COVID breath-testing – could it be next? Research says yes

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From left: University of Canterbury researchers postdoctoral fellow Dr Fiona Given and Associate Professor Deborah Crittenden at the Biomolecular Interaction Centre. Credit: University of Canterbury

Anyone who's experienced a sharp swab up the nose and a tense, isolated wait for results will surely be interested in a pain-free COVID test with a speedy result delivered in minutes, not days.

A new study led by University of Canterbury (UC) researchers at the Biomolecular Interaction Centre, along with Callaghan Innovation's Protein Science and Engineering team and MacDiarmid Institute researchers from Massey University, has shown it may be possible to detect COVID-19 in as little as five minutes, thanks to a simple breath test.

"We've developed a new approach to detecting COVID-19 viral proteins that is sensitive and accurate enough to directly detect coronavirus particles at biologically relevant levels, specifically in breath or saliva samples," says the paper's co-author, UC biochemist Associate Professor Deborah Crittenden.

The new scientific paper, "Optical Detection of CoV-SARS-2 Viral Proteins to Sub-Picomolar Concentrations," was published recently in *ACS Omega*, a journal of the American Chemical Society.

Associate Professor Crittenden, of UC's School of Physical and Chemical Sciences, brought together the MacDiarmid Institute's expertise in sensing measurements, Callaghan Innovation's ability to make the target protein, and the biochemical analysis skills of researchers within UC's Biomolecular Interaction Centre.

The result is a proof of principle for a new COVID-sensing test that could dramatically decrease turn-around times for testing, and increase the volume of tests that can be performed.

"Unlike other proposed COVID breath-testing technologies, this test directly detects the COVID spike protein antigen and so is expected to be as accurate as the current gold standard lab-based approach," Dr.

Crittenden says.

The research was motivated and made possible by the COVID-19 pandemic, as it allowed resource that would have been allocated elsewhere to be directed to the study, following the national lockdown in March and April 2020.

"Over lockdown, we started brainstorming how we could adapt existing biomolecular sensing approaches to detecting COVID. The key insight is that you need a 'recognition element' that specifically and selectively binds to part of the virus—in our case, the spike protein," Dr. Crittenden says.

"The first thing we tried was part of the ACE2 receptor to which the virus is known to bind but it was too hard to make enough of it. We then discovered a paper in the literature about non-helical DNA sequences that were evolved to bind to the spike protein, and then built them into a range of different sensing systems, and tested how well they worked."

What does this mean for COVID detection in New Zealand?

"If developed and commercialized, we could have near-immediate point of use/care COVID-testing with the same accuracy as current gold standard lab tests. One could imagine having these devices at all border facilities, such as airports, ports, and MIQ facilities, for example," Dr. Crittenden says.

Are there any plans to implement/commercialize the test?

"We'd love to hear from other scientists and research engineers with expertise in nanomaterial design for point-of-use surface-enhanced Raman scattering applications."

What are the next steps?

"We will continue developing this as a 'platform technology' for other sensing applications, for example, rapid detection of other pathogens or environmental pollutants. In future, if other pathogens emerge, it would be really useful to be able to use what we have learned to roll out real-time sensors/diagnostics a lot more quickly."

More information: Tamsyn Stanborough et al. Optical Detection of CoV-SARS-2 Viral Proteins to Sub-Picomolar Concentrations, *ACS Omega* (2021). [DOI: 10.1021/acsomega.1c00008](https://doi.org/10.1021/acsomega.1c00008)

Provided by University of Canterbury

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