Research efforts on Covid-19

Local researchers have played a critical role in Singapore's response to Covid-19 by contributing to a pool of international knowledge on the virus, developing novel test kits and therapeutics to combat Covid-19, and beginning trials on our own vaccine. **Cheryl Tan** and **Shabana Begum** highlight some of these contributions.

$45 million Covid-19 Research Fund set up by the National Research Foundation (NRF) and the Health Ministry to support research in areas such as developing novel therapies and translating research into products and solutions

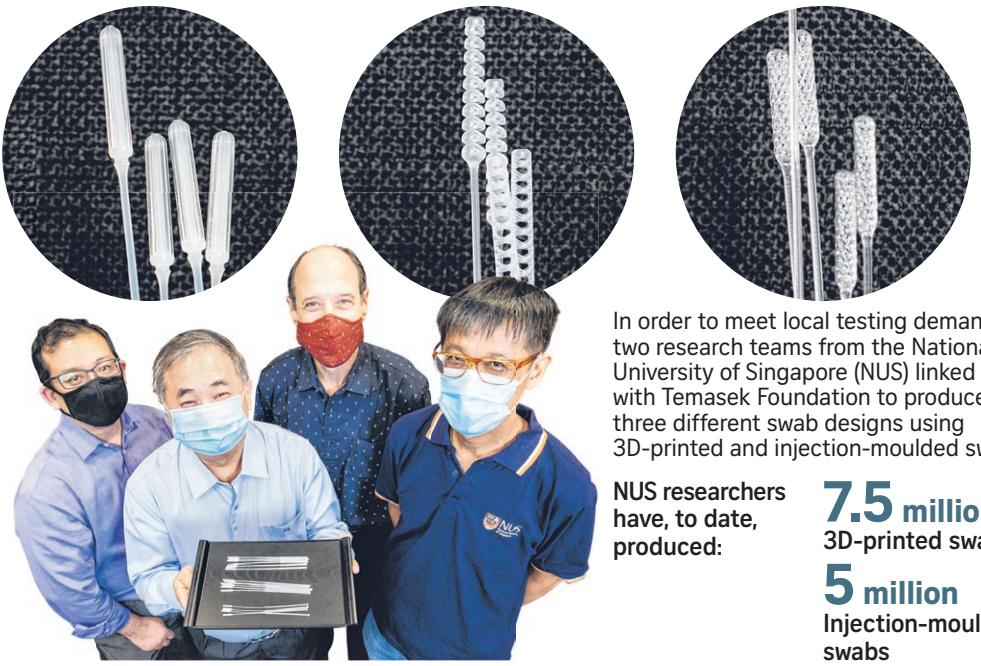
$40 million dedicated to the National Innovation Challenge, co-organised by Enterprise Singapore, the Infocomm Media Development Authority and NRF to accelerate innovation efforts and overcome challenges in the post Covid-19 world

>1,100 Peer-reviewed papers that scientists in Singapore have published on Covid-19 (as at end-November)

156 Covid-19 test kits* that have been given provisional authorisation by the Health Sciences Authority (HSA)

NOTE: *Including PCR tests, antigen rapid tests and antibody tests.

3D-PRINTED AND INJECTION-MOULDED SWABS



In order to meet local testing demands, two research teams from the National University of Singapore (NUS) linked up with Temasek Foundation to produce three different swab designs using 3D-printed and injection-moulded swabs.

NUS researchers have, to date, produced:

7.5 million 3D-printed swabs

5 million Injection-moulded swabs

DEVELOPED COVID-19 TEST-KITS FOR LOCAL USE

HSA has given provisional authorisation to 156 test kits, including polymerase chain reaction (PCR) tests, antigen rapid tests and antibody tests.

Fortitude (Feb 8)

- First made-in-Singapore diagnostic test, which is able to detect the coronavirus with high accuracy.
- Since February, the kit has been deployed in 13 hospitals and labs locally, as well as more than 20 countries globally.
- It comprises a pre-packed mix of reagents to test patient samples, which are then fed into a PCR machine to analyse the results.

Resolute 2.0 Test Kit (July 18)

- PCR test co-developed by DSO National Laboratories and the Agency for Science, Technology and Research (A*Star) which can cut Covid-19 testing time by half (it usually takes around four hours).
- Takes about 60 to 90 minutes to get test results.

