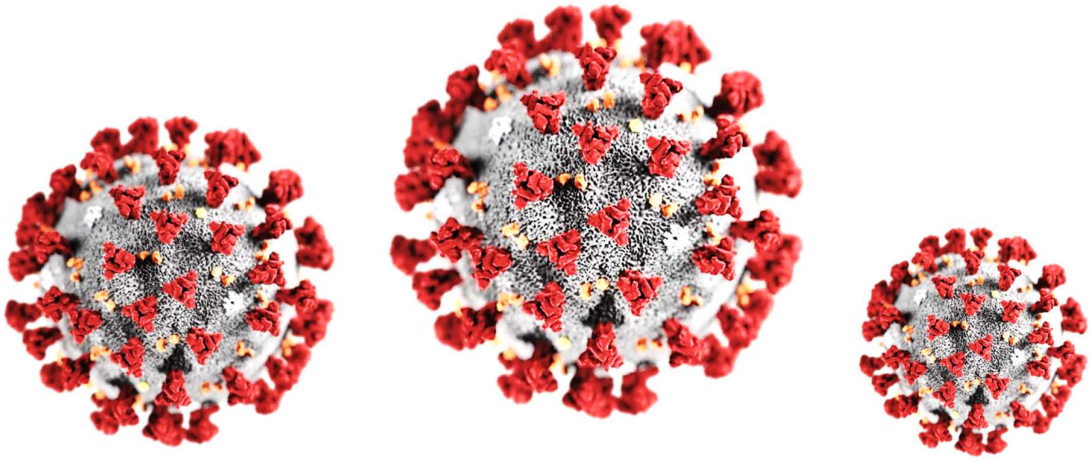
A Guide for awareness and prevention of Covid-19



Prepared by Surat Municipal Corporation
for general awareness and information

Guidance notes on COVID-19 for students

1. COVID-19 an overview

Coronaviruses are a group of viruses that cause diseases such as Severe Acute Respiratory Syndrome (SARS) and some types of common cold.COVID-19 is a disease caused by a new coronavirus – the COVID19 virus (or SARS-CoV-2 virus). 'CO' stands for corona, 'VI' for virus, and 'D' for disease. The virus causing COVID-19 was earlier referred to as '2019 Novel coronavirus' or '2019-nCoV'.

2. Differences between Virus and Bacteria

What is a Virus?

Virus is an extremely small entity which contains either RNA or DNA as the genetic material. They are also smaller than most bacteria. Virus is not fully acknowledged as living organisms as they cannot survive outside a host. Anatomically, a typical virus is girdled by a protein coat that is enclosed by a membrane made of proteins. In some virus, this protein coat is covered by a lipid membrane called the viral envelope.

What is a Bacteria?

Bacteria are prokaryotic microorganisms. They are found almost everywhere. They can survive even the harshest of conditions such as hot springs, deep ocean, snow and even in the volcanos. Any organism (bacteria / virus or other) causing a disease is called a pathogen.

What is Bacteriophage?

Viruses can infect bacteria. A virus which can enter the bacteria and infect it is called bacteriophage. It is so small that it can enter smallest living organism like bacteria. This proves that it is more pathogenic.

