAUSE study cannot be understated. St. Joe’s physicians are not only practicing in their respective fields – **they are building new medical knowledge and living our Mission of Discovery by conducting high impact research.**”

Dr. Tom Stewart

President & CEO,
St. Joseph’s Health System

Direct oral anticoagulants (DOACs) are used to prevent blood clots from forming or growing in size. DOACs are a class of blood thinners typically prescribed to patients with atrial fibrillation, where an irregular heartbeat can cause blood to collect in the heart and form a clot.

While previous studies have shown DOACs to be more effective at preventing blood clots compared to warfarin, this relatively new class of drug has raised concerns during surgical procedures, when its blood-thinning effects could lead to a higher risk of bleeding. Unlike warfarin, an older blood thinner that can be easily counteracted with vitamin K, DOACs do not have a countermeasure capable of reversing their effects.

Developing guidelines to enhance DOAC safety during surgery is critical, since an estimated 2 million people in North America currently receiving this type of drug therapy will need a surgical procedure over the next year.

Dr. James Douketis is a clinician-researcher at St. Joseph’s Healthcare Hamilton and Professor in the Department of Medicine at McMaster University. His research focus is on hematology and thrombosis, including the use of DOACs. Recognizing the need to develop consistent and effective methods to manage DOAC medications during surgery, Dr. Douketis began a 5 year research project in 2014.

In August 2019, the results of the Perioperative Anticoagulation Use for Surgery Evaluation (PAUSE) study were published in *JAMA Internal Medicine*. The study aimed to balance the benefits of DOACs in preventing blood clots with the risk of bleeding around the time of a surgical procedure. The PAUSE study included over 3,000 research participants across 23 clinical centres in Canada, the United States, and Europe.

Researchers tested an approach that included a guided interruption to patients taking a DOAC, followed by a resumption of DOAC therapy after surgery. The approach can be summarized as not taking the DOAC





Dr. Douketis meets with Mary Ann to discuss her DOAC therapy

medication for 1 day before and after procedures associated with a low bleeding risk, and 2 days before and after procedures associated with a high bleeding risk.

Patients were monitored for 30 days after their procedure. Dr. Douketis and his colleagues found that this simple approach was easy for patients and health care professionals to follow, with over 95 percent adherence.

The study also found that by stopping DOAC medication shortly before surgery, patients' residual anticoagulant levels dropped to an optimal level to perform surgery without the complexities of introducing temporary medications, such as heparin.

“Previously, there was no standard approach for patients taking DOACs who required an elective surgery or medical procedure,” says Dr. Douketis. “Knowing when to stop and restart these drugs is important so that the risk to a patient of developing bleeding or a stroke is minimized.”

By leading international studies, St. Joe's researchers are making surgery safer for people in Hamilton and around the world.

In October 2019, Dr. Douketis was awarded the **American College of Physicians Laureate Award** for his leadership in hematology research on thrombosis and other related diseases.

Improving gestational diabetes outcomes for women and newborns

“As women, we tend to become the care-givers of our children, our parents, our friends and families, but rarely do we focus on our own health and wellbeing. That’s why I established this award to support research at St. Joe’s that is focused on women’s health specifically. **Because if we don’t take care of ourselves, we won’t be able to care for those we love.**”

Teresa Cascioli

Founder, Teresa Cascioli
Charitable Foundation

Clinical practice guidelines offer detailed instructions for clinicians, allowing them to optimize screening, treatment, drug dosing – anything pertinent to patient care. New research often informs changes in the way medicine is practiced, and updates to clinical practice guidelines are routinely shared throughout the medical community.

However, even the best guidelines are rendered ineffective if their recommendations are not taken into consideration. Regardless of the cause – outdated training, poor communication, lack of educational resources, resistance to change – the end result is sub-optimal care.

