CORONAVIRUS: UNDERSTANDING THE MICRO ORGANISM

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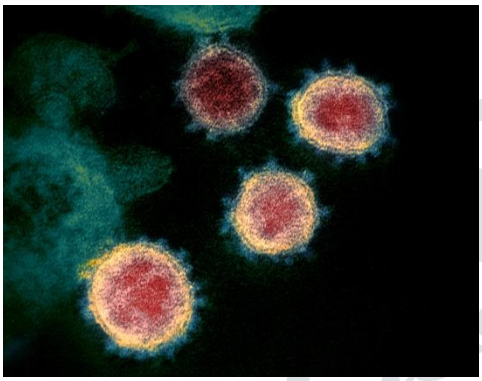


In December 2019, the Chinese notified the world a virus was spreading through their country. It was first noticed in Wuhan, China. In just a matter of a few months, this virus had spread to different countries over the world.

As of March 2020, this virus has affected 239,804 people and has killed 9,953 people.

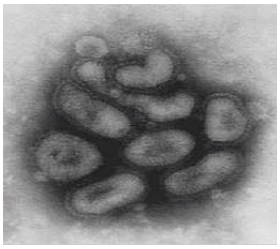
This virus is the SARS-CoV-2 (Severe Acute Respiratory Syndrome – Related Corona Virus 2). It is responsible for causing the disease COVID – 19. It is this disease that people are simply calling Coronavirus.

Let's have a deeper look into this:

First, before, we get into this topic, we need to understand the very basics.

What is a virus?

Viruses are microscopic parasites, generally much smaller than bacteria. They lack the capacity to thrive and reproduce outside of a host body.



← Electron Micrograph of a cluster of Influenza Viruses


← Electron Micrograph of Tobacco Mosaic Virus

Viruses are technically non – living organisms. They are unable to replicate outside a living cell. (This is due to the fact that they lack ribosomes thus unable to make their own proteins)

The principle feature about viruses replicating is that they penetrate the living cell (of the host organism) and they release their genetic material into the cell which causes the host cell to start generating more viruses. In other words, they hijack the cell.

Keeping these in mind, let's address the main question.

What is this *Coronavirus*?

Like all other plants and animals, viruses also have different families. They are placed in each of them because of varying characteristics.

Coronavirus is one of these families of viruses. This family consists of many different types of viruses. SARS-CoV-2 is placed here in this family. The viruses in this family can cause simple infections like common cold. It can also cause more dangerous infections like COVID – 19, which is caused by the virus we want to focus on in this article, SARS-CoV-2.

The symptoms of COVID – 19 can range from symptoms of common cold to more serious ones like aches, pains, diarrhea, etc.

However, many people can get affected by this virus, yet remain asymptomatically and lead a normal day to day life without requiring any special treatment. It is the younger people who can either have mild symptoms of common cold or no symptoms at all. The older, however are more likely to get affected by this virus.

This virus is mostly spread by droplets, i.e. sneezing, coughing, etc. It can also get transferred by surfaces previously touched by any person or carrier of the virus.

Here's a catch.

