



COVID-19

Understanding mRNA COVID-19 Vaccines

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What You Need to Know

- Messenger RNA (mRNA) vaccines teach our cells how to make a protein that will trigger an immune response inside our bodies.
- Like all vaccines, mRNA vaccines benefit people who get vaccinated by giving them protection against diseases like COVID-19 without risking the potentially serious consequences of getting sick.
- mRNA vaccines are newly available to the public. However, researchers have been studying and working with mRNA vaccines for decades.
- The same COVID-19 mRNA vaccine product should be used for both doses of a two-dose primary series and for an [additional primary dose](#), if needed. However, any of the COVID-19 vaccines can be used for a [booster dose](#). The booster dose product does not need to match the product used for the primary series.
- Learn more about [getting your vaccine](#).

The Pfizer-BioNTech and Moderna COVID-19 vaccines are messenger RNA vaccines also called mRNA vaccines. mRNA vaccines are some of the first COVID-19 vaccines authorized and approved for use in the United States.

How mRNA Vaccines Work

To trigger an immune response, many vaccines put a weakened or inactivated germ into our bodies. Not mRNA vaccines. Instead, mRNA vaccines use mRNA created in a laboratory to teach our cells how to make a protein—or even just a piece of a protein—that triggers an immune response inside our bodies. That immune response, which produces antibodies, is what protects us from getting infected if the real virus enters our bodies.

1. First, COVID-19 mRNA vaccines are given in the upper arm muscle. The mRNA will enter the muscle cells and instruct the cells' machinery to produce **a harmless piece** of what is called the spike protein. The spike protein is found on the surface of the virus that causes COVID-19. After the protein piece is made, our cells break down the mRNA and remove it.
2. Next, our cells display the spike protein piece on their surface. Our [immune system](#) recognizes that the protein doesn't belong there. This triggers our immune system to produce antibodies and activate other immune cells to fight off what it thinks is an infection. This is what your body might do to fight off the infection if you got sick with COVID-19.
3. At the end of the process, our bodies have learned how to protect against future infection from the virus that causes COVID-19. The benefit of COVID-19 mRNA vaccines, like all vaccines, is that those vaccinated gain this protection without ever having to risk the potentially serious consequences of getting sick with COVID-19. Any [temporary discomfort](#) experienced after getting the vaccine is a natural part of the process and an indication that the vaccine is working.



Facts About COVID-19 mRNA Vaccines

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FACTS ABOUT COVID-19 mRNA VACCINES

COVID-19 mRNA vaccines cannot give someone the virus that causes COVID-19 or other viruses.

- mRNA vaccines do not use the live virus that causes COVID-19 and cannot cause infection with the virus that causes COVID-19 or other viruses.

They do not affect or interact with our DNA in any way.

- mRNA never enters the nucleus of the cell where our DNA (genetic material) is located, so it cannot change or influence our genes.

The mRNA and the spike protein don't last long in the body.

- Our cells break down mRNA and get rid of it within a few days after vaccination.
- Scientists estimate that the spike protein, like other proteins our bodies create, may stay in the body up to a few weeks.

COVID-19 mRNA Vaccines Have Been Rigorously Evaluated for Safety

mRNA vaccines are [safe](#) and [effective](#).

mRNA vaccines have been held to the same [rigorous safety and effectiveness standards](#) as all other types of vaccines in the United States. The only COVID-19 vaccines the Food and Drug Administration (FDA) makes available for use in the United States (by approval or emergency use authorization) are those that meet these standards.

While COVID-19 vaccines were developed rapidly, [all steps have been taken to ensure their safety and effectiveness](#).

mRNA Vaccines Are Newly Available to the Public But Have Been Studied for Decades

Researchers have been studying and working with mRNA vaccines for decades. Interest has grown in these vaccines because they can be developed in a laboratory using readily available materials. This means vaccines can be developed and produced in large quantities faster than with other methods for making vaccines.

mRNA vaccines have been studied before for flu, Zika, rabies, and cytomegalovirus (CMV). As soon as the necessary information about the virus that causes COVID-19 was available, scientists began designing the mRNA instructions for cells to build the unique spike protein into an mRNA vaccine.

Future mRNA vaccine technology may allow for one vaccine to provide protection against multiple diseases, thus decreasing the number of shots needed for protection against common vaccine-preventable diseases.

Beyond vaccines, cancer research has used mRNA to trigger the immune system to target specific cancer cells.

Learn more about [getting your vaccine](#).

Learn More About mRNA Vaccines

INFOGRAPHIC
How mRNA COVID-19 Vaccines Work

PDF infographic explaining how mRNA COVID-19 vaccines work.

How mRNA COVID-19 Vaccines Work

Understanding the virus that causes COVID-19.

Coronaviruses, like the one that causes COVID-19, are named for the crown-like spikes on their surface, called **spike proteins**. These **spike proteins** are ideal targets for vaccines.

What is mRNA?

Messenger RNA, or mRNA, is genetic material that tells your body how to make proteins.

What is in the vaccine?

The vaccine is made of mRNA wrapped in a coating that makes delivery easy and keeps the body from damaging it.

How does the vaccine work?

The mRNA in the vaccine teaches your cells how to make copies of the **spike protein**. If you are exposed to the real virus later, your body will recognize it and know how to fight it off.



The vaccine **DOES NOT** contain ANY virus, so it cannot give you COVID-19. It cannot change your DNA in any way.

When your body responds to the vaccine, it can sometimes cause a mild fever, headache, or chills. This is completely normal and a sign that the vaccine is working.

After the mRNA delivers the instructions, your cells break it down and get rid of it.

Antibody

GETTING VACCINATED?
For information about COVID-19 vaccine, visit: [cdc.gov/coronavirus/vaccines](https://www.cdc.gov/coronavirus/vaccines)



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For Healthcare and Public Health

COVID-19 Clinical and Professional Resources

More Information

[How Long Do mRNA and Spike Proteins Last in the Body?](#)



[FDA's Emergency Use Authorization for Vaccines Explained](#)



[Johns Hopkins: How Do mRNA Vaccines Work? \[00:01:48\]](#)

[PBS Newshour: How Do mRNA Vaccines Work? \[00:02:27\]](#)

[FDA's Vaccine Development 101](#)

[FDA Infographic: The Path for a COVID-19 Vaccine from Research to Emergency Use Authorization \[724 KB, 1 page\]](#)

[Infectious Disease Society of America: mRNA Vaccines](#)