A Guide on COVID-19

A Compendium by Aayush Mohanty

Vivekananda International Foundation

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COVID-19

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Author's Note

The COVID-19 pandemic is one of the toughest challenges humankind faces. Scores of people have been directly or indirectly affected by the pandemic. Major cities in India and abroad are under state-mandated lockdown while healthcare officials and workers all over the world along with essential services workforce are selflessly providing care to people who have been diagnosed or suspected to have the virus. This compilation of data, terms and other things related to COVID-19 is the author's and the Vivekananda International Foundation's team effort to provide a one-stop information base of all things related to COVID-19. The following is not an original work but a well-intended guidebook for those who want to know more about this virus and the terms, organisations related to it. All the content has been taken from authoritative, credible websites and journals which are properly-referenced for the reader's perusal.

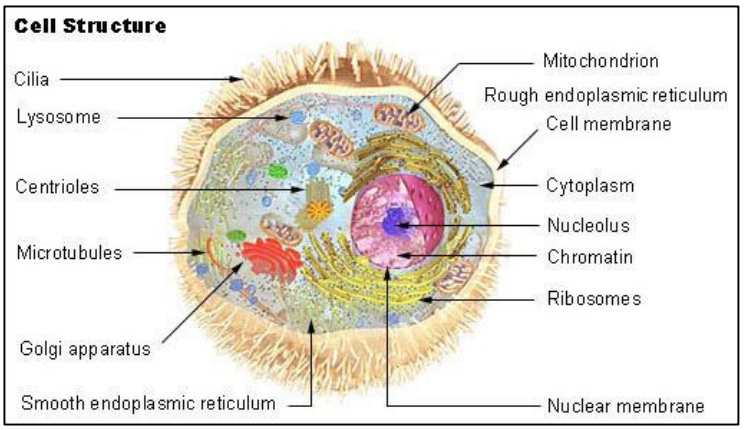
S. No	Terms related to COVID-19	What do they mean and further description
1.	**Amino Acids**	Amino acids are compounds that combine to make proteins. When a person eats a food that contains protein, their digestive system breaks the protein down into amino acids. The body then combines the amino acids in various ways to carry out bodily functions. The body needs 20 different amino acids to maintain good health and normal functioning. People must obtain nine of these amino acids, called the essential amino acids, through food. Good dietary sources include meat, eggs, tofu, soy, buckwheat, quinoa, and dairy.[1] Amino acids are required for the synthesis of body protein and other important nitrogen-containing compounds, such as creatine, peptide hormones, and some neurotransmitters. Although allowances are expressed as protein, the biological requirement is for amino acids.[2]
2.	**Bio-Chemistry**	Biochemistry is the science in which chemistry is applied to the study of living organisms and the atoms and molecules which comprise living organisms.

		What Is Biochemistry Used For? • Biochemistry is used to learn about the biological processes which take place in cells and organisms. • Biochemistry may be used to study the properties of biological molecules, for a variety of purposes. • Biochemists find uses for biomolecules. • Alternatively, a biochemist might find a substitute for a usual biomolecule • Biochemists can help cells to produce new products. Gene therapy is within the realm of biochemistry. **What Does a Biochemist Do?** • Many biochemists work in chemistry labs. Some biochemists may focus on modeling, while others study biochemical system in an organism. • Biochemists typically are associated with other scientists and engineers. **What Disciplines Are Related to Biochemistry?** Biochemistry is closely related to other biological sciences that deal with molecules. There is considerable overlap between these disciplines: • Molecular Genetics • Pharmacology • Molecular Biology • Chemical Biology [3] **What are Biochemists saying on COVID-19?** A team of academic and industry researchers is reporting new findings about how exactly an investigational antiviral drug stops corona viruses. Their paper was published the same day that the National Institutes of

		Health announced that the drug in question, Remdesivir, is being used in the nation's first clinical trial of an experimental treatment for COVID-19 (see COVID-19), the illness caused by the SARS-CoV-2 virus. Previous research in cell cultures and animal models has shown that Remdesivir, a drug used in the treatment of AIDS, can block replication of a variety of corona viruses, but until now it hasn't been clear how it does so. The research team, which studied the drug's effects on the corona virus that causes Middle East Respiratory Syndrome, reports that Remdesivir blocks a particular enzyme(see Enzyme) that is required for viral replication. Their work was published in the Journal of Biological Chemistry. All viruses have molecular machinery that copies their genetic material so they can replicate. Corona viruses replicate by copying their genetic material using an enzyme known as the RNA-dependent RNA (see RNA) polymerase. Until now, it has been difficult to get the polymerase complex, which contains multiple proteins, to work in a test tube. Using polymerase enzymes from the corona virus that causes MERS, scientists in Götte's lab, found that the enzymes can incorporate Remdesivir, which resembles an RNA building block, into new RNA strands. Shortly after adding Remdesivir, the enzyme stops being able to add more RNA subunits. This puts a stop to genome replication. Götte's lab previously showed that Remdesivir can stop the polymerase in other viruses with RNA genomes, such as Ebola. Remdesivir, which is manufactured by the American company Gilead Sciences, has not been approved as a drug anywhere in the world. According to Gilead, results from a clinical trial with COVID-19 patients in China are expected in April.[4]

		Further Breakthroughs by Biochemists CRISPR technology is a simple yet powerful tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function. Its many potential applications include correcting genetic defects, treating and preventing the spread of diseases and improving crops. However, its promise also raises ethical concerns. In popular usage, "CRISPR" (pronounced "crisper") is shorthand for "CRISPR-Cas9." CRISPRs are specialized stretches of DNA. The protein Cas9 (or "CRISPR-associated") is an enzyme that acts like a pair of molecular scissors, capable of cutting strands of DNA.[5] CRISPR (clustered regularly interspaced short palindromic repeats)-based genetic screens have helped scientists identify genes that are key players in sickle-cell anaemia, cancer immunotherapy, lung cancer metastasis, and many other diseases. [6]
3.	**CELL**	Cells are the basic unit of life. In the modern world, they are the smallest known world that performs all of life's functions. All living organisms are either single cells, or are multi-cellular organisms composed of many cells working together. Cells are the smallest known unit that can accomplish all of these functions. **Defining characteristics that allow a cell to perform these functions include:** • A cell membrane that keeps the chemical reactions of life together. • At least one chromosome, composed of genetic material that contain the cell's "blueprints" and "software." • Cytoplasm – the fluid inside the cell, in which the chemical processes of life occur.

		Function of Cells Scientists define seven functions that must be fulfilled by a living organism. These are: 1. A living thing must respond to changes in its environment. 2. A living thing must grow and develop across its lifespan. 3. A living thing must be able to reproduce, or make copies of itself. 4. A living thing must have metabolism. 5. A living thing must maintain homeostasis, or keep its internal environment the same regardless of outside changes. 6. A living thing must be made of cells. 7. A living thing must pass on traits to its offspring. It is the biology of cells which enables living things to perform all of these functions. [7] In biology, the smallest unit that can live on its own and that makes up all living organisms and the tissues of the body. A cell has three main parts: the cell membrane, the nucleus, and the cytoplasm. The cell membrane surrounds the cell and controls the substances that go into and out of the cell. The nucleus is a structure inside the cell that contains the nucleolus and most of the cell's DNA. It is also where most RNA is made. The cytoplasm is the fluid inside the cell. It contains other tiny cell parts that have specific functions, including the Golgi complex, the mitochondria, and the endoplasmic reticulum. The cytoplasm is where most chemical reactions take place and most proteins get made. The human body has more than 30 trillion cells.[8]

		 *(Source:https://training.seer.cancer.gov/anatomy/cells_tissues_membranes/cells/structure.html)*
4.	**CORONAVIRUS**	Corona viruses are animal and human pathogens that can cause lethal zoonotic infections (see Zoonotic) like SARS (see SARS) and MERS (see MERS). They have polycistronic plus-stranded RNA genomes and belong to the order Nidovirales, a diverse group of viruses. **Taxonomy** Corona viruses and toro viruses are two virus genera within the virus family Coronaviridae, order Nidovirales. Corona viruses are well-established pathogens of humans and animals while the toro-viruses are recognized as causes of animal diarrhoea. Toro viruses have also been found in human faeces but their aetiological role remains unclear. Corona viruses are classified into three groups, initially based on antigenic relationships of the spike (S), membrane (M) and nucleocapsid (N) proteins and now re-enforced by viral genetic phylogeny. The HCoVs 229E and NL63 are group 1 corona viruses, while OC43, HKU-1 and SARS corona viruses are classified in group 2. Group 3 corona viruses are found in avian species. Genetic recombination readily occurs between members of the same and of different corona virus groups providing opportunity for increased genetic diversity.

		It is noteworthy that recent studies on the comparative evolution of animal and human corona viruses have led to the conclusion that HCoV 229E and OC43, the causes of the common cold which are now globally endemic in humans, crossed species from their animal reservoirs (bats and cattle, respectively) to humans within the last 200 years, illustrating the fact that corona viruses continue to cross species barriers and cause novel diseases. In simpler words, The concept of corona virus isn't new. The term refers to a group of viruses that are known to cause respiratory issues. So even though many are referring to the illness circling around right now as "coronavirus," that's not actually the name of the disease. The severity of coronaviruses can range from being mild — like the common cold — to more serious symptoms that can lead to hospitalization, like lung problems.[9]
5.	**HISTORY OF CORONAVIRUS**	Coronavirus disease was first described in 1931, with the first coronavirus (HCoV-229E) isolated from humans in 1965. Until the outbreak of severe acute respiratory syndrome in late 2002, only two human coronaviruses (HCoV) were known – HCoV-229E and HCoV-OC43. Once the SARS coronavirus (SARS-CoV) had been identified, two further human coronaviruses were identified. Three groups of coronaviruses exist: group 1 (HCoV-229E and HCoV-NL63), group 2 (HCoVOC43 and HCoV-HKU1), group 3 (no human CoVs as yet). SARS-CoV is an outlier to all three groups, although some place it in group 2. Until 2003, coronaviruses attracted little interest beyond causing mild upper respiratory tract infections. This changed dramatically in 2003 with the zoonotic SARS-CoV and the more recent emergence of MERS-CoV has confirmed the coronaviruses as significant causes of severe respiratory disease.[10] Coronaviruses are viruses that circulate among animals with some of them also known to infect humans. Bats are considered as natural hosts of these viruses yet several other species of animals are also known to be a source. For instance, the Middle East Respiratory Syndrome

		Coronavirus (MERS-CoV) is transmitted to humans from camels, and the Severe Acute Respiratory Syndrome Coronavirus-1 (SARS-CoV-1) is transmitted to humans from civet cats.[11]
6.	**COVID-19**	Viruses, and the diseases they cause, often have different names. For example, HIV is the virus that causes AIDS. People often know the name of a disease, such as measles, but not the name of the virus that causes it (rubeola).There are different processes, and purposes, for naming viruses and diseases. Viruses (read Virus) are named based on their genetic structure to facilitate the development of diagnostic tests, vaccines and medicines. Virologists and the wider scientific community do this work, so viruses are named by the International Committee on Taxonomy of Viruses (ICTV). Diseases are named to enable discussion on disease prevention, spread, transmissibility, severity and treatment. Human disease preparedness and response is WHO's (Read WHO) role, so diseases are officially named by WHO in the International Classification of Diseases (ICD). ICTV announced "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" as the name of the new virus on 11 February 2020. This name was chosen because the virus is genetically related to the coronavirus responsible for the SARS outbreak of 2003. While related, the two viruses are different. WHO announced "COVID-19" as the name of this new disease on 11 February 2020, following guidelines previously developed with the World Organisation for Animal Health (OIE) and the Food and Agriculture Organization of the United Nations (FAO).[12] **The Chronology** Coronavirus is one of the major pathogens that primarily targets the human respiratory system. Previous

		outbreaks of coronaviruses (CoVs) include the severe acute respiratory syndrome (SARS)-CoV and the Middle East respiratory syndrome (MERS)-CoV which have been previously characterized as agents that are a great public health threat. In late December 2019, a cluster of patients was admitted to hospitals with an initial diagnosis of pneumonia of an unknown etiology. These patients were epidemiologically linked to a seafood and wet animal wholesale market in Wuhan, Hubei Province, China. Early reports predicted the onset of a potential Coronavirus outbreak given the estimate of a reproduction number for the 2019 Novel (New) Coronavirus (COVID-19, named by WHO on Feb 11, 2020) The chronology of COVID-19 infections is as follows. The first cases were reported in December 2019. From December 18, 2019 through December 29, 2019, five patients were hospitalized with acute respiratory distress syndrome and one of these patients died. By January 2, 2020, 41 admitted hospital patients had been identified as having laboratory-confirmed COVID-19 infection, less than half of these patients had underlying diseases, including diabetes, hypertension, and cardiovascular disease. These patients were presumed to be infected in that hospital, likely due to nosocomial infection. It was concluded that the COVID-19 is not a super-hot spreading virus (spread by one patient to many others), but rather likely spread due to many patients getting infected at various locations throughout the hospital through unknown mechanisms. In addition, only patients that got clinically sick were tested, thus there were likely many more patients that were presumably infected. As of January 22, 2020, a total of 571 cases of the 2019-new coronavirus (COVID-19) were reported in 25 provinces (districts and cities) in China. The China National Health Commission reported the details of the first 17 deaths up to January 22, 2020.

