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## Research & Development

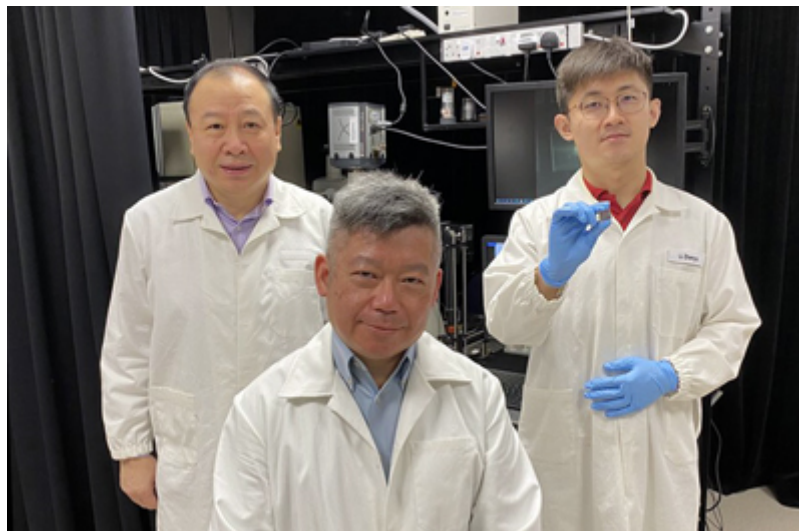
### Scientists create device that uses laser tweezers to trap viruses

01 Nov 2021

**Developers at NTU, Singapore, say it promises new approaches to disease diagnosis and study of viruses.**

A team of scientists led by **Nanyang Technological University**, Singapore (NTU) has created laser-powered “tweezers” that can trap and move viruses using light.

The device could aid in the development of new approaches to disease diagnosis and the study of viruses, say its developers, because it can precisely relocate a single virus to target a particular part of a cell, for example.



**Laser tweezer developers: Prof. Eric Yap, Prof. Liu Aiqun, and Li Zhenyu.**

It could also aid in vaccine development, as the device allows scientists to separate damaged or incomplete viruses from a group of thousands of other specimens in under one minute, compared to current processes which are tedious and lacking in precision, said the scientists.

Associate Professor Eric Yap, from NTU’s **Lee Kong Chian School of Medicine**, a medical geneticist who co-led the research, commented, “The conventional method of analysing viruses today is to study a population of thousands or millions of viruses. We only know their average behaviour as an entire population. With our laser-based technology, single viruses could be studied individually.

“As well as diagnosing diseases, our device could be used to spot the outliers – the rare individual virus that has the potential to evolve and create the next wave of an epidemic, for

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instance. This brings us into an era where we can contemplate precision diagnostics at the single virus level.”

### ‘Digital virus manipulation chip’

The researchers tested their device known as a digital virus manipulation chip on adenoviruses, which is a group of common viruses that can cause cold-like symptoms, measuring 90 to 100 nm in diameter. Although not yet tested on coronaviruses, it has the potential to be used for research on SARS-CoV-2 virus, between 80 to 120 nm in diameter.

Professor **Liu Aiqun**, from NTU’s School of Electrical and Electronic Engineering, who led the research, said, “Our invention uses light to manipulate viruses in a certain size range and we have proven that it works with adenoviruses. We believe our device could also be used to trap and concentrate SARS-CoV-2 for research and diagnosis.”

The findings of the study were published in **ACS Sensors**.

Measuring 20 x 20mm, the device consists of a chip that is made from a wafer of silicon oxide and silicon nitride, with nanometre sized cavities to contain the trapped viruses. Above the chip is a laser directing highly focused light beams with the right amount of energy to act as a pair of ‘tweezers’ that can isolate and move viruses.

It works by loading a fluid that contains viruses, such as blood, into the chip. After which, a laser beam is directed on to it, forming spots of light. As the intensity of the light is highest in the centre of the spots, this creates a strong force that attracts and traps the virus in designated cavities on the chip. By shifting the locations of the spots of light, viruses can be freely moved to other parts of the chip. This allows for the easy sorting and concentrating of viruses of different sizes, ranging from 40 nm to 300 nm.

“Our invention is a breakthrough in virus research as it allows us to single out individual specimens for study, while comparable technologies today can only handle viruses in large quantities,” said Prof **Liu**. “For example, we can isolate individual viruses with mutations to develop therapies against these variants. Our invention uses insulating materials that are biocompatible and do not heat up easily, unlike current sorting methods that generate a lot of heat. This means scientists should be confident in handling viruses with this device without affecting their properties and viability.”

Assoc Prof Yap added: “Using this technology, we could hand-pick specific virus particles and study them to gain novel insights into them and the diseases they cause. For example, it could open new channels for more detailed analysis of specific virus mutants, which could lead to new ways in characterising and countering these viral variants.

### Video explainer

#### Virus sorting device CUT3a

