COVID-19 Vaccines Induce Immune Response to Omicron

Studies found that COVID-19 vaccines elicit T cells that recognize the Omicron variant despite the many mutations in its spike protein.

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Viruses constantly evolve over time through mutations. This can result in new variants, like the fast-spreading Omicron variant of SARS-CoV-2. Omicron has a large number of mutations in its spike protein, which makes it more able to latch onto and infect cells. As a result, Omicron spreads more easily and causes more infections than previous versions of the virus.

Scientists are working to determine how well COVID-19 vaccines protect against infection from Omicron and other variants. The vaccines were designed to teach the immune system to recognize a key part of the spike protein. But they were developed using the initial SARS-CoV-2 spike protein. Studies have found that antibodies generated by these vaccines don't recognize their targets as well in heavily mutated variants like Omicron.

However, it's been unclear how well T cells, another arm of the immune response, recognize these variants. T cells coordinate the immune response and kill cells infected with virus. They're thought to play an important role in protection against SARS-CoV-2.

Two studies shed light on how immune cells induced by COVID-19 vaccines respond to variants. The teams, working independently, found evidence that current vaccines generate cellular immunity against Omicron.

One team, led by Drs. Shane Crotty, Alba Grifoni, and Alessandro Sette of La Jolla Institute for Immunology, examined T cell responses against several COVID-19 variants in vaccinated people. The study was funded in part by NIH's National Institute of Allergy and Infectious Diseases (NIAID). Results appeared in Cell on January 24, 2022.

The team studied samples from 96 adults who had received one of four vaccines (Pfizer-BioNTech, Moderna, Johnson & Johnson/Janssen, or Novavax). They examined immune responses at four different times, ending five to six months after the last vaccine dose.

They observed substantially fewer memory B cells and neutralizing antibodies in the blood of people 6 months after vaccination. Memory B cells help to quickly produce antibodies against

previously encountered viruses or other pathogens. Having fewer neutralizing antibodies increases the risk of “breakthrough” infections—when vaccinated people are reinfected.

In contrast to antibodies, the team found that T cell responses from the vaccines recognized all variants, including Delta and Omicron. The majority of T cell responses remained effective against Omicron. Six months after vaccination, 84% of CD4+ (helper) T cell responses and 85% of CD8+ (killer) T cell responses against Omicron remained the same compared to early variants.

Similarly, a team led by Dr. Dan Barouch at Beth Israel Deaconess Medical Center observed low antibody levels against Omicron but robust T cell responses. Their study, which was supported in part by NIH’s National Cancer Institute (NCI), appeared in Nature on January 31, 2022.

The team studied samples from 47 people vaccinated with the Johnson & Johnson or Pfizer-BioNTech vaccines. They measured CD4+ T cell and CD8+ T cell responses to the original SARS-CoV-2 strain and the Delta and Omicron variants after one month and again eight months following final vaccination.

They found that CD4+ and CD8+ T cell responses were more than 80% preserved compared to the response to the original strain of the virus.

Other groups around the world are reporting similar results. Together, the findings show that T cells induced by vaccines continue to recognize Omicron. Despite reduced antibody responses against the variants, T cells serve as a second line of defense. This may help to explain why Omicron infections, while easily spread, are less likely to lead to severe disease in fully vaccinated people.

“These T cells won’t stop you from getting infected, but in many cases, they are likely to keep you from getting very ill,” Grifoni says.

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