

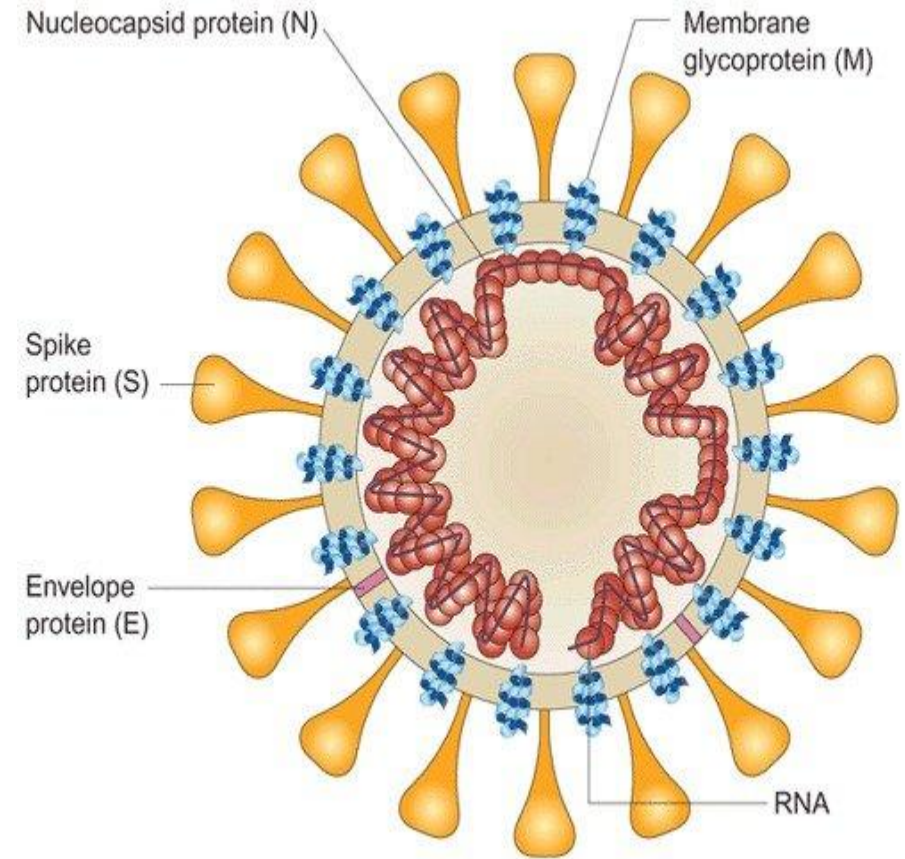
Coronavirus

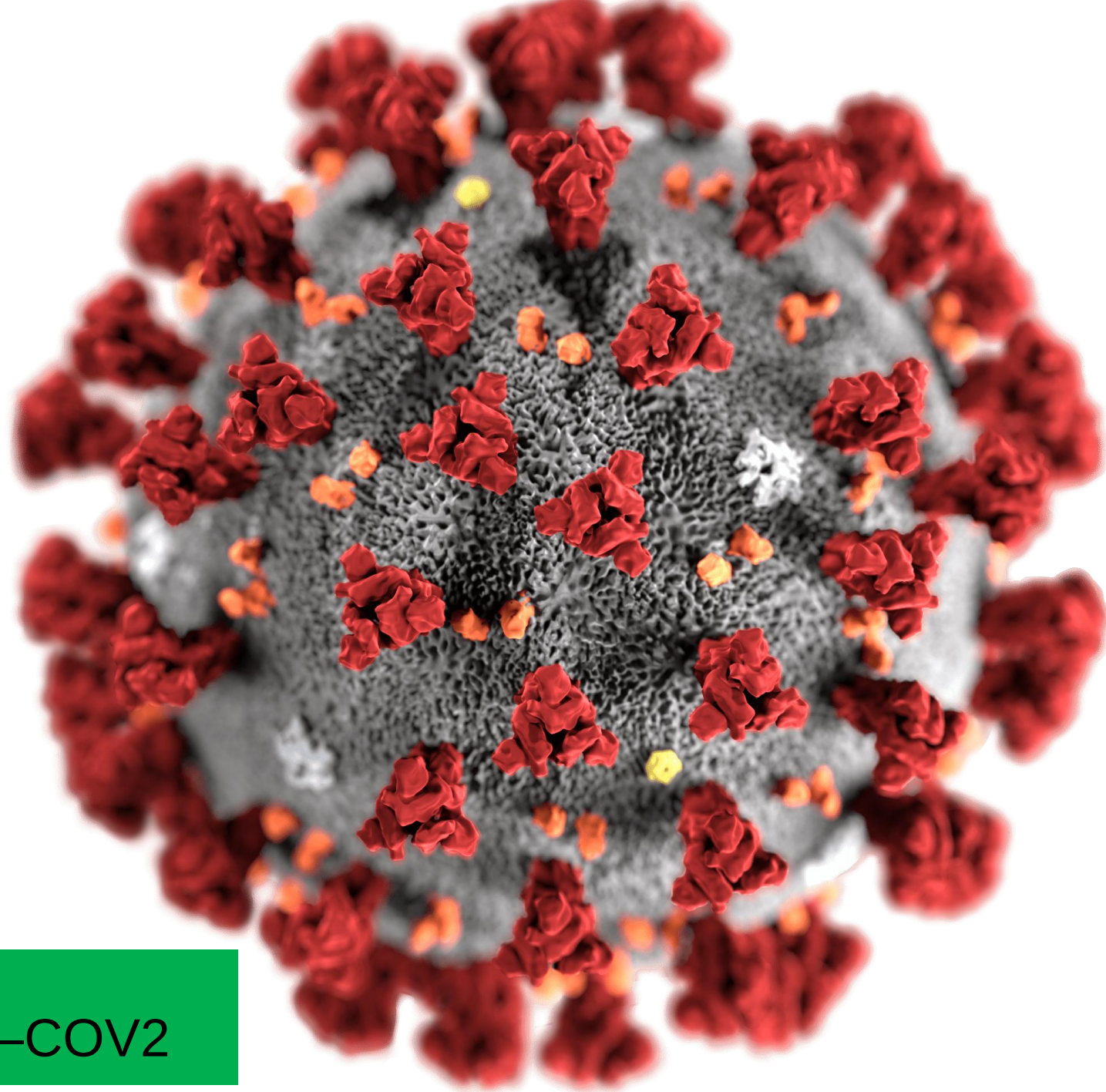
# Introduction

- Group of viruses that cause diseases in humans, mammals and birds
- The coronavirus family is so named because of the large spike protein molecules that are present on the virus surface and gives the virions a crown-like shape
- **Coronaviruses (CoVs)** are **enveloped positive sense, single-stranded RNA viruses** that belong to the, family Coronaviridae
- Four genera of CoVs, namely, Alphacoronavirus (**αCoV**), Betacoronavirus (**βCoV**), Deltacoronavirus (**δCoV**), and Gammacoronavirus (**γCoV**), are distinguished
- Cause respiratory infections which are typically mild but SARS, MERS and SARS CoV2 can be lethal
- SARS CoV2: novel beta corona virus, pleomorphic to spherical in shape
- Causes lower respiratory tract infection

# Characteristics

- **Enveloped, 120 to 160 nm particles**
- Unsegmented genome of **single-stranded positive-sense RNA**
- Helical nucleocapsid is 9–11 nm in diameter





SARS –COV2

# Introduction

- SARS-CoV-2 is the official, scientific name of the virus that causes the disease COVID-19
- COVID-19 is the name of the disease – the fever, cough, chills and other symptoms that people have when they are infected with the virus SARS-CoV-2
- The first known case was identified in Wuhan, China in **December 2019**
- On **11 March 2020**, WHO declared SARS-CoV-2 as a pandemic that causes novel coronavirus disease 2019 (Covid 19).
- In **Nepal**, the first case was reported on **23rd January 2020**.

- Phylogenetic analysis suggests that SARS-CoV-2 might have emerged from zoonotic cycle and rapidly spread by human to human transmission.
- However the exact source of SARS-CoV-2 has not been identified yet.
- Since December 2020, several variants have been identified that have now been assigned Greek letter designations by the World Health Organization (WHO).
- SARS-CoV-2 variants are designated as variants of concern (VOC) if they display certain characteristics, such as increased transmissibility or virulence.

