

Q & A for Everyone Who Wants to Know More About the Novel Coronavirus (children's edition)

How is a virus named?

There are many reasons for the names. The novel coronavirus we have now is named after the appearance of the surface. It is covered with shapes like a corona (ancient Greek word meaning “crown”). In the past, viruses were sometimes named after places where they started to spread. For example, Spanish flu (was thought to have) spread from Spain. But, if you name a virus after a place, people may think that everyone in the place has the disease, even though that is not true. That is why viruses are not named after a place anymore.

How do I get infected with the virus?

First of all, our body is made up of very many cells, which are like small rooms. When we are made in our mother’s womb, we start with a single cell, but as it divides and multiplies, the cells start to carry out the functions of our body, and that is how our body is formed. Viruses multiply in animals and people. When a virus is introduced into cells of the body, it takes over the mechanisms of the cells, working and multiplying, and makes copies of the virus. When animals and people cough or sneeze, the multiplied virus is carried out from the body by the spray and splash of droplets. After that, they are carried by water droplets in the air. Then, another person inhales those droplets. As a result, the virus sticks to the mucous membranes of the person who inhaled it. The mucous membranes are the red and moist parts in the mouth and nose. When this happens, depending on the size of the inhaled water droplets (big or small), the droplets stick in different locations, from the mouth or nose to the back of the lungs. The size of the droplets, carried in spray by coughing or sneezing, works well to enable the virus to stick to the nose and throat. (If a person who has the virus multiplying in the body is coughing or sneezing, the virus will easily spread to other people who are close by.) If it sticks to the mucous membranes of the nose and throat, the virus will enter directly into cells or nearby blood vessels. As I explained at the beginning, after entering a human cell, the virus tricks the cell to make many copies of the virus. Our immune cells act like police or firefighters. So, they come to find and attack those cells that have been tricked into making more virus, cells that have died, and virus particles that have been copied and multiplied. During this time, when the immune cells fight to kill the virus, the immune cells and other cells send a signal saying, "Help me kill the virus!" These signaling molecules are sent throughout the body. This is why the human body shows various symptoms, such as fever and pain (called inflammation), coughing, and sneezing. However, if the fight is not strong or the “help signal” is weak, symptoms may not appear. (This is called asymptomatic infection.) Even so, the virus may be multiplying. This is a problem; because, those people with the novel coronavirus don't know that the virus is multiplying in their bodies.

Why is it easy to enter from the mouth and nose, but not the skin?

Looking at the inside of the mouth and nose, it is different from the skin such as the palm of the hand. It's red and moist compared to the skin. This is called a mucous membrane. It's red because the blood vessels are close to the surface of the mucous membrane. One of the reasons why the virus is likely to enter through the mucous membrane is that the keratin (surface of the skin that dies and falls off) is not present in the mucous membrane. There are many other reasons. It may be because the blood vessels are close to the surface of the body. Or, it may be because it is wet and the water droplets containing the virus can easily stick there.

How does the virus die? Should I wash my hands with soap?

Isn't water alone enough?

Viruses are not living creatures. Germs (microbes and bacteria) are living creatures. The difference is whether or not they multiply by themselves or by eating food. Viruses do not do either. So, they don't die. However, viruses enter cells of living things such as humans and animals and make more virus. We want to stop this function. Generally, virus particles consist of containers and contents. The surface of the container walls (membrane) can dissolve in water, but the middle part of the walls can only dissolve in oil. (In fact, the structure of this container is the same as that of the cell membrane of our body.) There is only information stored in the container (genes = nucleic acids such as DNA and RNA) to make copies of itself. So, if the container breaks, the virus cannot work or enter the human cells, and as a result, it won't multiply.

[How to wash]

The way to break the container of the virus is to dissolve the part, which only dissolves in oil, in water by using soap. To do this, soak the oily soap in water (make lots of bubbles) or use strong alcohol. Water alone cannot break the virus container. The virus remains active.

Why is a closed space not good?

Sprayed water droplets from coughing and sneezing carry a lot of the virus. It is assumed that those water droplets float in the air one to two meters from the person who coughed or sneezed. That's why people, who have the virus multiplying in their body easily infect people by coughing or sneezing nearby. Also, if you close the windows and don't ventilate the room, a lot of water droplets filled with virus particles will remain in the air of the room. Then, people inside the room will inhale them.

Why is it harder to infect people who are one to two meters away?

Because, it is assumed that water droplets coming from coughing and sneezing can fly about one to two meters. Of course, the size of the water droplets coming from coughing and sneezing varies. The smaller they are, the farther they can fly and the longer they stay in the air. However, the smaller the

size (because the volume of each droplet is small), the fewer the virus particles a water droplet contains. Also, in general, water droplets from coughing and sneezing shoot out one to two meters. Therefore, we are told that it is important to stay one to two meters away from others.

Even in the same place, can there be people who are infected and people who are not infected by the virus?

Even if people inhale the virus in the same way, how many cells the virus gets into depends on the immunity of the person who inhales it. Immunity is a body function to protect the body. Therefore, even if people inhale it in the same way, everyone who inhales it will not be infected.

Can touching something that an infected person has touched infect people?

