



CELLULAR AND REGENERATIVE MEDICINE CENTRE

PRESENTED TO
Mining for Miracles

June 2022





SUPPORTING GROUND-BREAKING RESEARCH

Thank you, Mining for Miracles, for your unwavering support of child health in British Columbia. Your fundraising initiatives and generosity continue to change the face of pediatric medicine, giving researchers and clinicians the tools they need to improve the lives of children across the province and beyond. The latest success has been the accomplishments and promise of BC Children's Hospital's Cellular and Regenerative Medicine Centre (CRMC). The CRMC uses state-of-the-art technology to generate stem cells from a patient's own blood cells and transform them into other types of cells—such as beating heart cells or insulin-producing beta cells—to be studied. In doing so, researchers are better able to understand the genetic causes and potential treatments for heart conditions and diabetes.

For more details on this ground-breaking work, we turn to Dr. Francis Lynn and Dr. Glen Tibbits, who discuss their research and how the CRMC and the support of Mining for Miracles has revolutionized the use of stem cell culturing in studying heart arrhythmias and diabetes.

DR. GLEN TIBBITS

INVESTIGATOR, BC CHILDREN'S HOSPITAL RESEARCH INSTITUTE



WHAT IS YOUR RESEARCH FOCUS AT THE CRMC?

I work on inherited cardiac arrhythmias with Dr. Shubhayan Sanatani, head of cardiology at BC Children's. An arrhythmia is a problem with the rhythm or rate of your heartbeat, and it can be lethal if not detected and treated early.

We still don't know whether someone will develop arrhythmia. Two children with the same genetic variant that might be associated with arrhythmia may have completely different outcomes when it comes to how they display symptoms or how they respond to a treatment.

Traditional medications such as beta blockers do not work for some children, and alternatives may include implanting a device known as a defibrillator, which can sometimes cause harm and can be dangerous. General, one-size-fits-all therapies are simply not good enough.

Far more effective is a personalized approach, where a therapy is keyed to the individual child's genomic background and their unique responses to

particular medications. This is what we are working on at the CRMC. We are creating stem cells from a patient's blood and turning these into beating heart cells which we can study. We can then test different medications on these cells, or invoke an arrhythmia and learn more about how it could be managed. Because we are studying these cells in a petri dish, there is no danger to the child.

HOW HAVE NEW TECHNOLOGIES AT THE CRMC HELPED YOUR RESEARCH?

We greatly benefit from several pieces of equipment that we were able to purchase through Mining for Miracles support, such as the patchliner, which can measure the electrical currents of heart, and the use of optical mapping to study electrical behaviour in the heart. Now we have first-in-world robotic technology which enables us to produce far larger quantities of cells, allowing us to print more complex heart tissues and what we call organoids. Creating these more complex tissues requires far more cells—millions and millions of cells, compared to the million we might have made use of before. These organoids are more similar to a human heart, and are better predictors of what an individual child's heart is facing or will face in the future. It means that when we test the efficacy of different medications on these organoids, we can be far more confident of their effects on the child, reducing risk and optimizing our therapies.

HOW DOES THE CRMC HELP WITH THIS RESEARCH?

Without the equipment available at the CRMC, we might be able to help examine one to two patients a year for heart arrhythmias. With the CRMC's help we will soon be able to help 12 to 15 patients a year, and will also be able to conduct more exhaustive and complex analyses with more tissues derived from the roboticized instrument. The difference is in orders of magnitude, and reflects the number of kids we will be able to help with these new personalized therapies.

An estimated 7,000 British Columbians are affected by, or at risk of, an inherited heart rhythm condition.

“This funding from Mining for Miracles has been transformative. There is no better word to describe what their support has helped accomplish.”

- DR. GLEN TIBBITS

DR. FRANCIS LYNN

HEAD OF CANUCKS FOR KIDS FUND CHILDHOOD DIABETES LABORATORIES, INVESTIGATOR, BC CHILDREN'S HOSPITAL RESEARCH INSTITUTE



WHAT IS YOUR RESEARCH FOCUS AT THE CRMC?

I lead the team which undertakes type 1 diabetes research. Type 1 diabetes is caused by a person's own immune system attacking and destroying the cells that make insulin, called beta cells. Insulin controls a person's glucose levels. Without it, glucose levels can get dangerously high, and a child can face serious health complications, which can be life threatening.

