

Banking on the future

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



By Marjo Johne

THERE ARE OVER 163,000 OUTPATIENT VISITS TO THE PETER MUNK CARDIAC CENTRE (PMCC) each year, where cardiovascular diseases that range from arrhythmia to heart failure are treated. Over the last three years, a growing number of these patients have also become contributors to the centre's biobank – an ambitious research infrastructure project that's opening the way to a deeper understanding of cardiovascular disease and the treatments that work best for each patient.

“What we have at the PMCC is a unique opportunity to examine specimens from thousands of patients [in order] to look for biological markers and novel pathways of cardiovascular disease,” explains Dr. Phyllis Billia, a scientist and Co-director of the Peter Munk Cardiac Centre Cardiovascular Biobank. “The

goal ultimately is to use this information to discover potential new treatments for the various types of cardiovascular disease.”

Housed in a secured facility at the PMCC, the biobank is a massive repository containing more than 25,000 blood and tissue samples – a significant increase from the roughly 2,000 samples collected two years ago. The recent acceleration of blood and tissue sample collection can be attributed to the efforts of the PMCC's Ted Rogers Centre for Heart Research site, where biobanking is an essential pillar to many of the research activities. To build the biobank, the PMCC asks patients who go through procedures that require the collection or removal of biological specimen – such as blood tests or surgery – for permission to store their tissue or blood.

These samples are then linked to

patients' clinical data, including MRI and other imaging.

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

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

The value of biobanks to researchers is underlined by numerous success stories in various fields. In cancer research, the ability to screen banked tissue samples led to the discovery of an antibody – which was

subsequently developed into a drug called Herceptin – that targets HER2-positive breast cancer cell receptors.

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

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

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

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

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

Dr. Richard Weisel, a cardiovascular surgeon at the PMCC and Co-director of the Biobank, says the biobank has already had an impact in cardiac surgery. As an example, he cites



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Senior Scientist, Toronto General
Research Institute

cases involving patients with dilated aortas, which would normally be removed and replaced once the affected blood vessels have grown to a radius of at least five centimetres.

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

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

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

“Our goal is to create a large consortium of cardiovascular researchers in the Greater Toronto Area who would have access to this incredible resource,” he says. “We also hope to expand our capabilities to the extent where we'll have samples from all patients at the PMCC – something that's done as routine in some places in the United States and Europe.”



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