

2020: A YEAR IN REVIEW



UNIVERSITY OF
WATERLOO



**Office of Innovation
& Research**

Grand River Hospital

This year in healthcare has been like no other seen for many of us. The impact of the discovery of COVID-19 to the first case seen locally had a dramatic effect on our community, our healthcare providers, and our research partners.

While this pandemic has gripped the entire world, there is much pride in witnessing the research projects being completed right here, in our own community, by people we call our neighbours and friends. Our existing relationship with the University of Waterloo allowed us to quickly identify those that we could partner with to bring about outstanding contributions to initiatives and innovations to lead the fight against COVID-19.

The following report outlines the ongoing collaborative relationship between Grand River Hospital and the University of Waterloo, which continues to be a point of pride for the hospital. The Office of Innovation & Research remains committed to actively nurturing partnership and engagement through research to realize learnings and insights that inform and fuel transformation and innovation of how we work to deliver care.

QUICK FACTS



- 4 - New Studies
- 11 - Ongoing Studies
- 3 - Closed Studies



- 4 - New Collaborations
- 4 - Grant Applications



- 4 - Education Sessions

Table of Contents:

Research Studies

Research and Development of a Serological (ELISA) Assay to Determine COVID-19 Infection Status of Individuals 2

Establishment of a SARS-CoV-2 Antibody Bank to Profile the Immune Response to COVID-19 3

Optimizing Operations of Cancer Centres During the Pandemic 4

Smart Multi-Dose Packaging: Integration and Impact on Medication Intake Behavior 4

Profs Present..... 5

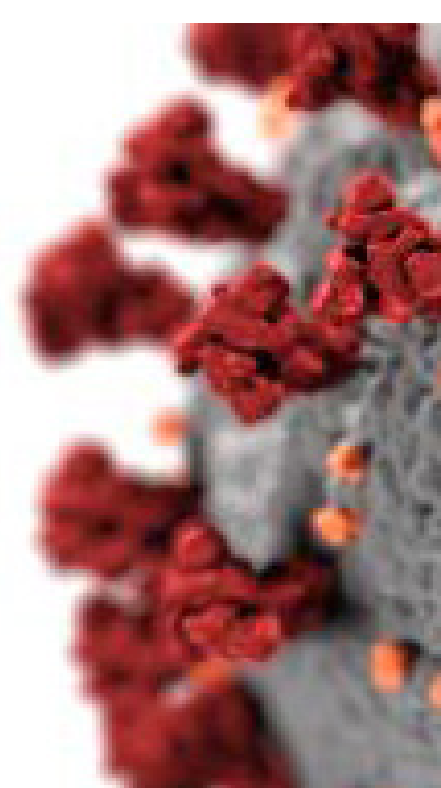
Grant Applications 5

Grant Awards 6

CREATE 6

CAN Health 7

COVID RESEARCH



RESEARCH AND DEVELOPMENT OF A SEROLOGICAL (ELISA) ASSAY TO DETERMINE COVID-19 INFECTION STATUS OF INDIVIDUALS

Brian Dixon, Professor Department of Biology, University of Waterloo

Marc Aucoin, Professor Department of Chemical Engineering, University of Waterloo

Kevin Stinson, Infection Control Practitioner, St. Mary's General Hospital

Antibody markers provide an indication of an individual's immunity to COVID-19, as well as how long the immunity lasts, providing the possibility of its use as an indicator of who may be at a greater risk for infection. Infection-causing viruses, including COVID-19, produce two different types of antibodies — one about four days after the initial infection and the other about 14 days later. Identifying which antibodies someone produces indicates how recent a COVID-19 infection is, and if someone has already been exposed, are they now protected from the virus.

Professor Dixon and his lab are exploring ways to test blood samples for antibody markers, which indicate if someone has previously been exposed to COVID-19, has their body produce antibodies, and how long do those antibodies last.