		On January 25, 2020, a total of 1975 cases were confirmed to be infected with the COVID-19 in mainland China with a total of 56 deaths [8]. Another report on January 24, 2020 estimated the cumulative incidence in China to be 5502 cases. As of January 30, 2020, 7734 cases have been confirmed in China and 90 other cases have also been reported from a number of countries that include Taiwan, Thailand, Vietnam, Malaysia, Nepal, Sri Lanka, Cambodia, Japan, Singapore, Republic of Korea, United Arab Emirates, United States, The Philippines, India, Australia, Canada, Finland, France, and Germany. The case fatality rate was calculated to be 2.2% (170/7824). The first case of COVID-19 infection confirmed in the United States led to the description, identification, diagnosis, clinical course, and management of this case. This includes the patient's initial mild symptoms at presentation and progression to pneumonia on day 9 of illness.[13] **What is SARS-CoV-2? What is COVID-19?** Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) is the name given to the 2019 novel coronavirus. COVID-19 is the name given to the disease associated with the virus. SARS-CoV-2 is a new strain of coronavirus that has not been previously identified in humans. **Where do coronaviruses come from?** Coronaviruses are viruses that circulate among animals with some of them also known to infect humans. Bats are considered as natural hosts of these viruses yet several other species of animals are also known to be a source. For instance, the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) is transmitted to humans from camels, and the Severe Acute Respiratory Syndrome Coronavirus-1 (SARS-CoV-1) is transmitted to humans from civet cats.

		Is this virus comparable to SARS or to the seasonal flu? The novel coronavirus detected in China is genetically closely related to the SARS-CoV-1 virus. SARS emerged at the end of 2002 in China, and it caused more than 8 000 cases in 33 countries over a period of eight months. Around one in ten of the people who developed SARS died. The current COVID-19 outbreak caused around 7 000 reported cases in China during the first month after initial reports (January 2020), with a further 80 000 cases reported globally during the second month (February 2020). Of these first 87 000 cases, about 3 000 died. Cases are now being detected in Europe and across the globe. See the situation updates for the latest available information. While the viruses that cause both COVID-19 and seasonal influenza are transmitted from person-to-person and may cause similar symptoms, the two viruses are very different and do not behave in the same way. ECDC estimates that between 15 000 and 75 000 people die prematurely due to causes associated with seasonal influenza each year in the EU, the UK, Norway, Iceland and Liechtenstein. This is approximately 1 in every 1 000 people who are infected. By comparison, the current estimated mortality rate for COVID-19 is 20-30 per 1 000 people. Despite the relatively low mortality rate for seasonal influenza, many people die from the disease due to the large number of people who contract it each year. The concern about COVID-19 is that, unlike influenza, there is no vaccine and no specific treatment for the disease. It also appears to be as transmissible as influenza if not more so. As it is a new virus, nobody has prior immunity which in theory means that the entire human population is potentially susceptible to COVID-19 infection.[14]

		COVID-19 is what experts are calling this particular disease Experts refer to this coronavirus as the "novel coronavirus," meaning it's a new type of coronavirus that was not previously known or understood by health experts. COVID-19 is the illness caused by the novel coronavirus. COVID-19 can lead to major health problems like pneumonia and organ failure, and it can also cause issues like shortness of breath and fever (more on general symptoms in a moment). People who are at the highest risk for severe complications from COVID-19 are those who are over 65, anyone who may be immunocompromised, and those with chronic medical conditions like heart disease, diabetes and lung disease. **How did it spread?** Some coronavirus strains live in humans, and some live in animals. In the case of COVID-19, the virus was passed from an animal to a human. This is what the World Health Organization calls "a spill over event." "Every once in a while, one of these animal viruses gets rogue and jumps species from the animal species to the human," William Schaffner, medical director of the National Foundation for Infectious Diseases and a professor in the Division of Infectious Diseases at Vanderbilt University Medical Center, previously told HuffPost. COVID-19 is mainly spread person to person, likely through respiratory droplets when someone coughs or sneezes. Transmission can happen when people are in close contact with one another, usually up to about six feet. COVID-19 can also live on surfaces up to a few days.[15]
7.	**DNA**	Deoxyribonucleic acid (DNA) is a nucleic acid that contains the genetic instructions for the development and function of living things. All known cellular life and

		some viruses contain DNA. The main role of DNA in the cell is the long-term storage of information. It is often compared to a blueprint, since it contains the instructions to construct other components of the cell, such as proteins and RNA molecules.[16] In scientific terms, DNA is a polymer made up of four nucleotide bases - adenine and guanine, which are double-ringed purines, and cytosine and thymine that are single-ringed pyrimidines - all of which are attached to a deoxyribose sugar and a phosphate group, which make up the structural "sugar-phosphate backbone" of DNA.[17] In short, DNA is a long molecule that contains each person's unique genetic code. It holds the instructions for building the proteins that are essential for our bodies to function. DNA instructions are passed from parent to child, with roughly half of a child's DNA originating from the father and half from the mother. DNA is a two-stranded molecule that appears twisted, giving it a unique shape referred to as the double helix. Each of the two strands is a long sequence of nucleotides or individual units made of: a phosphate molecule a sugar molecule called deoxyribose, containing five carbons a nitrogen-containing region There are four types of nitrogen-containing regions called bases: adenine (A) cytosine (C) guanine (G) thymine (T)

		The order of these four bases forms the genetic code, which is our instructions for life. The bases of the two strands of DNA are stuck together to create a ladder-like shape. Within the ladder, A always sticks to T, and G always sticks to C to create the "rungs." The length of the ladder is formed by the sugar and phosphate groups. Each length of DNA that codes for a specific protein is called a gene. For instance, one gene codes for the protein insulin, the hormone that helps control levels of sugar in the blood. Humans have around 20,000–30,000 genes, although estimates vary. Our genes only account for around 3 percent of our DNA, the remaining 97 percent is less well understood. The outstanding DNA is thought to be involved in regulating transcription and translation. Chromosomes are tightly coiled strands of DNA. Genes are sections of DNA that code individual proteins. Put another way, DNA is the master plan for life on earth.[18]
8.	**ENDEMIC**	A characteristic of a particular population, environment, or region. Examples of endemic diseases include chicken pox that occurs at a predictable rate among young school children in the United States and malaria in some areas of Africa. The disease is present in a community at all times but in relatively low frequency. The word "endemic" comes from the Greek "en-", "in" + "demos", "people or population" = "endemos" = "in the population." An endemic is in the people.[19] The amount of a particular disease that is usually present in a community is referred to as the baseline or endemic level of the disease. This level is not necessarily the desired level, which may in fact be zero, but rather is the observed level. In the absence of intervention and assuming that the level is not high enough to deplete the pool of susceptible persons, the disease may continue to occur at this level indefinitely. Thus, the baseline level is often regarded as the expected level of the disease.

		Epidemic (see Epidemic) refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area. Outbreak carries the same definition of epidemic, but is often used for a more limited geographic area. Cluster refers to an aggregation of cases grouped in place and time that are suspected to be greater than the number expected, even though the expected number may not be known. Epidemics occur when an agent and susceptible hosts are present in adequate numbers, and the agent can be effectively conveyed from a source to the susceptible hosts. More specifically, an epidemic may result from: • A recent increase in amount or virulence of the agent, • The recent introduction of the agent into a setting where it has not been before, • An enhanced mode of transmission so that more susceptible persons are exposed, • A change in the susceptibility of the host response to the agent, and/or Factors that increase host exposure or involve introduction through new portals of entry[20] As diseases become endemic, they become increasingly tolerated, and the locus of responsibility may shift to the individual. Rather than public authorities actively detecting cases and subsidizing risk protection, people may be increasingly encouraged to pay for the means to manage their own risk and seek care. Likewise, the focus of any global response may move away from direct provision of services by international agencies to other forms of intervention, such as building national capacity more generally, supported by domestic financing.[21]
9.	**ENZYME**	Enzymes are complex proteins that cause a specific chemical change in all parts of the body. For example, they can help break down the foods we eat so the body

		can use them. Blood clotting is another example of enzymes at work. Enzymes are needed for all body functions. They are found in every organ and cell in the body, including in the: • Blood • Intestinal fluids • Mouth (saliva) • Stomach (gastric juice)[22] Enzymes are biological molecules (typically proteins) that significantly speed up the rate of virtually all of the chemical reactions that take place within cells. They are vital for life and serve a wide range of important functions in the body, such as aiding in digestion and metabolism. Some enzymes help break large molecules into smaller pieces that are more easily absorbed by the body. Other enzymes help bind two molecules together to produce a new molecule. Enzymes are highly selective catalysts, meaning that each enzyme only speeds up a specific reaction.[23] **What do enzymes do?** • The digestive system – enzymes help the body break down larger complex molecules into smaller molecules, such as glucose, so that the body can use them as fuel. • DNA replication – each cell in your body contains DNA. Each time a cell divides, that DNA needs to be copied. Enzymes help in this process by unwinding the DNA coils and copying the information. • Liver enzymes – the liver breaks down toxins in the body. To do this, it uses a range of enzymes.[24]

		What affects enzymes? Enzymes work best at your normal body temperature. The average body temperature is 98.6°F (37°C), but normal body temperatures can range from 97°F to 99°F (36.1°C to 37.2°C). If you run a fever and your temperature increases too much, the structure of enzymes breaks down. They no longer function properly. Restoring your body temperature to its optimal range will help restore enzyme health. Certain health conditions, such as pancreatitis, which is inflammation of the pancreas, hurts your pancreas and can also reduce the number and effectiveness of certain digestive enzymes. The pH level of your stomach or intestines can also affect enzyme activity. A low pH means something is very acidic. A high pH means it's basic, also known as alkaline. Enzymes work best in a fairly narrow pH range. If the environment surrounding an enzyme becomes too acidic or too basic, the enzyme's shape and function will suffer. Chemicals called inhibitors can also interfere with an enzyme's ability to cause a chemical reaction. Inhibitors can occur naturally. They can also be manufactured and produced as medications. Antibiotics are a good example. They inhibit or prevent certain enzymes from helping bacterial infections spread. Your diet can also influence your body's enzyme activity. That's because many foods contain digestive enzymes that help share the burden of the naturally occurring enzymes in your body. Eating enzyme-rich foods can boost enzyme activity in your body. Just keep in mind the calories and other nutritional information about the foods in your diet.

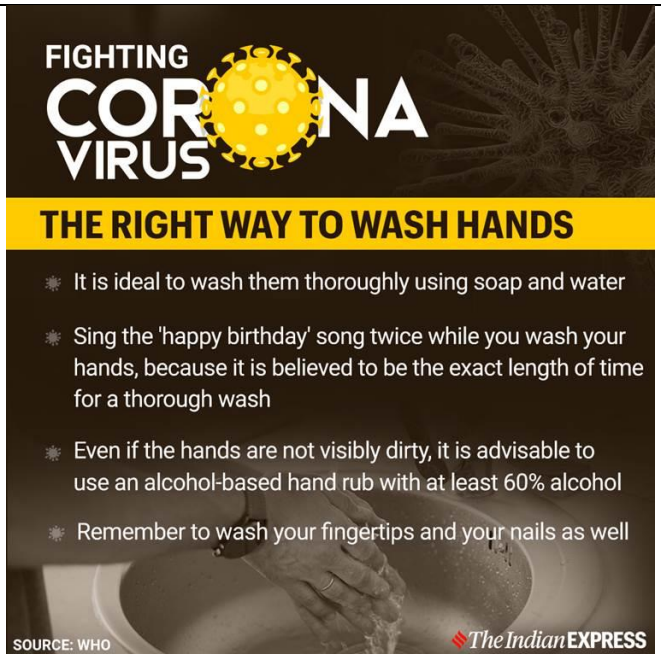
		In addition to your diet habits, your body's overall state of health will also affect how well it produces, stores, and releases enzymes and how efficiently its enzymes function. This will vary from one person to the next. Eating a nutritious diet in moderation on a regular basis and staying in good health will help your body's enzyme activity to stay more regular. Otherwise, for example, if you intermittently binge on a large meal here or there, you may have untoward effects like indigestion, nausea, or even diarrhoea if you don't have enough enzymes readily available to aid in digestion.[25] **The Central Role of Enzymes as Biological Catalysts** A fundamental task of proteins is to act as enzymes—catalysts that increase the rate of virtually all the chemical reactions within cells. Although RNAs are capable of catalyzing some reactions, most biological reactions are catalyzed by proteins. In the absence of enzymatic catalysis, most biochemical reactions are so slow that they would not occur under the mild conditions of temperature and pressure that are compatible with life. Enzymes accelerate the rates of such reactions by well over a million-fold, so reactions that would take years in the absence of catalysis can occur in fractions of seconds if catalyzed by the appropriate enzyme. Cells contain thousands of different enzymes, and their activities determine which of the many possible chemical reactions actually take place within the cell.[26]
10.	**H1N1**	**History** Swine flu was first isolated from pigs in the 1930s by researchers in the United States and was subsequently recognized by pork producers and veterinarians as a cause of flu infections in pigs worldwide, and for the next 60 years, H1N1 was the predominant swine influenza strain. People who are closely associated with pigs have been known to develop an infection, and pigs have also been infected with human flu from these handlers. In the vast majority of cases, cross-species transmission of the

		virus had remained confined to the specific area and not caused national or global infections in either pigs or humans. Unfortunately, due to the potential for genetic variation in the swine flu virus, there is always a possibility for cross-species transmission with the influenza viruses to occur. Investigators concluded that the "2009 swine flu" strain, which originated in Mexico, was termed novel H1N1 flu since it was mainly found infecting humans and exhibits 2 main surface antigens, hemagglutinin type 1 and neuraminidase type 1. During the 2009 pandemic, the Centers for Disease and Control and Prevention (CDC) estimated that there were 43 to 89 million cases of swine flu reported during a 1-year span, with 1799 deaths in 178 countries worldwide. The 1918 deadly influenza pandemic caused by H1N1 influenza virus, infected approximately 500 million people around the world and caused the death of roughly fifty to a hundred million people. The H1N1 variant of swine flu is the progeny of the strain that caused the 1918 swine flu pandemic. More recently in 2015, a mutant strain of H1N1 which caused the global pandemic in 2009, spread across India with over 10,000 reported cases and 774 deaths. People who have a higher risk of becoming seriously ill if infected include: • Children younger than 5 years old • Adults older than age 65, younger adults, and children under age 19 who are on long-term aspirin therapy • People with compromised immune systems due to diseases such as AIDS • Currently gestating females • People suffering from chronic diseases such as asthma, heart disease, diabetes mellitus, or neuromuscular disease[27] This is an influenza virus that had never been identified as a cause of infections in people before the current

