Booster for immune protection after COVID infection

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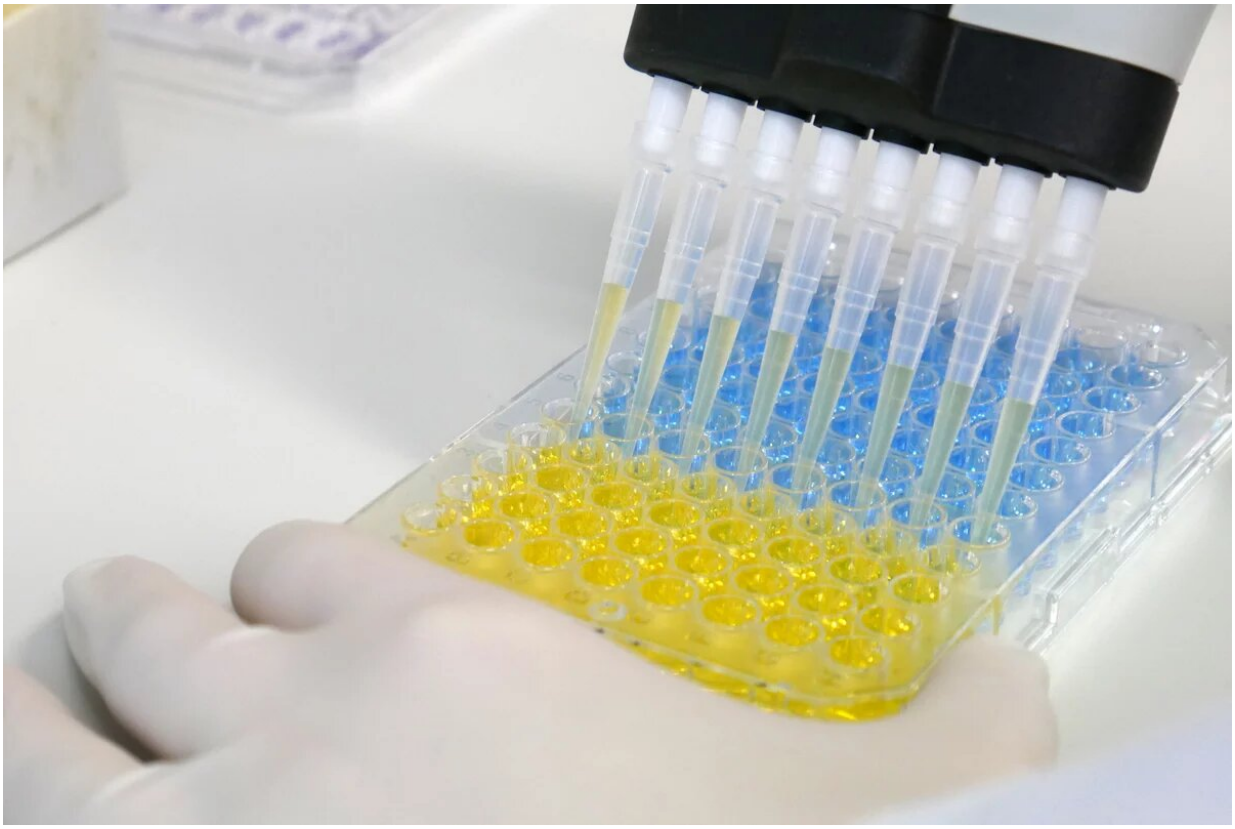

Test system for the detection of coronavirus antibodies (enzyme-linked immunosorbent assay (ELISA)). Credit: Max Planck Institute of Molecular Physiology

When our immune system comes into contact with the SARS-CoV-2

coronavirus, it fights back and produces antibodies. A similar immune response is triggered by coronavirus vaccines. However, there is still little data available on the strength and durability of immune protection. A team led by Carsten Watzl from the Leibniz Research Centre for Working Environment and Human Factors Institute for Occupational Research, in cooperation with the Max Planck Institute of Molecular Physiology and the Klinikum Dortmund, has now been able to detect high levels of neutralizing antibodies in test persons even 300 days after a coronavirus infection with the original variant of the coronavirus. And what's more: after complete vaccination, the recovered probands showed antibody levels about five times higher than those vaccinated without prior infection. This would provide much better protection against a severe course of the disease in the event of a new infection with other coronavirus variants.

