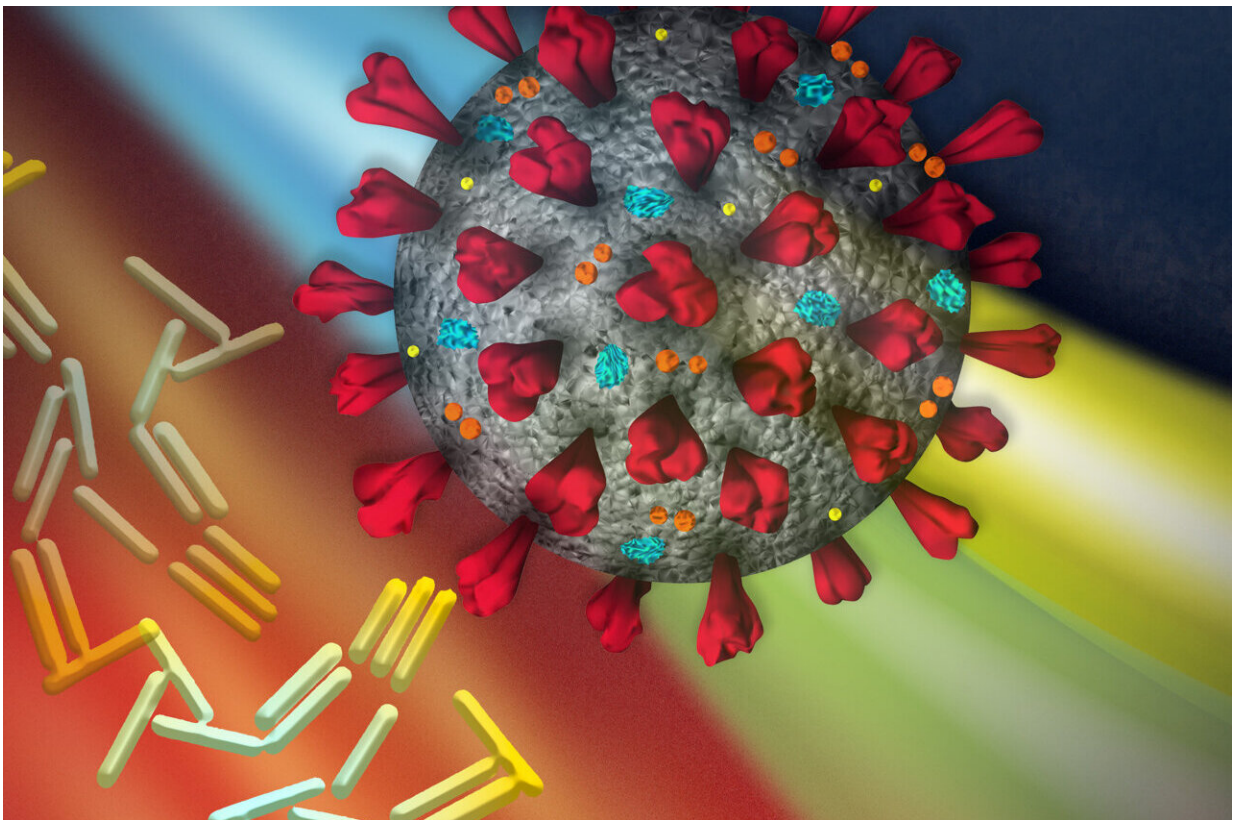


New COVID-19 rapid-test technology performs PCR faster than similar tests on the market

July 25 2022



Infrared heating of plasmonic nanoparticles facilitates multiplexed reverse transcriptase quantitative PCR for rapid detection of SARS-CoV-2. Credit: Abigail Ayers and Nicoletta Barolini/Columbia Engineering,