		H1N1 pandemic. Genetic analyses of this virus have shown that it originated from animal influenza viruses and is unrelated to the human seasonal H1N1 viruses that have been in general circulation among people since 1977. After early outbreaks in North America in April 2009 the new influenza virus spread rapidly around the world. By the time WHO declared a pandemic in June 2009, a total of 74 countries and territories had reported laboratory confirmed infections. To date, most countries in the world have confirmed infections from the new virus. Unlike typical seasonal flu patterns, the new virus caused high levels of summer infections in the northern hemisphere, and then even higher levels of activity during cooler months in this part of the world. The new virus has also led to patterns of death and illness not normally seen in influenza infections. Most of the deaths caused by the pandemic influenza have occurred among younger people, including those who were otherwise healthy. Pregnant women, younger children and people of any age with certain chronic lung or other medical conditions appear to be at higher risk of more complicated or severe illness. Many of the severe cases have been due to viral pneumonia, which is harder to treat than bacterial pneumonias usually associated with seasonal influenza. Many of these patients have required intensive care. **How do people become infected with the virus?** The pandemic H1N1 virus is spread from person to person, similar to seasonal influenza viruses. It is transmitted as easily as the normal seasonal flu and can be passed to other people by exposure to infected droplets expelled by coughing or sneezing that can be inhaled, or that can contaminate hands or surfaces. To prevent spread, people who are ill should cover their mouth and nose when coughing or sneezing, stay home when they are unwell, clean their hands regularly, and

		keep some distance from healthy people, as much as possible.[28]
11.	**DIFFERENCE BETWEEN COVID-19 AND H1N1**	The 2009 flu pandemic was the second H1N1 pandemic the world had seen — the first being the 1918 Spanish flu, still the most deadly pandemic in history. The 2009 pandemic was caused by a new strain of H1N1 that originated in Mexico in the spring of 2009 before spreading to the rest of the world. By June of that year, there were enough cases that the World Health Organization declared the swine flu outbreak a pandemic. There is typically some herd immunity to seasonal flu, Strathdee said. This means that so many people are immune to the infection, because of vaccines or because their immune system has already fought the infection, that the few people who aren't immune are somewhat protected. There might be some groups of people who have immunity to the 2019-CoV-2 virus, too, but that's an area that's still being researched. So far, COVID-19 is most deadly for people over 60 who have underlying health conditions. Another difference is that flu viruses are spread in respiratory droplets and airborne particles, while 2019-CoV-2 is primarily spread through respiratory droplets, and in some instances may be shed in faeces,[29]
12.	**HAND SANITIZER**	Liquid hand sanitizers - mostly alcohol-based gels - have enjoyed an explosion in popularity in the last 10 years. Hand washing and hand sanitizers reduce microbial populations in different ways. Hand washing - whether done with "antibacterial" soap or plain soap - physically removes microorganisms from the skin, literally washing the live microbes down the drain. Hand sanitizers reduce levels of microorganisms by killing them chemically, just like disinfectants kill germs on environmental surfaces. Unlike disinfectants, which may be left practically on surfaces for up to about 5 minutes, hand sanitizers must do their job within a brief period of time to produce the necessary effect.[30]

		Technique: Four steps: • Make sure all organic matter is removed from hands. • All visible organic matter (for example: dirt) must be removed from hands prior to applying waterless hand sanitizer. • Apply a dime sized amount of waterless hand sanitizer to the palm of one hand or use a waterless hand sanitizer wipe. • Rub hands together covering all surfaces of hands and fingers. Rub until waterless hand sanitizer is absorbed. **How it works:** • Waterless hand sanitizer provides several advantages over hand washing with soap and water. However, they are not effective if organic matter (dirt, food, or other material) is visible on hands. **Benefits of waterless hand sanitizer:** • require less time than hand washing • act quickly to kill microorganisms on hands • are more accessible than sinks • reduce bacterial counts on hands • do not promote antimicrobial resistance • are less irritating to skin than soap and water • some can even improve condition of skin[31] Dr Farah Ingale, Senior Consultant, Internal Medicine, at the Hiranandani Hospital in Vashi, says that people have to read the combination on the bottle of the sanitiser before purchasing it. "It should have anti-bacterial and anti-viral properties. It should always be alcohol based, with 60 to 70 per cent alcohol. While washing of hands with soap and water for 20 seconds at least is equally effective, it is not always possible. When you are touching something while you are travelling, you cannot

		always use soap and water; that is when you can use sanitiser. It can be used anytime and anywhere. The bottle has to stored properly, away from heat, and in a cool place," she says.[32]
13.	**HAND WASHING**	 *(Source:https://indianexpress.com/article/lifestyle/health/coronavirus-heres-what-you-should-look-out-for-when-buying-a-hand-sanitizer-6320219/)* To curb the virus' spread, experts stress the importance of hand hygiene: keeping your hands clean by regularly lathering up with soap and water, or, as a solid second choice, thoroughly rubbing them down with an alcohol-based sanitizer. That might sound like simple, even inconsequential advice. But such commonplace practices can be surprisingly powerful weapons in the war against infectious disease. "[Washing your hands] is one of the most important ways to interrupt transmission of viruses or other pathogens," says Sallie Permar, a physician and infectious disease researcher at Duke University. "It can have a major impact on an outbreak."[33] **Fast Facts And Figures About Hand washing** • Hand washing with soap at critical times - including before eating or preparing food and

		after using the toilet - can reduce diarrhoea rates by more than 40 per cent. • Hand washing with soap can reduce the incidence of acute respiratory infections (ARI's) by around 23 per cent. • Pneumonia, is the number one cause of mortality among children under five years old, taking the lives of an estimated 1.8 million children per year. • Hand washing can be a critical measure in controlling pandemic outbreaks of respiratory infections. Several studies carried out during the 2006 outbreak of severe acute respiratory syndrome (SARS) suggest that washing hands more than 10 times a day can cut the spread of the respiratory virus by 55 per cent. • Hand washing with soap has been cited as one of the most cost-effective interventions to prevent diarrhoeal related deaths and disease. • A review of several studies shows that hand washing in institutions such as primary schools and day-care centers reduce the incidence of diarrhoea by an average of 30 per cent. • Rates of hand washing around the world are low. Observed rates of hand washing with soap at critical moments – i.e, before handling food and after using the toilet - range from zero per cent to 34 per cent. • A study shows that hand washing with soap by birth attendants and mothers significantly increased newborn survival rates by up to 44 per cent. • Water alone is not enough; yet soap is rarely used for hand washing. The lack of soap is not a significant barrier to hand washing – with the vast majority of even poor households having soap.

		Soap was present in 95 per cent of households in Uganda, 97 per cent of households in Kenya and 100 per cent of households in Peru. Laundry, bathing and washing dishes are seen as the priorities for soap use. • New studies suggest that hand washing promotion in schools can play a role in reducing absenteeism among primary school children. In China, for example, promotion and distribution of soap in primary schools resulted in 54 per cent fewer days of absence among students compared to schools without such an intervention. [34]
14.	**HERD IMMUNITY**	Herd immunity is an important element in the balance between the host population and the micro-organism, and represents the degree to which the community is susceptible or not to an infectious disease as a result of members of the population having acquired active immunity from either previous infection or prophylactic immunization Herd immunity can be measured: 1. Indirectly from the age distribution and incidence pattern of the disease if it is clinically distinct and reasonably common. 2. Directly from assessments of immunity in defined population groups by antibody surveys The decision whether to introduce herd immunity artificially by immunization against a particular disease will depend on several epidemiological principles. • The disease must carry a substantial risk. • The risk of contracting the disease must be considerable. • The vaccine must be effective. • The vaccine must be safe. The effectiveness and safety of immunization programmes are monitored by observing the expected

		and actual effects of such programmes on disease transmission patterns in the community by appropriate epidemiological techniques.[35] According to a 2011 paper published in medical journal Clinical Infectious Diseases, while the term herd immunity is "widely used", it carries "a variety of meanings". Academics from the London School of Hygiene and Tropical Medicine wrote that while some authors use the term to describe the proportion of individuals in a community who are immune to a condition, others use it in reference to "a particular threshold proportion of immune individuals that should lead to a decline in incidence of infection".[36] **Herd Immunity and COVID-19?** With the new coronavirus infection — called COVID-19 — as more and more people become infected, there will be more people who recover and who are then immune to future infection. "When about 70% of the population have been infected and recovered, the chances of outbreaks of the disease become much less because most people are resistant to infection," as a said by said Martin Hibberd, a professor of Emerging Infectious Disease at the London School of Hygiene & Tropical Medicine. With the new coronavirus outbreak, current evidence suggests that one infected person on average infects between two and three others. This means that, if no other measures are taken, herd immunity would kick in when between 50% and 70% of a population is immune. By reducing the number of people that one person infects — with social distancing measures such as closing schools, working from home, avoiding large gatherings and frequent hand washing — the point at which herd immunity kicks in can be lowered.

		"From an epidemiological point of view, the trick is to reduce the number of people we are in contact with ... so that we can drive down the number of contacts we infect, and herd immunity starts earlier," as said by Matthew Baylis, a professor at the Institute of Infection, Veterinary and Ecological Sciences at Liverpool University.[37]
15.	**ICMR**	The Indian Council of Medical Research (ICMR), New Delhi, the apex body in India for the formulation, coordination and promotion of biomedical research, is one of the oldest medical research bodies in the world. The Council's research priorities coincide with the National health priorities such as control and management of communicable diseases, fertility control, maternal and child health, control of nutritional disorders, developing alternative strategies for health care delivery, containment within safety limits of environmental and occupational health problems; research on major non-communicable diseases like cancer, cardiovascular diseases, blindness, diabetes and other metabolic and haematological disorders; mental health research and drug research (including traditional remedies). All these efforts are undertaken with a view to reduce the total burden of disease and to promote health and well-being of the population. The Governing Body of the Council is presided over by the Union Health Minister. It is assisted in scientific and technical matters by a Scientific Advisory Board comprising eminent experts in different biomedical disciplines. The Board, in its turn, is assisted by a series of Scientific Advisory Groups, Scientific Advisory Committees, Expert Groups, Task Forces, and Steering Committees etc. which evaluate and monitor different research activities of the Council.[38] **ICMR's COVID-19 preparation** The ICMR made functional 52 laboratories for testing samples while 57 labs have been designated for helping in sample collection to enhance the capacity for diagnosis and detection of the disease as of 7th March

		2020. The ICMR has told all testing sites in the country to ensure proper disinfection measures and avoid cross-contamination by cleaning all work surfaces in the molecular biology laboratory with bleach followed by 70 per cent ethanol. **Current scenario:** • All individuals requiring to be tested are being offered at no cost. • Accessibility and availability of the test is being increased every day by adding optimum numbers of testing laboratories every week. • Currently, the cost of the first step screening assay is INR 1500 and additional confirmatory assays is INR 3000. • As a part of the laboratory expansion process, ICMR has engaged with non-ICMR / MOHFW Govt. laboratories to initiate testing facilities. This includes CSIR, DBT, DRDO, Govt. Medical Colleges etc. • ICMR is also engaging with high-quality private laboratories that include NABL accredited labs to understand the modalities of increasing access to the test while ensuring appropriate safeguards. • ICMR is operationalizing already existing high throughput diagnostic systems (upto 1400 samples per day) to exponentially augment the testing capacity in heavily overloaded states. It is proposed to install high throughput systems in at least 5 locations (with the possibility of scale-up to 10 locations) on an urgent basis. • ICMR-NIV, Pune has already placed orders to augment the existing stockpile of reagents to 1 million tests which would be available soon. WHO has also been requested to provide an additional 1 million probes for testing.

		• Advisory for testing are being reviewed and updated periodically (09/03/2020 and 16/03/2020). The testing strategy is reviewed by a high-level Expert Committee constituted by Secretary DHR & DG, ICMR and Chaired by Prof, Randeep Guleria, Director, All India Institute of Medical Sciences, Delhi. **Current testing strategy:** **All asymptomatic people who have undertaken international travel: -** • They should stay in the home quarantine for 14 days. • They should be tested only if they become symptomatic (fever, cough, difficulty in breathing, etc.). • If the test result is positive, then they should be isolated and treated as per the standard protocol. **All contacts of laboratory-confirmed positive cases:** - • They should stay in home quarantine for 14 days. • They should be tested only if they become symptomatic (fever, cough, difficulty in breathing etc.). • If the test result is positive, then they should be isolated and treated as per the standard protocol. **Health care workers managing respiratory distress / Severe Acute Respiratory Illness should be tested when they are symptomatic.** Guidelines for private sector laboratories intending to initiate COVID19 testing: - • Laboratory tests should be only offered when prescribed by a qualified physician as per ICMR guidance for testing. Since the guidance evolves periodically, the latest revised version should be followed.

