Capital Health Research focus

cardiac Surgery

Cardiac surgery researchers at Capital Health are finding creative solutions to the challenges of heart disease and improving patient wellbeing along the way.

Working together for healthier hearts

Capital Health cardiac surgeons and their clinical and basic science colleagues at Dalhousie Medical School are working together to better understand, treat and prevent heart disease.

Together, Capital Health/Dalhousie cardiac surgery researchers are leading the way to better solutions for heart failure, improved outcomes of heart surgery, and a heart-healthier future. Their work is funded by the Canada Foundation for Innovation, the Canadian Institutes of Health Research, Capital Health, Dalhousie Department of Surgery, Dalhousie Medical Research Foundation, Heart & Stroke Foundation of Canada, and the Nova Scotia Health Research Foundation.

Empowering informed decisions

A team of cardiac surgery researchers wants to ensure that patients with serious heart conditions have all the information they need to make the most appropriate and well-considered decisions possible when it comes to heart surgery.

The Capital Health/Dalhousie research team is designing and testing a new informed consent and decision-making process. Their first study will help older people with heart disease, and possibly other conditions that may make them frail, fully understand the benefits and potential risks that surgery presents to them.

"People who are frail face a higher risk of serious complications from cardiac surgery," explains team lead Dr. Greg Hirsch, head of the Division of Cardiac Surgery. "They're more likely to be admitted to intensive care and to develop ventilator-associated pneumonia or delirium. They're even at risk of losing their independence."

For many patients, however, the benefits of surgery outweigh the risks. "We want people to have all the information they need to make the decision that's right for them," explains Dr. Hirsch. "That means we will thoroughly assess their degree of frailty and give them information about the surgery that's tailored to their own specific health issues. We want them to have all the information they need to feel confident going in to surgery, or to feel comfortable with a decision not to go forward."

Former cardiac surgery patient Geri Kearns shares her insights about improving the informed consent process with Ryan Gainer, facilitator of Cardiac Surgery's *Informed Consent and Shared Decision-Making* research project.

The Canadian Institutes of Health Research (CIHR) has awarded the researchers nearly $300,000 to develop the new informed consent and shared decision-making process. It's a multi-stage project that involves patients' input and feedback every step of the way.

Geri Kearns is a former cardiac surgery patient who took part in early focus groups that helped launch the project. As someone who has gone through open-heart surgery twice, she feels that giving patients more information and more opportunity to reflect on their decision promotes better outcomes.

"If you know what to expect from surgery and are prepared to deal with it, you will have a more successful recovery," says Geri. "On the other hand, if you decide against a difficult procedure–because you understand the risks are greater than the benefits–you can rest easier knowing your decision is protecting your quality of life."

DISCOVERY AND INNOVATION

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A multi-faceted approach to the heart failure challenge

Heart failure is the most common form of heart disease and the leading cause of hospitalization and disability in Atlantic Canada. The condition is fatal within a few years, unless the person is able to receive a mechanical heart pump or donor heart transplant. While dramatically successful in the short term, these treatments allow only about ten years of survival.

Researchers at Capital Health, the IWK Health Centre and Dalhousie Medical School are addressing the challenge of heart failure from many angles, through both clinical and laboratory-based research. They're working to prolong good-quality life for people with heart failure, while searching for ways to prevent the heart from failing in the first place.

Dr. Stacy O'Blenes

Muscle-cell transplants for healing heart-attack scars

Cardiac surgeon Dr. Stacy O'Blenes is working on a revolutionary approach to healing the damage left by heart attacks, so that heart-failure-causing scars are unable to form and the heart can continue to function normally.

"The heart becomes scarred after a heart attack, because heart muscle cells are unable to regenerate to heal the injured tissues," explains Dr. O'Blenes. "The scarred areas of the heart don't beat, so the rest of the heart has to work so much harder to compensate, that eventually it fails."

Dr. O'Blenes and his team are working with myoblasts, the precursor cells that form skeletal muscle. "Unlike heart muscle cells, skeletal muscle cells have amazing abilities to repair injuries," he says, noting that his mentor, the late Dr. Magda Horackova, first showed that transplanting myoblasts into hearts immediately after a heart attack could prevent scarring. He and his team are advancing this work by exploring how various growth factors improve the ability of myoblasts to successfully repair heart attack damage.