Dr. Beth Murray-Davis is a registered midwife and the Scientific Director of the McMaster Midwifery Research Centre, who conducts research in the areas of nutrition and exercise during pregnancy and postpartum, midwifery experiences of caring for complicated pregnancies, and client and health care provider experiences of models of maternity practice. Her extensive experience in perinatal research has led Dr. Murray-Davis to become an investigator for the Diabetes, Obesity, and Hypertension in Pregnancy Research Network, leveraging her expertise in mixed methods research.

In 2019, Dr. Murray-Davis received the Teresa Cascioli Charitable Foundation Research Award in Women’s Health, which is granted to researchers to pursue impactful investigations related to women’s health. The award will allow Dr. Murray-Davis to lead a research project exploring how health care providers implement the clinical practice guidelines for screening gestational diabetes mellitus.

Gestational diabetes mellitus (GDM) is a condition in which non-diabetic women develop high blood sugar levels during pregnancy, increasing the risk of pre-eclampsia, depression, and the need for a cesarean. If left untreated, newborns are more likely to be too large, have low blood sugar, and experience jaundice, while mothers are more likely to develop type 2 diabetes postpartum.





Dr. Beth Murray-Davis leads the McMaster Midwifery Research Centre

Ontario has seen an increase in the number of GDM cases, which have risen from nearly 3 percent in 1996 to over 7 percent today. Fortunately, research has shown that effective screening and treatment of GDM lowers the incidence of adverse outcomes. As a result of these findings, Canadian guidelines have changed from risk-based to universal screening. Yet, little is known about how consistently these changes have been adopted among care providers. Also, new evidence suggests that midwives, family physicians, and obstetricians may be approaching screening differently, resulting in missed opportunities for the management of GDM and the prevention of large for gestational age infants.

“The problem we are seeing is inconsistency across jurisdictions, with some disagreement regarding universal screening for GDM,” says Dr. Murray-Davis. “We believe the factors that may contribute to these differences include inconsistent uptake of guidelines, regional policies, provider characteristics and beliefs about GDM, and provider counselling practices.”

The mixed-methods project will include a retrospective cohort study looking at rates of screening and variations in these rates across geographic locations and by types of health care providers along with qualitative interviews with family physicians, midwives, obstetricians, and their patients. This unique approach will allow researchers to understand trends over time, identify knowledge gaps, and get a true sense of the impact of missed screening opportunities.

“Our ultimate goal is to improve GDM screening and counselling practices of health care providers and improve health outcomes for mothers and babies. We hope to inform knowledge translation activities and create resources and care pathways to assist care providers.” [Learn more about the McMaster Midwifery Research Centre at mmrc.mcmaster.ca](http://mmrc.mcmaster.ca)

Supporting research with leading imaging technology

“At the Peter Boris Centre for Addictions Research, we rely on the IRC’s novel imaging technology to conduct our research. The IRC’s expertise and state-of-the-art equipment make them a tremendous resource for researchers seeking advanced imaging solutions.

Another great resource is the wonderful people working at the IRC. They provide timely support for any questions or needs that researchers have. People like Norm ensure that the studies run smoothly and great technologists like Julie, Carol, and Shannon make participants feel welcome and safe.”

Dr. Iris Balodis

Department of Psychiatry & Behavioural Neurosciences



Magnetic Resonance Imaging (MRI) allows scientists and clinicians to peer into the body’s inner workings with incredible detail. The technology uses a strong magnetic field to align hydrogen atoms from the abundance of water and fat molecules in the body. By momentarily altering that magnetic field, images can be produced by measuring the time it takes for individual atoms to realign.

Standard clinical MRI technology allows physicians to see a wide variety of tissues. This includes brain, cartilage, muscle, fat, anomalies like tumour growth, aneurisms, tissue damage, and more. Since it uses a magnetic field and radio waves instead of x-rays, clinicians can perform diagnostic work without exposing the patient to potentially harmful ionizing radiation.