		• ICMR will share the SOPs for laboratory testing and provide positive controls for establishing the test as soon as the concerned private laboratory has procured the primers, probes, and reagents as per SOPs. The adoption of commercial kits for testing should be based on validations conducted by ICMR-National Institute of Virology (NIV), Pune. • Appropriate biosafety and biosecurity precautions should be ensured while collecting samples from a suspect patient. Alternatively, a disease-specific separate collection site may be created. • All the private testing laboratories ensure immediate/ real-time reporting to the State officials of IDSP (Integrated Disease Surveillance Program of Govt. of India) and ICMR HQ for timely initiation of contact tracing and research activities. • ICMR strongly appeals that private laboratories should offer COVID19 diagnosis at no cost.[39]
16.	**IMMUNITY**	All living things are subject to attack from disease-causing agents. Even bacteria, so small that more than a million could fit on the head of a pin, have systems to defend against infection by viruses. This kind of protection gets more sophisticated as organisms become more complex. Multi-cellular animals have dedicated cells or tissues to deal with the threat of infection. Some of these responses happen immediately so that an infecting agent can be quickly contained. Other responses are slower but are more tailored to the infecting agent. Collectively, these protections are known as *the immune system*. The human immune system is essential for our survival in a world full of potentially dangerous microbes, and serious impairment of even one arm of this system can predispose to severe, even life-threatening, infections.[40]

		The immune system protects the body against infection and disease. It is a complex and integrated system of cells, tissues, and organs that has specialized roles in defending against foreign substances and pathogenic microorganisms, including bacteria, viruses, and fungi. The immune system also functions to guard against the development of cancer. For these actions, the immune system must recognize foreign invaders, as well as abnormal cells and distinguish them from self. However, the immune system is a double-edged sword in that host tissues can be damaged in the process of combating and destroying invading pathogens. A key component of the immediate immune response is inflammation, which can cause damage to host tissues, although the damage is usually not significant. Inflammation is discussed in a separate article; this article focuses on nutrition and immunity. Cells of the immune system originate in the bone marrow and circulate to peripheral tissues through the blood and lymph. Organs of the immune system include the thymus, spleen, and lymph nodes. T-lymphocytes develop in the thymus, which is located in the chest directly above the heart. The spleen, which is located in the upper abdomen, makes antibodies and removes old and damaged red blood cells. The immune system is broadly divided into two major components: innate immunity and adaptive immunity. Innate immunity involves immediate, nonspecific responses to foreign invaders, while adaptive immunity requires more time to develop its complex, specific responses.[41] T**wo types of immunity exist — active and passive:** • Active immunity occurs when our own immune system is responsible for protecting us from a pathogen • Passive immunity occurs when we are protected from a pathogen by immunity gained from someone else.[42]

17.	**LOCK DOWN**	There are several definitions for the term lockdown, the most common of which pertains to a state of containment or a restriction of progression. A lockdown is an emergency protocol to prevent people or information escaping, which usually can only be ordered by someone in command. Lockdowns are also used to protect people inside a facility or, for example, a computing system, from a dangerous external event. There may be various levels of lockdown. For example, in the case of buildings, a partial lockdown means that the doors leading outside of the building are locked and people may not exit or enter the building. A full lockdown means that people must stay where they are and may not exit or enter a classroom, apartment unit, store unit, an office space, condo unit or the building. If people are in a hallway they must go into the nearest classroom, apartment unit, condo unit, office space or store unit.[43] While "lockdown" isn't a technical term used by public-health officials, it can refer to anything from mandatory geographic quarantines to non-mandatory recommendations to stay at home, closures of certain types of businesses, or bans on events and gatherings.[44]
18.	**MERS**	Middle East Respiratory Syndrome (MERS) is an illness caused by a virus (more specifically, a coronavirus) called Middle East. Respiratory Syndrome Coronavirus (MERS-CoV). Most MERS patients developed severe respiratory illness with symptoms of fever, cough and shortness of breath. About 3 or 4 out of every 10 patients reported with MERS have died. **All cases are linked to the Arabian Peninsula** Health officials first reported the disease in Saudi Arabia in September 2012. Through retrospective (backward-looking) investigations, they later identified that the first known cases of MERS occurred in Jordan in April 2012. So far, all cases of MERS have been linked through travel to, or residence in, countries in and near the Arabian

		Peninsula. The largest known outbreak of MERS outside the Arabian Peninsula occurred in the Republic of Korea in 2015. The outbreak was associated with a traveller returning from the Arabian Peninsula.[45] **Symptoms** The clinical spectrum of MERS-CoV infection ranges from no symptoms (asymptomatic) or mild respiratory symptoms to severe acute respiratory disease and death. A typical presentation of MERS-CoV disease is fever, cough and shortness of breath. Pneumonia is a common finding, but not always present. Gastrointestinal symptoms, including diarrhoea, have also been reported. Severe illness can cause respiratory failure that requires mechanical ventilation and support in an intensive care unit. The virus appears to cause more severe disease in older people, people with weakened immune systems, and those with chronic diseases such as renal disease, cancer, chronic lung disease, and diabetes. Approximately 35% of patients with MERS have died, but this may be an overestimate of the true mortality rate, as mild cases of MERS may be missed by existing surveillance systems and until more is known about the disease, the case fatality rates are counted only amongst the laboratory-confirmed cases. **Source of the virus** MERS-CoV is a zoonotic virus, which means it is a virus that is transmitted between animals and people. Studies have shown that humans are infected through direct or indirect contact with infected dromedary camels. MERS-CoV has been identified in dromedaries in several countries in the Middle East, Africa and South Asia. The origins of the virus are not fully understood but, according to the analysis of different virus genomes, it is believed that it may have originated in bats and was transmitted to camels sometime in the distant past.

		Transmission Non-human to human transmission: The route of transmission from animals to humans is not fully understood, but dromedary camels are the major reservoir host for MERS-CoV and an animal source of infection in humans. Strains of MERS-CoV that are identical to human strains have been isolated from dromedaries in several countries, including Egypt, Oman, Qatar, and Saudi Arabia. Human-to-human transmission: The virus does not pass easily from person to person unless there is close contact, such as providing unprotected care to an infected patient. There have been clusters of cases in healthcare facilities, where human-to-human transmission appears to have occurred, especially when infection prevention and control practices are inadequate or inappropriate. Human to human transmission has been limited to date, and has been identified among family members, patients, and health care workers. While the majority of MERS cases have occurred in health care settings, thus far, no sustained human to human transmission has been documented anywhere in the world. **Prevention and treatment** No vaccine or specific treatment is currently available, however several MERS-CoV specific vaccines and treatments are in development. Treatment is supportive and based on the patient's clinical condition. As a general precaution, anyone visiting farms, markets, barns, or other places where dromedary camels and other animals are present should practice general hygiene measures, including regular hand washing before and after touching animals, and should avoid contact with sick animals. The consumption of raw or undercooked animal products, including milk and meat, carries a high risk of infection from a variety of organisms that might cause

		disease in humans. Animal products that are processed appropriately through cooking or pasteurization are safe for consumption, but should also be handled with care to avoid cross contamination with uncooked foods. Camel meat and camel milk are nutritious products that can continue to be consumed after pasteurization, cooking, or other heat treatments. Until more is understood about MERS-CoV, people with diabetes, renal failure, chronic lung disease, and immune-compromised persons are considered to be at high risk of severe disease from MERS-CoV infection. These people should avoid contact with camels, drinking raw camel milk or camel urine, or eating meat that has not been properly cooked.[46] **Current Situation** Since the disease was first identified in Saudi Arabia in April 2012, more than 2 400 cases of Middle East respiratory syndrome coronavirus (MERS-CoV) have been detected in 27 countries. In Europe, eight countries have reported confirmed cases, all with direct or indirect connections to the Middle East. The majority of MERS-CoV cases continue to be reported from the Middle East. The source of the virus remains unknown, but the pattern of transmission and virological studies point toward dromedary camels in the Middle East as a reservoir from which humans sporadically become infected through zoonotic transmission. Human-to-human transmission is amplified among household contacts and in healthcare settings. In 2019 and as of 2 December 2019, 212 MERS-CoV cases have been reported in Saudi Arabia (198), Oman (13) and the United Arab Emirates (1), including 57 deaths in Saudi Arabia (53) and Oman (4). In Saudi Arabia, 118 cases were primary (51 of whom reported contact with camels), 41 were healthcare-acquired, 32 were household contacts, and seven were unspecified secondary cases. In 2019, 78% of the 198 cases in Saudi Arabia were reported in Riyadh (117), Eastern Provinces (19) and Quassim (18). Since April 2012 and as of 30

		September 2019, 2 494 cases of MERS-CoV, including 912 deaths, have been reported by health authorities worldwide.[47]
19.	**mRNA**	Messenger RNA (mRNA) is a single-stranded RNA (see RNA) molecule that is complementary to one of the DNA (see DNA) strands of a gene. The mRNA is an RNA version of the gene that leaves the cell nucleus and moves to the cytoplasm where proteins are made. During protein synthesis, an organelle called a ribosome moves along the mRNA, reads its base sequence, and uses the genetic code to translate each three-base triplet, or codon, into its corresponding amino acid. Messenger RNAs, also known as mRNA, are one of the types of RNA that are found in the cell. This particular one, like most RNAs, are made in the nucleus and then exported to the cytoplasm where the translation machinery, the machinery that actually makes proteins, binds to these mRNA molecules and reads the code on the mRNA to make a specific protein. So in general, one gene, the DNA for one gene, can be transcribed into an mRNA molecule that will end up making one specific protein.[48]
20.	**NUCLEOTIDES**	A nucleotide is an organic molecule that is the building block of DNA and RNA. They also have functions related to cell signalling, metabolism, and enzyme reactions. A nucleotide is made up of three parts: a phosphate group, a 5-carbon sugar, and a nitrogenous base. The four nitrogenous bases in DNA are adenine, cytosine, guanine, and thymine. RNA contains uracil, instead of thymine. A nucleotide within a chain makes up the genetic material of all known living things. They also serve a number of function outside of genetic information storage, as messengers and energy moving molecules. A series of three nucleotides within the DNA is known as a codon, and directs the proteins within the cell to attach a specific protein to a series specified by the rest of the DNA. Special codons even specify to the machinery where to stop and start the process. DNA translation, as it is known, converts the information from DNA into the

		language of proteins. This chain of amino acids can then be properly folded, and provide one of many functions within the cell.[49] **Nucleotide and Coronavirus** Advancements in genetic technology are making it easier, faster, and less expensive for public health experts to understand how the new coronavirus spreads. Researchers got an early win in January. It only took two weeks after public health officials reported the virus to the World Health Organization (WHO) for scientists to isolate the virus and figure out the full sequence of its genetic material. As soon as that sequence was public, biotechnology companies started creating synthetic copies of the virus that could be used in research. This all happened faster than it ever has before. During the SARS outbreak in 2002, it was months before the viral genome was sequenced and longer still before it was remade in the lab. Speed is important because the outbreak is unlike anything public health experts have seen before. Genetic synthesis is also much cheaper than it was two decades ago. Then, it cost $10 to create a synthetic copy of one single nucleotide, the building block of genetic material. Now, it's under 10 cents. The new coronavirus gene is around 30,000 nucleotides long, so that reduction in price makes a big difference in how many copies scientists can make. With genetic sequences and synthetic copies, experts were able to quickly develop diagnostic tests for the virus. Just over a month after the virus was reported, the Centers for Disease Control and Prevention (CDC) started shipping testing kits it developed to labs in the US and internationally. It was also able to start creating vaccines. Dozens are under development at pharmaceutical companies. [50]

21.	**PANDEMIC**	An epidemic (a sudden outbreak) that becomes very widespread and affects a whole region, a continent, or the world due to a susceptible population. By definition, a true pandemic causes a high degree of mortality (death). The word "pandemic" comes from the Greek "pan-", "all" + "demos," "people or population" = "pandemos" = "all the people." A pandemic affects all (nearly all) of the people. By contrast, "epi-" means "upon." An epidemic is visited upon the people. And "en-" means "in." An endemic is in the people.[51] **COVID-19 as Pandemic** The WHO defines the word pandemic loosely - "the worldwide spread of a new disease". According to the US Centers for Disease Control and Prevention (CDC), a pandemic is a disease that has spread in multiple countries around the world, usually affecting a large number of people.[52] The World Health Organisation (WHO), on March 11, declared the coronavirus outbreak a 'pandemic', adding that it is not a term to be used 'lightly or carelessly'. A pandemic is the worldwide spread of a new disease, according to the WHO. "It is a word that, if misused, can cause unreasonable fear, or unjustified acceptance that the fight is over, leading to unnecessary suffering and death," Tedros Adhanom Ghebreyesus, the Director-General of WHO said in a media briefing.[53]
22.	**PCR**	The polymerase chain reaction is a technique which has revolutionized molecular biology since its development in the early 1980s. It allows researchers to amplify small amounts of DNA to quantities which can be used for analysis. Some of the uses to which PCR has been applied include : • Disease diagnosis, where the causative agent of a disease is identified by its DNA. This is

		particularly useful when disease agents are difficult to grow in culture or are present in low numbers in a sample. • Forensic investigations, where trace amounts of DNA found at crime scenes (e.g. in hair, tissue or body fluids) may be amplified up to a level which allows them to be analysed using methods like DNA profiling. PCR may also be used in other areas where the amount of DNA recovered is vanishingly small or damaged (e.g. archaeology) • Genetic engineering, where genes are introduced into new species – to do this, the genetic material to be introduced must be of a sufficient quantity to ensure efficient transformation of the host cell.[54]
23.	**POLYMER USE**	Plastics are a group of materials, either synthetic or naturally occurring, that may be shaped when soft and then hardened to retain the given shape. Plastics are polymers. A polymer is a substance made of many repeating units. The word polymer comes from two Greek words: poly, meaning many, and meros, meaning parts or units. A polymer can be thought of as a chain in which each link is the "mer," or monomer (single unit). The chain is made by joining, or polymerizing, at least 1,000 links together. Polymerization can be demonstrated by making a chain using paper clips or by linking many strips of paper together to form a paper garland.[55] **Polymer use and Covid-19** The masks made for medical personnel and for consumer purchase require a once-obscure material called melt-blown fabric. It's an extremely fine mesh of synthetic polymer fibers that forms the critical inner filtration layer of a mask, allowing the wearer to breath while reducing the inflow of possible infectious particles.[56]

