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# QualPharma

Volume 3, Issue 4 April 2020, 30/-  
The Learning and Development Journal

## CORONAVIRUS

EVERYTHING YOU SHOULD KNOW

Transmission electron  
microscopy imaging of  
COVID-19

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# NAMASTE

## INDIAN TRADITION DOMINATING ON WORLD

COVID-19  
SPECIAL



STAY HOME

STAY SAFE

STAY POSITIVE

# CORONAVIRUS

## Everything you should know

### What is coronavirus?

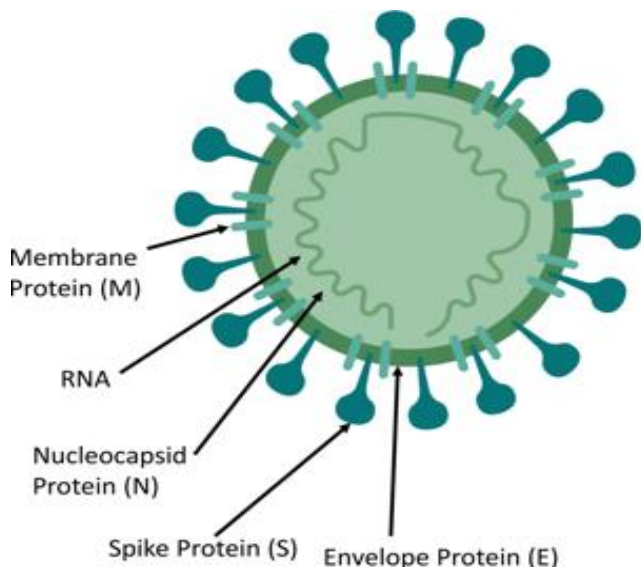
The coronavirus is a family of viruses that can cause a range of illnesses in humans including common cold and more severe forms like SARS and MERS which are life-threatening. The first human coronaviruses (HCoV) were discovered in the 1960s. Human coronavirus is a common, enveloped, positive-sense RNA virus. The virus is named after its shape which takes the form of a crown with protrusions around it and hence is known as **coronavirus**.

There are six currently known strains of coronaviruses that infect humans. The six human coronaviruses are:

- alpha coronaviruses 229E and NL63
- beta coronaviruses OC43,
- HKU1
- SARS-CoV (SARS)
- MERS-CoV (the coronavirus that causes Middle East Respiratory Syndrome or MERS).

The HCoVs 229E and NL63 are group 1 coronaviruses, while OC43, HKU-1 and SARS coronaviruses are classified in group 2.

Coronaviruses are classified into three groups, initially based on antigenic relationships of the spike (S), membrane (M) and nucleocapsid (N) proteins and now reinforced by viral genetic phylogeny.



### Morphology and structure

Coronaviruses are pleomorphic and enveloped, varying between 60–220 nm in diameter in negatively stained virus particles. Club-shaped surface projections or peplomers (composed of trimers of spike (S) protein) of approximately 20 nm in length are seen in all species, giving the particles their characteristic fringed appearance. Some group 2 coronaviruses (OC43, bovine coronavirus) have an additional shorter haemagglutinin-esterase protein on the virus surface which forms a distinct inner fringe of short peplomers. Coronaviruses have a non-segmented single stranded positive-sense RNA genome of approximately 30 kb, making these the largest known RNA virus genomes. In the virion, viral RNA is complexed.

Structural Protein	Function of Protein
Nucleocapsid Protein (N)	<ul style="list-style-type: none"> <li>• Bound to RNA genome to make up nucleocapsid</li> </ul>
Spike Protein (S)	<ul style="list-style-type: none"> <li>• Critical for binding of host cell receptors to facilitate entry of host cell</li> </ul>
Envelope Protein	<ul style="list-style-type: none"> <li>• Interacts with M to form viral envelope</li> </ul>
Membrane Protein (M)	<ul style="list-style-type: none"> <li>• Central organizer of CoV assembly</li> <li>• Determines shape of viral envelope</li> </ul>

## **SARS-CoV-2 (Wuhan coronavirus / COVID-19 )**

The World Health Organization (WHO) defines SARS-CoV-2 as 'a new strain of coronavirus that has not been previously identified in humans. The novel coronavirus responsible for the coronavirus disease 2019 pandemic –Covid 19. The virus is similar to SARS coronavirus therefore it is known as SARS coronavirus 2. It has created worldwide destruction. The world is struggling to survive in appalling conditions as there is no vaccine yet for the new illness. The infected person have below symptoms

- Difficult breathing
- Sneezing
- Fever
- Exacerbated asthma
- Severe cough
- Impaired liver and kidney function
- Kidney failure
- Diarrhea
- Nausea

Modi announced an unprecedented three-week lockdown which came into effect on March 25 to curb the spread of the coronavirus pandemic.

There are two opinions in India. The first group believes that the coronavirus effect will start reducing after 2nd April, 2020 and it will completely be in control by 16th April, 2020. Whereas the second group believes the effect will remain till end of

May. Therefore the government have to increase the lockdown period.