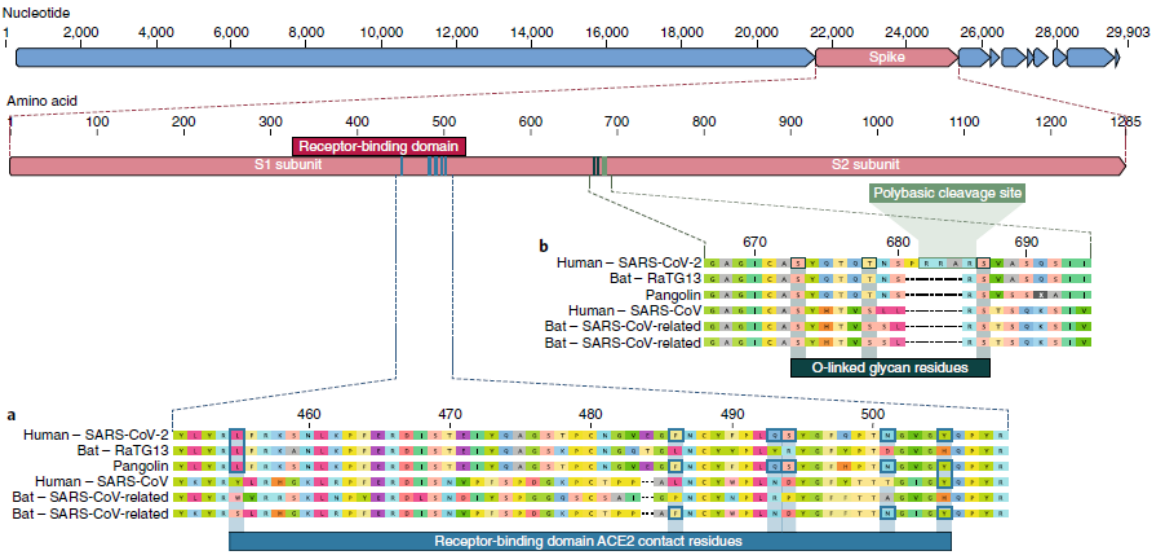
The people who might get affected by SARS-CoV-2 yet remain asymptomatically, are also unknowingly spreading the disease by travelling, touching surfaces, and simply coughing.

Despite illness due to COVID – 19 being mild for most people, there can be cases (1 in every 5 people) who can need hospital care sue to serious illness.

Let us now have a look as to how this virus originated.

It is improbable that SARS-CoV-2 emerged through laboratory manipulation of a related SARS-CoV – like coronavirus.
It has been observed the 6 receptor binding domains of SARS-CoV-2 are optimized for binding with Human Angiotensin Converting Enzyme 2 receptor.
However, if genetic manipulation had been performed, one of the reverse genetic systems available for beta coronaviruses would probably have been used. However, the genetic data show that SARS-CoV-2 is not derived from any previously used virus backbone.

Thus this makes it bluntly clear that this virus was not engineered in any lab to use it as a bioweapon.



Features of the spike protein in human SARS-CoV-2 and related coronaviruses.

1. Mutations in contact residues of the SARS-CoV-2 spike protein. The spike protein of SARS-CoV-2 (red bar at top) was aligned against the most closely related SARS-CoV-like coronaviruses and SARS-CoV itself.
   Key residues in the spike protein that make contact to the ACE2 receptor are marked with blue boxes in both SARS-CoV-2 and related viruses, including SARS-CoV (Urbani strain).
2. Acquisition of polybasic cleavage site and O-linked glycans. Both the polybasic cleavage site and the three adjacent predicted O-linked glycans are unique to SARS-CoV-2 and were not previously seen in lineage B betacoronaviruses.

So far, 2 theories have been stated to explain the origin of this virus:

1. **Natural selection in an animal host before zoonotic transfer:**
   As many early cases of COVID-19 were linked to the Huanan market in Wuhan, it is possible that an animal source was present at this location.
2. **Natural selection in humans following zoonotic transfer:**
   It is possible that a progenitor of SARS-CoV-2 jumped into humans, acquiring the genomic features described above through adaptation during undetected human-to-human transmission.

Having understood the cause, let us now have a look at how this virus causes the disease:

Being a virus which affects the respiratory system, one can easily understand that it will affect the human respiratory system.
The human lungs are lined with billions of epithelial cells. These cells are usually the border cells of the body, lining the organs and the mucosa.
The SARS-CoV-2 virus attaches to the ACE 2 (Human Angiotensin Converting Enzyme 2) receptor. Once inside, the genetic material of this virus (RNA) is released into the cell. This then 'hijacks' the cell and forces it to make more copies of the virus and finally causing the cell to lyse and release all these viruses which was made inside the cell. These viruses repeat the same process.
After the incubation period, i.e. 10 days, the damage may not be severe. However, the virus would now use the human's own immune system against them. How you ask?
As the cells of the immune system pour into the lungs, the virus infects some of them and thus causes 'confusion'. These immune cells respond and react to informational protein called as cytokines.
This 'confusion' causes more amounts of cytokines to be released thus summoning way more immune system cells to the lungs. This causes a waste in the resources and also to some extent, damage. This is caused by mainly two cells – Neutophiles and Killer T cells.
Neutrophiles can cause our own cells to die as well and Killer T cells cause infected cells to die.