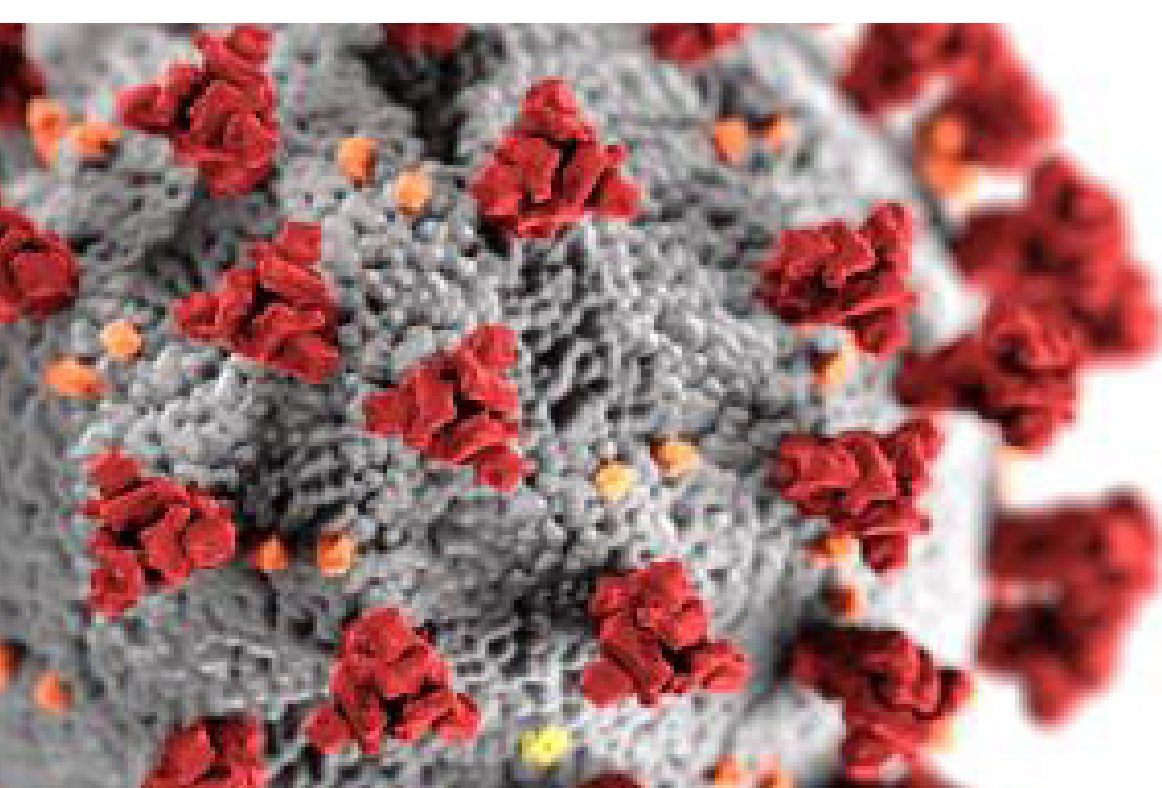
There are several rapid (yes/no) tests for antibody responses, but they need validation with a PCR test, the ability to determine clearly that someone has developed protective immunity to SARS-CoV-2 requires access to their antibody titre and isotype.

Early in the pandemic, GRH and SMGH established a

COVID-19 BioBank of plasma and peripheral blood mononuclear cells (PBMCs/buffy coat), for use in immunological research collaborations. Specimens are collected throughout a patient's encounter, utilizing post-processing blood samples from the core laboratory. The preemptive collection of these samples allowed for GRH and SMGH to rapidly respond to requests for research collaborations.

Professor Dixon's lab will be provided with blood samples from patients who have tested both positive and negative for COVID-19 and are admitted to hospital. Repeat samples from the same patient will be provided during various dates throughout the course of infection and/or hospitalization. With the provided samples, an assay will be developed to assess whether an individual is a) immune to SARS-CoV-2, b) recently infected with SARS-CoV-2 and developing an immune response or c) unexposed and therefore potentially susceptible.