24.	**PRIMER**	A primer is a short nucleic acid sequence that provides a starting point for DNA synthesis. In living organisms, primers are short strands of RNA. A primer must be synthesized by an enzyme called primase, which is a type of RNA polymerase, before DNA replication can occur. The synthesis of a primer is necessary because the enzymes that synthesize DNA, which are called DNA polymerases, can only attach new DNA nucleotides to an existing strand of nucleotides. The primer therefore serves to prime and lay a foundation for DNA synthesis. The primers are removed before DNA replication is complete, and the gaps in the sequence are filled in with DNA by DNA polymerases. In the laboratory, scientists can design and synthesize DNA primers with specific sequences that bind to sequences in a single-stranded DNA molecule. These DNA primers are commonly used to perform the polymerase chain reaction to copy pieces of DNA or for DNA sequencing.[57]
25.	**PROBE**	A probe is a single-stranded sequence of DNA or RNA used to search for its complementary sequence in a sample genome. The probe is placed into contact with the sample under conditions that allow the probe sequence to hybridize with its complementary sequence. The probe is labelled with a radioactive or chemical tag that allows its binding to be visualized. In a similar way, labelled antibodies are used to probe a sample for the presence of a specific protein. Probes are stretches of DNA or RNA that we've attached a label to. The label allows us to see where the DNA binds either in a cell, or in a chromosome, or even in pure isolated DNA. We label probes with different molecules to follow them. We can use radioactive material or fluorescent material to chemically attach it to a probe. And then we can use that probe to look for where certain mRNAs are expressed in a cell or in a tissue. We can also use probes to screen the genome to find out if there are extra copies, which often happens in cancers, or missing copies of certain parts of the genome, which happens in hereditary syndromes and in cancers.[58]

26.	**PROTEIN**	Protein is a macronutrient that is essential to building muscle mass. It is commonly found in animal products, though is also present in other sources, such as nuts and legumes. There are three macronutrients: protein, fats and carbohydrates. Macronutrients provide calories, or energy. The body requires large amounts of macronutrients to sustain life, hence the term "macro," according to the University of Illinois McKinley Health Center. Each gram of protein contains 4 calories. Protein makes up about 15 percent of a person's body weight. Chemically, protein is composed of amino acids, which are organic compounds made of carbon, hydrogen, nitrogen, oxygen or sulphur. Amino acids are the building blocks of proteins, and proteins are the building blocks of muscle mass, according to the National Institutes of Health (NIH).[59] The significance of a DNA is very high. The gene's sequence is like language that instructs cell to manufacture a particular protein. An intermediate language, encoded in the sequence of Ribonucleic Acid (RNA), translates a gene's message into a protein's amino acid sequence. It is the protein that determines the trait. This is called central dogma of life.[60]  Central dogma of life. *Source: https://www.bioinformatics.org/tutorial/1-1.html*

27.	**QUARANTINE**	The practice of quarantine, as we know it, began during the 14th century in an effort to protect coastal cities from plague epidemics. Ships arriving in Venice from infected ports were required to sit at anchor for 40 days before landing. This practice, called quarantine, was derived from the Italian words quaranta giorni which mean 40 days.[61] Quarantine is used to separate and restrict the movement of well persons who may have been exposed to a communicable disease to see if they become ill. These people may have been exposed to a disease and do not know it, or they may have the disease but do not show symptoms. Quarantine can also help limit the spread of communicable disease.[62]
28.	**REAGENTS**	A substance that is used in a chemical reaction to detect, measure, examine, or produce other substances is known as chemical reagent. A reagent in chemical science is a "substance or compound that is added to a system in order to bring a chemical reaction or is added to check whether a reaction is occurred or not." Such a reaction is used to confirm the detection of the presence of another substance. Although the terms "reactant and reagent" are often used interchangeably, a reactant is more specifically a "substance that is consumed in the course of a chemical reaction." Commonly, the involvement of solvents and catalysts in the course of a chemical reaction is not considered as reactants. Small organic molecules and metal salts/compounds in organic chemistry play a significant role in different organic reactions of laboratory and industrial importance.[63]
29.	**RETROVIRUS**	Retroviruses are a type of virus in the viral family called Retroviridae. They use RNA as their genetic material and are named for a special enzyme that's a vital part of their life cycle — reverse transcriptase. There are many technical differences between viruses and retroviruses. But generally, the main difference between the two is how they replicate within a host cell.

		Here's a look at the steps of the life cycle of human immunodeficiency virus (HIV) to help illustrate how retroviruses replicate: • **Attachment.** The virus binds to a receptor on the surface of the host cell. In the case of HIV, this receptor is found on the surface of immune cells called CD4 T cells. • **Entry.** The envelope surrounding the HIV particle fuses with the membrane of the host cell, allowing the virus to enter the cell. • **Reverse transcription.** HIV uses its reverse transcriptase enzyme to turn its RNA genetic material into DNA. This makes it compatible with the host cell's genetic material, which is vital for the next step of the life cycle. • **Genome integration.** The newly synthesized viral DNA travels to the cell's control center, the nucleus. Here, a special viral enzyme called integrase is used to insert the viral DNA into the host cell's DNA. • **Replication.** Once its DNA has been inserted to the host cell's genome, the virus uses the host cell's machinery to produce new viral components, such as viral RNA and viral proteins. • **Assembly.** The newly made viral components combine close to the cell surface and begin to form new HIV particles. • **Release.** The new HIV particles push out from the surface of the host cell, forming a mature HIV particle with the help of another viral enzyme called protease. Once outside the host cell, these new HIV particles can go on to infect other CD4 T cells.

		The key steps that differentiate retroviruses from viruses are reverse transcription and genome integration. In conclusion, Retroviruses are a type of virus that use a special enzyme called reverse transcriptase to translate its genetic information into DNA. That DNA can then integrate into the host cell's DNA. Once integrated, the virus can use the host cell's components to make additional viral particles.[64]
30.	**RNA**	Ribonucleic acid (RNA) is an important biological macromolecule that is present in all biological cells. It is principally involved in the synthesis of proteins, carrying the messenger instructions from DNA, which itself contains the genetic instructions required for the development and maintenance of life. In some viruses, RNA, rather than DNA, carries genetic information. **RNA vs DNA** There are two distinct types of nucleic acid: DNA and RNA. The nucleic acid of DNA is deoxyribose, whereas the nucleic acid of RNA is ribose. As demonstrated by their names, the deoxyribose of DNA lacks one oxygen molecule as compared to the ribose sugar of RNA. The nucleotides that comprise DNA include adenine (A), guanine (G), cytosine (C) and thymine (T), whereas RNA nucleotides include A, G, C and uracil (U). While the structure of DNA is a double-helix in eukaryotic cells, RNA is typically single-stranded and comes in various forms. The single-stranded structure of RNA allows this molecule to fold back on itself and form various stable secondary structures as necessary.[65] **RNA and COVID-19** A basic challenge confronts all viral therapies: most viruses have just a handful of genes, and they rely on proteins in the cells they infect (host cells) to perform many of the functions needed to reproduce. But therapies that target host cell proteins run the risk of killing uninfected cells, making matters worse. So antiviral therapies usually target something unique

		about the virus—something important enough that a few mutations in the virus won't make the therapy ineffective. When a protein needs to be built, the relevant bit of DNA is read and the cell makes a temporary copy of the information using a very similar chemical called RNA. This piece of RNA is then translated into a sequence of amino acids, which form the protein. While there are some exceptions to this—many RNAs perform important functions without ever being translated into proteins—all RNA in our cells is made by transcribing a DNA sequence. But we've known for a long time that this process doesn't hold for viruses. Many viruses, including HIV and the influenza virus, use RNA for their basic genetic material. The coronavirus is also an RNA virus; it consists of a single, 30,000-base-long RNA molecule. It turns out that the virus carries its own solution with it. When virus' RNA genome first enters a cell, it interacts with the host's protein-making machinery, using it to make proteins that can copy RNA molecules. These RNA-copying proteins, called "polymerases," make an enticing target for therapies. Because host cells don't naturally have them, therapies that target these RNA-making proteins should have a lower chance of off-target effects. Block these RNA polymerases, and the virus can no longer reproduce, stopping an infection. That's the good news. The bad news is that DNA and RNA are so closely related that it can be difficult to make a drug that affects only one type of polymerase. We saw this with some of the first therapies against HIV, which targeted the enzymes that copied the virus' RNA genome: they did slow the virus down, but they also harmed any rapidly dividing cells in the host.[66]

31.	**SARS**	**SARS (Severe Acute Respiratory Syndrome)** **Cause** SARS coronavirus (SARS-CoV) – virus identified in 2003. SARS-CoV is thought to be an animal virus from an as-yet-uncertain animal reservoir, perhaps bats, that spread to other animals (civet cats) and first infected humans in the Guangdong province of southern China in 2002. **Transmission** An epidemic of SARS affected 26 countries and resulted in more than 8000 cases in 2003. Since then, a small number of cases have occurred as a result of laboratory accidents or, possibly, through animal-to-human transmission (Guangdong, China). Transmission of SARS-CoV is primarily from person to person. It appears to have occurred mainly during the second week of illness, which corresponds to the peak of virus excretion in respiratory secretions and stool, and when cases with severe disease start to deteriorate clinically. Most cases of human-to-human transmission occurred in the health care setting, in the absence of adequate infection control precautions. Implementation of appropriate infection control practices brought the global outbreak to an end. **Nature of the disease** Symptoms are influenza-like and include fever, malaise, myalgia, headache, diarrhoea, and shivering (rigors). No individual symptom or cluster of symptoms has proved to be specific for a diagnosis of SARS. Although fever is the most frequently reported symptom, it is sometimes absent on initial measurement, especially in elderly and immunosuppressed patients. Cough (initially dry), shortness of breath, and diarrhoea are present in the first and/or second week of illness. Severe cases often evolve rapidly, progressing to respiratory distress and requiring intensive care.

		Geographical distribution The distribution is based on the 2002–2003 epidemic. The disease appeared in November 2002 in the Guangdong province of southern China. This area is considered as a potential zone of re-emergence of SARS-CoV. Other countries/areas in which chains of human-to-human transmission occurred after early importation of cases were Toronto in Canada, Hong Kong Special Administrative Region of China, Chinese Taipei, Singapore, and Hanoi in Viet Nam.[67] **SARS vs. COVID-19** SARS had a much higher mortality rate. And the number of asymptomatic or mildly symptomatic people after infection was quite low. So, it was a lot easier to do isolation and contact tracing with SARS, because if you were infected, then it was quite obvious. And so SARS really went away because of public health measures. But with COVID-19 it's much harder to find and track those who are infected. It's a good thing that it's less deadly than SARS and MERS, but the [higher] transmissibility makes it much more difficult to control.[68] **Response Difference** China's initial response to SARS was plagued by a "fatal period of hesitation regarding information sharing and action," according to a 2004 report on its handling of the outbreak. It took several months before the Chinese government started sharing information with the World Health Organization (WHO). During that time, the Chinese public was kept largely in the dark about the new illness, which the 2004 report said "heightened anxieties, fear, and widespread speculation."

		Some experts say that this time around, Chinese officials were once again reluctant to share information during the early stages of the current outbreak, which hampered global recognition of the threat. For weeks, local officials in Wuhan — where the virus first appeared — downplayed the seriousness of the threat, reporting that people with the infection had contracted it through exposure to live animals at a market. But as cases of human-to-human transmission started appearing, the seriousness of the outbreak became more clear. Still, there are signs that Chinese officials tried to avoid repeating the mistakes of SARS. “With the recent outbreak, I think the Chinese government has been much more willing to share information and be open. In fact, the head of WHO has been praising them for their willingness to share,” said Anne W. Rimoin, PhD, MPH, an epidemiologist and director of the UCLA Center for Global and Immigrant Health. However, even with this greater transparency, some news outlets report that the Chinese government continues to censor unfavorable news about the outbreak, including on social media. Dr. Arnold S. Monto, an epidemiologist in the University of Michigan’s School of Public Health agrees that China’s initial response was slow, but he said some of this is due to what happens when dealing with a large bureaucracy.For example, some hospitals lacked testing kits for the virus. Also, case reports from local hospitals had to be reviewed by China’s central health commission before being made public. One of the biggest changes since SARS is the advances in technology needed to understand the virus and develop diagnostic tests or treatments.

		In January, 2020 Chinese scientists had already sequenced the virus, which first appeared in December, 2019. They also made that information available to scientists around the world. With SARS, it took scientists about 5 months to identify the virus after it began to spread.[69]
32.	**SARS-COV-2**	In December 2019, a new coronavirus caused an outbreak of pulmonary disease in the city of Wuhan, the capital of Hubei province in China, and has since spread globally. The virus has been named SARS-CoV-2 (3), because the RNA genome is about 82% identical to the SARS coronavirus (SARS-CoV); both viruses belong to clade b of the genus Betacoronavirus . The disease caused by SARS-CoV-2 is called COVID-19. Whereas at the beginning of the outbreak, cases were connected to the Huanan seafood and animal market in Wuhan, efficient human-to-human transmission led to exponential growth in the number of cases. On March 11, the World Health Organization (WHO) declared the outbreak a pandemic.[70] Rarely, animal coronaviruses can infect people and then spread between people such as with MERS-CoV, SARS-CoV, and now with this new virus (named SARS-CoV-2).The SARS-CoV-2 virus is a betacoronavirus, like MERS-CoV and SARS-CoV. All three of these viruses have their origins in bats.[71]
33.	**SELF-QUARANTINE**	Right now, the Centers for Disease Control and Prevention (CDC) recommends self-quarantining only if you have a high or medium risk of exposure to the new coronavirus. **How to self-quarantine** Based on what's currently known about how long symptoms last, the recommended length of quarantine is 14 days. The goal is to prevent potentially spreading the virus by separating yourself from other people long enough to determine whether or not you're infected and showing symptoms.[72]

		Difference between Isolation and self-quarantine A diagnosis of COVID-19 triggers isolation. "Isolation is when you are sick, either at home or in the hospital," says Benjamin. "Infectious disease precautions are then much more rigid than in self-quarantine." Medical staff, for example, wear gear that is more protective. In addition, the person in isolation would be asked to wear a mask when leaving their room or traveling from home to a medical facility — to try to prevent spreading droplets that might contain the virus.[73]
34.	**SOCIAL DISTANCING**	While it may be disappointing to hear that so many sports events, cruises, festivals and other gatherings are being cancelled, there is a public health reason for these measures. These cancellations help stop or slow down the spread of disease allowing the health care system to more readily care for patients over time. Cancelling events that are likely to draw crowds is an example of **social distancing.** Social distancing is deliberately increasing the physical space between people to avoid spreading illness. Staying at least six feet away from other people lessens your chances of catching COVID-19. Other examples of social distancing that allow you to avoid larger crowds or crowded spaces are: • Working from home instead of at the office • Closing schools or switching to online classes • Visiting loved ones by electronic devices instead of in person • Cancelling or postponing conferences and large meetings[74] Since coronavirus is spread mainly through respiratory droplets (especially when people cough or sneeze), maintaining a bit of distance will help to decrease the spread of the virus.