Due to this 'confusion' these two cells, i.e. Neutrophiles and Killer T cells cause the death of healthy epithelial cells in the lung. Due to the massive number of immune cells, more damage is done and thus killing more amounts of healthy tissue.
This can cause lifelong, permanent, irreversible damage like Fibrosis.

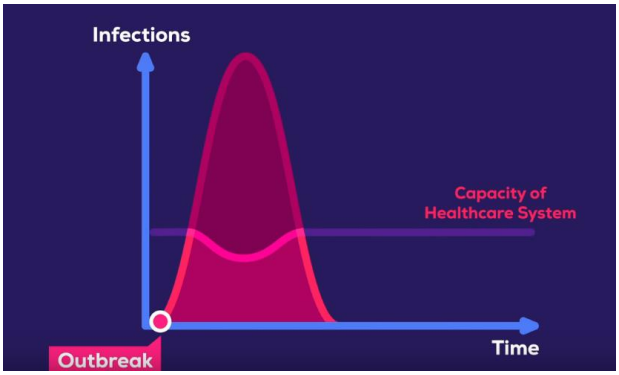
It most cases, the immune system gains control and kills the infected cells, intercepts the viruses trying to infect new ones. Thus recovery begins and as stated above, majority will get though COVID -19 with simple symptoms like cough and cold.
However, in some cases, this can become a severe case. Due to the high number to cells dying, the protective lining of epithelial cells is gone. This causes the bacteria to easily affect the alveoli. This causes patients to get pneumonia.
Another reason for this to occur is that due to the body's immune system working to kill the virus, it gets exhausted. Thus this causes the bacteria to overwhelm it. Once they enter blood and over run the body, death is very likely.

There has also been an interesting discovery. COVID – 19 has been observed to affect people with type A blood group much more and it has been seen that it affects type AB and O blood group in lesser numbers. The people in Wuhan showed that 7.75%, 26.42%, 10.03% and 25.80% of the patients affected were A, B, AB and O, respectively.
Currently scientists do not know the reason behind this. Research is ongoing and trying to show, what is causing this.

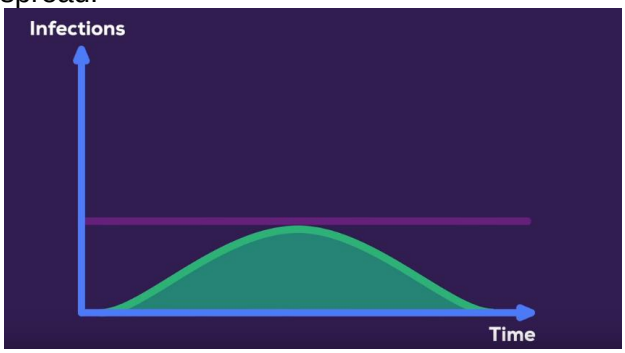
How is COVID – 19 more dangerous?

