



Sioux Lookout
First Nations
Health Authority

CORONAVIRUS COVID-19

INFORMATION SHEET

Immune Response to COVID-19 Vaccines

July 5, 2021

Our immune system works in a wonderful way to keep us healthy. It protects us from disease-causing germs. Our immune system identifies and fights germs when they enter our body. It creates armies of cells that know what germ to attack and destroy. This process happens naturally when we get sick. Our immune system can help keep us from getting severe symptoms if the same germ tries to invade again. It remembers what happened before and knows how to respond.

This process also happens when we use vaccines. Vaccines can prevent people from getting very sick. Vaccines cause our immune system to recognize the germ that could make you sick. If you are exposed to that germ in the future, your immune system can respond quickly to kill it before it has a chance to make you sick.

This information sheet presents a basic explanation of our immune system and how it works together with COVID-19 vaccines to protect us against COVID-19 infection.

Pathogens

Germs that can make you sick are called pathogens. A virus is an example of a pathogen. COVID-19 is a viral pathogen.

Antigens

The antigen is a piece of the pathogen. The antigen can be made up of a protein, a polysaccharide, lipids, or nucleic acids. The antigen is the key part of any vaccine because it will cause your immune system to respond to the pathogen that could make you sick.



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There are two main parts of the immune system

1. **The innate immune system** includes your skin, mucous layers in your nose, mouth and gut, and special immune cells in your blood. These parts quickly attack germs that enter our body. They do not recognize specific germs, so the attack is very broad and can kill most pathogens.
2. **Adaptive immunity:** You might become sick if you are invaded by a new pathogen. Your immune system will try to fight it off. It will also remember the invader. If you are invaded by the same pathogen again, it will be ready to respond and fight against it.

Dendritic cells

Dendritic cells are a part of your innate immune system. They are your frontline security guard cells. They are found in the layers of your skin and in your lymph nodes. When this cell finds a pathogen, it swallows it and breaks it apart. Then, it displays info about the pathogen on its outer cell wall, like a trophy or a “wanted poster”.

T-cells and B-cells

T-cells and B-cells are types of white blood cells. They respond to the info displayed by the dendritic cells.

T-cells release chemical signals which alert other parts of the immune system to fight. They stimulate B-cells to make antibodies. They also find cells that have already been invaded by pathogens and kill them.

B-cells make antibodies. The antibodies look for and grab a hold of the invader. B-cells alert the T-cells, which come and kill the pathogen.



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Basic anatomy of a cell

Cells are the basic building blocks of life. The nucleus is the control centre of the cell. It holds genetic information. All around the nucleus is cytoplasm. Cytoplasm is the liquid environment of the cell. It is mostly made of water and salt.

There are other substances and structures in the cytoplasm. Some of the substances are called amino acids, which are the building blocks to make proteins. Ribosomes are one of the structures in the cytoplasm. They gather amino acids to make whatever they are given a recipe for.

mRNA COVID-19 vaccines

In traditional vaccines, antigens are delivered to the dendritic cells. But with the new mRNA COVID-19 vaccines such as Pfizer and Moderna, only the *recipe to make the antigen* is delivered. In this case, it is the recipe for making the spike proteins of the COVID-19 virus. The recipe is coded in the mRNA.

When the vaccine is injected through the skin, your dendritic cells spring to action. They see the vaccine cells as invaders, so they attack and swallow them up. When the vaccine cell breaks apart inside the dendritic cell, the mRNA recipe is released into the cytoplasm. Ribosomes in the cytoplasm read the recipe. They use amino acids to build the spike proteins (see Figure 1). The spike proteins are displayed on the outer layer of the dendritic cell. Your adaptive immune system sees this and uses this info to prepare its response. It makes T-cells and B-cells. B-cells make antibodies that will recognize COVID-19 virus because of the spike proteins. T-cells will come and destroy cells that have spike proteins or cells that have been infected by the pathogen (see Figure 2).