Early results indicate that the assay can perfectly match the known COVID-19 infection status of a patient.



ESTABLISHMENT OF A SARS-CoV-2 ANTIBODY BANK TO PROFILE THE IMMUNE RESPONSE TO COVID-19

Thierry Le Biham, Principal Scientist, Rapid Novor, Inc
Bin Mah, Professor Cheriton School of Computer Science, University of Waterloo
Kevin Stinson, Infection Control Practitioner, St. Mary's General Hospital

Rapid Novor, a University of Waterloo spin-off company, decodes blood samples for exploration of possible treatments. Among many of the projects being undertaken by the startup, decoding the antibodies in the blood of patients who are recovering from COVID-19 provides hope that the information can be used to develop new treatment options for these patients.

Using proprietary technology, Rapid Novor will be able to identify monoclonal antibody sequences with neutralizing activity specific to SARS-CoV-2, this information can then be utilized in the development of novel therapeutics and diagnostics for the management of COVID-19 infections.

The team from Rapid Novor have partnered with GRH and SMGH to obtain samples from the COVID-19 BioBank. This study aims to establish an antibody library from COVID-19 patients to track COVID-19 immune responses. Plasma and white blood cell samples from the biobank along with data indicating the clinical course and severity of disease, days post-positive swab collection date of samples, and clinical outcome will be provided to Rapid Novor

Inc. Following affinity purification and BCR sequencing, the plasma and buffy coat bio-informatics data will be correlated to COVID-19 infection stages. The type and titers of antibodies found in this study will allow an in-depth characterization of the COVID-19 immune response.

OPTIMIZING OPERATIONS OF CANCER CENTRES DURING THE PANDEMIC

Houra Mahmoudzadeh, Assistant Professor Management Sciences, University of Waterloo
Hossein Abouee Mehrizi, Associate Professor Management Sciences, University of Waterloo
Ernest Osei, Medical Physicist, Grand River Hospital

The COVID-19 pandemic has affected hospital operations on multiple levels including cancellation of procedures, reduce program access for patients, or a shift to virtual appointments. The purpose of this study is to provide insights into cancer centre operations during a pandemic outbreak.

Using historical data on scheduling, clinical care paths (radiation therapy planning and treatment process), clinical protocols, and pandemic progression, resource optimization for different scenarios of the disease outbreak among current and future cancer patients will be simulated. Scenario-based simulation tools can provide insights into operation of a system under different scheduling scenarios. In addition, data-driven optimization tools can allow for patient and staff scheduling strategies that maximize input through the healthcare system while minimizing risk of disease transmission in pandemics such as COVID-19.

It is hopeful that the output of this research will shed light on what policies can cancer centres generally employ to increase the resilience of the system against resource uncertainties and provide general insights into how to manage future pandemics. It is believed that the study results will be generalizable to other cancer centres in Canada, as well as other ambulatory programs.

This research has been made possible through NSERC funding.

SMART MULTI-DOSE BLISTER PACKAGING: INTEGRATION AND IMPACT ON MEDICATION INTAKE BEHAVIOUR

Tejal Patel, Clinical Associate Professor School of Pharmacy, University of Waterloo
Sadaf Faisal, PhD Student, University of Waterloo
Luna Salameh, Pharmacist, Grand River Hospital

Chronic diseases often require long-term therapy with complex medication regimens, which are difficult to manage and require many prescriptions with multiple daily dosing. Non-adherence to medications can lead to non-optimal management of disease, poor clinical outcomes and cost to health care system.

The use of technology has grown rapidly in the past two decades to address non-adherence and seems to affect medication adherence. However, little has occurred with respect to smart devices for multiple daily medication regimens.

Literature has reported various health behaviour theories in order to identify barriers to change when it comes to medication intake. By applying one, or more than one, of these behaviour theories, one can understand the process and design effective interventions to address issues of complex medication regimen.