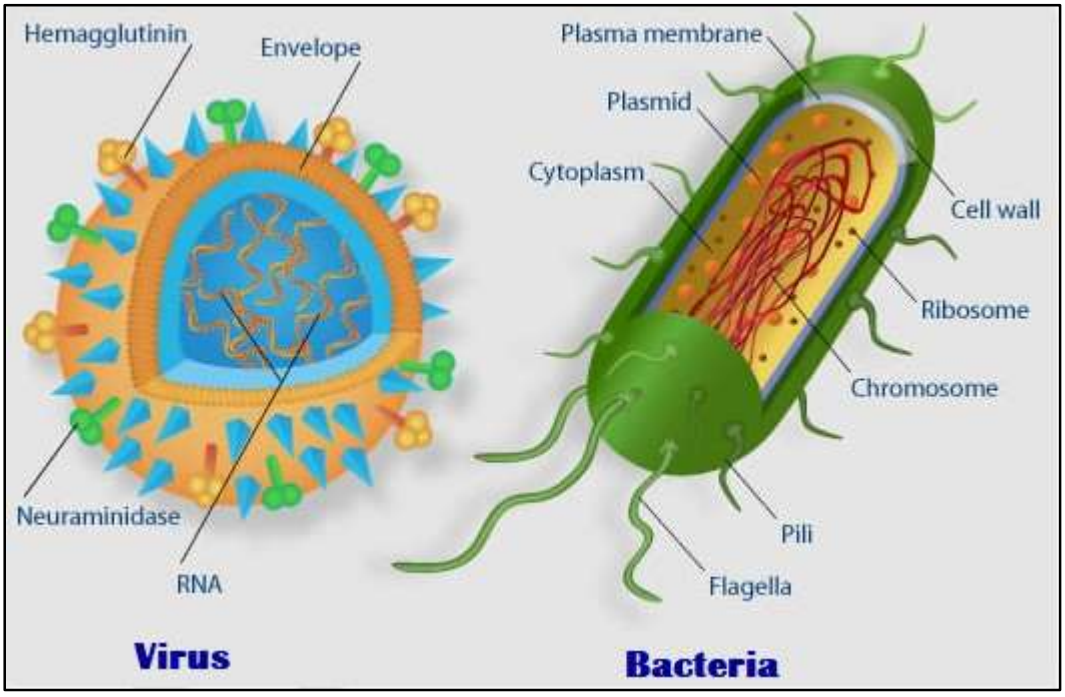


Figure 1: Structural differences between Virus and Bacteria

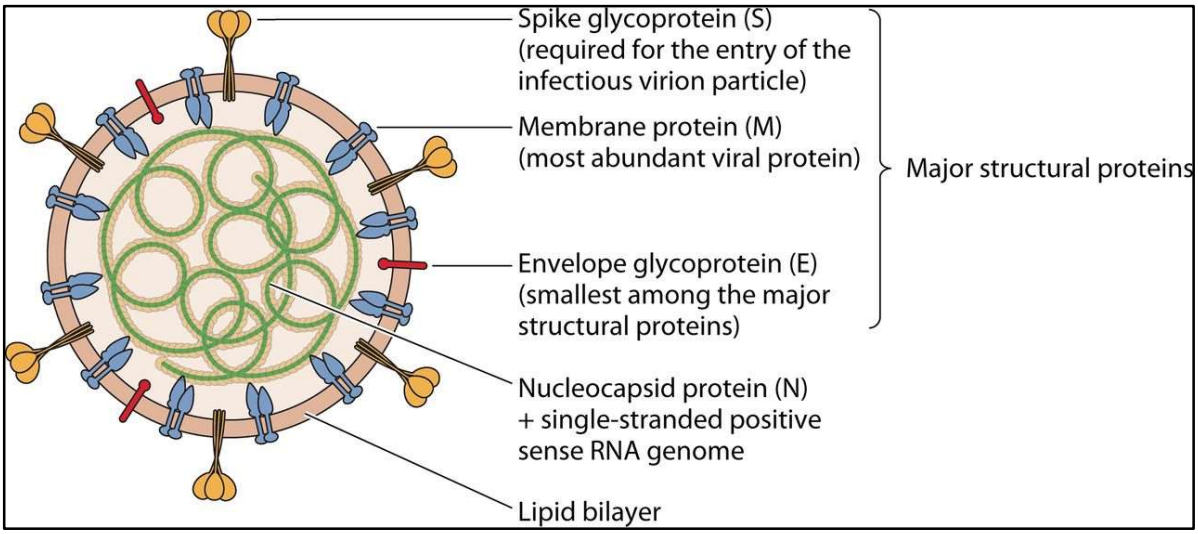


Figure 2: SARS-Cov-2 virus structure

Table 1: Difference between Virus and Bacteria

Characteristics	Bacteria	Virus
Outer Cell Wall	Bacterial cell wall is made up of peptidoglycan	Viruses do not contain a cell wall. The genetic material is enveloped by a protein coat known as a capsid
Size	Bacteria are large in size. The size ranges from 900 to 1000nm	Smaller in size. The size ranges from 30 to 50nm
Non-Living/Living	They are living organisms	They can replicate only within the host cell
Mode of Reproduction	Reproduce asexually by binary fission	Insert their genome in the host genome and make multiple copies
Host Dependence	Host independent reproduction	Host dependent reproduction
Ribosomes	Present	Absent
RNA and DNA	DNA or RNA is present in the cytoplasm	DNA or RNA are enveloped inside a protein coat known as a capsid
Diseases	cholera, typhoid, etc.	Polio, smallpox, chicken pox, hepatitis, AIDS, etc.

3. Types of Viruses

Baltimore Classification

The Baltimore classification of viruses is based on the mechanism of mRNA synthesis. Viruses must generate mRNAs from their genomes to produce proteins and replicate themselves, but different mechanisms are used to achieve this in each virus group. Viral genomes may be single-stranded (ss) or double-stranded (ds), RNA or DNA, and may or may not use reverse transcriptase (RT).

