First laser-powered device that can trap a virus created here

This opens up avenues for viral studies that could not be carried out previously

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In a first of its kind, a laser-powered device can trap a single virus using light and has been created in Singapore.

The device is able to trap, analyze and count viruses of different types and sizes. So far, it has been proven to work on adenoviruses—a group of common viruses measuring 90 nanometers in diameter that can cause cold-like symptoms. A nanometer is one billionth of a meter.

Adenoviruses are similar in size to Sars-CoV-2, which causes Covid-19.

Created by a team of scientists led by Prof Lim Ai Guan from the Nanyang Technological University’s (NTU) School of Electrical and Electronic Engineering and Associate Professor Wei Yap from NTU’s Lee Kong Chian School of Medicine, the device includes a laser beam that hits the virus at a right angle. The light is then used to analyze the virus, which is then captured by the device.

The device is able to sort viruses of different sizes ranging from 40nm to 300nm.

A single virus can then be placed inside a cell to investigate how it interacts with the cell, and whether a single virus is sufficient to infect the cell, or if 10 or 50 viruses are needed to infect it, Prof Yap said.

“This opens up avenues for viral studies that could not be done previously as we are now able to study single viruses,” he added.

All these experiments can be done directly on the chip, if more than one type of virus is present, they can be labeled with different fluorescent dyes.

This discovery also has huge potential in Covid-19 diagnostics. Currently, polymerase chain reaction tests, though very sensitive, is unable to distinguish between active infection and an old infection, or between the different variants, Prof Yap said.

“However, this chip can digitally count individual viruses, and distinguish between whole viruses that are present in active infections and residual RNA from previous infections.”

The device took five years to build and was a breakthrough after 20 years of collaboration between the physicists and the medical scientists, said Prof Lim.

They hope to use the digital virus chip to evaluate a wide variety of viruses, including Sars-CoV-2 viruses that currently require larger and more expensive facilities.

Asked if there would be time for the current Covid-19 pandemic, Prof Yap said that it would depend on patent approval and research funding.

Trapping a single virus

A chip with 25 carries, each having a diameter of 100 nanometers (nm).

- The size of the particles can be customized to fit different types of viruses.
- The chip is made from a wafer of silicon oxide and silicon nitride.

NUS—A compound is one billionth of a meter. (Photo: Cherie Cheung)