Safer surgery for fragile hearts

The hearts of young babies and frail seniors have something in common–they are fragile and easily damaged during heart surgery, when cardioplegic solutions are used to stop the heart from beating. Pediatric and adult cardiac surgeons Dr. Stacy O'Blenes and Dr. Camille Hancock Friesen have teamed up with Dr. Susan Howlett, a professor of pharmacology at Dalhousie Medical School, to minimize surgery-related damage with better cardioplegic solutions. They're refining solutions developed for infant surgeries and testing them in cell models of old hearts to find the most protective formulations. These they will then test in humans. They hope to dramatically improve the success of heart surgeries in young and old alike.

Preventing the scars that come with age

It doesn't take something as dramatic as a heart attack to trigger scar formation in the heart. Over time, repeated small injuries–such as those caused by high blood pressure–cause tiny scars to form throughout the heart. Like the larger scars left behind by heart attacks, this diffuse scarring reduces the heart's pumping efficiency and leads to heart failure.

Cardiac surgeon Dr. Jean-François Légaré and his team are shedding light on the molecular processes that drive this slow and steady scar formation, called fibrosis. They have found that even minor damage prompts the heart to send distress signals that attract collagen-forming 'fixit' cells from the bone marrow. "Instead of doing the repairs and leaving, we've discovered that these cells remain in the heart and continue to lay down collagen," Dr. Légaré says. "This leads to scarring and, eventually, heart failure."

Dr. Légaré and his team overturned the previously held belief that heart failure is driven only by processes within the heart. In fact, their discovery opens the door to entirely new possibilities for preventing heart failure.

"Because the damaging cells migrate to the heart through the bloodstream, there's an opportunity to stop them before they ever get to the heart," he says. "We're looking for target molecules that could be blocked with a drug delivered to the bloodstream very simply via capsule or pill."

The researchers have found that older hearts are more vulnerable to scarring and produce higher levels of scar-promoting factors. These findings are helping them narrow their search for effective scar-blocking targets.

At the same time, Dr. Légaré and his colleagues in the Division of Cardiac Surgery are working to save the lives of people who currently suffer from heart failure. They are particularly interested in optimizing the use of mechanical heart pumps.

Mechanical heart pumps as a bridge to transplant

At the age of 49, William Marr was running out of options. An inherited heart-muscle disorder made his heart work so hard, he eventually developed heart failure. "Dr. Légaré recommended a mechanical heart pump to keep me going until a donor heart becomes available," recounts Mr. Marr, a New Brunswick resident with three grown children and two successful businesses he and his wife run together. "My condition had deteriorated so badly, I wouldn't be alive today without this device." In fact, his brother died of the same disorder more than a decade ago, at the age of 34, before mechanical hearts were available.

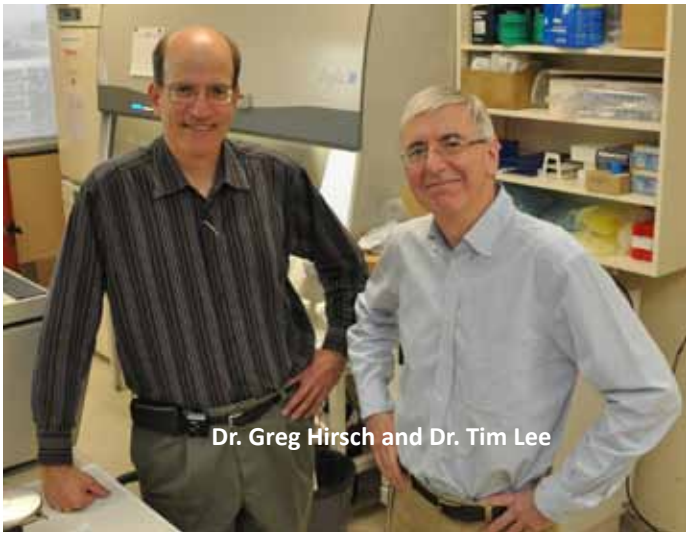
Dr. Jean-François Légaré examines William Marr before discharging him from the QEII Health Sciences Centre seven weeks after receiving a mechanical heart pump.

Because he is young and otherwise healthy, Mr. Marr was an ideal candidate for a mechanical heart pump as a bridge to transplant. But the decision is not always so clear-cut. Dr. Légaré and his colleagues in the Division of Cardiac Surgery are analyzing patient outcomes and working with the Canadian Cardiac Transplant Network to establish guidelines for selecting which patients will benefit most from the mechanical pumps.