The final genome of sequenced SARS-CoV-2 consists of a single, positive-stranded RNA that is 29,811 nucleotides long, broken down as follows: 8,903 (29.86%) adenosines, 5,482 (18.39%) cytosines, 5,852 (19.63%) guanines, and 9,574 (32.12%) thymines. The genome appears to be more similar to the strain found in bats suggesting that it has also originated from bats. At the moment it is not yet clear that the virus jumped directly from bats to human or there is a mammalian intermediate in between.

### **What happens in the body**

In order to infect the host cell the spikes of the virus bind to the molecule on the cell surface called as receptor. The specificity of this binding explains why the viruses are specific to the host as they have receptor in same species and not others. Host jumping is usually triggered by mutations in spike proteins so that they can bind to the receptor in other species.

The novel coronavirus appears to attach to the same coronavirus as SARS CoV and that receptor is Angiotensin converting enzyme 2 (ACE 2). Infection usually starts with the cells of the respiratory mucosa then spreads to the epithelial cells of alveoli cells in lungs. Receptor binding is followed by fusion of viral

membrane with the host membrane. Coronavirus invades in two types of cells in the lungs.

- Mucus producing (Goblet ) cells
- Ciliated Cells

Mucus keeps your lungs from drying out. And protect from pathogens. Cilia beats the mucus towards exterior and clear debris including virus out of your lungs. Ciliated cells are the preferred hosts for SARS COV and likely to be the preferred hosts for new coronavirus too. The virus release the Nucleocapsid to the host cell. The virus then use the host machinery to replicate producing viral RNAs and Proteins . These are then assembled into new viral particles called **Virions**. The virions are then released and the host cells dies. The continuous activity of the virions destroys respiratory tissues. When ciliated cells dies, they slough off into your airways filling them with debris and fluid. Infection triggers the body inflammatory response and bring immune cells to the site to fight with the virus.

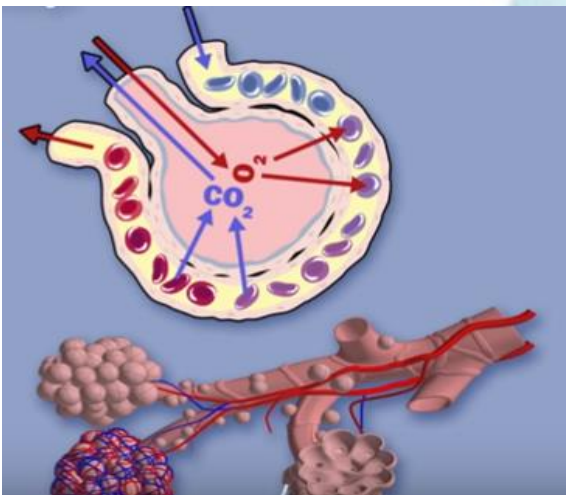
Inflammation is an important defense mechanism. It may damage body's own tissues based on the severity of the disease. In a healthy person the virus generally eliminates during this process and the patient recovers but some may require supportive treatment.



On the other hand people with weak immune systems or underlying chronic diseases people leads to severe pneumonia or acute respiratory destruction which can be fatal.

The inflammation results in more permeable alveoli. Alveoli are the location of the thin interface of the gas exchange where the lungs replace CO<sub>2</sub> in your blood with fresh Oxygen you just inhaled. Increased permeability causes fluid to leak into the lungs which decrease the lungs ability to oxygenate blood. In severe cases, flood them so that the person cannot breathe. The immune system over reaction can also cause another type of damage. Proteins called cytokines are the immune system's alarm systems, recruiting immune cells to the infection site. Over production of cytokines can result in a cytokines storm which

- Results in large scale inflammation in the body.
- Blood vessels become more permeable



ble and fluid seeps out.

This makes it difficult for blood and oxygens to reach rest of the body and can result in multi organ failure. This happens in more severe cases in Covid-19.

### Current problems:-

There are no specific treatment for coronavirus. The symptom can be treated through supportive care. The vaccines are currently in development stage.

### What should we do to protect from COVID-19

Advisory varies in different countries. But most basic requirements are

- regular hand washing.
- Avoid anyone who is coughing / Sneezing
- Avoid unnecessary contact with animals.
- Washing hands after contact with animals.
- Thoroughly cook meat and eggs.
- Covering your mouth and nose while coughing or Sneezing.

Respiratory viruses are typically transmitted via droplets in sneezes or coughs of those infected, so preventing their travel stops the spread of disease.

~ Dr. Sanjay Agrawal



### Dr Sanjay Agrawal

Dr Agrawal founded PHARMA CONSULTANTS and INVENTOR to fulfill his passion, capabilities and desire to assist pharmaceutical companies around the globe. He has actively worked in pharmaceutical and related industries for more than 28 years and started this firm in 2005. He is **Editor-in-Chief** of renowned IJM Today and honorable member of the editorial board of **The Antiseptic**.