

COVID-19: Putting NML to the Test

On January 26, 2020, a team of specialized respiratory illness researchers at the Public Health Agency of Canada's (PHAC) National Microbiology Laboratory (NML) restlessly awaited the arrival of a delivery that would change Canadian history. A sample from Canada's first presumptive positive COVID-19 case. As soon as the patient was presumed positive for COVID-19, the NML was preparing to have the sample shipped to their laboratory in Winnipeg to confirm the diagnosis.

Dr. Nathalie Bastien, Senior Research Scientist at the NML, knew what steps to take to prepare for the arrival of the virus that causes COVID-19. She is an expert on respiratory viruses like the flu, and led the lab team on previous major outbreaks in Canada, such as SARS and H1N1.



Dr. Nathalie Bastien, Senior Research Scientist at the NML

Preparation is key

"We began making preparations when we first saw the virus developing early in January," says Dr. Bastien.

"We knew it was only a matter of time before the virus found its way to Canada so we began preparing right away. We had not seen anything like this since SARS. There were no easily accessible tests to confirm the virus, so we had to be inventive and create our own. It felt like a race against time and the wellbeing of Canadians was at stake."

Dr. Bastien and her team already had extensive experience dealing with coronaviruses, which positioned them well to handle the emerging pandemic virus that causes COVID-19. Her team learned a lot about coronaviruses after Canada's SARS outbreak in 2003.

During the SARS outbreak, Dr. Bastien's team developed specialized lab tests meant to detect any type of coronavirus that could arise in the future. Since the team had been hard at work since the virus first emerged in January, the time had come to see if the hard work paid off—specifically, would the tools they had developed accurately detect this new pandemic strain?

Cashing out at the genetic bank

"We were sitting on pins and needles," said Laura Hart, a technician on the team who worked to develop the test. "We started the preliminary work needed to develop the test when we first heard about this virus emerging in China, but we really had nothing to confirm it with until our first positive sample arrived. We made our preparations and at some point, all we could do was wait."

In the short time between when the virus was shipped from Toronto, to when it arrived in Winnipeg, Dr. Bastien's team of specialized respiratory disease researchers stood on

the backs of COVID-19 trailblazers—scientists who had already been battling with the virus around the world and had sequenced the virus with what we call genomics.

The genetic information that is shared by scientists around the globe is stored in a public genome sequence database called “GISAID”, an international collaboration of scientists who decode and archive the genetic material of different living things, including viruses like the one that causes COVID-19. This genetic information can be used to answer research questions and develop new testing approaches.

Burning the midnight oil

Dr. Bastien’s team toiled tirelessly through the night, testing, isolating, and confirming the first COVID-19 virus sample. Using only peer-reviewed information that scientists in other countries had shared, they put Canada’s first diagnostic tool for the virus that causes COVID-19 to the test and subsequently confirmed that it worked. Multiple people were required to develop and validate the first test to ensure its accuracy.

“That first evening was a ‘make it or break it’ moment,” said April Powell, a technician on the team who works to diagnose COVID-19. “Detecting those first cases was critical to help slow the spread in Canada. With a positive lab test, you can isolate patients and do contact tracing to try to reduce further transmission. We worked nonstop in those first weeks for almost twelve hours a day, seven days a week. You get used to seeing mysterious things with respiratory viruses, so our jobs had already prepared us for this level of intensity.”



A scientist working with COVID-19 in a biosafety cabinet.

The team relied on genome sequencing—or, scanning the genetic material of all the COVID-19 virus samples in parallel with the molecular diagnostic test. This process ensured testing accuracy, which was vital in those early stages without fast, standardized tests like what we use now.

Continuing to help

During the early days of Canada’s response to COVID-19, all laboratory samples were sent to the NML from provincial and territorial public health labs to confirm the presumptive results. Still now, the NML continues to work in close collaboration with these public health labs to ensure that the test we use to diagnose COVID-19 remains accurate.

The NML provides all provinces and territories with laboratory reference services on an ongoing basis. These testing services provide a variety of support to provincial and territorial laboratories across Canada including confirmatory testing for all presumed

positive samples, quality assurance to ensure testing is accurate, and in-depth analysis of difficult to diagnose specimens.

One day soon, Dr. Bastien's team at the NML hopes that they will no longer need to do tests in Canada for the virus that causes COVID-19. Once that day comes, they will continue their research to prepare for any future viruses that could impact Canadians or people around the world.

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