

Tulane develops test that can detect COVID-19 that nasal swabs miss

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Tony Hu, Weatherhead Presidential Chair in Biotechnology Innovation at Tulane University School of Medicine, developed a new, highly sensitive blood test for SARS-CoV-2 using CRISPR gene-editing technology.

Tulane University researchers have developed a highly sensitive blood test that can detect COVID-19 in rare cases when infections were missed by nasal swab PCR tests.

The research [results](#) were published in the [Journal of Clinical Investigation](#).

Most PCR-based COVID-19 tests use nasal swabs because the virus actively replicates in the upper respiratory tract immediately after infection. However, virus levels in the nose wane through the course of infection. Studies have shown that the virus can be detected in blood and blood viral levels can indicate disease severity, but PCR tests aren't sensitive enough for reliable blood screening.

Tony Hu, Weatherhead Presidential Chair in Biotechnology Innovation at Tulane University School of Medicine, developed a test that solves the issue using CRISPR gene-editing technology. His test amplifies a genetic fragment of the SARS-CoV-2 virus, similar to conventional testing assays, but then uses CRISPR to greatly amplify the signal produced in response to this target DNA region.

The test could be especially useful in clinical applications where patients may be presenting with severe symptoms of COVID-19 but consistently test negative for the disease using nasal swab PCR tests, Hu said.

"This approach could not only improve the accuracy of COVID-19 diagnoses but it may also help doctors predict the severity of infection and whether patients have fully cleared the virus," Hu said.

Using a nonhuman primate model of asymptomatic COVID-19, Hu and his team compared the new test with PCR tests immediately after infection. SARS-CoV-2 RNA was detectable in plasma from the first day after virus exposure and remained high thereafter, unlike nasal swab levels, which steadily declined after infection.

Hu and his team also used the plasma test to screen blood samples from patients.

They detected virus RNA in 32 of 34 samples collected from symptomatic COVID-19 patients who had positive nasal swab PCR tests (91% sensitivity) and did not detect virus RNA in 124 of the 125 samples collected before the pandemic (99% specificity). PCR-based screening, however, detected virus RNA in only 44% of the blood samples from the COVID-19 patients.

Researchers also evaluated the test on samples from children and a small cohort of cancer patients. In a group of 32 children screened for COVID-19, the CRISPR-based test found three infections missed by nasal swab PCR tests. These cases were later confirmed by antibody testing. Researchers tested samples from five patients with a history of leukemia who exhibited COVID-19 symptoms, but whose nasal swab PCR tests results were negative. The CRISPR test detected COVID-19 in four of these

patients.

Tulane researchers also found that COVID-19 patients who had the most serious symptoms had the highest levels of virus RNA in their blood. Understanding more about the virus can lead to better treatments for patients, Hu said.