Our immune protection is provided by two systems working hand in hand. When infected with a virus, the immune system reacts by producing antibodies that can prevent the virus from infecting further cells. At the same time, so-called T-killer cells can recognize the foreign virus components and thus kill already infected cells. During the immune reaction, the antibodies constantly improve and are finally tailor-made for the pathogen. The amount of these neutralizing antibodies indicates how well a new infection can be fought off by the body.

"When the corona pandemic broke out, we as immunologists were of course interested in how our immune system defends itself against the corona virus. That's why, together with our colleagues from the Max Planck Institute and the Dortmund Hospital, we developed a reliable test system to detect neutralizing antibodies," Carsten Watzl says, director at the Leibniz Research Centre for Working Environment and Human Factors Institute for Occupational Research. In order to be able to fish antibodies out of the blood in a targeted manner, you need an appropriate bait. One of the main targets of the immune system is the

spike protein, which is used by the virus to bind to human cells and then infect them. "We have been able to produce a part of this protein, or more precisely the area that docks with the cell, in high purity in the test tube," reports Jan-Erik Hoffmann, head of protein production at the Max Planck Institute in Dortmund.

With this exact copy and blood samples from the Klinikum Dortmund the researchers at the Leibniz Research Centre were able to develop a reliable and meaningful detection system for coronavirus antibodies. In close exchange with the Dortmund health department and the Dortmund hospital, the scientists used this system to perform a study with about 140 volunteers from a Dortmund health facility with several documented cases of SARS-CoV-2 infection at the beginning of the pandemic (March 2020).

Higher antibody levels after vaccination in recovered patients

Effective amounts of neutralizing antibodies against the spike protein could be detected in almost all of the subjects tested positive for SARS-CoV-2. And even after 300 days, the antibody levels had hardly decreased in three out of four subjects. However, test persons were infected with the original variant of the coronavirus and neutralizing antibodies against the original spike protein were measured. As we know, the virus has now evolved in such a way that immunity to the original virus currently offers significantly less protection.

Therefore, the researchers also investigated the effect of vaccination with the vaccines from AstraZeneca and BioNTech on the immune system. The astonishing result: After complete vaccination, recovered test persons developed up to five times more neutralizing antibodies than vaccinated persons without prior infection. This should also provide

better protection against current variants.

"There are now several studies on the immune response after a COVID-19. Our study differs from this in that we had blood samples before and from the first weeks of the pandemic. So we knew exactly whether a test person was already infected or not. In addition to this unbiased data, the long period of the study of almost one year is also remarkable," Watzl says. "The rules of the game have changed in the meantime, of course, because there are new variants like Omikron. However, it is important to know how long immunity actually lasts, because this can also protect against a severe course of the disease in the case of a new infection with other coronavirus variants. Currently, we are also using our jointly developed test systems to study the immune response to the COVID-19 vaccines and their protection against different coronavirus variants."

"This study is a prime example of successful interdisciplinary cooperation that not only yields important scientific findings but is also highly relevant to society," says Bernhard Schaaf, director of the Department of Pneumology and Infectious Diseases at Klinikum Dortmund. "This is transfer of knowledge into everyday life and at the same time transparent cooperation at eye level."

More information: Doris Urlaub et al, Neutralizing antibody responses 300 days after SARS-CoV-2 infection and induction of high antibody titers after vaccination, *European Journal of Immunology* (2022). DOI: 10.1002/eji.202149758

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