Unlike a clinical MRI, there is nothing standard about the imaging techniques offered by St. Joe’s Imaging Research Centre (IRC), which includes a research MRI machine. Scientists at the IRC work with researchers across Hamilton, including many from St. Joe’s, as well as others from McMaster University and Hamilton Health Sciences.

“While clinical MRI is a powerful diagnostic tool, the IRC takes this one step further,” says Dr. Michael Noseworthy, Director of Imaging Physics and Engineering Research at the IRC, and Professor of Electrical and Computer Engineering at McMaster. “We are able to offer researchers access to state-of-the-art imaging techniques not available in clinical MRI centres. Our team is also developing new technologies and new methods of processing data to enhance and markedly speed up acquisition of medical images.”

For instance, one limitation of clinical MRI is that it cannot adequately detect the fine details of the lungs, since they lack adequate water content. The solution, which the IRC makes available to St. Joe’s researchers, is to use hyperpolarized xenon gas. Xenon is an inert gas that is denser than air. “The gas is hyperpolarized, making it highly visible on the IRC’s specially-tuned MRI when inhaled by the patient,” says Norm Konyer,



Noseworthy and Konyer prepare hyperpolarized xenon gas using liquid nitrogen

who has done considerable technical work to refine the process at St. Joes. Researchers can create detailed maps of the structure of the lungs and search for problematic areas.

Techniques for measuring other elements, including sodium and phosphorus, have also been developed and are continually being refined. These elements can reveal pathological changes before they are visible elsewhere. Since sodium and phosphorus are less abundant in the body compared to hydrogen, they are harder to detect. IRC scientists, Noseworthy and Konyer, are working to increase the sensitivity and reduce noise to improve the image quality and reduce scan time. Together they have over 50 years of MRI experience over a vast array of topics, from clinical work to basic physics and engineering.

The IRC is also an interdisciplinary academic hub – teams of researchers and students are building the future of magnetic resonance technology. Dr. Noseworthy’s graduate students come from diverse academic backgrounds, including data science, electrical engineering, medical physics, and biomedical engineering. Together, these students are learning to build new software for imaging and data analysis, create instruments to improve detection of other elements, and enhance various aspects of MRI technology.

The IRC is a nexus of leading-edge imaging technology, interdisciplinary education, and precision engineering, offering researchers the opportunity to conduct investigations that would otherwise not be possible.

To learn more about how St. Joe’s researchers are using advanced imaging, refer to “**Personalizing treatment of severe asthma for better outcomes**” on page 14.

