

Podcast: Introduction to vaccines

As of May 2021

My name is Ute Papkalla, I am a member of the health team of the German Institute for Medical Mission, also called Difäm. With me is my colleague, Carina Dinkel. Today you will listen to information about the different types of vaccines and how they work.

First, let us shortly remember how our bodies answer to a coronavirus infection:

White blood cells constantly patrol in our blood to find foreign particles like viruses, bacteria or parasites. An intruder is identified by white blood cells and after this identification the body starts to produce antibodies against the virus. With these antibodies, the intruding virus can be inactivated and eliminated. The immune system also has a memory function. Therefore, when the same virus tries to re-enter the body even after a long time, the white blood cells recognize the virus and quickly produce the specific antibodies. This functions in such a high speed that the infection can be terminated before disease symptoms occur.

Where do vaccines come into the picture?

The aim of Covid-19 vaccinations is to stimulate our organism to develop an immune response to the coronavirus, without going through a full infection itself. Vaccines trigger this immune response in two ways: they help the body to develop neutralizing antibodies and they stimulate the memory-cells. In this way, a vaccinated person is well prepared to defeat the dangerous virus in future.

What kind of vaccines have been developed in this very short time since last year?

Although the World Health Organization (WHO) counts hundreds of vaccine projects, to date there are four main-types of COVID-19 vaccines:

These types are the nucleic acid vaccines mostly mRNA vaccines, the vector based vaccines, and vaccines with inactivated whole virus.

How do the different types work?

The nucleic acid vaccines like the messenger ribonucleic acid vaccines or in short, the mRNA vaccines contain genetic material from the virus. They are designed to provide our bodies with the code to produce the non-infectious virus spike protein, which then stimulates a natural immune response. Our bodies recognize that the protein should not be there and build T-lymphocytes and B-lymphocytes that will remember how to fight the virus that

causes COVID-19 if we are infected in the future. The spike protein, which enables the virus to hijack our cells, will be blocked and the virus will be eliminated.

Good to know:

mRNA vaccines do not use the live virus that causes COVID-19.

They do not affect or interact with our own genetic code in any way:

mRNA never enters the nucleus of the cell, which is where our DNA (genetic material) is kept.

The cell breaks down and gets rid of the mRNA soon after it is finished using the instructions.

So, in a nutshell: The messenger-RNA stimulates our cells to build a non-infectious spike protein. Then our immune cells recognize this protein as an enemy and defeats it. The hereby-generated memory T- and B-cells will remain in the body and once the “real” coronavirus-spike-protein enters, it will be defeated.

Available mRNA vaccines are Pfizer-BioNTech and Moderna.

Now let us talk about the vector based vaccines, how do they work?

Viral vector vaccines use a modified version of a harmless virus like a virus that causes a common cold to serve as a transporter. This transporter is called a vector. It delivers important instructions to our cells. For COVID-19 viral vector vaccines, it transports the genetic information of the spike protein. The vector will enter a cell in our body, release the genetic information and then use the cell’s machinery to produce a harmless piece of the coronavirus. From there on, the vaccination works in the same way as the mRNA vaccinations: the spike protein triggers the immune system to begin producing antibodies and activating other immune cells to fight off what it thinks is an infection.

At the end of the process, our bodies have learned how to protect us against future infection with the virus that causes COVID-19.

Good to know:

The vector-based vaccine is using an adenovirus

The genetic material delivered by the viral vector does not integrate into a person’s DNA.

In summary: Viral vector vaccines use harmless other viruses to transfer genetic information of coronavirus spike protein into the human cell. The cell’s machinery gets stimulated to build this spike protein. Again, the immune cells recognise this spike protein as an intruder and fight it. The hereby-generated memory T- and B-cells will remain in the body and once the “real” coronavirus-spike-protein enters, it will be defeated.

Vector based vaccines are AstraZeneca, Johnson & Johnson, Sputnik V.

Finally, let us talk about vaccines with the inactivated whole virus:

Protein subunit or whole virus vaccines include harmless pieces (proteins) of the virus or inactivated whole coronaviruses that can no longer replicate in our cells. Once vaccinated, our bodies recognize that the protein should not be there and build T-lymphocytes and antibodies that will remember how to fight the virus that causes COVID-19 if we are infected in the future.

In short: this is rather the “classic” way to produce an immune response to virus through vaccination. By triggering the immune response with dead parts of the original virus, the same mechanism as in a real infection will be activated, and the memory immune response and the production of neutralizing antibodies will be made available. Once the body is in contact with the live and aggressive virus, the memory T-cells and the neutralizing antibodies are quickly available to defeat the intruder.

Vaccines with inactivated virus are Sinopharm (by Wuhan Institute of Biological Products / Wuhan Institute of Virology of the Chinese Academy of Sciences) and Sinovac Biotech.

So let us summarize and look at the answer on how vaccinations work.

The way to create an immune response to coronavirus is different:

1. Through messengerRNA, triggering the cell to create the spike protein of the virus and then defeat it.
2. By using a vector for transferring information into the cell, to create the spike protein of the virus and then defeat it.
3. By simulating an infection with dead virus parts and triggering an immune response on them.

The outcome of any vaccination should always be that the body builds up an immune response against a specific intruder during the vaccination process.

A last word on immunity – Will we be immune directly after being vaccinated?

Well - after vaccination the body needs some time to do all this immune work. Therefore, it will take about two weeks until a person is protected to a certain level after vaccination. The second dose that is required by most of the current vaccines will boost and strengthen the immune response further.

How long will immunity last against coronavirus after vaccination ?

We will develop immunity against a range of variants of coronavirus with the current vaccines. However, as we have seen in another Podcast before, the virus may mutate and develop new variants, which cannot be recognised anymore by the neutralizing antibodies, and memory cells that the body developed after the first vaccination. We know this from vaccinations against the flu. Every year these vaccines have to be adapted so that they fit the

actual variations of the influenza viruses that circulate globally. It is most likely that for coronavirus new updates of the vaccines have to be produced in the future.

However, vaccinated or not, immune or not, the best thing is not to contract the virus! So wash your hands, keep physical distance and wear a mask!

[Be blessed and stay safe!](#)

Sources:

<https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/how-they-work.html>

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