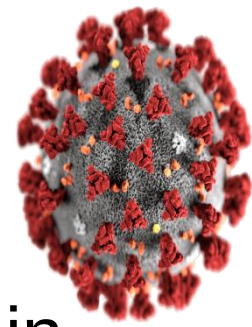
# Variants of concern

|                                                                                   |                                                                                    |                                                                                     |                                                                                                                                 |                                                                                     |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |                                              |  |
| <b>May 2020</b><br>UK                                                             | <b>August 2020</b><br>South Africa                                                 | <b>November 2020</b><br>Brazil                                                      | <b>October 2020</b><br>India                                                                                                    | <b>November 2021</b><br>Multiple countries                                          |
| Spreads more easily                                                               | Spreads more easily and some vaccines may be less effective against it             | Spreads more easily and some vaccines may be less effective against it              | Spreads more easily<br>Symptoms may present differently<br>May reduce vaccine efficacy<br>Still protects against severe disease | Early studies show that it spreads more easily                                      |

Source: [www.who.int/en/activities/tracking-SARS-CoV-2-variants/](https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/)



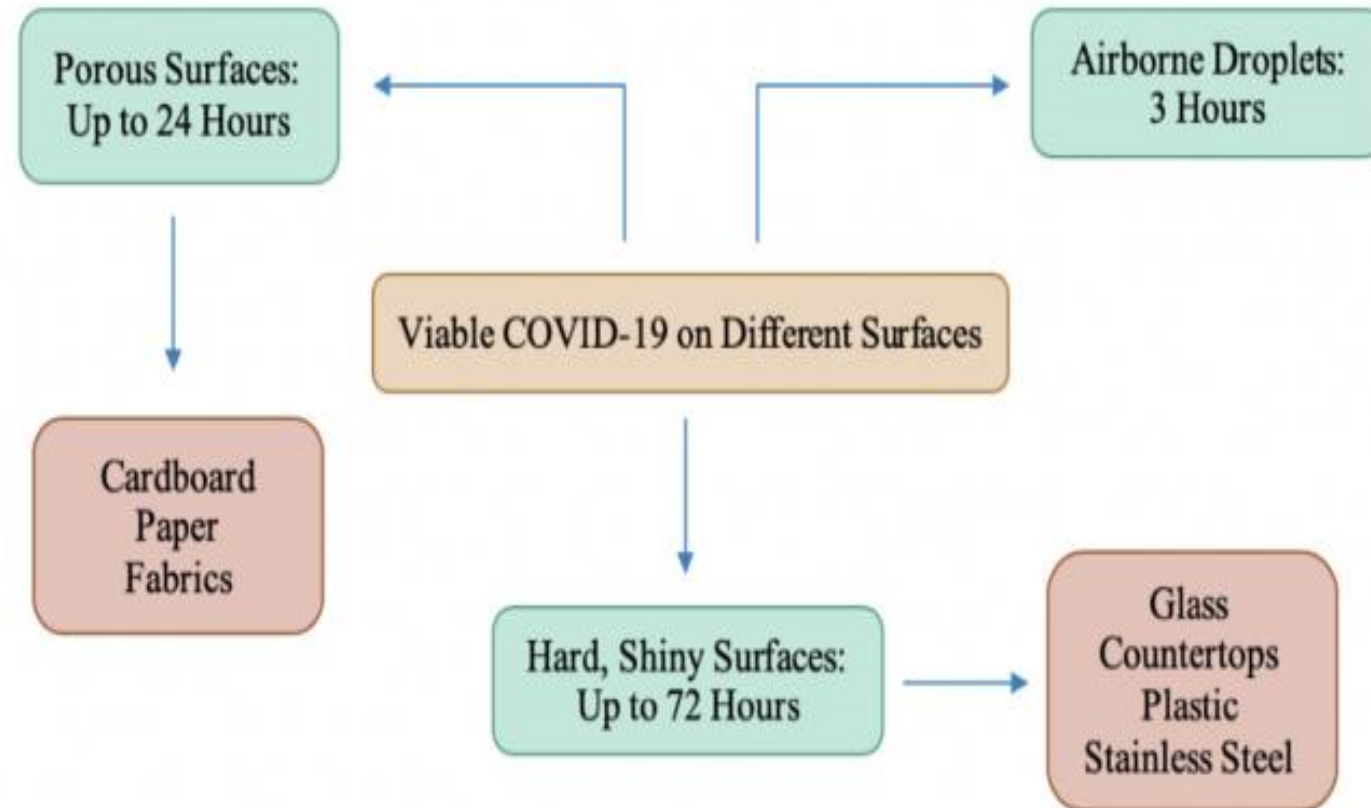
# SARS-Cov-2 origin



- Bat to a mammal (pangolin?) to human in Nov/Dec 2019
- Pangolins used in Chinese medicine
- Probable link to seafood/exotic animal market
- Other plausible theory:
  - Wuhan Level 4 Biohazard lab experimental animals sold for human consumption