Table 2: Classification of viruses

Class	Method of Replication	Example
I	Double-stranded DNA virus	Adenoviruses, Herpesviruses, Poxviruses
II	Single-stranded DNA virus	Parvoviruses
III	Double-stranded RNA virus	Reoviruses
IV	Positive Sense Single-stranded RNA viruses	Coronaviruses, Picornaviruses, Togaviruses
V	Negative sense Single-stranded RNA virus	Orthomyxoviruses, Rhabdoviruses
VI	Single-stranded RNA virus with a DNA intermediate in life cycle	Retroviruses
VII	Double-stranded DNA viruses with an RNA intermediate in life-cycle	Hepadnaviruses

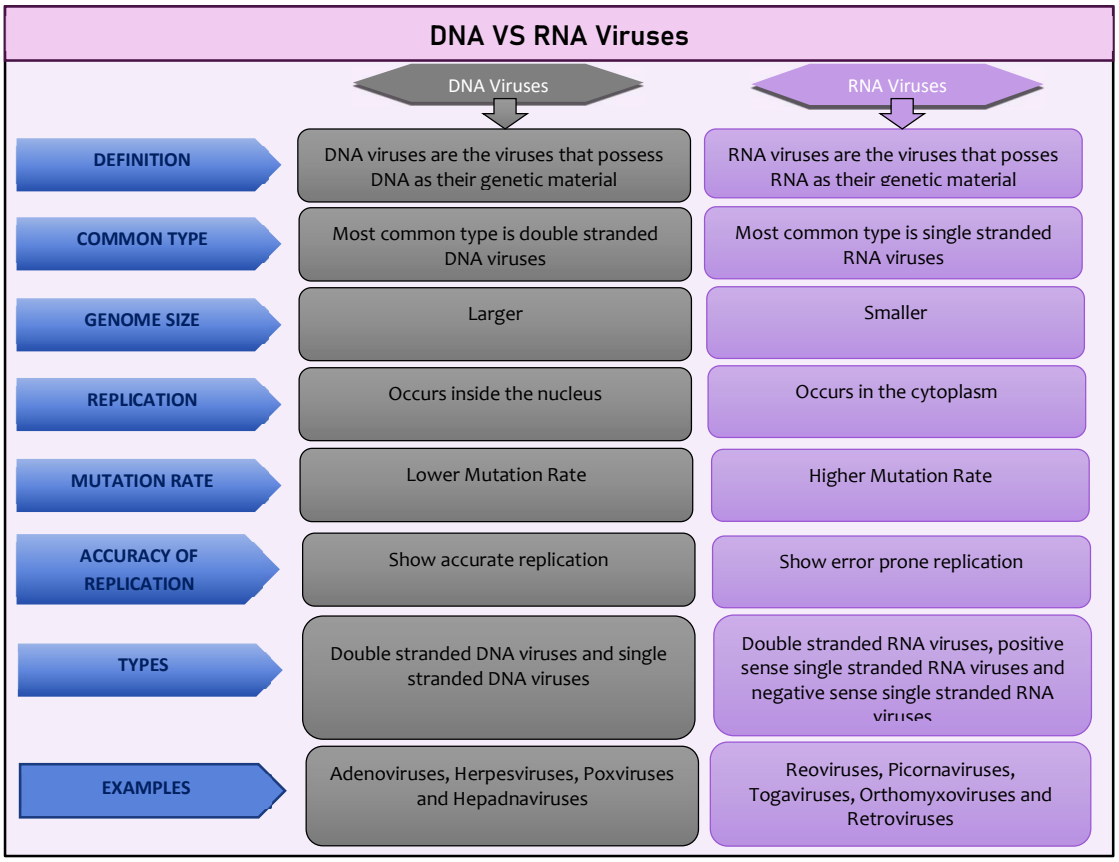


Figure 3: DNA versus RNA virus

4. Virus Variants

All viruses (including SARS-CoV-2, the virus that causes COVID-19) – evolve over time. When a virus replicates or makes copies of itself, it sometimes changes a little bit, which is normal for a virus. These changes are called "mutations". A virus with one or more new mutations is referred to as a "variant" of the original virus.

What causes a virus to change to a new variant?

When a virus is widely circulating in a population and causing many infections, the likelihood of the virus mutating increases. The more opportunities a virus has to spread, the more it replicates – and the more opportunities it has to undergo changes. India posseses high population and therefore COVID-19 virus has more likelihood of mutating itself.