		Social distancing aims to reduce the amount of interaction people have while allowing them to carry out their necessary day-to-day activities. It also helps reduce the chances of picking the virus up and then spreading it to others. These measures are especially important for people at higher risk of severe disease if they get coronavirus. This might include the elderly, especially those over 70, people with significant long-term medical problems like lung disease, heart disease, weak immune system, diabetes, neurological problems, kidney disease; and pregnant women.[75]
35.	**SWINE FLU**	**The History** Swine flu (swine influenza) is a respiratory disease caused by viruses (influenza viruses) that infect the respiratory tract of pigs, resulting in nasal secretions, a barking cough, decreased appetite, and listless behavior. Swine flu produces most of the same symptoms in pigs as human flu produces in people. Swine flu can last about one to two weeks in pigs that survive. Swine influenza virus was first isolated from pigs in 1930 in the U.S. and has been recognized by pork producers and veterinarians to cause infections in pigs worldwide. In a number of instances, people have developed the swine flu infection when they are closely associated with pigs (for example, farmers, pork processors), and likewise, pig populations have occasionally been infected with the human flu infection. In most instances, the cross-species infections (swine-origin virus to man; human flu virus to pigs) have remained in local areas and have not caused national or worldwide infections in either pigs or humans. Unfortunately, this cross-species situation with influenza viruses (human infections with swine viruses) has had the potential to change. Investigators decided the 2009 so-called "swine flu" strain, first seen in Mexico, should be termed novel H1N1 flu since it was mainly found infecting people and exhibits two main surface antigens, H1 (hemagglutinin

		type 1) and N1 (neuraminidase type1). The eight RNA strands from novel H1N1 flu have one strand derived from human flu strains, two from avian (bird) strains, and five from swine strains. The main swine flu viruses in pigs in the recent years are swine triple reassortant (it means a viral strain with genes from three different organisms) H1N1, trH3N2, and trH1N2. However, in August 2018, China first reported a new swine flu outbreak in pigs in Liaoning province. The pig flu strain known as African swine flu (although some researchers think it originated in Russia), almost 100% fatal to pigs, was the cause. This strain is highly infectious, survives in heat and cold environments, and can remain viable and infectious on surfaces for days to weeks. Currently, there is no effective vaccine or drug to stop its spread, so the disease is treated by immediate slaughter of infected pigs. China has about 50% of the world's pig population and relies on pork to provide a large amount of protein for the Chinese population. Culling the pig population in China may result in China needing to import pork that would likely be a large economic blow to China's economy. This virus has not yet been detected in the U.S. This flu strain reportedly does not spread to humans.[76] **In simpler terms** Swine flu is an infection caused by a virus. It's named for a virus that pigs can get. People do not normally get swine flu, but human infections can and do happen. In 2009 a strain of swine flu called H1N1 infected many people around the world. The virus is contagious and can spread from human to human. Symptoms of swine flu in people are similar to the symptoms of regular human flu and include fever, cough, sore throat, body aches, headache, chills and fatigue.[77]

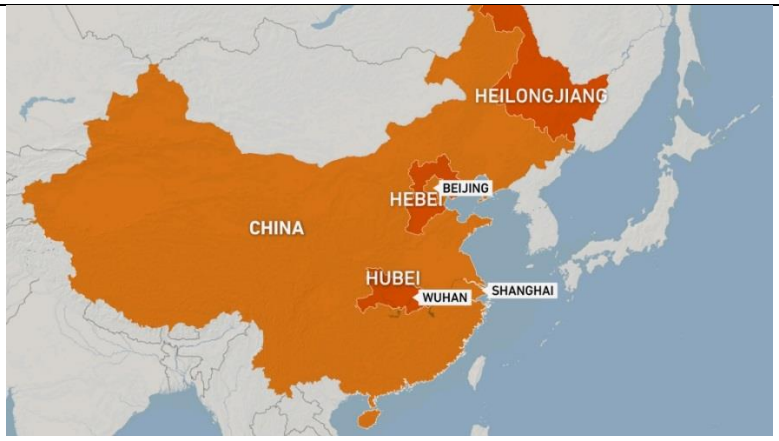
		A look back on the 2009 swine flu pandemic with eight key facts; 1. The flu strain responsible for the outbreak — influenza A (H1N1)pdm09 — was first detected in America in April 2009. 2. The strain represented a unique combination of influenza viruses never before seen in humans or animals. 3. The virus quickly spread globally, primarily affecting children and adults under 65 who lacked immunity to H1N1. 4. The WHO declared the swine flu outbreak a pandemic on June 11, 2009. 5. Between April 12, 2009, and April 10, 2010, the CDC estimates swine flu caused 60.8 million illnesses, 273,304 hospitalizations and 12,469 deaths in the U.S. 6. On Oct. 5, 2009, the U.S. began administering a newly approved H1N1 vaccine to select Americans, with vaccination coverage expanding nationwide by that December. 7. WHO declared an end to the pandemic on Aug. 10, 2010. 8. Globally, an estimated 151,700 to 575,400 people died from swine flu in the first year of the pandemic.[78]
36.	**TESTING KIT**	A test kit is a commercially packaged system of the principal or key components of an analytical method used to determine the presence of a specific analyte(s) in a given matrix(es). Test kits include directions for their use and are often self-contained, complete analytical systems; but they may require supporting supplies and equipment. The key components frequently represent proprietary elements or reagents that may be readily prepared only by the producer of the kit.[79]

37.	**TREATMENT OF VIRUS**	Many viral infections resolve on their own without treatment. Other times, treatment of viral infections focuses on symptom relief, not fighting the virus. For example, cold medicine helps alleviate the pain and congestion associated with the cold, but it doesn't act directly on the cold virus. There are some medications that work directly on viruses. These are called antiviral medications. They work by inhibiting the production of virus particles. Some interfere with the production of viral DNA. Others prevent viruses from entering host cells. There are other ways in which these medications work. In general, antiviral medications are most effective when they're taken early on in the course of an initial viral infection or a recurrent outbreak. Different kinds of antiviral medications may be used to treat chickenpox, shingles, herpes simplex virus-1 (HSV-1), herpes simplex virus-2 (HSV-2), HIV, hepatitis B, hepatitis C, and influenza.[80]
38.	**VACCINE**	Vaccines are products that protect people against many diseases that can be very dangerous and even deadly. Unlike most medicines that treat or cure diseases, vaccines prevent you from getting sick with the disease in the first place. You will see the terms **vaccines, vaccinations**, and **immunizations** used a lot. The following is a simple guide to help you remember their definitions: • **Vaccines** are products that produce immunity to a specific disease. Most vaccines are given by injection (needle), but some are given orally (by mouth) or nasally (sprayed into the nose). *"Researchers have been working on a new vaccine against Zika virus."* • **Vaccination** is the act of introducing a vaccine into the body to produce immunity to a specific disease. *"I am taking my child to get vaccinated against HPV."*

		• **Immunization** is the process by which a person or animal becomes protected against a disease. This term is often used interchangeably with vaccination. *"Vaccines cause immunization."*[81] Vaccines can reduce the risk of acquiring some viral illnesses. Vaccines are available to help protect against the flu, hepatitis A, hepatitis B, chickenpox, herpes zoster (shingles), cancer-causing strains of human papillomavirus (HPV), measles/mumps/rubella (MMR), polio, rabies, rotavirus, and other viruses. Vaccines vary in effectiveness and in the number of doses required to confer protection. Some vaccines require booster shots to maintain immunity.[82]
39.	**VIRUS MUTATION**	Viruses are simple entities, lacking an energy-generating system and having very limited biosynthetic capabilities. The smallest viruses have only a few genes; the largest viruses have as many as 200. Genetically, however, viruses have many features in common with cells. Viruses are subject to mutations, the genomes of different viruses can recombine to form novel progeny, the expression of the viral genome can be regulated, and viral gene products can interact.[83] To survive: unlike plants, animals and other organisms, the only way a virus can reproduce is through a host cell, which it does by attaching its surface proteins to the cell's membrane and injecting its genetic material into the cell. This genetic material, either DNA or RNA, then carries with it the instructions to the cell's machinery to make more viruses. These new viruses then leave the cell and spread to other parts of the host organism. But host organisms are not passive observers to this process, and over time a human's or pig's immune system can learn from these encounters and develop strategies to prevent reinfection. The next time the same virus comes to a host cell, it may find that it is no longer able to attach to the cell's surface membrane. So to survive, viruses must adapt or evolve, changing its surface proteins enough to trick the host cell into

		allowing it to attach. To survive: unlike plants, animals and other organisms, the only way a virus can reproduce is through a host cell, which it does by attaching its surface proteins to the cell's membrane and injecting its genetic material into the cell. This genetic material, either DNA or RNA, then carries with it the instructions to the cell's machinery to make more viruses. These new viruses then leave the cell and spread to other parts of the host organism. But host organisms are not passive observers to this process, and over time a human's or pig's immune system can learn from these encounters and develop strategies to prevent reinfection. The next time the same virus comes to a host cell, it may find that it is no longer able to attach to the cell's surface membrane. So to survive, viruses must adapt or evolve, changing its surface proteins enough to trick the host cell into allowing it to attach.[84]
40.	**WHO**	World Health Organisation began when its Constitution came into force on 7 April 1948 – a date that is now celebrate every year as World Health Day. It has more than 7000 people from more than 150 countries working in 150 country offices, in 6 regional offices and at headquarters in Geneva.[85] With administrative headquarters in Geneva, governance of WHO operates through the World Health Assembly, which meets annually as the general policy-making body, and through an Executive Board of health specialists elected for three-year terms by the assembly. The WHO Secretariat, which carries out routine operations and helps implement strategies, consists of experts, staff, and field workers who have appointments at the central headquarters or at one of the six regional WHO offices or other offices located in countries around the world. The organization is led by a director general nominated by the Executive Board and appointed by the World Health Assembly. The director general is supported by a deputy director general and multiple assistant directors general, each of whom specializes in a specific area within the

		WHO framework, such as family, women's, and children's health or health systems and innovation. The organization is financed primarily from annual contributions made by member governments on the basis of relative ability to pay. In addition, after 1951 WHO was allocated substantial resources from the expanded technical-assistance program of the UN. WHO sponsors measures for the control of epidemic and endemic disease by promoting mass campaigns involving nationwide vaccination programs, instruction in the use of antibiotics and insecticides, the improvement of laboratory and clinical facilities for early diagnosis and prevention, assistance in providing pure-water supplies and sanitation systems, and health education for people living in rural communities. These campaigns have had some success against AIDS, tuberculosis, malaria, and a variety of other diseases. In May 1980 smallpox was globally eradicated, a feat due largely to the efforts of WHO.[86]
41.	**WUHAN**	Wuhan capital and major industrial and commercial city of Hubei sheng (province), China. It is located at the confluence of the Han and Yangtze rivers and consists of a conurbation of three adjacent former cities—Hankou (Hankow), Hanyang, and Wuchang. Hankou lies on the north bank of the Yangtze River (Chang Jiang) at the mouth of the Han River. Immediately across the Han from it is the older town of Hanyang, and across from these two, on the south bank of the Yangtze, is the ancient metropolis of Wuchang, which is the seat of the provincial government. In 1949 the government of the newly formed People's Republic of China merged the three cities into the single entity of Wuhan.