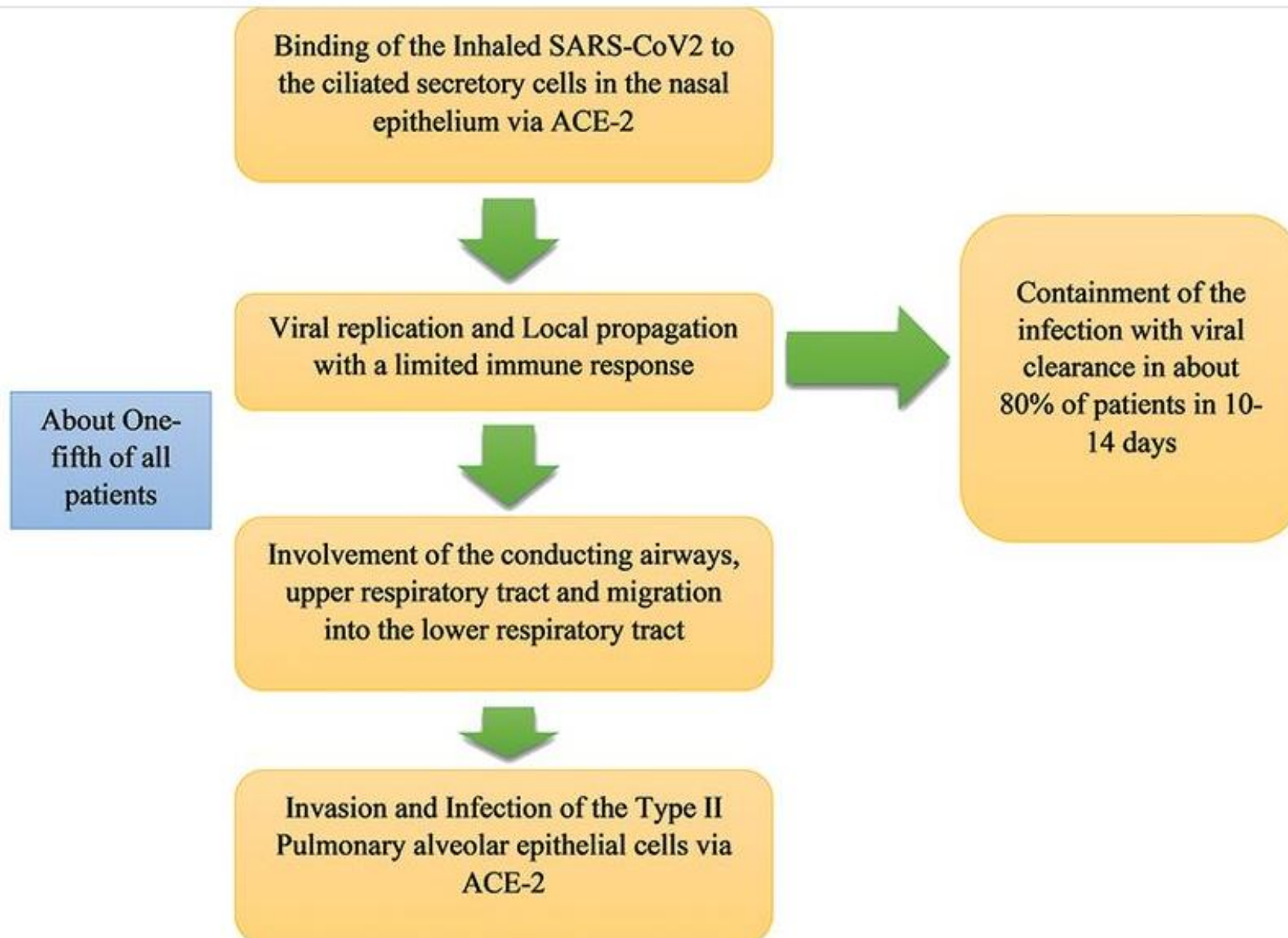


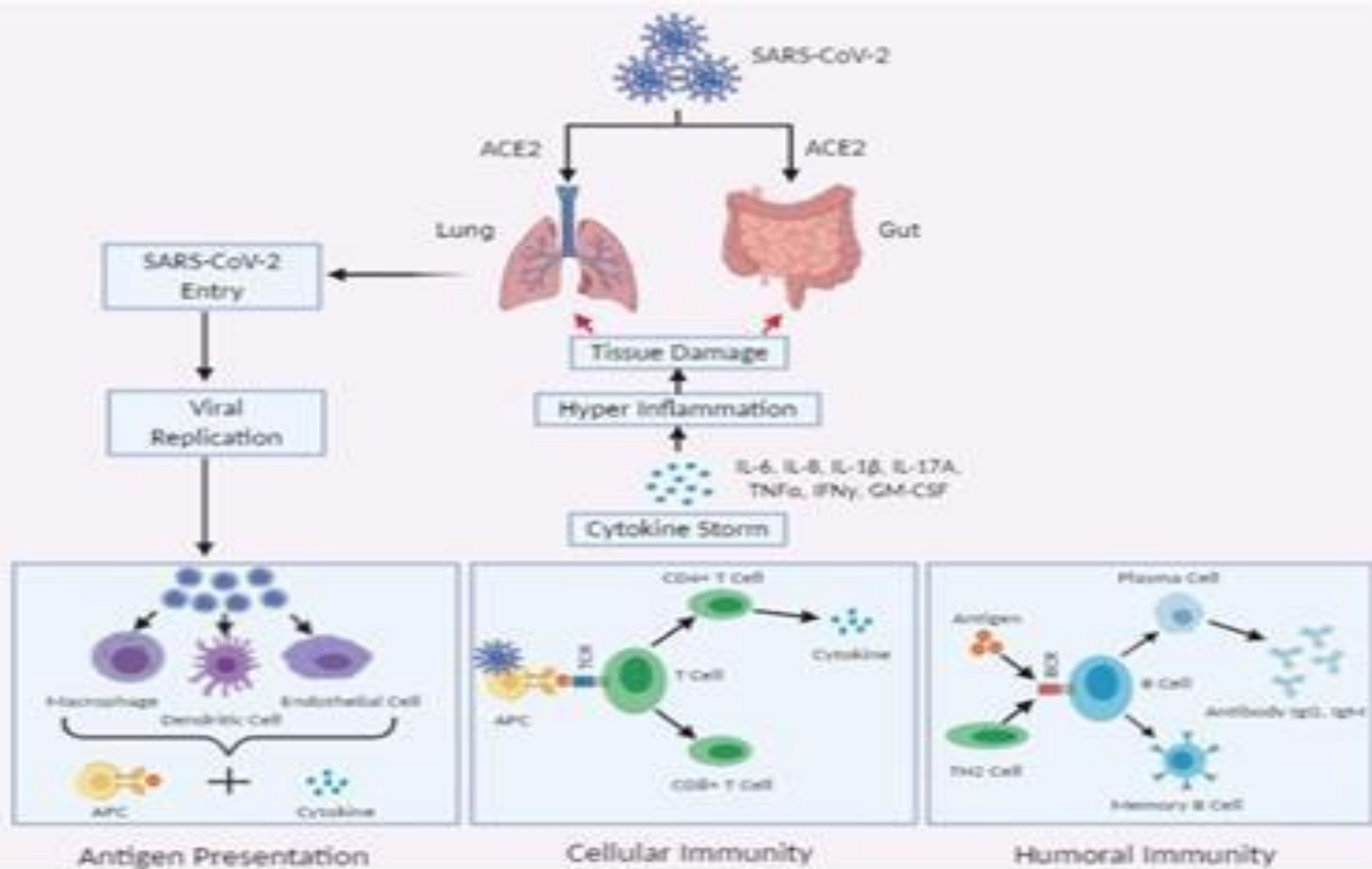
# Resistance



**FIGURE 4: The survival time of coronavirus on different surfaces**

# Pathogenesis

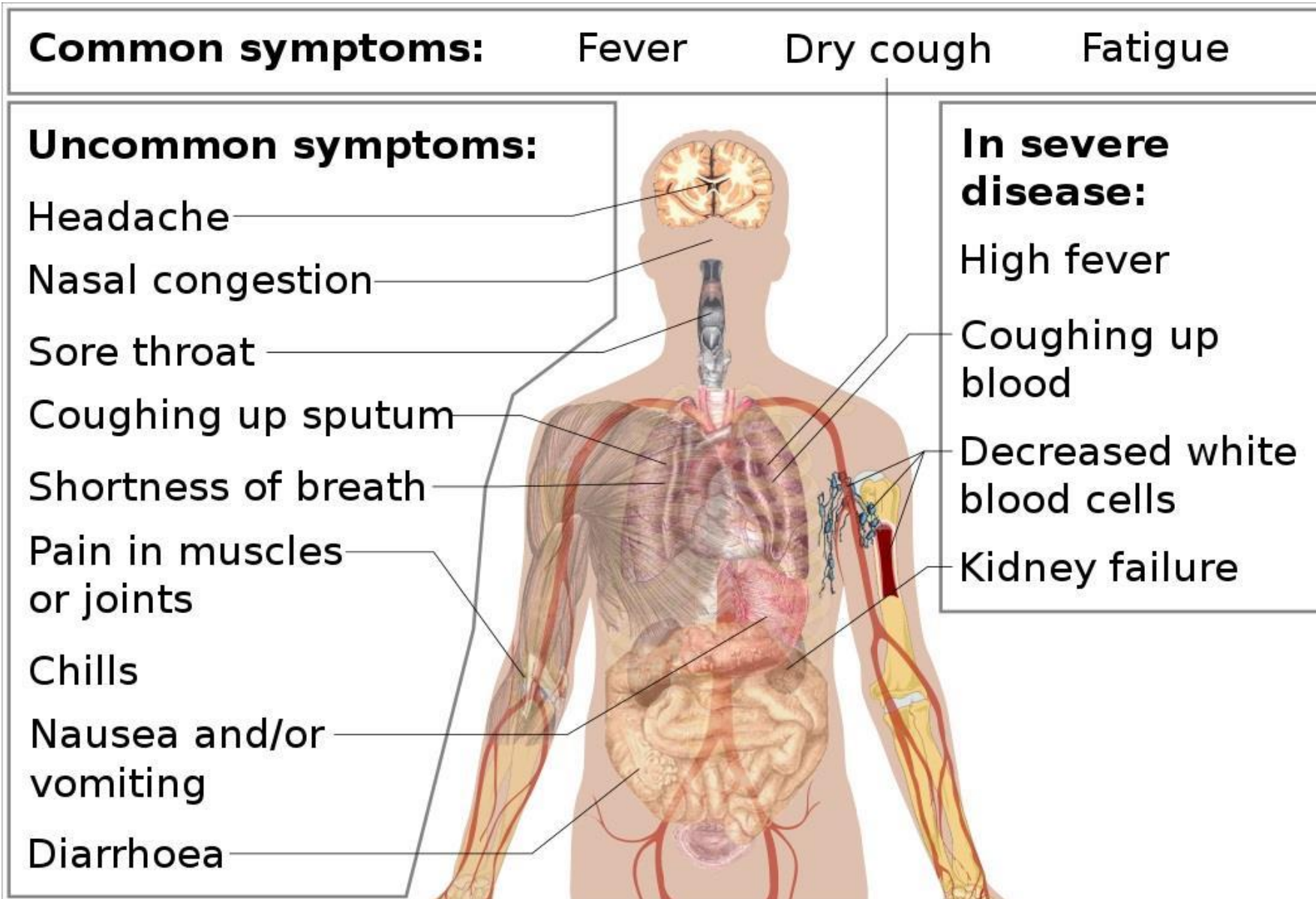




# Clinical Manifestations

- Patients with SARS-CoV-2 infection can experience a range of clinical manifestations, from no symptoms to critical illness.
- In general, adults with SARS-CoV-2 infection can be grouped into the following severity of illness categories;
  - ✓ *Asymptomatic or Presymptomatic Infection:*
  - ✓ *Mild illness*
  - ✓ *Moderate illness*
  - ✓ *Severe illness*
  - ✓ *Critical illness*

# CLINICAL FEATURES



# EXTRA PULMONARY MANIFESTATIONS

## Neurologic

Headaches  
Dizziness  
Encephalopathy  
Guillain-Barré  
Ageusia  
Myalgia  
Anosmia  
Stroke