The researchers also want to know if mechanical heart pumps could be used as a long-term solution to heart failure, rather than solely as a bridge to heart transplant. "There is an acute shortage of donor hearts," remarks Dr. Légaré, "and the ongoing problem of the immune system's rejection of the donor heart. There is no issue with rejection of a mechanical heart pump."

Extending the life of heart transplants

Heart transplants provide tremendous short term results, thanks to advances in immune suppression therapy that prevent the recipient from immediately rejecting the donor heart. In spite of these advances, 50 per cent of patients experience failure of their transplanted hearts within 10 years. This is due to a more subtle process called chronic rejection.



Dr. Greg Hirsch and Dr. Tim Lee

Cardiac surgeon Dr. Greg Hirsch and Dalhousie immunologist Dr. Tim Lee are uncovering the precise mechanisms that lead the body to gradually reject the donor heart. They've discovered that immune suppression therapy fails to disable killer T-cells, which are free to attack the heart recipient's coronary arteries. They've also identified the key mechanisms that help the T-cells resist immune suppression and are searching for ways to disable these mechanisms so that heart transplant recipients can live many more years with their donor hearts.

Cardiac surgeon Dr. Camille Hancock Friesen is tackling transplant rejection from another angle. She is studying how injury that occurs to donor hearts while they're 'on ice' prior to transplant contributes to the rejection process, and isolating the early immune responses involved in chronic rejection. She hopes that someday her work will lead to new ways of improving the recipient's tolerance to the donor's heart.

Wait times for cardiac surgery: how long is too long?

Traditionally, the wait time for cardiac surgery is measured from the time the specialist refers the patient for surgery. Capital Health/Dalhousie researchers are changing this, so that the clock starts ticking from the time the patient first presents to a health care provider with signs or symptoms that ultimately lead to cardiac surgery. This new definition is revealing much longer wait times than previously assumed and driving new efforts to streamline health services so patients at risk receive surgery sooner.

'Heart Healthy Kids' yields real gains in children's fitness

Dr. Camille Hancock Friesen

While cardiac surgeon Dr. Camille Hancock Friesen is involved in research to make heart surgeries safer and heart transplants last longer, her real passion is encouraging children to be more physically active, to reduce demand for such radical procedures in the future. The need, she says, is urgent.

"One-third of the children in Atlantic Canada are overweight or obese, and we are seeing type 2 diabetes, high blood pressure, high cholesterol, and other key cardiovascular risk factors increasing in children," says Dr. Hancock Friesen, who is chief of the IWK Health Centre's cardiac surgery program. "These trends will have devastating consequences, unless something happens to alter the course."

That's why Dr. Hancock Friesen and her colleagues at Dalhousie University, the IWK and the Maritime Heart Center have designed and launched Heart Healthy Kids (H2K).

Heart Healthy Kids is training children to be peer mentors who encourage their classmates to be more physically active.

With H2K, the Maritime Heart Center is working with elementary schools to see if a peer-mentoring approach to physical activity promotion can produce measurable changes in children's activity and fitness levels.

"We want to harness the power of peer influence to inspire kids to be more physically active," says Dr. Hancock Friesen, explaining that the project trains kids to be official H2K peer mentors who lead their classmates in regular physical activity at school. "Our initial pilot study showed that peer mentoring increased activity levels–measured by pedometer steps at school–by 17 per cent."

Encouraged by the pilot results, Dr. Hancock Friesen and the Maritime Heart Center team embarked on a larger study involving 800 children in grades four to six in ten Halifax-area schools. They ran the standard H2K heart health program, involving education sessions and a lunchtime-based physical activity challenge, in five schools. They ran the same program–with the addition of peer mentoring–in the other five schools.

Preliminary data analysis shows that children in peer mentoring schools logged 1,000 more steps per day, on average, than children who took part in the program without peer mentoring. "This early result is a strong indication that peer mentoring works," Dr. Hancock Friesen says. "Our preliminary data also shows stronger gains in cardiovascular fitness among the peer mentoring group, along with an increase in heart-health knowledge."

While more in-depth data analysis is underway, Dr. Hancock Friesen and the Maritime Heart Center team are planning the next phase–to roll H2K out to more Nova Scotia schools. "We're building a network of volunteer 'champions' to help us train kids to be peer mentors in their schools," says John Britton, executive director of the Maritime Heart Center, a charitable organization devoted to patient support and heart health promotion. "Ultimately, we would like to see peer mentors and daily physical activity in every school in the province."

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