Possibilities already exist where we can take cells from donors' pancreases and transplant those cells into a patient with diabetes in order to reverse diabetes. The difficulty is that the number of available organs from which the cells are taken is limited. This is where the CRMC comes in—we're able to make stem cells in the lab, grow them in large numbers, and then transform them into insulin-producing cells. We're working towards the point where we can take fully-functional, insulin-producing cells grown from stem cells, and transplant them into a person to treat their diabetes, which means we could treat far more children than if we were to rely only on organ donors.

HOW IS THE CRMC HELPING RESEARCH NEW THERAPIES FOR DIABETES?

In addition to helping us develop ways to produce large numbers of insulin-producing cells, the CRMC is allowing us to address new questions about how and why diabetes occurs. We know that many children have diabetes because of a genetic difference, but we don't really understand why those genetic differences contribute to the disease. At the CRMC we can take blood samples from kids with diabetes, reprogram them into stem cells, then make those stem cells into insulin-producing cells and study those cells to better understand how that patient developed diabetes.

If we can understand the genetics behind what is causing the disease, we can find new ways to intervene, and maybe prevent diabetes. An example of the kind of results this genetic approach can achieve is a recent breakthrough in linking the genetics that affect a type of pore in a beta cell, called a potassium channel, to diabetes. This research led to developing a medication that children can receive orally, rather than having to inject themselves with insulin everyday. By understanding how beta cells work, we can come up with new ways of helping kids. This is our mission here at the CRMC.

Every three to four days, a child is diagnosed with diabetes—a serious, life-long condition that currently has no cure. More than 900 kids count on BC Children's for expert diabetes care every year.

WHAT WOULD THIS RESEARCH LOOK LIKE WITHOUT THE CRMC?

It would look very different. The infrastructure of the CRMC makes everything so much easier for us. It allows us to generate these stem cells in far greater quantities, and more efficiently, than has ever been possible. The CRMC also allows us to apply new approaches to studying the beta cells once we generate them, so it facilitates the whole spectrum of research—from generating the cells to studying beta cells and the causes behind diabetes.

“I’m hugely grateful to Mining for Miracles. It has enabled our research here. Since receiving their support, our ability to create stem cell-derived cells has increased many fold, meaning we can look ahead to a treating more children with diabetes, and work towards curing diabetes altogether.”

- DR. FRANCIS LYNN



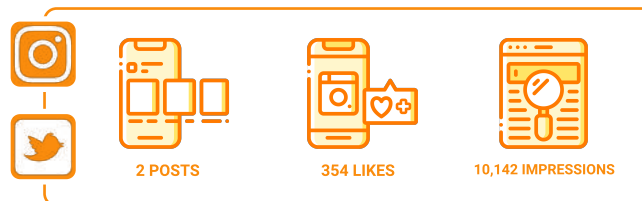
SHARING YOUR IMPACT

The work of the CRMC and the game-changing new technologies made available by Mining for Miracles received wide media coverage across BC in April 2022. Multiple news outlets aired interviews with Drs. Tibbits, Lynn, and Sanatani, and the Vancouver Sun celebrated the support of Mining for Miracles. This province-wide coverage has helped put the CRMC on the map for ground-breaking stem cell research and regenerative medicine, and this was only possible through excitement for the new technologies Mining for Miracles has funded.





SOCIAL MEDIA ENGAGEMENT



LOOKING AHEAD

With the successful establishment of the CRMC, Drs. Sanatani, Lynn, Tibbits, and their research teams are continuing to look ahead towards the research opportunities of faster and more accurate stem cell production made possible through new robotic technologies. This includes not only further accomplishments in the study of heart arrhythmias and diabetes, but also for other pediatric diseases. For example, researchers are exploring how the approaches refined at the CRMC can be applied to the study of cancers, and the reduction of risks related to particular aggressive chemotherapies. Children living with cancer are sometimes treated with a chemotherapy medication called doxorubicin, which is extremely toxic to the heart and can lead to heart failures decades after therapy is completed. Using the technologies available at the CRMC, researchers hope it is possible to study genetic variants that might increase a child's risk of experiencing the toxic side-effects of this medication, and ensure these kids are given another form of effective treatment. This is one of many future possibilities opening up due to the establishment of the CRMC.

DRIVING THE FUTURE OF MEDICINE

Thank you, Mining for Miracles, for enabling this ground-breaking work to be undertaken at the CRMC. Because of your generosity, researchers at BC Children's are closer than ever to curing diabetes in children, and reducing the risks of heart arrhythmias. Your support in purchasing state-of-the-art technologies has also helped the country stop and take notice of the incredible work taking place at the CRMC. On behalf of the researchers, and the many kids their work will help—now, and in the future—thank you.

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