Most viral mutations have little to no impact on the virus's ability to cause infections and disease. But depending on where the changes are located in the virus's genetic material, they may affect a virus's properties, such as transmission (for example, it may spread more or less easily) or severity (for example, it may cause more or less severe disease). For example, initially UK variant of COVID-19 was more transmissible in comparison to other variants. Recently, Delta variant is found to be more transmissible than any other variants.

WHO have classified different variants of SARS-CoV-2 into Variant of Concern (VOC) and Variant of Interest (VOI):

Variant of Concern (VOC)

A SARS-CoV-2 variant that meets the definition of a VOI (see below) and, through a comparative assessment, has been demonstrated to be associated with one or more of the following changes at a degree of global public health significance:

• Increase in transmissibility or detrimental change in COVID-19 epidemiology; OR
• Increase in virulence or change in clinical disease presentation; OR
•Decrease in effectiveness of public health and social measures or available diagnostics, vaccines, therapeutics.

Variant of Interest (VOI)

A SARS-CoV-2 variant:

• with genetic changes that are predicted or known to affect virus characteristics such as transmissibility, disease severity, immune escape, diagnostic or therapeutic escape; AND
• Identified to cause significant community transmission or multiple COVID-19 clusters, in multiple countries with increasing relative prevalence alongside increasing number of cases over time, or other apparent epidemiological impacts to suggest an emerging risk to global public health.

Given below image is the current classification of identified VOCs and VOIs (it is dynamic and keeps changing time to time):

WHO label	Pango lineage	GISAID clade	Nextstrain clade	Earliest documented samples	Date of designation
Variants of Concern (VOCs):					
Alpha	B.1.1.7	GRY (formerly GR/501Y.V1)	20I (V1)	United Kingdom, Sep-2020	18-Dec-2020
Beta	B.1.351	GH/501Y.V2	20H (V2)	South Africa, May-2020	18-Dec-2020
Gamma	P.1	GR/501Y.V3	20J (V3)	Brazil, Nov-2020	11-Jan-2021
Delta	B.1.617.2	G/478K.V1	21A	India, Oct-2020	VOI: 4-Apr-2021 VOC: 11-May-2021
Variants of Interest (VOIs):					
Epsilon	B.1.427/ B.1.429	GH/452R.V1	21C	United States of America, Mar-2020	5-Mar-2021
Zeta	P.2	GR/484K.V2	20B	Brazil, Apr-2020	17-Mar-2021
Eta	B.1.525	G/484K.V3	21D	Multiple countries, Dec-2020	17-Mar-2021
Theta	P.3	GR/1092K.V1	21E	Philippines, Jan-2021	24-Mar-2021
Iota	B.1.526	GH/253G.V1	21F	United States of America, Nov-2020	24-Mar-2021
Kappa	B.1.617.1	G/452R.V3	21B	India, Oct-2020	4-Apr-2021
Lambda	C.37	GR/452Q.V1	20D	Peru, Dec-2020	14-Jun-2021

Figure 4: SARS-CoV-2 Variants of Concern (VOCs) and Variants of Interest (VOI)

5. Epidemics and Pandemics due to Virus

Epidemic –

Epidemic is the occurrence in a community or region of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy. The community or region and the period in which the cases occur are specified precisely. The number of cases indicating the presence of an epidemic varies according to the agent, size, and type of population exposed, previous experience or lack of exposure to the disease, and time and place of occurrence.

Pandemic –

A pandemic is defined as "an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people". The classical definition includes nothing about population immunity, virology or disease severity.

Table 3: Epidemic versus pandemic

EPIDEMIC	PANDEMIC
An epidemic is an outbreak of disease that spreads rapidly and affects many individuals at the same time	A pandemic is an outbreak of a disease that occurs over a wide geographic area and affects an extremely high proportion of the population
Spread is limited to a specific region or even a continent	Affects multiple continents or the whole world
Not necessarily contagious	Always contagious
Western African Ebola virus (2013 – 2016) and SARS in 2003 are examples	The 1918 Spanish flu and the 2019 corona virus are examples