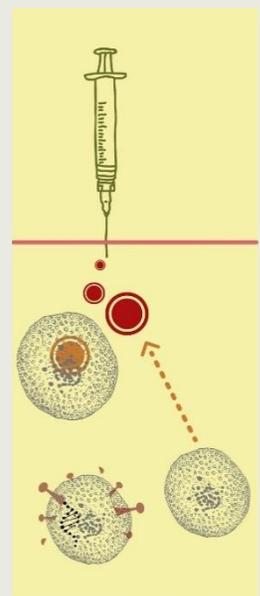


Figure 1 Dendritic cells make spike proteins



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Viral-vector COVID-19 vaccines

Viral-vector COVID-19 vaccines like AstraZeneca and Janssen, use a different method to deliver the same info to produce the same result. A harmless adenovirus is used to carry DNA info for the COVID-19 spike protein. The outer layer of the adenovirus is attracted to the outer layer of the dendritic cells. As the vaccine is injected through the skin layer, the dendritic cells spring to action and they find each other easily. The dendritic cell swallows the adenovirus and breaks it apart inside. The DNA info is released and enters into the cell nucleus. In the nucleus, which handles genetic info, the DNA double strand is “unzipped” or split into 2 mRNA strands. The mRNA spike protein recipe is released into the cell cytoplasm. From this point, the process is much like what happens with the other vaccines.

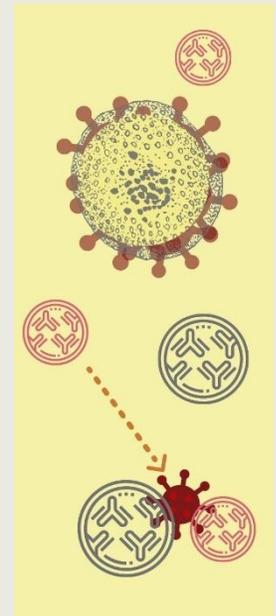


Figure 2 Immune cells recognize COVID-19 by the spikes

How do the vaccines work then?

Both mRNA and viral vector vaccines deliver a recipe that teaches your immune cells how to make the COVID-19 spike protein. Your immune system learns to recognize and respond to that spike protein by making more immune cells and antibodies which will fight the COVID-19 virus if you are exposed to it.

Dendritic cells use the recipe in the mRNA to make spike proteins. The spike proteins are displayed on the outer cell walls, like a “wanted poster”. Your immune system responds by making T-cells and B-cells. T-cells signal B-cells to make antibodies. Antibodies will recognize COVID-19 because of the spike proteins. If you are invaded by this pathogen, antibodies would go after it and hold on to it until T-cells come and kill it. T-cells will also find cells that are infected by the virus and kill them too.

Memory cells will remember the spike protein and will be ready to mount an attack if you are invaded in the future. We do not know yet how long they will remember



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the spike protein of COVID-19. One way to help them remember is through a “booster shot”, one more dose of vaccine. So far, all of the approved COVID-19 vaccines in Canada have been effective at preventing serious COVID-19 infection, that is, together with the help of your amazing immune system.

Questions? Write to us at: ACWinfo@slfhna.com

<https://www.news-medical.net/news/20210531/Function-and-regeneration-of-dendritic-cells-impaired-in-COVID-19.aspx>

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

<https://scopeblog.stanford.edu/2020/12/22/how-do-the-new-covid-19-vaccines-work/>

<https://www.nature.com/articles/d41586-020-02400-7>

<https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/different-types-of-covid-19-vaccines/art-20506465>

<https://www.goodrx.com/blog/how-the-immune-system-fights-covid-19/>

<https://www.nytimes.com/interactive/2020/health/oxford-astrazeneca-covid-19-vaccine.html>

<https://www.pfizer.com/news/hot-topics/how-the-immune-system-protects-you-from-infection>