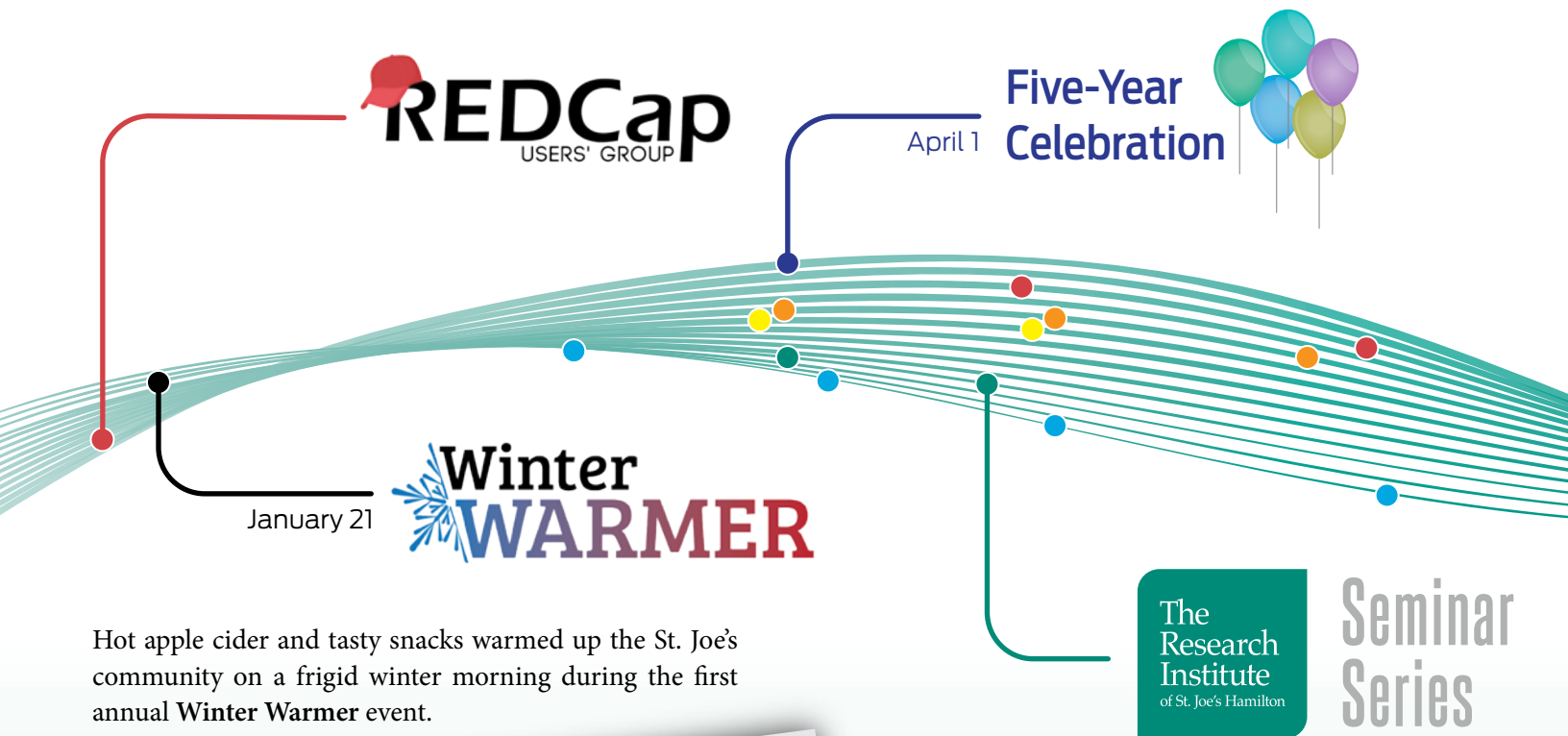
An eventful year

The Research Institute hosts several standalone and recurring events throughout the year. These events are designed to engage researchers and research staff, students, corporate stakeholders, Hospital staff, and the general community.

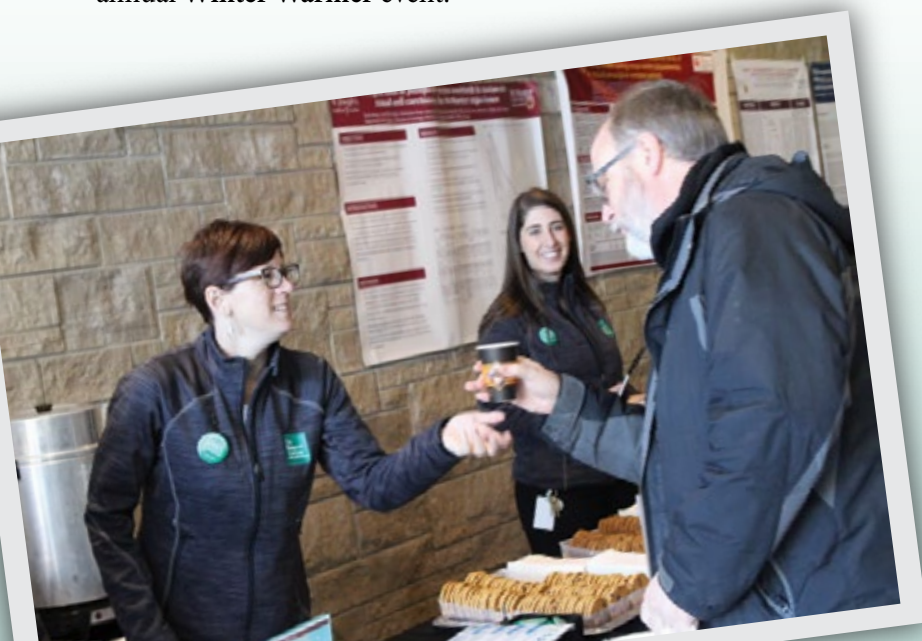
While recurring events such as the **REDCap Users' Group** and **Coordinators CONNECT!** provide opportunities for research personnel to improve their skills and share experiences, standalone events, including the **Midsummer**

