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How Bharat Biotech's Vaccine Works

5-6 minutes

The Indian company Bharat Biotech partnered with the National Institute of Virology and the Indian Council of Medical Research to develop an inactivated coronavirus vaccine called **Covaxin**. India [authorized the vaccine](#) for emergency use on Jan. 3, and trial results later showed the vaccine has an efficacy of 78 percent.

A Vaccine Made From Coronaviruses

Covaxin works by teaching the immune system to make antibodies against the SARS-CoV-2 coronavirus. The antibodies attach to viral proteins, such as the so-called spike proteins that [stud its surface](#).

To create Covaxin, Bharat Biotech used a sample of the coronavirus isolated by India's National Institute of Virology.

Killing the Virus

Once the researchers produced large stocks of the coronaviruses, they

doused them with a chemical called beta-propiolactone. The compound disabled the coronaviruses by bonding to their genes. The inactivated coronaviruses could no longer replicate. But their proteins, including spike, remained intact.

The researchers then drew off the inactivated viruses and mixed them with a tiny amount of an aluminum-based compound called an adjuvant. Adjuvants stimulate the immune system to boost its response to a vaccine.

Inactivated viruses have been used for over a century. Jonas Salk used them to create his [polio vaccine](#) in the

1950s, and they're the bases for vaccines against other diseases including [rabies](#) and [hepatitis A](#).

Prompting an Immune Response

Because the coronaviruses in Covaxin are dead, they can be injected into the arm without causing Covid-19. Once inside the body, some of the inactivated viruses are swallowed up by a type of immune cell called an antigen-presenting cell.

The antigen-presenting cell tears the coronavirus apart and displays some of its fragments on its surface. A so-called helper T cell may detect the fragment.

If the fragment fits into one of its surface proteins, the T cell becomes activated and can help recruit other immune cells to respond to the vaccine.

Making Antibodies

Another type of immune cell, called a B cell, may also encounter the inactivated coronavirus. B cells have surface proteins in a huge variety of shapes, and a few might have the right shape to latch onto the coronavirus.

When a B cell locks on, it can pull part or all of the virus inside and present coronavirus fragments on its surface.

A helper T cell activated against the

coronavirus can latch onto the same fragment. When that happens, the B cell gets activated, too. It proliferates and pours out antibodies that have the same shape as their surface proteins.

Stopping the Virus

Once vaccinated with Covaxin, the immune system can respond to an infection of live coronaviruses. B cells produce antibodies that stick to the invaders. Antibodies that target the spike protein can prevent the virus from entering cells. Other kinds of antibodies may block the virus by other means.

Remembering the Virus

Covaxin is being tested in two doses, given four weeks apart.

If Bharat Biotech's Phase 3 clinical trial demonstrates that Covaxin protects people against Covid-19, researchers will have to observe it for months to see how long that protection lasts. It's possible that the level of antibodies will drop, but the immune system also contains special cells called memory B cells that might retain information about the coronavirus for years or even decades.

Vaccine Timeline

June, 2020 Covaxin is [the first coronavirus vaccine created in India](#) to be approved for clinical trials.

July A [Phase 1/2 clinical trial](#) begins with 755 participants.

September Results from [monkey](#) and [hamster](#) studies show that Covaxin provides protection against infection.

Oct. 23 The company [announces](#) a [Phase 3 trial](#) with up to 25,800 participants.

A dose of Covaxin in Ahmedabad, India. Amit Dave/Reuters

December Covaxin's Phase 1/2 trial [shows](#) the vaccine [produces antibodies](#) to the coronavirus without causing

serious side effects.

Dec. 22 Bharat Biotech announces a partnership with Pennsylvania-based Ocugen to [develop Covaxin for the United States market](#).

Jan. 3, 2021 The Indian government grants Covaxin [emergency authorization](#), despite no release of Phase 3 data showing the vaccine is safe and effective. The country also authorizes a vaccine made by [Oxford University and AstraZeneca](#).

April 21 The vaccine has an estimated efficacy of 78 percent against mild, moderate, and severe Covid-19.

Sources: National Center for

Biotechnology Information; Science;
The Lancet; Lynda Coughlan,
University of Maryland School of
Medicine; Jenna Guthmiller, University
of Chicago.

Tracking the Coronavirus