		 *(Source: https://www.aljazeera.com/news/2020/01/china-battles-coronavirus-outbreak-latest-updates-200124063503577.html)* The triple city of Wuhan has a geographical centrality that gives its site immense strategic and commercial significance. Lying at the very heart of China, it is roughly equidistant from the cities of Beijing and Guangzhou (Canton) on a north-south axis and also is equidistant from Shanghai and Chongqing on an east-west line.[87] On Dec. 31, 2019, Chinese authorities alerted the World Health Organization of pneumonia cases in Wuhan City, Hubei province, China, with an unknown cause. What started as a mystery disease was first referred to as 2019-nCoV and then named COVID-19.[88]
42.	**ZOONOTIC**	Pertaining to a zoonosis: a disease that can be transmitted from animals to people or, more specifically, a disease that normally exists in animals but that can infect humans. There are multitudes of zoonotic diseases. Some examples include: • Anthrax • Ascariasis • Brucellosis • Plague • Echinococcosis • Lassa fever • Listeriosis • Lyme disease • Monkeypox • Psittacosis • Rabies

		• Salmonellosis • Trichinosis • Toxoplasmosis • typhus and, • West Nile fever Zoonoses may appear suddenly and be relatively virulent, as illustrated by HIV which ignited the AIDS epidemic and the coronavirus responsible for the outbreak of SARS.[89] WHO defines it as any disease or infection that is naturally transmissible from vertebrate animals to humans. Animals thus play an essential role in maintaining zoonotic infections in nature. Zoonoses may be bacterial, viral, or parasitic, or may involve unconventional agents. As well as being a public health problem, many of the major zoonotic diseases prevent the efficient production of food of animal origin and create obstacles to international trade in animal products.[90] Over 60 per cent of infectious diseases that we get are zoonotic, and 75 per cent of new, "emerging" infectious diseases are zoonotic. These diseases range from mild, gastro-intestinal (stomach) illnesses like Giardiasis (beaver fever) to deadly rabies. Many of the foodborne illnesses are zoonotic, coming from raw foods of animal origin, such as meats. Influenza, like the H1N1 pandemic flu strain is zoonotic as well. Many of these diseases may start with animals, but can be transmitted between people.[91]
43.	**VRDL**	The Viral and Rickettsial Disease Laboratory (VRDL) provides laboratory support, technical assistance, and research required for the diagnosis, investigation, and control of viral and rickettsial diseases and for the implementation and maintenance of high quality local viral laboratory services.[92]

		Indian VRDL initiatives Realizing the high risk faced by the country due to emerging/re-emerging viral infections and limited capacity for timely detection of such viruses, the Department of Health Research (DHR)/Indian Council of Medical Research (ICMR) took a far sighted decision of enhancing the country's capacity for early identification and diagnosis of all viral infections of public health importance. This initiative of DHR/ICMR has been rolled out on approval of the VRDL Scheme by the Union Cabinet wherein it was envisaged to set up 160 Virus Research & Diagnostic Laboratories (VRDLs) in most of the Government Medical Colleges of the country in 12th Plan Period (2012-2017). The target was then scaled down to establishment of 125 VRDLs during 14th finance commission period.[93]
44.	**DHR**	The President notified the creation of the Department of Health Research under the Ministry of Health & Family Welfare through an amendment to the Government of India (Allocation of Business) Rules, 1961 on the 17th September 2007. The Department of Health Research was formally launched on 5th October 2007 by the Minister for Science & Technology and Earth Sciences in a function presided over by the Minister for Health & Family Welfare, in the presence, inter-alia, of the Minister of State for Health & Family Welfare. Department of Health Research (DHR) was created as a separate Department within the Ministry of Health & Family Welfare by an amendment to the Government of India (Allocation of Business) Rules, 1961 on 17th Sept, 2007. The Department became functional from November 2008 with the appointment of first Secretary of the Department. The aim of the DHR is to bring modern health technologies to the people through research and innovations related to diagnosis, treatment methods and vaccines for prevention; to translate them into products and processes and, in synergy with concerned organizations, introduce these innovations into public health system.

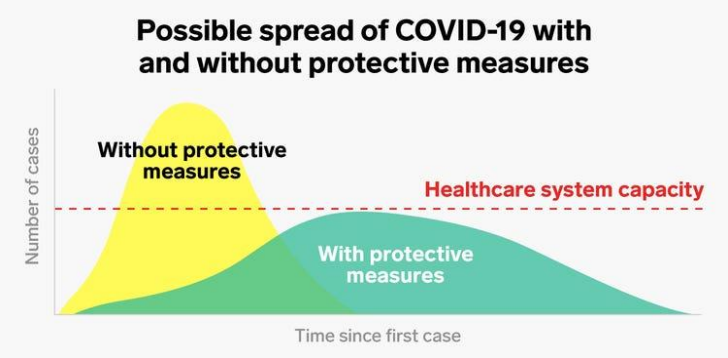
		The following 10 functions (nine new functions, plus the function of administering the ICMR) have been allocated to the Department of Health Research: 1. Promotion and co-ordination of basic, applied and clinical research including clinical trials and operational research in areas related to medical, health, biomedical and medical profession and education through development of infrastructure, manpower and skills in cutting edge areas and management of related information thereto. 2. Promote and provide guidance on research governance issues, including ethical issues in medical and health research. 3. Inter-sectoral coordination and promotion of public- private – partnership in medical, biomedical and health research related areas. 4. Advanced training in research areas concerning medicine and health, including grant of fellowships for such training in India and abroad. 5. International co-operation in medical and health research, including work related to international conference in related areas in India and abroad. 6. Technical support for dealing with epidemics and natural calamities. 7. Investigation of outbreaks due to new and exotic agents and development of tools for prevention. 8. Matters relating to scientific societies and associations, charitable and religious endowments in medicine and health research areas. 9. Coordination between organization and institutes under the Central and State Governments in areas

		related to the subjects entrusted to the Department and for the promotion of special studies in medicine and health. 10. Administering and monitoring of Indian Council of Medical Research (ICMR).[94]
45.	**REAL TIME PCR ASSAY**	Real-time PCR uses an increase in the intensity of a fluorescent signal generated by an intercalating dye or from the breakdown of a dye-labeled probe during amplification of a target sequence to detect nucleic acids either for their presence or absence or for their amount.[95] PCR theoretically amplifies DNA exponentially, doubling the number of target molecules with each amplification cycle. When it was first developed, scientists reasoned that the number of cycles and the amount of PCR end-product could be used to calculate the initial quantity of genetic material by comparison with a known standard. To address the need for robust quantification, the technique of realtime quantitative PCR was developed and end-point PCR is used mostly to amplify specific DNA for sequencing, cloning, and use in other molecular biology techniques. The advantages of real-time PCR include: • Ability to monitor the progress of the PCR reaction as it occurs in real time • Ability to precisely measure the amount of amplicon at each cycle, which allows highly accurate quantification of the amount of starting material in samples. • An increased dynamic range of detection • Amplification and detection occurs in a single tube, eliminating post-PCR manipulations[96]

46.	**SEROLOGICAL ASSAY**	Serologic tests are blood tests that look for antibodies in your blood. They can involve a number of laboratory techniques. Different types of serologic tests are used to diagnose various disease conditions. Serologic tests have one thing in common. They all focus on proteins made by your immune system. This vital body system helps keep you healthy by destroying foreign invaders that can make you ill. The process for having the test is the same regardless of which technique the laboratory uses during serologic testing. **What are the types of serologic tests?** Antibodies are diverse. So, there are various tests for detecting the presence of different types of antibodies. These include: • An **agglutination assay** shows whether antibodies exposed to certain antigens will cause particle clumping. • A precipitation test shows whether the antigens are similar by measuring for the presence of antibody in body fluids. • The Western blot test identifies the presence of antimicrobial antibodies in your blood by their reaction with target antigens. **What do the results mean?** **Normal test results** Your body produces antibodies in response to antigens. If testing shows no antibodies, it indicates you don't have an infection. Results that show there are no antibodies in the blood sample are normal. **Abnormal test results** Antibodies in the blood sample often mean you've had an immune system response to an antigen from either

		current or past exposure to a disease or foreign protein. Testing may also help your doctor diagnose an autoimmune disorder by finding out if antibodies to normal or non-foreign proteins or antigens are present in the blood. The presence of certain types of antibodies can also mean that you're immune to one or more antigen. This means that future exposure to the antigen or antigens won't result in illness.[97]
47.	**INCUBATION PERIOD**	In medicine, the time from the moment of exposure to an infectious agent until signs and symptoms of the disease appear. For example, the incubation period of chickenpox is 14-16 days. [98] The time interval between initial contact with an infectious agent and the first appearance of symptoms associated with the infection. In a vector, it is the time between entrance of an organism into the vector and the time when that vector can transmit the infection (extrinsic incubation period). The period in people between the time of exposure to a parasite and the time when the parasite can be detected in blood or stool is called *the prepatent period*.[99]
48.	**ISOLATION**	As applied to patients, **isolation** represents separation, for the period of communicability, of infected persons or animals from others in such places and under such conditions as to prevent or limit the direct or indirect transmission of the infectious agent from those infected to those who are susceptible to infection or who may spread the agent to others. In contrast, quarantine (q.v.) applies to restrictions on the healthy contacts of an infectious case. CDC has recommended that Universal Precautions be used consistently for all patients (in hospital settings as well as outpatient settings) regardless of their bloodborne infection status. This practice is based on the possibility that blood and certain body fluids (any body secretion that is obviously bloody, semen, vaginal secretions, tissue, CSF, and synovial, pleural, peritoneal, pericardial and amniotic fluids) of all

		patients are potentially infectious for HIV, HBV and other bloodborne pathogens. Universal precautions are intended to prevent parenteral, mucous membrane and nonintact skin exposures of healthcare workers to bloodbome pathogens. Protective barriers include gloves, gowns, masks and protective eyewear or face shields. A private room is indicated if patient hygiene is poor. Waste management is controlled by local and state authority.[100]
49.	**EPIDEMIC ACT**	The Centre can invoke the provisions of the Epidemic Act of 1897. Whenever there is an outbreak of an epidemic, the government can impose the Act if it thinks that ordinary provisions of the law, which are in force, are insufficient to contain an epidemic. The 1897 Act is invoked when the authorities assess *"that the ordinary provisions of the law for the time being in force are insufficient for the purpose, may take, or require or empower any person to take, such measures and, by public notice, prescribe such temporary regulations to be observed by the public or by any person or class of persons as 9 [it] shall deem necessary to prevent the outbreak of such disease or the spread thereof, and may determine in what manner and by whom any expenses incurred (including compensation if any) shall be defrayed*," the act reads. [101] The Act empowers a person to take certain measures and prescribe temporary regulations to prevent the outbreak of a disease or its spread. The provisions of the Act state that the government can fine people or imprison them for violating rules and regulations, set to contain the outbreak. Section 3 of the Act says any person disobeying any regulation or order made under this Act shall be deemed to have committed an offence punishable under Section 188 of the Indian Penal Code. The Act was brought into force before Independence to control plague in the late 1800s that killed thousands of people.

		As per the Section 4, no suit or legal proceeding shall be held against any person who acts in good faith to serve the purpose of the Act.[102]
50.	**MITIGATION**	The elimination or reduction of the frequency, magnitude, or severity of exposure to risks, or minimization of the potential impact of a threat or warning.[103]
51.	**FLATTERING THE CURVE**	Flattening the curve refers to using protective practices to slow the rate of COVID-19 infection so hospitals have room, supplies and doctors for all of the patients who need care. A large number of people becoming very sick over the course of a few days could overwhelm a hospital or care facility. Too many people becoming severely ill with COVID-19 at roughly the same time could result in a shortage of hospital beds, equipment or doctors. On a graph, a sudden surge in patients over a short time could be represented as a tall, narrow curve. On the other hand, if that same large number of patients arrived at the hospital at a slower rate, for example, over the course of several weeks, the line of the graph would look like a longer, flatter curve. In this situation, fewer patients would arrive at the hospital each day. There would be a better chance of the hospital being able to keep up with adequate supplies, beds and health care providers to care for them.[104]  *(Source:https://i.insider.com/5e67f2f3e4f9fe0f7c117ce3?width=750&format=jpeg&auto=webp)*

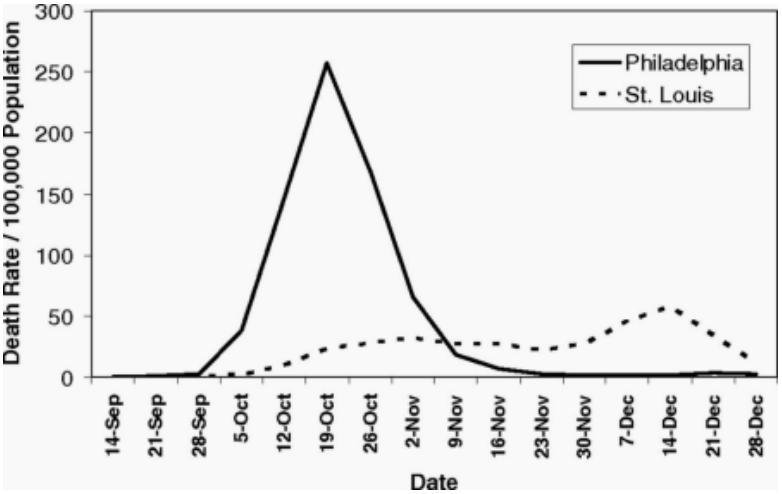
52.	**OUTBREAK**	Disease outbreaks are usually caused by an infection, transmitted through person-to-person contact, animal-to-person contact, or from the environment or other media. Outbreaks may also occur following exposure to chemicals or to radioactive materials. Outbreaks can be defined initially on clinical diagnosis and subsequently confirmed by laboratory diagnosis once an outbreak has been declared and faecal specimens have been collected for testing. An outbreak is decided based on the initial clinical symptoms of cases, which allows for early detection and therefore a rapid public health response. Key indicators of a norovirus outbreak may be the sudden onset of vomiting or diarrhoea amongst a group of people and a rapidly rising attack rate.[105]
53.	**SPANISH FLU**	The 1918 influenza pandemic was the most severe pandemic in recent history. It was caused by an H1N1 virus with genes of avian origin. Although there is not universal consensus regarding where the virus originated, it spread worldwide during 1918-1919. Mortality was high in people younger than 5 years old, 20-40 years old, and 65 years and older. The high mortality in healthy people, including those in the 20-40 year age group, was a unique feature of this pandemic. While the 1918 H1N1 virus has been synthesized and evaluated, the properties that made it so devastating are not well understood. With no vaccine to protect against influenza infection and no antibiotics to treat secondary bacterial infections that can be associated with influenza infections, control efforts worldwide were limited to non-pharmaceutical interventions such as isolation, quarantine, good personal hygiene, use of disinfectants, and limitations of public gatherings, which were applied unevenly.[106] **Did it originate from Spain?** An estimated 500 million people from the South Seas to the North Pole fell victim to Spanish Flu. One-fifth of

		those died, with some indigenous communities pushed to the brink of extinction. The flu's spread and lethality was enhanced by the cramped conditions of soldiers and poor wartime nutrition that many people were experiencing during World War I. Despite the name Spanish Flu, the disease likely did not start in Spain. Spain was a neutral nation during the war and did not enforce strict censorship of its press, which could therefore freely publish early accounts of the illness. As a result, people falsely believed the illness was specific to Spain, and the name Spanish Flu stuck.[107] **What caused the Spanish flu?** The outbreak began in 1918, during the final months of World War I, and historians now believe that the conflict may have been partly responsible for spreading the virus. On the Western Front, soldiers living in cramped, dirty and damp conditions became ill. This was a direct result of weakened immune systems from malnourishment. Their illnesses, which were known as "la grippe," were infectious, and spread among the ranks. Within around three days of becoming ill, many soldiers would start to feel better, but not all would make it. During the summer of 1918, as troops began to return home on leave, they brought with them the undetected virus that had made them ill. The virus spread across cities, towns and villages in the soldiers' home countries. Many of those infected, both soldiers and civilians, did not recover rapidly. The virus was hardest on young adults between the ages of 20 and 30 who had previously been healthy. [108] **Difference between Spanish Flu and COVID-19** Although the two diseases are both respiratory infections with common symptoms such as a runny nose and fever, they belong to different families of viruses. “Pneumonia and pleurisy caused a lot of death in 1918; people were suffocated – they felt like they were drowning,” said Rasmussen. “With regard to the

coronavirus, France's director general for health Jérôme Salomon emphasised how different it is from the influenza virus; the clinical profile, the severity, the biological signs are all different."