## Renal

Acute kidney injury  
Proteinuria  
Hematuria

## Hepatic

Elevated  
aminotransferases  
Elevated bilirubin

## Gastrointestinal

Diarrhea  
Nausea/vomiting  
Abdominal pain  
Anorexia

## Thromboembolism

Deep vein thrombosis  
Pulmonary embolism  
Catheter-related thrombosis

## Cardiac

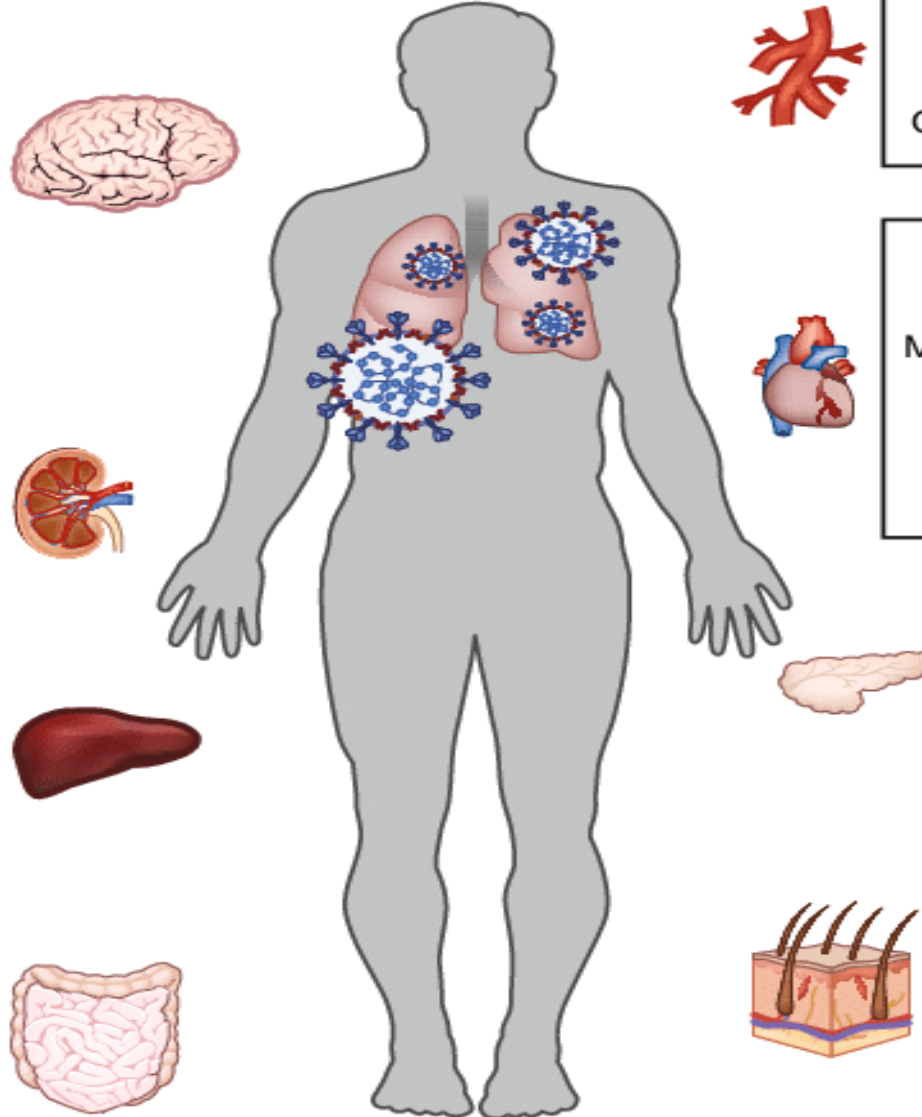
Takotsubo cardiomyopathy  
Myocardial injury/myocarditis  
Cardiac arrhythmias  
Cardiogenic shock  
Myocardial ischemia  
Acute cor pulmonale

## Endocrine

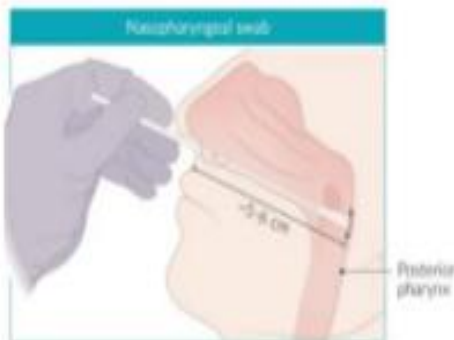
Hyperglycemia  
Diabetic ketoacidosis

## Dermatological

Petechiae  
Livedo reticularis  
Erythematous rash  
Urticaria  
Vesicles  
Pernio-like lesions