6. Difference between Communicable and Non-Communicable disease:

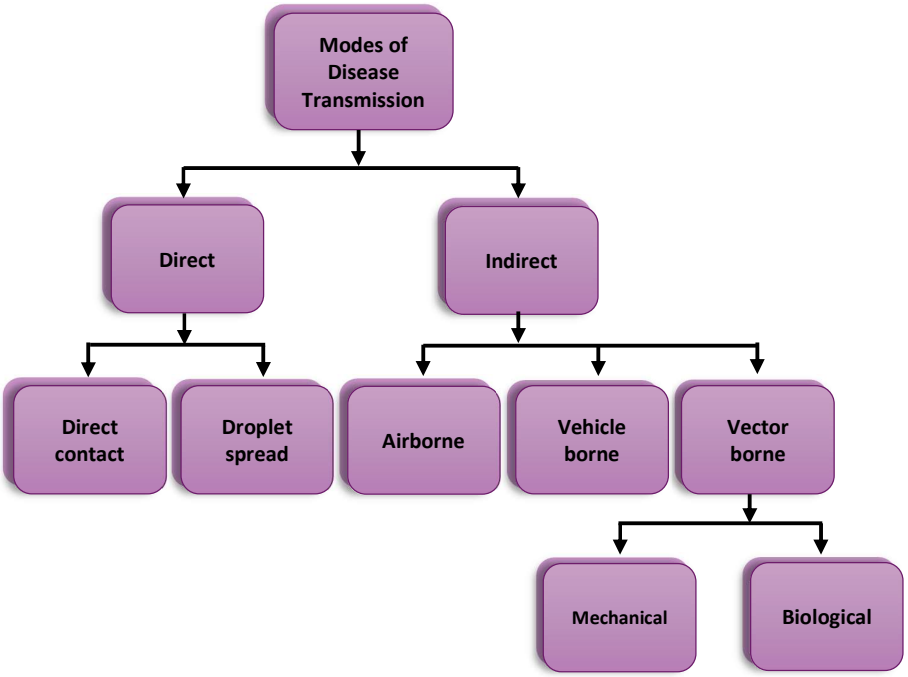
Communicable disease - A *communicable (or infectious) disease* is an illness which can transmit from infected person, animal or inanimate source to an uninfected person, either directly or indirectly. Examples: Tuberculosis, Mumps, Ebola, Influenza, COVID-19,HIV, Hepatitis A, Hepatitis B, Measles, Chicken Pox, Plague, Leprosy, Diphtheria, Poliomyelitis, Malaria, Tetanus, Rabies, etc

Non-Communicable disease –also known as chronic diseases, are not transmitted from person to person. They are generally of long duration and slow progression. Examples: Heart Attack, Stroke, Cancer, Chronic Obstructed Pulmonary Disease, Diabetes, etc

Table 4: Communicable versus Non-Communicable disease

COMMUNICABLE DISEASES	NON-COMMUNICABLE DISEASES
Communicable diseases refer to diseases that can transmit from one person to another.	Non-communicable diseases occur in one person and cannot be transmitted to another person.
Communicable diseases are also known as infectious diseases.	Non-communicable diseases are referred to as chronic diseases
Communicable diseases are more likely to be acute, which means the disease develops quickly.	Non-communicable diseases tend to be chronic, which means they last a long time and progress slowly.
Vehicles of transmission, environment and the vectors play a major role in the spread of disease.	Dietary habits, environment and lifestyle play a role in the causation of these diseases.

7. How are Infectious Diseases Transmitted?



8. COVID 19 mode of transmission:

The virus can spread through droplets that come out from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breathe. These particles range from larger respiratory droplets to smaller aerosols.

- Current evidence suggests that the virus spreads mainly between people who are in close contact with each other, typically within 1 metre (short-range). A person can be infected when aerosols or droplets containing the virus are inhaled or come directly into contact with the eyes, nose, or mouth.
- The virus can also spread in poorly ventilated and/or crowded indoor settings, where people tend to spend longer periods of time. This is because aerosols remain suspended in the air or travel farther than 1 metre (long-range). For example, schools, theatres, offices, gyms, malls, etc.
- People may also become infected by touching surfaces that have been contaminated by the virus when touching their eyes, nose or mouth without cleaning their hands.

9. How COVID19 affects the lungs

COVID-19 is a disease which affects the respiratory tract. The virus, after getting into the body, comes in contact with the mucous membranes that lines the nose, mouth, and eyes. The virus travels down the airway causing inflammation to the mucous membrane and in some cases, may reach all the way down into the alveoli. Virus multiplies within the cells and new viruses emerge.

About 80% of people who have COVID-19 get mild to moderate symptoms. They may have a dry cough or a sore throat. Some people have pneumonia, a lung infection in which the alveoli are inflamed.

On a chest CT scan, people may see something which is called as "ground-glass opacity" because it looks like the frosted glass on a shower door.

In critical situations, the infection can damage the walls and linings of the air sacs in the lungs. As the body tries to fight it, the lungs become more inflamed. The air sacs get filled with mucus, fluid, and other cells that are trying to fight the infection. This can make it harder for the body to breathe oxygen and people may feel breathing difficulty and may also breathe faster. People may have severe pneumonia or acute respiratory distress syndrome (ARDS), in which the lungs may need help of a ventilator.

