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## NTU team's Covid-19 rapid test can pick up variants

Clara Chong

A new Covid-19 rapid test that can detect variants of the virus has been developed in Singapore.

It produces results within 30 minutes and can be used directly on patient samples. It is also about 10 times more accurate than anti-gen rapid tests currently in use in the country.

The Variant Nucleotide Guard (VaNGuard) test is the first rapid test here to make use of a gene editing tool known as Crispr.

Developed by scientists from Nanyang Technological University (NTU), the VaNGuard test uses a reaction mix containing a specific enzyme that acts like a pair of "molecular scissors".

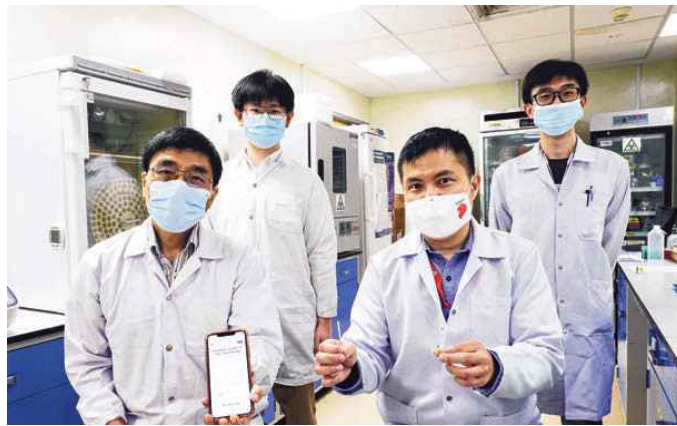
The enzyme targets specific segments of the genetic material of Sars-CoV-2 – the virus responsible for Covid-19 – and snips them off the rest of the viral genome. Successfully snipping off these segments is how the enzyme identifies the presence of the virus.

To ensure that variants are not missed, two short genetic sequences – known as guide RNAs – are used to recognise sequences that are extremely similar across the variants but also unique to the virus.

Associate Professor Tan Meng How, who led the project, said yesterday: "Should these binding regions mutate, a new test can be redesigned in under a week."

Crispr technology is traditionally used in scientific research to alter DNA sequences, giving it the potential to cure – and not just treat – any disease caused by DNA

## Aim to refine test to identify specific variant



Members of the Nanyang Technological University team that came up with the new rapid Covid-19 test – (from left) Professor Lin Weisi, PhD student Hou Jingwen, Associate Professor Tan Meng How and project officer Ooi Kean Hean – with their test kit and mobile app that helps to analyse the results. PHOTO: NANYANG TECHNOLOGICAL UNIVERSITY

### FROM A1

differences.

Currently, antigen rapid tests that detect proteins called antigens on the surface of the virus are used in Singapore. Should a mutation affect the viral antigen, some of these tests may be ineffective.

Redesigning an antigen rapid test takes a longer time because the test relies on antibodies and the redesigning of an antibody requires more time, Prof Tan added.

Several strains of the Sars-CoV-2 have been identified globally, such as Britain's B117 strain, the Brazilian P1 variant and South Africa's B1351 variant.

Prof Tan, who is from NTU's

School of Chemical and Biomedical Engineering, said the new test would likely cost slightly less than a traditional antigen rapid test when sold in the market.

"Polymerase chain reaction tests – the gold standard for testing – can detect extremely low viral loads of around five copies of the viral RNA per reaction. The limit of our test is around 50 RNA copies," he said.

To make the test easier to use once it is approved, it has been integrated into a specially treated paper strip that looks similar to a pregnancy test.

The paper strip is dipped into a swab sample and the reaction mixture. In the presence of the Sars-

CoV-2 virus or its variant, two bands will appear. Otherwise, only one band will appear.

Since August last year, the NTU team has been working with a local hospital to obtain clinical samples for use on the new test kit.

The scientists hope to obtain more samples to further refine their test and eventually develop a kit that can identify the specific variant and not simply detect the presence of viral strains in general.

The project was started in January last year and the team hopes to obtain regulatory approval this year.

chongcjy@sph.com.sg

### VaNGuard versus other test kits

A new Covid-19 test kit that makes use of a gene editing tool has been added to Singapore's testing arsenal. **Clara Chong** takes a look at VaNGuard and how it compares with existing test kits.

#### RAPID TESTS **A** VaNGuard (Variant Nucleotide Guard) test

An enzyme which targets specific segments of the genetic material of Sars-CoV-2 – the virus causing Covid-19 – snips them off the rest of the viral genome. Successfully cutting off these segments is how the enzyme identifies the presence of the virus.

#### How the VaNGuard test works:

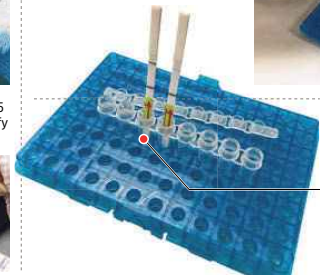
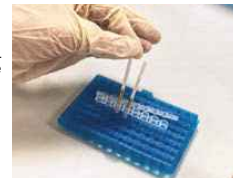
**1** A swab sample is added to a tube of reaction mix that amplifies viral RNA.



**2** The tube is heated to 60 to 65 deg C for 22 minutes to amplify the viral RNA in the sample.



**3** enAsCas12a, the enzyme that "detects" the virus, is added to the tube, which is heated again at 60 to 65 deg C for 5 minutes. The paper test strip can now be dipped into the tube.



**4** In the presence of Sars-CoV-2, two bands appear on the strip (positive result on the left).

#### **B** Antigen rapid test (ART)

ART looks for proteins on the surface of the virus called antigens.

+ It is faster (less than 30 minutes), cheaper and easier to administer.

- It has lower sensitivity and specificity, and may carry a higher risk of false positives and false negatives.

#### POLYMERASE CHAIN REACTION (PCR) TEST

The PCR test looks for genetic sequences of Covid-19.

+ It is the most accurate test available today.

- The process from swabbing to seeing results takes about one to two days. Its lab-based nature necessitates a logistical chain to convey the samples and specialised systems to monitor/report the results.