The team had set out to explore the integration of smart multi-dose blister packaging for daily use by patients and would the implementation of such technology influence medication intake behavior. At the time the team was ready to move forward with application to ethics, the COVID-19 pandemic began. In the interest of researcher safety, it was determined to cancel plans to move forward with the study.

PROFS PRESENT...

As with many activities, the monthly Pizza with the Profs education sessions took a shift during the COVID-19 pandemic. Modifying from its traditional in-person discussions over pizza, the sessions shifted to a virtual presentation. This shift resulted in a name change from Pizza with the Profs to Profs Present... to reflect the new format using Zoom meetings.



Physical Activity: Impact & Accessibility Among Persons Living with MCI/ Dementia

Laura Middleton, Associate Professor
Kinesiology



The Tell-Take Sign of Antibodies: Determining COVID-19 immunity with Blood Testing

Brian Dixon, Professor
Biology



Cognitive-Motor Interactions and their Implications for Motor Learning-Based Interventions Post Stroke

Sean Meehan, Assistant Professor
Kinesiology



How Can Intelligent Humancentered Robots Transform Health Care in the Future?

Katja Mombaur, Professor
Mechanical and Mechatronic Engineering

GRANT APPLICATIONS

Our office was pleased to facilitate a number of collaborative discussions regarding potential future research partnerships. On behalf of the study teams, Letters of Support were generated to accompany grant application processes. We look forward to hearing about application success and initiation of project work.



Next Generation of Surgical Microscopes for Real-time Virtual Histopathology (CIHR-Fall 2020)

Parsin Reza, Assistant Professor
Systems Design Engineering



Moving beyond blood glucose with continuous multiplexed hormone measurement (CIHR-Fall 2020)

Mahla Poudineh, Assistant Professor
Electrical Engineering



Improving Care for Knee Osteoarthritis by Predicting Who Will Get Worse (CIHR-Fall 2020)

Monica Maly, Associate Professor
Department of Kinesiology



Optimized application of mechanical waves for vibratory pulmonary drainage stimulation (NFRF-Fall 2020)

Giovanni Cascante, Professor
Civil & Environmental Engineering

GRANT AWARDS



Improving Care Transitions for Older Rehabilitation Patients: The InfoRehab Model (CIHR-SPRING 2020)

Paul Stolee, Professor Department of Applied Health Sciences

While many interventions have been implemented to reduce the adverse outcomes often associated with care transitions, successful engagement of patients and their family remains an area where further work is critically needed. Dr. Stolee and his team will gain an in-depth understanding of current engagement practices and how these practices align with the CHOICE Framework and determine what factors facilitate or hinder patient and family engagement during care transitions.

CREATE

Center for Bioengineering and Biotechnology NSERC grant for the CREATE program is the first “needs-first” graduate program in Canada, in which trainees learn to directly interact with end-users and stakeholders in the patient, medical, biotechnology industry communities to co-discover technology problems and solutions. The program’s long-term objective is to produce high-quality personnel capable of thriving in a biomedical technology career.

The CREATE program spreads its learning requirements across three key learning objectives: Design Training, Biomedical Commercialization, and Professional Soft Skills. Under the theme of Biomedical Commercialization, Director of Innovation, Research & Clinical Trials, Carla Girolametto, provided a guest lecture entitled “Ethics and Regulations, Conducting Research in Clinical Settings: A focus on Specific Cases.”