A few people may need lung transplants because of severe tissue damage from COVID-19.

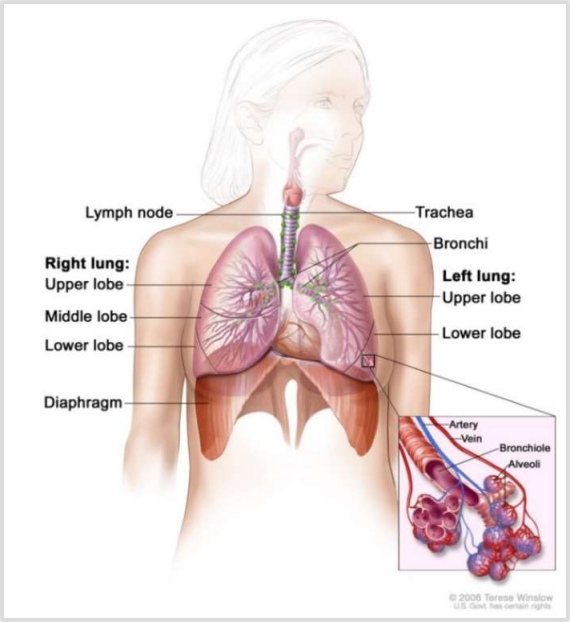


Figure 6: Structure of Lung

10. Symptoms of COVID19:

Most common symptoms:

- fever
- dry cough
- tiredness

Less common symptoms:

- aches and pains
- sore throat
- diarrhoea
- conjunctivitis
- headache
- loss of taste or smell
- a rash on skin, or discolouration of fingers or toes

Serious symptoms:

- difficulty breathing or shortness of breath
- chest pain
- loss of speech or movement

11. Types of COVID testing

Molecular (RT-PCR): Reverse transcription polymerase chain reaction

This is a laboratory technique combining reverse transcription of RNA into DNA (in this context called complementary DNA or cDNA) and amplification of specific DNA targets using polymerase chain reaction (PCR). It is primarily used to measure the amount of a specific RNA. This is achieved by monitoring the amplification reaction using fluorescence, a technique called real-time PCR or quantitative PCR (qPCR).

Rapid Antigen Test (RAT)

RAT is a rapid diagnostic test suitable for point-of-care testing that directly detects the presence or absence of an antigen. It is commonly used for the detection of SARS-CoV-2, the virus that causes COVID-19. Rapid tests are a type of lateral flow tests that detect protein, distinguishing it from other medical tests that detect antibodies (antibody tests) or nucleic acid (nucleic acid tests). Rapid tests generally give a result in 5 to 30 minutes, require minimal training or infrastructure, and have significant cost advantages than RT-PCR. Samples are collected from the nose and/or throat with a swab. These tests perform best when there is more viruses circulating in the community.