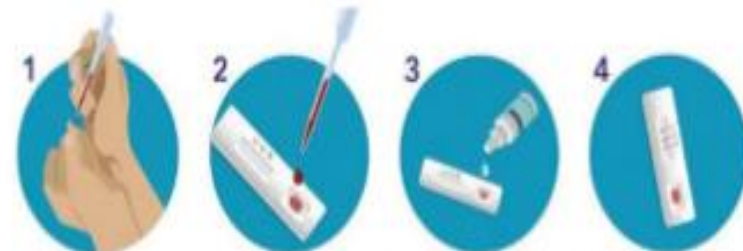
# Sample Collection and Diagnosis of COVID-19



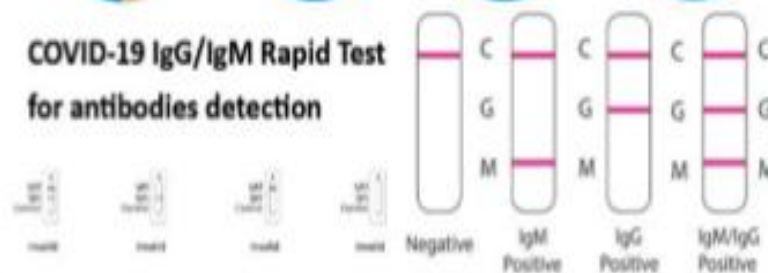
**Specimen Collection**



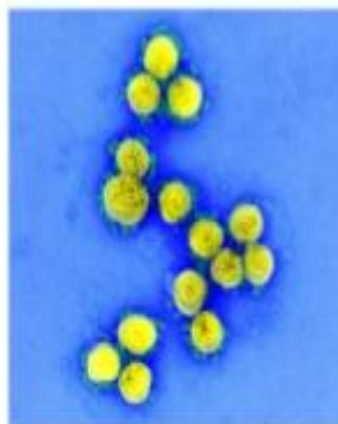
**RNA Detection by Real time PCR**



**COVID-19 IgG/IgM Rapid Test for antibodies detection**



**Electron Microscopy**



**Xpert Xpress SARS-CoV-2**

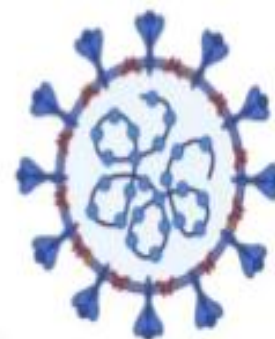


Figure: Sample collection and Diagnosis of COVID-19, created with biorender.com

# COVID – 19 Sample

- Suspected patients get diagnosed for SARS-COV-2 infection by collecting various specimens, including nasopharyngeal or oropharyngeal swab, bronchoalveolar lavage, tracheal aspirates, blood
- Specimens can be stored at 4<sup>0</sup>c for upto 72 hours after sample collection and may be stored at - 70<sup>0</sup>c for longer periods of time.

# Nucleic Acid Amplification/RNA Detection

- Regular confirmation of COVID-19 is based on the detection of particular sequences of viral RNA by NAAT such as **real-time reverse-transcription polymerase chain reaction (qRT-PCR)**.
- The viral genes which are targeted include the **N, E, S and RdRP genes** from samples like nasopharyngeal, oropharyngeal swab and even blood.

❖ IgM/IgG Antibody Detection:

- Qualitative detection of IgM and IgG antibodies against SARS-CoV-2
  - Gives results within 2 to 10 minutes.
  - Low sensitivity
  - Used for seroprevalence study and vaccine efficacy studies
- ❖ Rapid Antigen Tests: Rapid antigen tests would provide the advantage of fast time to results and low-cost detection

# Viral Sequencing

- Viral sequencing can also be used to provide confirmation of the presence of the virus.
- Virus whole-genome sequencing can also be done for molecular epidemiology studies

# Virus Isolation

- Virus isolation is not recommended as a routine diagnostic procedure
- SARS-CoV-2 will grow in primary monkey cells and cell lines such as **Vero and LLC-MK2**.

# Electron Microscopy

- Spikes on the surface of the virus can be seen under the electron microscope (which gives the coronavirus its name, meaning 'crown').