LEARNING IN ACTION

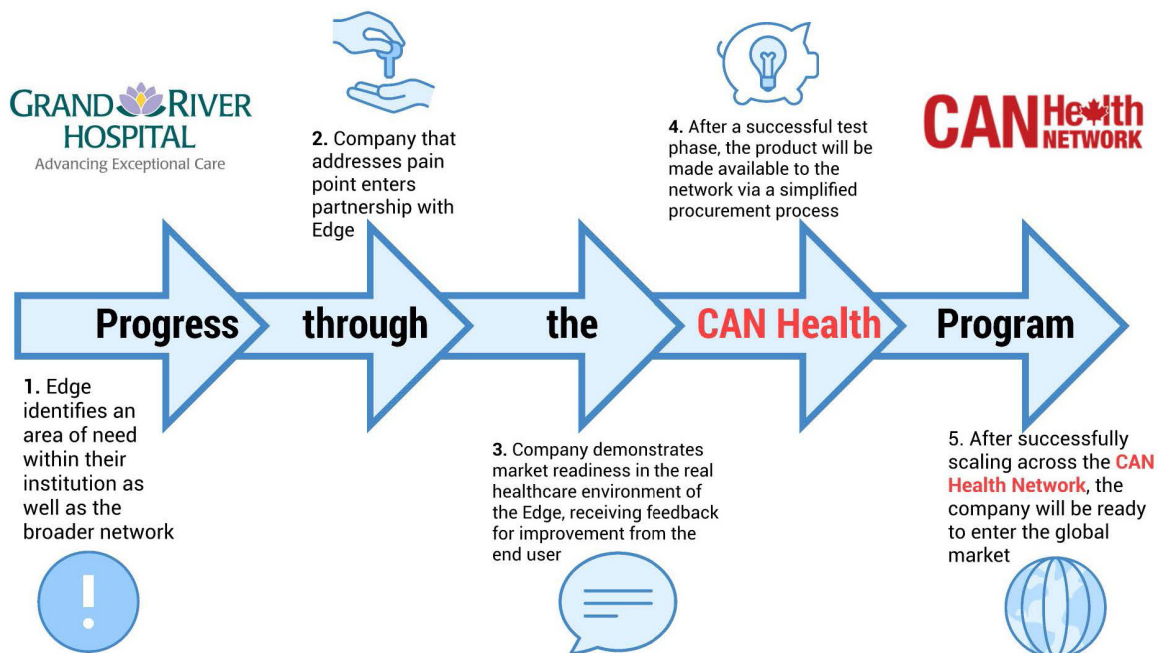
Additional work is ongoing with the first student project team to provide direct interaction between student and clinicians. Under the supervision of Professors Clarke Dickerson and Tom Willet, PhD Candidate Cristiana Herrera is actively engaging with clinical team members at GRH to design a research project focused on addressing the effective rehabilitation of post-treatment breast cancer patient functional capacity. The CREATE student will receive mentorship on project design and implementation by a GRH Oncologist, Medical Physicist, Nurse Practitioner, and Project Coordinator to facilitate learning in all aspects of interdisciplinary hospital research.



CANHEALTH

Grand River Hospital is proud to have been chosen as one of the Ontario edges in the CAN Health Network. This partnership of leading Canadian medical and technology institutions will take a nationwide approach to introduce technology into the health care system.

As one of the edges, Grand River Hospital will provide a space where the most promising Canadian health-tech companies will have access to real health care environments. Here, their products will receive the support they need for widespread adoption, helping companies scale first locally, then nationally and finally internationally. The CAN Health Network will allow promising companies to work directly with health care organizations to understand their needs and commercialize health technologies to meet those needs and scale up their companies. Through this, small and medium-sized enterprises and leading start-ups will be able to work with early adopter institutions to collaboratively innovate, research, develop, and refine Canadian medical technologies to make them market-ready.



Active work is ongoing with two University of Waterloo launched start-ups, Intellijoint Surgical and KA Imaging, to explore possible participation as GRH's first CAN Health initiatives.



CONNECT WITH THE OFFICE OF
INNOVATION & RESEARCH
AT GRAND RIVER HOSPITAL

research@grhosp.on.ca

grhosp.on.ca/research

 [@GRHresearch](https://twitter.com/GRHresearch)

 [OIR-GRH](https://www.linkedin.com/company/OIR-GRH)