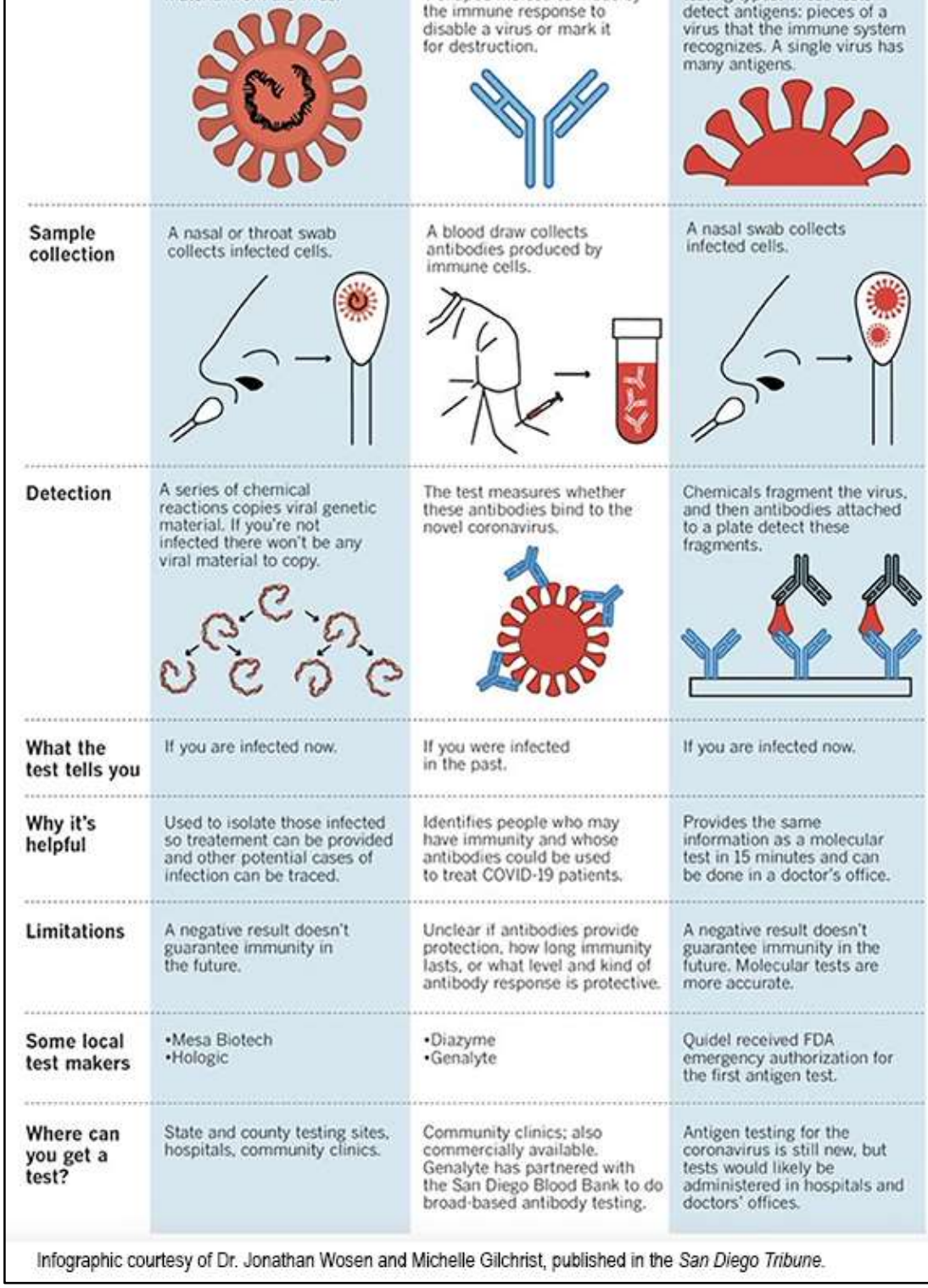
Antibody Test

Antibody or serology tests look for antibodies in your blood to determine if you had a past infection with the virus that causes COVID-19. Antibodies are proteins created by your body's immune system soon after you have been infected or vaccinated.

Types of coronavirus testing

What they tell you, what they don't and why it matters.

Type of test	Molecular test	Antibody test	Antigen test
	Molecular tests detect genetic material from the virus.	These tests detect antibodies: Y-shaped molecules made by the immune response to disable a virus or mark it for destruction.	This is the newest of the three testing types. These tests detect antigens: pieces of a virus that the immune system recognizes. A single virus has many antigens.
Sample collection	A nasal or throat swab collects infected cells.	A blood draw collects antibodies produced by immune cells.	A nasal swab collects infected cells.
Detection	A series of chemical reactions copies viral genetic material. If you're not infected there won't be any viral material to copy.	The test measures whether these antibodies bind to the novel coronavirus.	Chemicals fragment the virus, and then antibodies attached to a plate detect these fragments.
What the test tells you	If you are infected now.	If you were infected in the past.	If you are infected now.
Why it's helpful	Used to isolate those infected so treatement can be provided and other potential cases of infection can be traced.	Identifies people who may have immunity and whose antibodies could be used to treat COVID-19 patients.	Provides the same information as a molecular test in 15 minutes and can be done in a doctor's office.
Limitations	A negative result doesn't guarantee immunity in the future.	Unclear if antibodies provide protection, how long immunity lasts, or what level and kind of antibody response is protective.	A negative result doesn't guarantee immunity in the future. Molecular tests are more accurate.
Some local test makers	•Mesa Biotech •Hologic	•Diazyme •Genalyte	Quidel received FDA emergency authorization for the first antigen test.
Where can you get a test?	State and county testing sites, hospitals, community clinics.	Community clinics; also commercially available. Genalyte has partnered with the San Diego Blood Bank to do broad-based antibody testing.	Antigen testing for the coronavirus is still new, but tests would likely be administered in hospitals and doctors' offices.



Infographic courtesy of Dr. Jonathan Wosen and Michelle Gilchrist, published in the *San Diego Tribune*.