By coughing or sneezing, water droplets that contain lots of the novel coronavirus may get on the palm of the person's hands. If he or she touches or holds an object, the virus may stick to it. Pencils, scissors, and so on. Although it depends on the material, the virus may remain active from a few minutes to more than a few hours after infected hands touch an object. If another person touches the infected object with his or her hands, the remaining virus may stick to the hands. The person may touch his or her nose, eyes, and mouth with their hands and get infected. (If you just touch the infected object with your hands, you won't get infected. If you touch your face with your hands containing the virus and it sticks to your mucous membranes, you may be in danger of infection.) Of course, in this way, the amount of virus is lower than inhaling the spray from coughing and sneezing (contains more virus) and is assumed to be less dangerous. But it's better to be careful.

Why doesn't the all virus in the body come out when you cough or sneeze?

Once a cell is tricked by the virus, the cell keeps making copies of the virus until the immune system stops it. During that time, even if you cough or sneeze and force the virus out, new virus particles are made in your body. Therefore, you cannot release all the virus particles in your body just by coughing or sneezing.

I was told to spread my arms and keep a little distance from my friends. But if we spread our arms, won't we get infected?

If your friend's hands have water droplets with the virus, you may get the droplets by touching the friend's hands. If you then touch your face with your hands, you may get infected. So, don't touch each other when you spread your arms.

How fast do the water droplets in a sneeze travel?

It is assumed to be 100 to 300 kilometers per hour. It is as fast as the Shinkansen.

The virus is so small, why doesn't it come out of the mask cloth when people cough?

When the virus gets out in the air, it is in the water droplets of a cough and sneeze. So, if you use a mask to keep the water droplets from getting into the air, as a result, you can prevent the virus from getting into the air.

Why do cells take in the bad virus?

The surface of a cell works to receive and take in materials with information (substances and molecules) or nutrition when they come. The virus uses this mechanism of cells to get inside of the cells.

How does the virus let cells make copies of the virus?

When the container of the virus opens in a human cell, genes, a kind of blueprint for how to make copies of the virus, come out (materials may be nucleic acids, DNA, or RNA). Actually, the virus's blueprint works in the same way that human cells work to make materials by multiplying. That's how the virus takes over the whole human cell system and multiplies more and more.

Why does it take so long to make a medicine for it?

First, researchers have to find out what kind of things (substances) can stop the virus from multiplying. In order to prevent the virus from multiplying, it is necessary to prevent the virus from entering human cells or to prevent them from making copies of the virus. Researchers must study and find them. This takes a long time. Next, after finding something that works (substances), they have to see if it really works for many people. Not only that, they need to make sure that the substance doesn't have a side effect that can hurt people's health. In particular, the system that the virus uses to multiply is the same as the system human cells use to make their parts (proteins, etc.). So, researchers have to make sure the substance only stops the virus from multiplying. This also takes a long time.

If I get infected with the virus, will I get better? If so, how do I get better?

Usually, people will recover. For example, influenza is also caused by a virus, but people can recover. Some people are infected with the novel coronavirus and have no symptoms. Some people recover from the symptoms as if they had a common cold. But the problem we are having right now is that some people who have been infected with the novel coronavirus have difficulty breathing, or more specifically, have difficulty taking in the oxygen that they inhaled and sending it to the lungs, to the bloodstream, and to the entire body.

If a person cannot breathe (get oxygen into the body), the body will stop working and he or she will die. But nobody has found a solution to fix the cause of the breathing trouble, other than waiting for the body's immune system to fight the virus. (We can use a machine to send a dense oxygen to the

lungs and/or to help him/her inhaling.) So far (according to an article in Lancet published March 30, 2020), it's estimated that about 1 in 1500 people with the novel coronavirus are dying (0.066%). If it's an influenza virus, it is calculated to be about 1 in 10,000 people (0.01%), so it seems to be a little more than that. In addition, a calculation showed that about 1 to 2 in 100 people (1.5%) have died from the novel coronavirus among those who were tested positive.

Then, how can it be treated? First of all, cells that have been infected with a virus produce a lot of virus and usually die later. The body's immune cells clean this up. At that time, the immune cells "learn" and become able to detect the virus. More specifically, the number of immune cells that make antibodies that attach themselves to the virus increases, and the immune cells become able to produce more antibodies. If the virus is found (when the virus has antibodies attached, and the immune cells can find them), immune cells are able to destroy the virus. In this way, both the virus and the infected cells are reduced in the body and the person will recover. It is believed that people who are infected with the novel coronavirus recover in the same way. If a person has a problem breathing (oxygen) and it worsens before the immune system drives the novel coronavirus out of the body, the person may die. Is there any medicine to help immune cells fight the virus? For germs (microbes and bacteria), because germs are living creatures, there is medicine to kill them (called antibiotics). But there are not many effective medicines for viruses. One reason is that it is difficult to stop the multiplying virus because the human cells are multiplying the virus. Another reason is that in the case of ordinary viruses, the body's immune system alone cures the disease after a while, so medicines are rarely needed.

However, for some viruses that cannot be treated or treated easily by the immune system alone, there are some medicines. (Coronavirus infections were thought to resolve normally until the novel coronavirus came out, so there is no medicine yet.) A few medicines are available, including those for influenza, herpesviruses that cause chicken pox, hepatitis B and C viruses, and HIV viruses that cause AIDS. There are two main functions of those medicines. One of the functions is to prevent the virus from entering human cells. The other is to prevent the virus from multiplying. These medicines use a material very similar to the material needed for the virus to enter and multiply in human cells, so the virus mistakenly takes in the medicine as the material they need. As a result, the virus will not be able to multiply any more.

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Let's Consider the Novel Coronavirus!

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