Mixer, allow the Research Institute to engage with the community at large to showcase the academic, research-intensive work being conducted within the Hospital.

The Research Institute, in partnership with St. Joseph's Healthcare Hamilton and St. Joseph's Healthcare Foundation, also participates in numerous external events that support research. Some of these events include the **Around the Bay Road Race**, the **Paris to Ancaster Bike Race**, and the **Run for Women**.



Hot apple cider and tasty snacks warmed up the St. Joe's community on a frigid winter morning during the first annual **Winter Warmer** event.



- Coordinators CONNECT!
- REDCap Users' Group
- Research Institute Seminar Series
- SJHH Events in Support of Research
- Research Community Outreach

Midsummer MIXER

July 11



The second annual Midsummer Mixer invited the St. Joe's community to enjoy the sun with games, music, and frozen treats. This community-building event has grown in popularity since it began in 2018.

Coordinators CONNECT!

Celebrate RESEARCH

October 24

Attendees of the annual Celebrate Research event enjoyed a special reception after the award ceremony, in recognition of the Research Institute's 5-year milestone.



The search for a more effective treatment for high blood pressure

“We are incredibly proud of the work our researchers are doing at the Hamilton Centre for Kidney Research.

As a testament to the excellence of Dr. Krepinsky’s research, her recent Canadian Institutes of Health Research (CIHR) Project Grant was ranked number one by the grant review committee.”

Dr. Richard Austin

Kidney Research Lead,
The Research Institute of St. Joe’s



Over 40 percent of Canadians have some degree of high blood pressure, also known as hypertension. Hypertension is compounded by other conditions, including diabetes and chronic kidney disease, which can lead to “secondary” hypertension, a form of high blood pressure that is attributed to specific diseases. However, the overwhelming majority of hypertension cases are considered to be “primary” or “essential” hypertension, and caused by nonspecific factors related to lifestyle and genetics.

While hypertension is the leading cause of morbidity and mortality, it is also the leading modifiable risk factor in the development of heart disease, stroke, and chronic kidney disease. Unfortunately, and for various reasons, up to 50 percent of people do not have adequately treated high blood pressure.

Dr. Joan Krepinsky and Dr. Jeffrey Dickhout are nephrology researchers of the Hamilton Centre for Kidney Research (HCKR) at St. Joe’s. Together, they are testing novel treatment strategies aimed at reducing hypertension and reversing the damage it causes to blood vessels. One of their projects examines whether follistatin can reduce primary hypertension. Follistatin is a protein that suppresses inflammation and fibrosis – it is also endogenous, meaning it is produced naturally in the body, but in disease its production can be decreased.

“We know that treatment with follistatin lowers blood pressure in secondary hypertension due to kidney disease in our animal models,” notes Dr. Krepinsky. “What we are now investigating is follistatin’s potential in lowering blood pressure in primary hypertension.”

