

# New vaccines protect against COVID-19 in non-human primates, study finds

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Senior author Dan H. Barouch, MD, PhD, Director of the Center for Virology and Vaccine Research at Beth Israel Deaconess Medical Center Credit: Credit Beth Israel Deaconess Medical Center

With nearly 5 million confirmed cases globally and more than 300,000 deaths from COVID-19, much remains unknown about SARS-CoV-2,

the virus that causes the disease. Two critical questions are whether vaccines will prevent infection with COVID-19, and whether individuals who have recovered from COVID-19 are protected against re-exposure. A pair of new studies led by researchers at Beth Israel Deaconess Medical Center (BIDMC) sheds new light on these questions. Both studies were published today in the journal *Science*.

"The global COVID-19 pandemic has made the development of a [vaccine](#) a top biomedical priority, but very little is currently known about protective immunity to the SARS-CoV-2 [virus](#)," said senior author Dan H. Barouch, MD, Ph.D., Director of the Center for Virology and Vaccine Research at BIDMC. "In these two studies, we demonstrate in rhesus macaques that prototype vaccines protected against SARS-CoV-2 infection and that SARS-CoV-2 infection protected against re-exposure."

In the first study, the team demonstrated that six candidate DNA vaccines induced neutralizing [antibody responses](#) and protected against SARS-CoV-2 in rhesus macaques. Barouch and colleagues—who began working toward a COVID-19 vaccine in mid-January when Chinese scientists release the [viral genome](#)—developed a series of candidate DNA vaccines expressing variants of the Spike protein, a key antibody target of the novel coronavirus. The vaccines are designed to train the body's immune system to recognize and respond quickly to the virus upon exposure.

To assess the efficacy of the vaccines, the researchers immunized 25 adult rhesus macaques with the investigational vaccines, and 10 animals received a sham control. Vaccinated animals developed neutralizing antibodies against the virus. Three weeks after a boost vaccination, all 35 animals were exposed to the virus. Follow-up testing revealed dramatically lower viral loads in vaccinated animals compared to the control group. Eight of the 25 vaccinated animals demonstrated no

detectable virus at any point following exposure to the virus, and the other animals showed low levels of virus. Moreover, higher antibody levels were linked to lower viral loads, suggesting that neutralizing antibodies may serve as a correlate of protection and may prove useful as a benchmark in clinical testing SARS-CoV-2 vaccines.

In the second study, the team demonstrated that macaques that recovered from COVID-19 developed natural protective immunity against re-infection. "Individuals who recover from many viral infections typically develop antibodies that provide protection against re-exposure, but not all viruses generate this natural protective immunity," said Barouch, who is also Professor of Medicine at Harvard Medical School and a member of the Ragon Institute of MGH, MIT, and Harvard.

After exposing nine adult macaques to the SARS-CoV-2 virus, the researchers monitored viral levels as the animals recovered. All nine animals recovered and developed antibodies against the virus. More than a month after initial infection, the team re-exposed the [rhesus macaques](#) to the virus. Upon second exposure, the [animals](#) demonstrated near-complete protection against the virus. These data suggest natural protective immunity against COVID-19 in this model.

"Our findings increase optimism that the development of COVID-19 vaccines will be possible," said Barouch. "Further research will be needed to address the important questions about the length of protection, as well as the optimal vaccine platforms for a SARS-CoV-2 vaccines for humans."

**More information:** Abishek Chandrashekar et al. SARS-CoV-2 infection protects against rechallenge in rhesus macaques. *Science* 20 May 2020:

[DOI: 10.1126/science.abc4776](https://doi.org/10.1126/science.abc4776)

Jingyou Yu et al. DNA vaccine protection against SARS-CoV-2 in rhesus macaques. *Science* 20 May 2020: [DOI: 10.1126/science.abc6284](https://doi.org/10.1126/science.abc6284)

Provided by Beth Israel Deaconess Medical Center

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