Researchers identify potent antibody cocktail with potential to treat COVID-19

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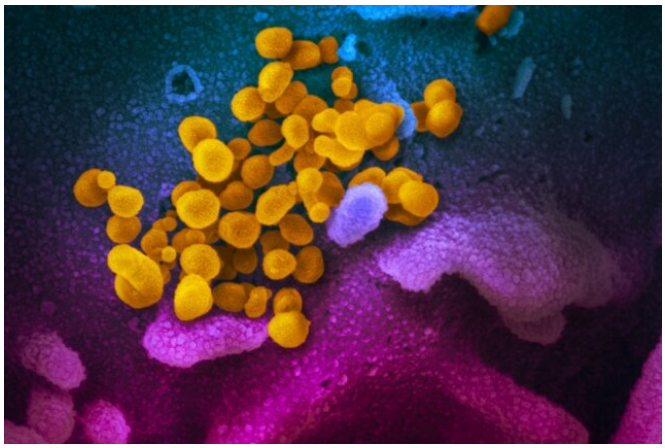

This scanning electron microscope image shows SARS-CoV-2 (yellow)—also known as 2019-nCoV, the virus that causes COVID-19—isolated from a patient, emerging from the surface of cells (blue/pink) cultured in the lab. Credit: NIAID-RML

Researchers at the University of Maryland School of Medicine (UMSOM) evaluated several human antibodies to determine the most potent combination to be mixed in a cocktail and used as a promising anti-viral therapy against the virus that causes COVID-19. Their research, conducted in collaboration with scientists at Regeneron Pharmaceuticals, was published today in the journal *Science*. The study demonstrates the rapid process of isolating, testing and mass-producing antibody therapies against any infectious disease by using both genetically engineered mice and plasma from recovered COVID-19 patients.

The antibody cocktail evaluated by UMSOM researchers will be used to treat COVID-19 patients in a clinical trial that was launched last week. The study was funded by Regeneron, a biotechnology company based in Tarrytown, New York.

Antibodies are proteins the immune system naturally makes in response to foreign invaders like viruses and bacteria. Antibody therapies were first tried in the late 19th century when researchers used a serum derived from the blood of infected animals to treat diphtheria.

To produce the so-called monoclonal antibodies for an antibody cocktail to fight COVID-19, the researchers first needed to identify which antibodies fight the novel coronavirus most effectively.

This involved determining which antibodies could bind most effectively to the spike protein found on the surface of SARS-CoV-2, the virus that causes COVID-19. The Regeneron team evaluated thousands of human antibodies from plasma donations from recovered COVID-19 patients. They also generated antibodies from mice genetically engineered to produce human antibodies when infected with the virus.

"The ability of the research team to rapidly derive antibodies using these two methods enabled us screen their selected antibodies against live virus to determine which had the strongest anti-viral effects," said study co-author Matthew Frieman, Ph.D., Associate Professor of Microbiology and Immunology at the University of Maryland School of Medicine. He has been studying coronaviruses for the past 16 years and has been carefully studying SARS-CoV-2 in his secure laboratory since February.

Dr. Frieman and his UMSOM colleagues evaluated four of the most potent antibodies for to determine the potential of each one to neutralize the SARS-CoV-2 virus. They identified the two that would form the most powerful mix when used in combination.

"An important goal of this research was to evaluate the most potent antibodies that bind to different molecules in the spike protein so they could be

mixed together as a treatment," said study co-author Stuart Weston, Ph.D., a post-doctoral research fellow in the Department of Microbiology and Immunology.

The cocktail containing the two antibodies is now being tested in a new clinical trial sponsored by Regeneron that will investigate whether the therapy can improve the outcomes of COVID-19 patients (both those who are hospitalized and those who are not). It will also be tested as a preventive therapy in those who are healthy but at high risk of getting sick because they work in a healthcare setting or have been exposed to an infected person.

"Our School of Medicine researchers continue to provide vital advances on all fronts to help fight the COVID-19 pandemic and ultimately save lives," said Dean E. Albert Reece, MD, Ph.D., MBA, who is also Executive Vice President for Medical Affairs, UM Baltimore, and the John Z. and Akiko K. Bowers Distinguished Professor, University of Maryland School of Medicine. "This particular research not only contributes to a potential new therapy against COVID-19 but could have broader implications in terms of the development of monoclonal antibody therapies for other diseases."

More information: Johanna Hansen et al, Studies in humanized mice and convalescent humans yield a SARS-CoV-2 antibody cocktail, *Science* (2020). DOI: 10.1126/science.abd0827

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