Studies have also shown that follistatin can protect against chronic kidney disease. However, higher doses of follistatin lose their effectiveness for reasons that are not fully understood. Researchers have now discovered that a molecule called miR299a actively reduces levels of endogenous follistatin in the kidney in chronic kidney disease models. They are



Dr. Krepinsky and Dr. Dickhout use highly specialized equipment in their laboratory

looking at ways to nullify the effects of miR299a, in hopes of allowing the body to produce higher levels of follistatin naturally, to both protect the kidney and lower blood pressure.

Developing new experimental methods and expanding lab infrastructure are critical aspects of this work. To that end, Dr. Dickhout's laboratory recently began using state-of-the-art radio telemetry devices to directly monitor blood pressure in animal models. This system is far more accurate and less stress-inducing compared to previous testing methods.

“The HCKR is one of the premier laboratories in Canada for studying hypertension,” says Dr. Dickhout. “The technology we are using gives us a clear picture of what is going on in the blood vessels and areas affected by hypertension.”

With the combined expertise of Dr. Krepinsky and Dr. Dickhout, and infrastructural support for their laboratory at the HCKR, St. Joe's is working towards developing the next generation of hypertension management.

In 2019, Dr. Jeffrey Dickhout was awarded the **Jacques de Champlain New Investigator Award** for his work on hypertension and chronic kidney disease. His work has shown that cellular stress occurs before the development of hypertension, and that inhibition of this stress, in mice models, reduces kidney injury related to high blood pressure. His many publications in high-impact journals have earned him several additional research awards.

Empowering patients to make informed medical decisions

“Nothing in science has any value to society if it is not communicated.”

Anne Roe
1904-91

Psychologist

In 2019, a diagnosis of kidney, bladder, or prostate cancer changed the lives of a staggering 42,000 Canadians, and while their experiences may have many common elements, no two patient journeys will be exactly alike.

Under the guidance and direction of Dr. Anil Kapoor, a urologic oncology surgeon and researcher, St. Joe's created the Urologic Cancer Centre for Research & Innovation (UCCRI) in 2018. The goal of the UCCRI is to become Ontario's leading urologic research centre.

Using a translational approach, researchers are able to take their discoveries from the lab bench right to the clinical bedside – all within the walls of the Hospital – by connecting basic scientists in St. Joe's laboratories with clinicians providing care for patients directly. Complementing the UCCRI research leads are students, research staff, residents, and fellows.