There are mainly two kinds of outbreaks for pandemics:

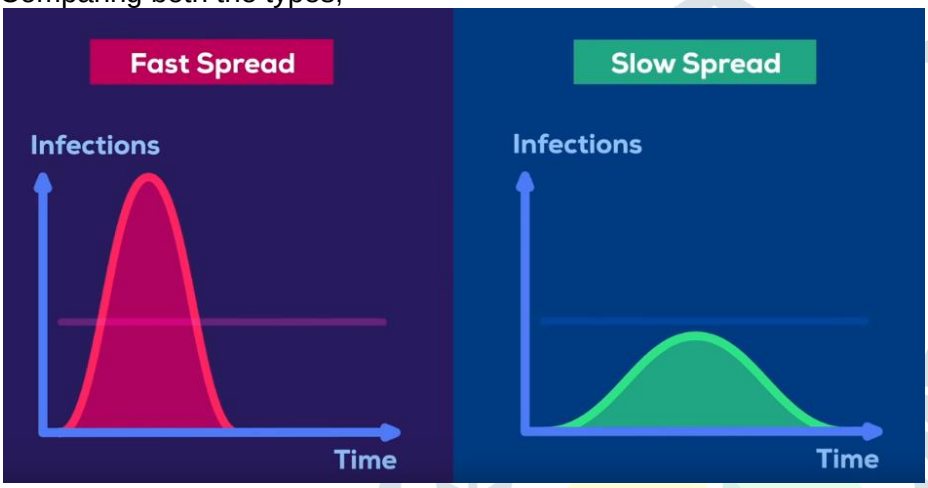
1. A fast spread: Here due to the very steep rise in the infections, the health resources get starved. There is a very rapid rate in the increase of the number of infections because of the lack of measures to slow it down.
   Many people get sick at the same time. If the numbers are too large, the healthcare may not be able to handle it. There can also be a case where the people in the healthcare industry can also be affected by the pandemic (shown by the depression in the graph below). The number of deaths also increases in such a scenario.



2. A slow spread: There is a gradual increase in the number of infections. Unlike the fast spread, resources are utilized slowly thus not causing a crunching in the healthcare industry. The death rate in this case is also much lesser.
   However, with the correct measures, a fast pandemic or spread can also be transformed into a slow spread.



Comparing both the types,



Now let's look at some of the common myths:

1. Wearing a mask will not help in any way to prevent infection. Unless you have a cough and cold, it is not required in any way.
   Viruses are approximately 10,000x smaller than a grain of salt.
2. Eating Non – Vegetarian food does not increase the chances of getting the virus in any way.
   What one needs to ensure is that, the meat should be properly cooked in order to prevent any bacterial infections to affect you.
3. From the evidence so far, the COVID-19 virus can be transmitted in ALL AREAS regardless of climate.
4. UV lights should not be used to sterilize any human body part as it can cause irritation and even cancer.
5. Spraying harsh chemicals on human body is an absolute no. It can cause skin irritation and burns.
   One can use soap and water to clean their hands or a solution of 60% or 70% ethyl alcohol to use as hand sanitizer.
   (The virus has a lipid envelope which is degraded by soap or alcohol thus killing the virus)
6. Consuming Antibiotics will not prevent the virus in any way. Antibiotics are meant to be consumed only if one has a bacterial infection. Consuming medicines without consulting a doctor should be strictly discouraged.

Due to the fact that we are still yet to come up with a vaccine for COVID – 19, we need to 'socially engineer' our behavior to suit this pandemic. Preventing shaking of hands and any other social gestures which require one to come in contact with another is a habit one needs to keep in mind.
Staying at home as much as possible would perhaps be the best option now.

If one has to stay in quarantine, he/she should respect that and stay in to prevent any further issues. This will just allow the people who have to be out in order for society to function (doctors, researchers,

policemen, etc.) to continue working and also allow researchers to find a solution for this pandemic by mainly buying them time.

Washing of hands with soap and water (or using 60% or 70% ethyl alcohol to sanitize our hands) when necessary (especially when entering our homes) is one of the main habits one needs to remember.
To make sure that one is washing their hands well, "wash your hands as if you have just cut up some jalapeños and want to put in your contact lenses next.

Our main motto now should be:

To not get infected, and to not infect others.

And to end with a line from Kurzgesagt,

"At this day and age, it really is in all of our hands – literally and figuratively."

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