

New study identifies 21 existing drugs that could treat COVID-19

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Sumit Chanda, Ph.D., a professor at Sanford Burnham Prebys Medical Discovery Institute, gestures to experimental assays that test for compounds that may treat COVID-19. Credit: Sanford Burnham Prebys Medical Discovery Institute

A *Nature* study authored by a global team of scientists and led by Sumit Chanda, Ph.D., professor at Sanford Burnham Prebys Medical Discovery Institute, has identified 21 existing drugs that stop the replication of SARS-CoV-2, the virus that causes COVID-19.

The scientists analyzed one of the world's largest collections of known

drugs for their ability to block the replication of SARS-CoV-2, and reported 100 molecules with confirmed antiviral activity in laboratory tests. Of these, 21 drugs were determined to be effective at concentrations that could be safely achieved in patients. Notably, four of these compounds were found to work synergistically with remdesivir, a current standard-of-care treatment for COVID-19.

"Remdesivir has proven successful at shortening the recovery time for patients in the hospital, but the drug doesn't work for everyone who receives it. That's not good enough," says Chanda, director of the [Immunity and Pathogenesis Program](#) at Sanford Burnham Prebys and senior author of the study. "As [infection rates](#) continue to rise in America and around the world, the urgency remains to find affordable, effective, and readily available drugs that can complement the use of remdesivir, as well as drugs that could be given prophylactically or at the first sign of infection on an outpatient basis."

Extensive testing conducted

In the study, the research team performed extensive testing and validation studies, including evaluating the drugs on human lung biopsies that were infected with the virus, evaluating the drugs for synergies with remdesivir, and establishing dose-response relationships between the drugs and antiviral activity.

Of the 21 drugs that were effective at blocking viral replication, the scientists found:

- 13 have previously entered clinical trials for other indications and are effective at concentrations, or doses, that could potentially be safely achieved in COVID-19 patients.
- Two are already FDA approved: astemizole (allergies), clofazamine (leprosy), and remdesivir has received Emergency

Use Authorization from the agency (COVID-19).

- Four worked synergistically with remdesivir, including the chloroquine derivative hanfangchin A (tetrandrine), an antimalarial drug that has reached Phase 3 clinical trials.

"This study significantly expands the possible therapeutic options for COVID-19 patients, especially since many of the molecules already have clinical safety data in humans," says Chanda. "This report provides the scientific community with a larger arsenal of potential weapons that may help bring the ongoing global pandemic to heel."

The researchers are currently testing all 21 compounds in small animal models and "[mini lungs](#)," or lung organoids, that mimic human tissue. If these studies are favorable, the team will approach the U.S. Food and Drug Administration (FDA) to discuss a clinical trial(s) evaluating the drugs as treatments for COVID-19.

"Based on our current analysis, clofazimine, hanfangchin A, apilimod and ONO 5334 represent the best near-term options for an effective COVID-19 treatment," says Chanda. "While some of these drugs are currently in clinical trials for COVID-19, we believe it's important to pursue additional drug candidates so we have multiple therapeutic options if SARS-CoV-2 becomes drug resistant."

Screening one of the world's largest drug libraries

The drugs were first identified by high-throughput screening of more than 12,000 drugs from the ReFRAME drug repurposing collection—the most comprehensive drug repurposing collection of compounds that have been approved by the FDA for other diseases or that have been tested extensively for human safety.

Arnab Chatterjee, Ph.D., vice president of medicinal chemistry at Calibr

and co-author on the paper, says ReFRAME was established to tackle areas of urgent unmet medical need, especially neglected tropical diseases. "We realized early in the COVID-19 pandemic that ReFRAME would be an invaluable resource for screening for drugs to repurpose against the novel coronavirus," says Chatterjee.

The [drug](#) screen was completed as rapidly as possible due to Chanda's partnership with the scientist who discovered the first SARS virus, Kwok-Yung Yuen, M.D., chair of Infectious Diseases at the University of Hong Kong; and Shuofeng Yuan, Ph.D., assistant research professor in the Department of Microbiology at the University of Hong Kong, who had access to the SARS-CoV-2 virus in February 2020.

More information: Laura Riva et al. Discovery of SARS-CoV-2 antiviral drugs through large-scale compound repurposing, *Nature* (2020). [DOI: 10.1038/s41586-020-2577-1](https://doi.org/10.1038/s41586-020-2577-1)

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