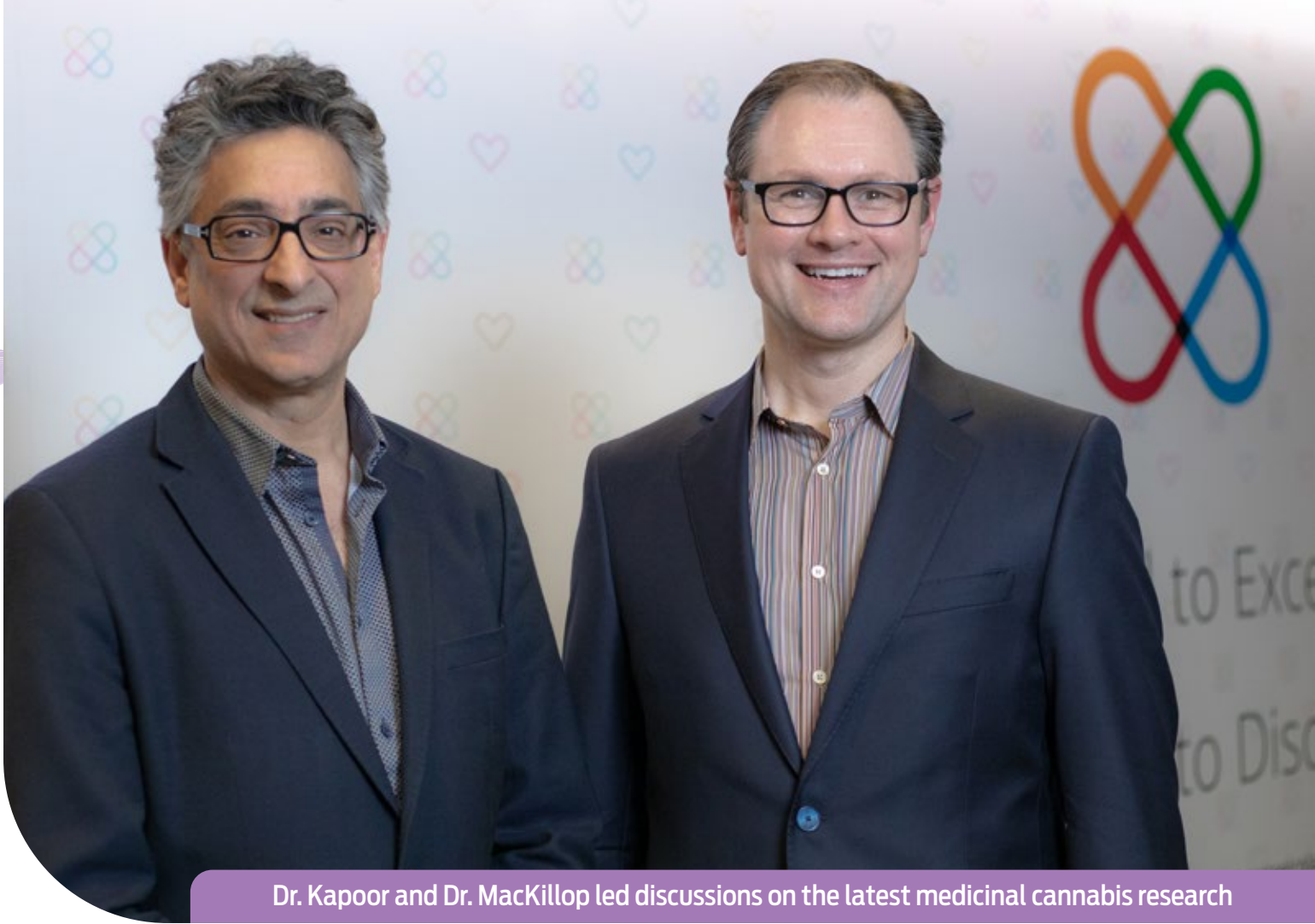
With previously discrete research groups now working under the same banner, there is tremendous potential for collaboration and the expansion of knowledge. Advancements in patient care and other research findings will be shared with clinicians across the country and beyond our borders.

Clinicians will not be the only ones to learn from the UCCRI's discoveries. As part of its mandate, the Centre has been working to expand efforts to empower patients with medical knowledge in the pursuit of shared decision-making, including knowledge of clinical trials and the latest research. To that end, researchers have hosted several community outreach events since the UCCRI's public launch in 2019.

These well-attended seminars have brought together patients, their families, caregivers, physicians, and researchers to discuss how the latest advancements are affecting care.

In a time when misinformation runs rampant, particularly from online sources that lack scientific merit, these public outreach events provide reliable, evidence-based information on a variety of novel topics. Presentations have featured the rise of immunotherapies, surgical





Dr. Kapoor and Dr. MacKillop led discussions on the latest medicinal cannabis research

training through simulation, robotics, and much more. Patients and patient advocates have also spoken at these events, offering their unique perspectives; they have navigated through the health system, participated in clinical trials, and become advocates for their own health care.

The topic of medicinal cannabis for pain and treatment management in cancer was addressed in the UCCRI's third outreach event. Among the presenters was Dr. James MacKillop, Director of the Centre for Medicinal Cannabis Research at St. Joe's, who gave an informative presentation to an attentive crowd. Since recreational cannabis was legalized in October 2018, many questions have arisen on the efficacy and safety of cannabis and cannabis derivatives for pain management.

By sharing knowledge and experiences, the UCCRI hopes to enable people to make informed decisions about their care, helping them navigate the journey towards remission.

