Ultrapotent COVID-19 Vaccine Designed via Computer

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Preclinical data published in Cell show the nanoparticle vaccine spurs extremely high levels of protective antibodies in animal models.

An innovative nanoparticle vaccine candidate for the pandemic coronavirus produces virus-neutralizing antibodies in mice at levels 10 times greater than is seen in people who have recovered from COVID-19 infections. Designed by scientists at the University of Washington School of Medicine in Seattle, the vaccine candidate has been transferred to two companies for clinical development.

Compared to vaccination with the soluble SARS-CoV-2 Spike protein, on which many leading COVID-19 vaccine candidates are based, the new nanoparticle vaccine produced 10 times more neutralizing antibodies in mice, even at a sixfold lower dose. The data also show a strong B-cell response after immunization, which can be critical for immune memory and a durable vaccine effect. When administered to a single nonhuman primate, the nanoparticle vaccine produced neutralizing antibodies targeting multiple different sites on the Spike protein. Researchers say this may ensure protection against mutated strains of the virus, should they arise. The Spike protein is part of the coronavirus infectivity machinery.

The findings are published today, Oct. 30, in Cell. Here is the paper. The lead authors of this paper are Alexandra Walls, a research scientist in the laboratory of David Veesler, a UW associate professor of biochemistry; and Brooke Fiala, a research scientist in the lab of Neil King, UW assistant professor of biochemistry.

The vaccine candidate was developed using structure-based vaccine design techniques invented at UW Medicine. It is a self-assembling protein nanoparticle that displays 60 copies of the SARS-CoV-2 Spike protein's receptor-binding domain in a highly immunogenic array. The molecular structure of the vaccine roughly mimics that of a virus, which may account for

its enhanced ability to provoke an immune response.

“We hope that our nanoparticle platform may help fight this pandemic that is causing so much damage to our world,” said King, inventor of the computational vaccine design technology at the Institute for Protein Design. “The potency, stability, and manufacturability of this vaccine candidate differentiate it from many others under investigation.”

Hundreds of candidate vaccines for COVID-19 are in development around the world. Many require large doses, complex manufacturing, and cold-chain shipping and storage. An ultrapotent vaccine that is safe, effective at low doses, simple to produce and stable outside of a freezer could enable vaccination against COVID-19 on a global scale.

“I am delighted that our studies of antibody responses to coronaviruses led to the design of this promising vaccine candidate,” said Veesler, who spearheaded the concept of a multivalent, receptor-binding, domain-based vaccine.

The lead vaccine candidate from this report is being licensed non-exclusively and royalty-free during the pandemic by the University of Washington. One licensee, Icosavax, a Seattle biotechnology company co-founded in 2019 by King, is currently advancing studies to support regulatory filings and has initiated the U.S. Food and Drug Administtion’s Good Manufacturing Practice. To accelerate progress by Icosavax to the clinic, Amgen has agreed to manufacture a key intermediate for these initial clinical studies. Another licensee, SK bioscience of South Korea, is advancing its own studies to support clinical and further development.

Read the original article on University of Washington.