Serology Test

cPass Test to detect neutralising antibodies

- First of its kind to receive approval from the United States' Food and Drug Administration.
- Developed by Professor Wang Linfa, director of Duke-NUS' emerging infectious diseases programme, GenScript Biotech Corporation and the A*Star's Diagnostics Development Hub.
- The neutralising antibodies are thought to be preventing the coronavirus from entering the patient's cells.
- Can be used to see if vaccines are working, to check what proportion of the population has already been infected, and to assist in contact tracing.
- Can yield results within an hour.

THERAPEUTICS

MONOCLONAL ANTIBODIES

Monoclonal antibodies are immune system proteins created in the laboratory, and are specifically engineered to neutralise Sars-CoV-2, the virus causing Covid-19.

DSO National Laboratories

- Announced the discovery of five antibodies which could neutralise Covid-19, after screening antibodies from recovered patients.
- Currently working with the Experimental Drug Development Centre in the pre-clinical and clinical development of AOD01, the most promising antibody of the five.
- Antibodies from a recovered patient would stay in one's system for a month, and would help the patient to fight the infection and recover faster.

Tychan

- Currently conducting clinical trials for the final phase of its drug, an immune system protein known as TY027, after it received approval from HSA in October.
- T027 is being tested for its ability to slow down the progression of the disease and confer temporary protection against infection.
- The trial, which began last Friday, will involve 1,305 volunteers.

A*Star and Chugai Pharmabody Research in Japan

- Developing therapeutic antibodies which bind to the virus, preventing it from attacking human cells.
- They are researching this for clinical use (since May).

LUNAR-COV19 VACCINE

mRNA vaccine developed by Duke-NUS Medical School and Arcturus Therapeutics is currently undergoing clinical trials and may be available early next year.

- Economic Development Board pumping in some US$45 million (S$60 million) into the manufacture of the vaccine.
- Around 106 volunteers enrolled in the early-stage trials observed antibody and T-cell response, with no adverse side effects that were deemed to be treatment-related.

How it works

- Delivers the spike gene of Sars-CoV-2, the cause of Covid-19, in the form of RNA or ribonucleic acid.
- This allows the body to recognise and fight the virus should it try to infect the person.

TOP PICKS

Out of the 1,100 publications, here are three noteworthy ones:

1 Serological investigation of the Covid-19 infection

Principally led by Wang Linfa

- Using serology tests, the study showed links between three clusters of Covid-19, comprising 28 locally transmitted cases.
- They were from two churches and a family gathering.
- An individual from Church A had transmitted the virus to a primary case from Church B at a family gathering they both attended.
- All tested positive for Covid-19 except individual A, who had recovered and tested negative. The individual was diagnosed with past infection using serology testing.

2 Interventions to mitigate early spread of Covid-19 in Singapore

Using modelling by Alex Cook

- Adapted an influenza epidemic simulation model to estimate the likelihood of Covid-19 transmission in Singapore.
- Took cumulative infections at 80 days, after detecting 100 cases of community transmission, under three infectivity scenarios, with 7.5 per cent of cases assumed asymptomatic.
- Ran a model with a range of intervention scenarios and found that quarantining infected individuals and their family members, workplace distancing and school closure once community transmission has been detected could significantly reduce the number of Covid-19 infections.

3 Singapore becomes the third country in the world outside of China to culture the Sars-CoV-2 virus

Researchers from Duke-NUS Medical School

- The team successfully cultured the coronavirus from an infected patient's sample, just four days after receiving the sample in late January, in the medical school's containment laboratory.
- Singapore becomes the third country in the world outside of China to culture the virus.
- On Jan 30, Duke-NUS said the cultured virus will be used for:

Developing new diagnostic methods | **Monitoring potential mutation** | **Testing for potential vaccine and drugs**

- The research was done in collaboration with scientists from institutions such as the National Centre for Infectious Diseases, Singapore General Hospital and the Ministry of Health.

PHOTOS: KELVIN CHNG, NUS, A*STAR, DSO NATIONAL LABORATORIES, GENSCRIPT BIOTECH CORPORATION STRAITS TIMES GRAPHICS