To learn more about the Centre and future public outreach events, visit the UCCRI online at www.stjoes.ca/uccri

Isolating the factors that accelerate the growth of prostate cancer

“Scientists at St. Joe’s Urologic Cancer Centre for Research & Innovation are pushing the boundaries of health care through a collaborative approach – one that combines the expertise of several medical disciplines towards **creating the future of prostate cancer management.**”

Dr. Jack Gauldie

Scientific Director,
The Research Institute of St. Joe’s

Vice President, Research,
St. Joseph’s Healthcare Hamilton



In Canada, 1 in 7 men will be affected by prostate cancer at some point in their lifetime. It is the second-leading cause of cancer death in men, yet there is an array of treatment options, including surgery, radiation therapy, as well as androgen deprivation therapy (ADT).

Androgens are hormones, such as testosterone, produced in the body by both men and women. They are often referred to as male hormones because they appear in much higher concentrations in men. Since prostate cancer can be driven by the presence of these hormones, ADT is used to reduce the level of androgens in the bloodstream, in hopes of stunting the cancer growth.

However, prostate cancer may become resistant to ADT. This is known as castration-resistant prostate cancer (CRPC). In these instances, tumours continue to grow despite the lack of circulating androgens. The cause of ADT resistance is not entirely understood.

“Something is driving the growth of these tumours, even when we drastically lower the levels of circulating androgens,” says Dr. Damu Tang, a researcher in the fields of cell biology and oncology at St. Joe’s Urologic Cancer Centre for Research & Innovation (UCCRI).

A team of scientists and clinicians, led by Dr. Tang and based primarily at the UCCRI, have been awarded a research grant of over \$575,000 from the Canadian Institutes of Health Research. The grant is supporting a 3-year research project, with the goal of isolating what is believed to be a primary cause of accelerated cancer growth in CRPC.

The research project is based on a novel concept – Dr. Tang and his fellow researchers hypothesize that castration-resistant prostate cancer cells produce an enzyme that is normally found in the liver. This enzyme accumulates LDL cholesterol inside the prostate tumour, where it is used to build androgens.

Effectively, the liver enzyme leads to the abnormal production of



Dr. Damu Tang and his students in his laboratory at St. Joe's

androgens from within the prostate tumour itself. This would explain why castration-resistant prostate cancer may continue to grow even when patients are on androgen deprivation therapy. Researchers have already detected high levels of the liver enzyme in prostate cancers that progressed to CRPC, suggesting the two are linked.

“We suspect there may be a local source of androgens being produced inside the tumour, which negate the therapeutic effects of ADT,” explains Dr. Tang.

Disrupting the chain of events that accelerates CRPC growth is one of the main objectives of their research project. Dr. Tang and his team have identified a compound that may hinder the effects of the liver enzyme. Whether this compound will have a beneficial effect towards treating CRPC remains to be demonstrated through pre-clinical in vivo models. If successful, it could lead to a clinical trial to test its safety and efficacy in humans.

The Research Institute of St. Joe's has been working diligently to increase its capacity to conduct novel research projects on urologic cancers.

The UCCRI was established in 2018 with the help of two significant philanthropic gifts from Mr. John Ribson and Mr. Jim Bullock, who have both benefitted from innovative care and clinical trials at St. Joe's.

Dr. Anil Kapoor, Director of the UCCRI, hopes to link groundbreaking discoveries, including identification of specific biomarkers and genetic testing, to diagnostics, reoccurrence assessment, and patient care.



NEW Discoveries & NEW Hope, Made Possible by You.

Last year, our Foundation granted \$2.2 million to the **Research Institute of St. Joe's Hamilton** to help fund numerous studies and clinical trials currently underway. From asthma to schizophrenia, addictions to robotic surgery, microbiology to palliative care, and so much more; **your gift helps our researchers** make new discoveries – so they can give our patients new hope.

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HOPE HEALING **DISCOVERY**