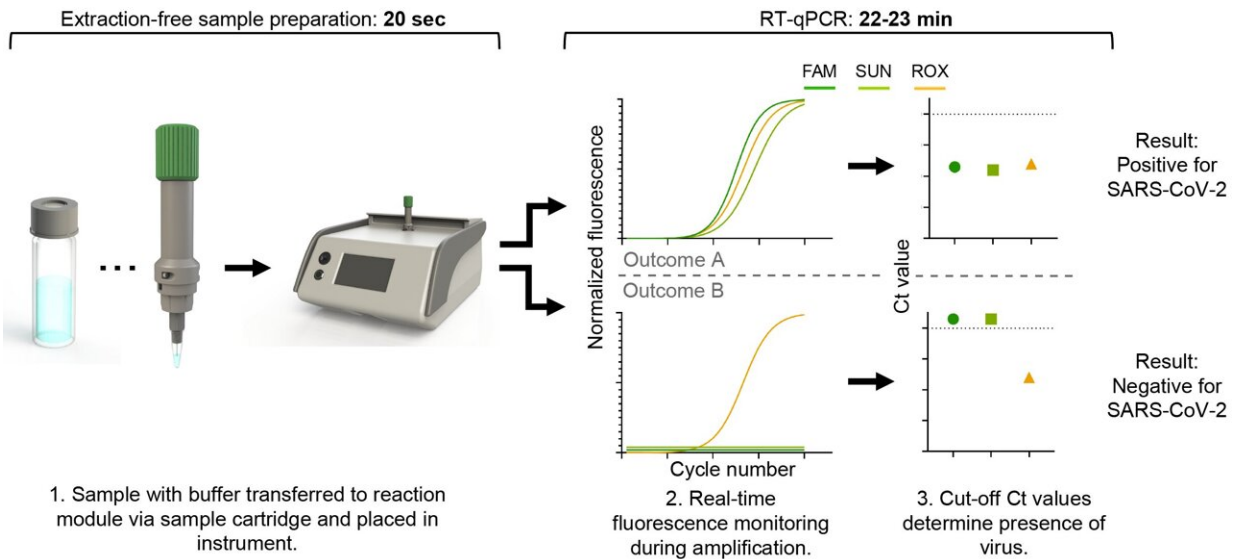
For more than 30 years, polymerase chain reaction (PCR) has been the gold standard in molecular diagnostic testing, detecting genetic material, such as those from a virus or from human DNA. But PCR, including reverse transcription polymerase chain reaction (RT-PCR), is mostly done at large, centralized laboratories, not in point-of-care (POC) settings, because its instrumentation is bulky, expensive, takes a long time for results, and requires trained technicians to run it. These limitations have led to a shortage of accurate POC diagnostics as well as bottlenecks in test results, particularly during the COVID-19 pandemic.

Researchers at Columbia Engineering and Rover Diagnostics announced today that they have built an RT-PCR platform that gives results in 23 minutes that match the longer laboratory-based tests—faster than other PCR tests on the market. It can be adapted to test for a broad range of infectious diseases including not just COVID-19 but also flu, strep, and other viruses that require fast diagnosis. Its targeted sensitivity is higher than other types of tests such as isothermal, antigen, and CRISPR. And, at just two pounds, the Rover PCR is easy to carry around and can be used by anyone.

"Our aim was to create a platform that can be used in locations where rapid turnaround results are critical, at pharmacies, transportation hubs, public events, and at companies screening employees coming back to work," said Sam Sia, professor of biomedical engineering and Vice Provost for the Fourth Purpose and Strategic Impact at Columbia.

The system was co-developed with Rover Diagnostics, a biotech start-up co-founded in 2018 by Sia and serial tech entrepreneur Mark Fasciano, Rover's CEO. The platform uses sample preparation techniques developed at Sia's lab, combined with a new approach to thermal cycling, bypassing the standard approach of Peltier device—which heats the sample from outside the vial. Instead, Rover's system uses a photothermal process—plasmonic thermocycling—that relies on

nanoparticles irradiated by light to rapidly generate heat from inside.



Sample-to-result workflow of RT-qPCR for rapid detection of SARS-CoV-2, including simple extraction-free sample preparation using a custom cartridge. Results are achieved in 23 minutes of thermocycling, facilitated by plasmonic heating of gold nanoparticles and multiplexed fluorescence monitoring in real-time. Credit: Abigail Ayers and Yuhang Hu/Columbia Engineering

The team successfully performed reverse-transcriptase quantitative PCR (RT-qPCR) in a reaction vessel containing all the PCR reagents. qPCR is the current gold-standard laboratory technique for identifying COVID infection. The technique provides quantitation of infectious units, but it also poses a number of hurdles for point-of-care (POC) miniaturization.

In the study published today in *Nature Nanotechnology*, the researchers addressed these challenges by leveraging plasmonic nanoparticles—discrete metallic particles that respond to infrared light by releasing heat—to achieve [real-time](#) and multiplexed RT-qPCR on

clinical specimens.

"This should really move the needle on delivering rapid and accurate molecular clinical diagnostics in decentralized settings," said Fasciano, a computer scientist turned software and biotech entrepreneur. "Thermal cycling, so critical to DNA and RNA testing, can now be sped up and clinicians and patients alike won't have to wait so long for results."

The Rover team is moving forward with a commercial product that can detect COVID-19, its variants, and other infectious diseases.

More information: Samuel Sia, Multiplexed reverse-transcriptase quantitative polymerase chain reaction using plasmonic nanoparticles for point-of-care COVID-19 diagnosis, *Nature Nanotechnology* (2022). [DOI: 10.1038/s41565-022-01175-4](https://doi.org/10.1038/s41565-022-01175-4).

www.nature.com/articles/s41565-022-01175-4

Provided by Columbia University School of Engineering and Applied Science

Citation: New COVID-19 rapid-test technology performs PCR faster than similar tests on the market (2022, July 25) retrieved 21 June 2024 from <https://phys.org/news/2022-07-covid-rapid-test-technology-pcr-faster.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.