Figure 7: Types of COVID testing

12. COVID Appropriate Behavior to prevent COVID-19 infection:

To prevent the spread of COVID-19 you should do the following:

- Greet without physical contact
- Maintain social distance of 6 feet (2 Gaj Ki Doori)
- Wear mask or face cover whenever in public
- Cover mouth and nose while coughing or sneezing,
- Use tissue while coughing and throw them away at a proper place
- Do not spit in the open
- Avoid touching eyes, nose and mouth repeatedly and with unwashed hands
- Wash hands with soap and water/ sanitize hands frequently and thoroughly
- Regularly clean and disinfect frequently touched surfaces
- Avoid unnecessary travel
- Discourage crowd / gatherings
- Conduct activities which will boost the immunity – exercise, yoga, proper healthy diet, sleep timely.

What you should do if you have any of the above symptoms or are feeling sick

- Stop going to school
- Isolate yourself at home
- Avoid visitors
- Inform your parents and school about your sickness
- Consult a doctor and get yourself tested for COVID-19
- Take proper rest and treatment
- If you turn out to be positive, be under home isolation for 14 days as per advice from a doctor
- Monitor your symptoms. If any other symptoms arise or there is increase in current symptoms, immediately inform your doctor.
- If you are more sick or feeling difficulty in breathing, consult your doctor and get admitted.

13. Currently available covid-19 vaccines:

- **Viral Vector:** AstraZeneca Oxford – **COVISHIELD (Serum Institute of India)**, Gamaleya Sputnik V, Janssen
- **Inactivated: COVAXIN (Bharat Biotech)**, Sinovac, Sinopharm
- **RNA vaccine:** Pfizer BioNTech, Moderna
- **Protein based:** Novavax, GSK/Sanofi

14. Use of steroids in Covid-19 and their side-effects:

Steroids are man-made version of a type of chemical similar to a natural hormone in our bodies. When produced naturally it is called natural steroids, and when introduced medically it is called synthetic steroids. Steroids are basically designed to reduce the amount of inflammation in the body, which might happen when the body's own natural immune system tries to fight any virus or bacteria. It is important to know that the steroids won't cure the condition, but they give relief to the patient by reducing the inflammation in the body.

In the case of Covid-19, corticosteroids like Dexamethasone are used to reduce the inflammatory overdrive and protect the lungs from fibrosis. However, it is important to note that the dose and duration of the steroid therapy are selected carefully and should only be used once prescribed by the physician. They should not be purchased directly without physician's advice. When used without proper precautions, they may cause mood and behavior changes, increase in blood sugar, and fungal infection among other things.

Key points to remember about steroids in Covid-19

- Steroids should not be stopped suddenly
- Steroids should be tapered off
- Steroids should never be self-prescribed
- It should be used and stopped only when recommended by the doctor
- All patients, not just diabetic needs to be careful with steroids

15. Link to educational material:

1. What causes a virus to change? https://www.youtube.com/watch?v=qD8dAbov5JU&t=7s
2. COVID-19: cause, pneumonia, vaccines https://www.youtube.com/watch?v=5DGwOJXSxqg
3. Vaccine: will it change my DNA? https://www.youtube.com/watch?v=Kd-E95tXfsY
4. What happened if you get Coronavirus? https://youtu.be/5DGwOJXSxqg
5. What happens if you get a severe case of COVID-19?https://www.youtube.com/watch?v=DhtO5kzY5js
6. How a Vaccine kills Coronavirus? https://www.youtube.com/watch?v=WHWUfk8-sNw
7. How Coronavirus kills? https://www.youtube.com/watch?v=0G0vq3tVAKE
8. How COVID-19 affects the lungs? https://www.youtube.com/watch?v=ZL1z3Uju-I0
9. How Coronavirus invades the lungs? https://www.youtube.com/watch?v=vAttiWu_B-A
10. How does COVID-19 affect the body? https://www.youtube.com/watch?v=Xj1nUFFVK1E
11. What is RT-PCR test for COVID-19 and how does it work? https://www.youtube.com/watch?v=I2wdJskulOo
12. RT-PCR animated video https://www.youtube.com/watch?v=ThG_02miq-4
13. COVID-19 Antigen test https://www.youtube.com/watch?v=m1OYKDhEe7k
14. How is a new vaccine prepared https://www.youtube.com/watch?v=Fcvgp6gNh6o
15. DNA Versus RNA Virus https://www.youtube.com/watch?v=IvMnnvv5NBA
16. 5 difference between DNA and RNA https://www.youtube.com/watch?v=ruUf7ntRCk8
17. COVID appropriate behaviors https://www.youtube.com/watch?v=yXncHLQA2_k

Disclaimer

The contents of this guide note are for information and education purpose only