One minute electro-optical coronavirus test developed

May 27 2020

Prof. Sarusi demonstrating the one minute covid-19 breath test.The BGU test is based on an electro-optical system that detects and identifies biological samples. It does not require a lab environment so it can be deployed at critical locations such as airports, border crossings, stadiums, and other environments, as well as healthcare facilities where rapid testing is required. Credit: Ben-Gurion University

Ben-Gurion University of the Negev's Prof. Gabby Sarusi has developed a one-minute electro-optical test of nose, throat or breath samples that will identify both asymptomatic and affected carriers of the COVID-19 virus in under one minute with greater than 90% accuracy.

Each test kit will cost approximately $50, which is far less costly than standard, laboratory-based polymerase chain reaction (PCR) tests. The BGU test is based on an electro-optical system that detects and identifies biological samples. It does not require a lab environment so it can be deployed at critical locations such as airports, border crossings, stadiums, and other environments, as well as healthcare facilities where rapid testing is required.

Initial clinical trials completed with the Israel Defense Ministry on more than 150 Israelis had a better than 90% success rate. The ongoing trials will compare samples from COVID-19 patients with samples of patients with other diseases to detect the presence as well as the specific stage of COVID-19 infection.

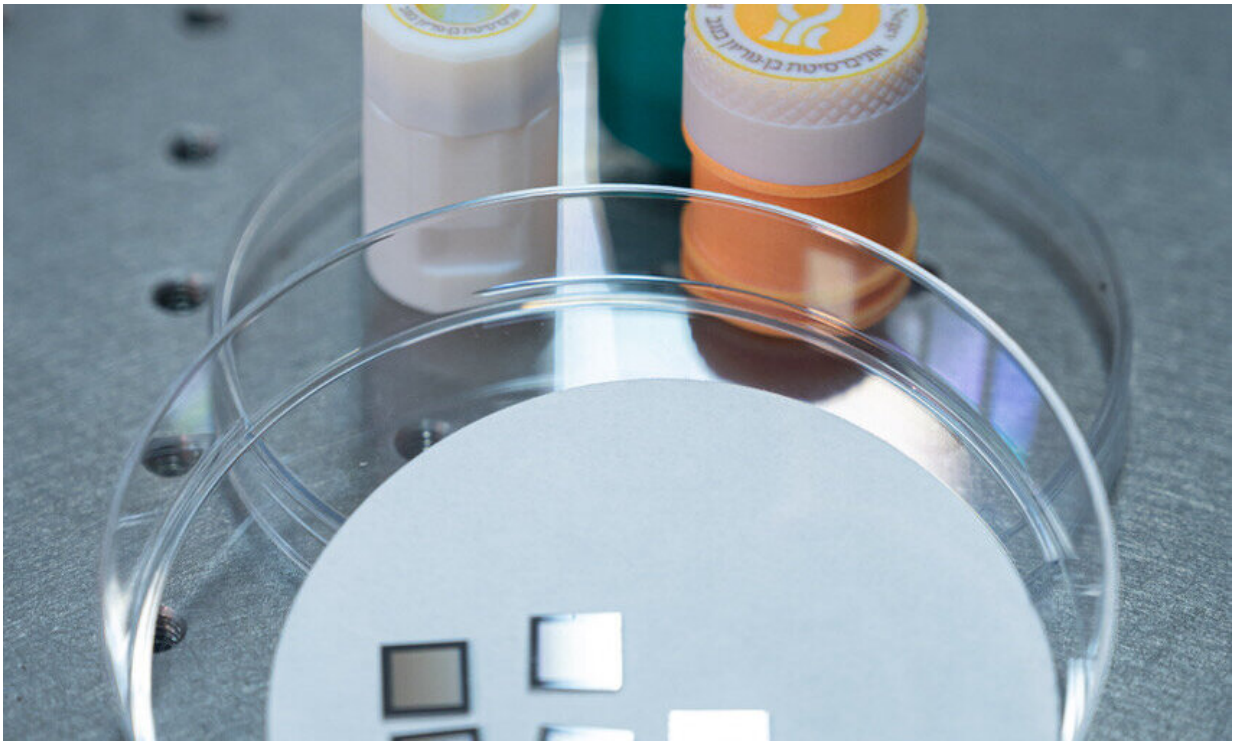
"Right from the beginning of the trials, we received statistically significant results in line with our simulations and actual PCR tests that were conducted in parallel," says Prof. Sarusi, deputy head of research at the School of Electrical and Computer Engineering and a faculty member of the Electro-Optical Engineering Unit at BGU. "We are now validating the robustness of the test and preparing to submit for FDA accelerated approval."

How does the test work?

"We asked ourselves, since this virus is just like a nano-particle or a quantum dot with a diameter between 100nm to 140nm in terms of its size and electrical properties, can we detect it using methods from the world of physics, photonics and electrical engineering," says Prof.

Sarusi. "We discovered that the answer is yes; this virus resonates in the THz frequency, and spectroscopy in these frequencies reveals it promptly."

PCR coronavirus test kits are based on amplifying and identifying the viral RNA/DNA sequences, and therefore depend on costly reagents in short supply and biochemical reactions that can be affected by heat and humidity. PCR-based kits take hours, and in many cases days, to yield results and require logistically complicated shipping and handling of sensitive and infectious biological samples and can only be performed at points of care.



Particles from a simple breath test or throat and nose swabs, currently used for other tests, are placed on a chip with a dense array of tens of thousands of metamaterial sensors that were designed specifically for this purpose. The system then analyzes the biological sample and provides an accurate

positive/negative result within a minute via a cloud-connected system. Credit: Ben-Gurion University

The new method is based on the change in the resonance in the THz spectral range imposed by the coronavirus through a THz spectroscopy performed on the electronic chip designed by Prof. Sarusi and his team. This spectral range has been employed in recent decades for the fast detection and identification of biological samples.

Particles from a simple breath test or throat and nose swabs, currently used for other tests, are placed on a chip with a dense array of tens of thousands of metamaterial sensors that were designed specifically for this purpose. The system then analyzes the biological sample and provides an accurate positive/negative result within a minute via a cloud-connected system. The point-of-care device automatically records the results into a database that can be shared by authorities, making it easier than ever to track the course of the virus, as well as triage and treat patients.

"The world needs rapid, less expensive and widespread COVID-19 detection and this one will be ready to deploy in Israel in just weeks," says Doug Seserman, chief executive officer of the New York City-based American Associates, Ben-Gurion University of the Negev. "BGU is working in many areas from vaccines to psychological support to mitigate the effects of this pandemic."

Provided by American Associates, Ben-Gurion University of the Negev