The coronavirus is also more threatening to very different age groups from those who were hit hardest by the Spanish flu. The former affects the elderly and those with pre-existing medical conditions most severely. By contrast, the latter was most deadly for young adults – a rare phenomenon that continues to intrigue epidemiologists.[109]

An example of Social Distancing, 100 years ago



***(Source:** https://qz.com/1816060/a-chart-of-the-1918-spanish-flu-shows-why-social-distancing-works/)*

In 1918, the city of Philadelphia threw a parade that killed thousands of people. Ignoring warnings of influenza among soldiers preparing for World War I, the march to support the war effort drew 200,000 people who crammed together to watch the procession. Three days later, every bed in Philadelphia's 31 hospitals was filled with sick and dying patients, infected by the Spanish flu.

A different story played out in St. Louis, just 900 miles away. Within two days of detecting its first cases among civilians, the city closed schools, playgrounds, libraries, courtrooms, and even churches. Work shifts were staggered and streetcar ridership was strictly limited.

		Public gatherings of more than 20 people were banned. The extreme measures—now known as social distancing, which is being called for by global health agencies to mitigate the spread of the novel coronavirus—kept per capita flu-related deaths in St. Louis to less than half of those in Philadelphia.[110]
54.	**COMMMUNITY SPREAD**	**Meaning** The spread of a contagious disease to individuals in a particular geographic location who have no known contact with other infected individuals or who have not recently travelled to an area where the disease has any documented cases.[111] **COVID-19 outbreak** Since the start of the outbreak, there have been more than 83,000 cases of the COVID-19, as the viral disease is now known. The sickness has shown up in at least 57 countries. A few regions — including Italy, Iran, South Korea and Japan — have reported sustained community spread. That means the virus is moving from person to person in places outside China's borders. The World Health Organization, or WHO, announced on February 28 that it had upgraded the risk of global spread by the COVID-19 virus to "very high." It did not yet call the disease a pandemic. "We don't see evidence yet that the virus is spreading freely in communities. As long as that is the case, we still have a chance of containing this virus," said Tedros Adhanom Ghebreyesus in a news briefing. He is the director-general of WHO, which is based in Geneva, Switzerland.[112]
55.	**CLOSE CONTACT**	A close contact is someone who has been face to face for at least 15 minutes, or been in the same closed space for at least 2 hours, as someone who has tested positive for the COVID-19 when that person was infectious.[113]

		What is a close contact (elaborately)? A case is considered as potentially infectious 48 hours prior to developing symptoms, while symptomatic, and until symptom-free for 24 hours. A close contact is anyone who has had one of the following contacts with a case while the case is infectious: • Living in the same household or household-like setting (e.g., in a hostel) as a COVID-19 case • Having spent two hours or longer in the same room as a COVID-19 case • Having been seated within two rows either side of a COVID-19 case on a flight, bus or train for two hours or longer • Having been face-to-face within two metre or less of the case for more than 15 minutes in any other setting not listed above.[114]
56.	**CDC**	The Centers for Disease Control and Prevention, the US agency charged with tracking and investigating public health trends. A part of the US Public Health Services (PHS) under the Department of Health and Human Services (HHS), the CDC is based in Atlanta, Georgia. It publishes key health information, including weekly data on all deaths and diseases reported in the US and travellers' health advisories. The CDC also fields special rapid-response teams to halt epidemic diseases.[115]
57.	**PRESUMPTIVE POSITIVE**	A sample taken from a person that is shown be presumptive positive is labelled that way if the sample was tested by a lab not run by the state. For example, a test run in a lab affiliated with the state government would be labelled as presumptive positive.[116] "Presumptive Positive," a term used by the Centres for Disease Control, means that a test administered by local health professionals is positive.[117]

58.	**CONTAINMENT**	The goal of containment is to define the problem extent and try to limit it. Problem effects have to be restrained and prompt action is important. Containment is a "first aid" action that protects from the problem until the root cause is defined and corrective actions are implemented permanently. [118]
59.	**CASE FATALITY RATE**	Case fatality rate (CFR) is the proportion of deaths within a defined population of interest. Case fatality rate measures the severity of the disease that causes death. For example, among a total of 200 patients with disease A, 20 of them died from the same disease within 30 days; the 30-day case fatality rate = $20/200 * 100 = 10\%$.[119] Between countries, case fatality rates vary significantly, which suggests considerable uncertainty over the exact case fatality rates. **What might be affecting the case fatality rate?** • The number of cases detected by testing might vary considerably by country; • Selection bias can mean those with severe disease are preferentially tested; • There may be delays between symptoms onset and deaths which can lead to underestimation of the CFR; • There may be factors that account for increased death rates such as co-infection, poorer healthcare, patient demographics (i.e., older patients might be more prevalent in countries such as Italy); • There may be increased rates of smoking or comorbidities amongst the fatalities.[120]
60.	**R-NAUGHT**	R0 is pronounced "R naught." It's a mathematical term that indicates how contagious an infectious disease is. It's also referred to as the reproduction number. As an infection spreads to new people, it reproduces itself.

		R0 tells you the average number of people who will catch a disease from one contagious person. It specifically applies to a population of people who were previously free of infection and haven't been vaccinated. If a disease has an R0 of 18, a person who has the disease will transmit it to an average of 18 other people, as long as no one has been vaccinated against it or is already immune to it in their community. **What do R0 values mean?** Three possibilities exist for the potential spread or decline of a disease, depending on its R0 value: • If R0 is less than 1, each existing infection causes less than one new infection. In this case, the disease will decline and eventually die out. • If R0 equals 1, each existing infection causes one new infection. The disease will stay alive and stable, but there won't be an outbreak or an epidemic. • If R0 is more than 1, each existing infection causes more than one new infection. The disease will spread between people, and there may be an outbreak or epidemic.[121] **COVID-19** The R0 of the new coronavirus so far seems to hover around 2 to 2.5, according to the World Health Organization. A study of poorly contained outbreak in the cruise ship Diamond Princess revealed an R0 consistent with those estimates: 2.2. That means it's more contagious than the seasonal flu, but less contagious than measles. [122]
61.	**GENOMES**	A genome is an organism's complete set of DNA, including all of its genes. Each genome contains all of the information needed to build and maintain that organism. In humans, a copy of the entire genome—more than 3 billion DNA base pairs—is contained in all cells that have a nucleus.[123]

62.	**AIIMS**	A generous grant from New Zealand under the Colombo Plan made it possible to lay the foundation stone of All India Institute of Medical Sciences (AIIMS) in 1952.The AIIMS was finally created in 1956, as an autonomous institution through an Act of Parliament, to serve as a nucleus for nurturing excellence in all aspect of health care. All-India Institute of Medical Sciences was established as an institution of national importance by an Act of Parliament with the objects to develop patterns of teaching in Undergraduate and Post-graduate Medical Education in all its branches so as to demonstrate a high standard of Medical Education in India; to bring together in one place educational facilities of the highest order for the training of personnel in all important branches of health activity; and to attain self-sufficiency in Post-graduate Medical Education. **Objectives of AIIMS** • To develop a pattern of teaching in undergraduate and postgraduate medical education in all its branches so as to demonstrate high standard of medical education to all medical colleges and other allied institutions in India. • To bring together in one place educational facilities of the highest order for the training of the personnel in all important branches of the health activity. • To attain self-sufficiency in postgraduate in medical education.[124]
63.	**CARRIER**	A person or animal that harbours a specific infectious agent without discernible clinical disease and serves as a potential source of infection. The carrier state may exist in an individual with an infection that is inapparent throughout its course (commonly known as healthy or asymptomatic carrier), or during the incubation period, convalescence and post-convalescence of an individual with a clinically recognizable disease (commonly known

		as an incubatory or convalescent carrier). Under either circumstance the carrier state may be of short or long duration (temporary or transient carrier, or chronic carrier).[125]
64.	**CHEMOPROPHYLAXIS**	The use of a chemical agent to prevent the development of a disease.[126] In general, chemoprophylaxis is not recommended during epidemics because of multiple sources of exposure and prolonged risk of exposure. Logistic problems and high cost also make this an impractical alternative. Chemoprophylaxis can be considered for people in close contact with patients in an endemic situation.[127]
65.	**COMMUNICABLE DISEASE**	Communicable, or infectious diseases, are caused by microorganisms such as bacteria, viruses, parasites and fungi that can be spread, directly or indirectly, from one person to another. Some are transmitted through bites from insects while others are caused by ingesting contaminated food or water.[128] Most of these diseases can be passed from person to person so the words "contagious" or "infectious" are often used when talking about communicable diseases. Some communicable disease spread through the air. Others require direct contact with a contaminated surface, food or beverage, blood or or other bodily fluid. In some cases, a bite from an infected animal or insect is also capable of spreading the disease. Some diseases can be transmitted in more than one way.[129]
66.	**COMMUNICABLE PERIOD**	The time during which an infectious agent may be transferred directly or indirectly from an infected person to another person, from an infected animal to humans, or from an infected person to animals, including arthropods.[130]
67.	**DISINFECTION**	The process of killing (inactivating) harmful and objectionable bacteria, cysts and other microorganisms (pathogenic) by various agents such as chemicals, heat,

		ultraviolet light, ultrasonic waves, or radiation. Disinfection is usually considered a 99+% kill compared to sterilization that generally attains 100% kill.[131] **Concurrent Disinfection** It is the application of disinfective measures as soon as possible after the discharge of infectious material from the body of an infected person, or after the soiling of articles with such infectious discharges. Concurrent disinfection consists of usually disinfection of urine, feces, vomit, contaminated linen, clothes, hands, dressings, aprons, gloves, etc throughout the course of an illness **Terminal Disinfection** It is the application of disinfective measures after the patient has been removed by death or to a hospital or has ceased to be a source of infection or after other hospital isolation practices have been discontinued. Terminal disinfection is now scarcely practiced; terminal cleaning is considered adequate along with airing and sunning of rooms, furniture and bedding**.** **Recurrent (prophylactic) disinfection** Disinfection by chlorination of water, pasteurization of milk and hand-washing may be cited as examples of pre-current disinfection.[132]
68.	**STERILIZATION**	Sterilization is a process, physical or chemical, that destroys or eliminates all organisms. A sanitizer is an agent that reduces the number of bacterial contaminants to safe levels as judged by public health requirements.[133] While the use of inadequately sterilized critical items represents a high risk of transmitting pathogens, documented transmission of pathogens associated with an inadequately sterilized critical item is exceedingly rare. This is likely due to the wide margin of safety associated with the sterilization processes used in healthcare facilities. The concept of what constitutes

		"sterile" is measured as a probability of sterility for each item to be sterilized. This probability is commonly referred to as the sterility assurance level (SAL) of the product and is defined as the probability of a single viable microorganism occurring on a product after sterilization.[134]
69.	**ENDEMIC**	A characteristic of a particular population, environment, or region. Examples of endemic diseases include chicken pox that occurs at a predictable rate among young school children in the United States and malaria in some areas of Africa. The disease is present in a community at all times but in relatively low frequency. The word "endemic" comes from the Greek "en-", "in" + "demos", "people or population" = "endemos" = "in the population." An endemic is in the people. By contrast, "epi-" means "upon." An epidemic is visited upon the people. And "pan-" means "all." A pandemic affects all the people.[135] The amount of a particular disease that is usually present in a community is referred to as the baseline or endemic level of the disease. This level is not necessarily the desired level, which may in fact be zero, but rather is the observed level. In the absence of intervention and assuming that the level is not high enough to deplete the pool of susceptible persons, the disease may continue to occur at this level indefinitely. Thus, the baseline level is often regarded as the expected level of the disease. Endemic refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area.[136]
70.	**HOST**	A person or other living animal, including birds and arthropods, that affords subsistence or lodgement to an infectious agent under natural (as opposed to experimental) conditions. Some protozoa and helminths pass successive stages in alternate hosts of different species. Hosts in which the parasite attains maturity or passes its sexual stage are primary or definitive hosts;

		those in which the parasite is in a larval or asexual state are secondary or intermediate hosts. A transport host is a carrier in which the organism remains alive but does not undergo development.[137]
71.	**INAPPARENT INFECTION**	The presence of infection in a host without recognizable clinical signs or symptoms. Inapparent infections are identifiable only by laboratory means such as a blood test or by the development of positive reactivity to specific skin tests. (Synonyms: asymptomatic, subclinical, occult infection)[138]
72.	**INCIDENCE RATE**	The incidence rate is a measure of the frequency with which some event, such as a disease or accident, occurs over a specified time period. Incidence rate or "incidence" is numerically defined as the number of new cases of a disease within a time period, as a proportion of the number of people at risk for the disease.[139]
73.	**INFECTION**	The invasion and multiplication of microorganisms such as bacteria, viruses, and parasites that are not normally present within the body. An infection may cause no symptoms and be subclinical, or it may cause symptoms and be clinically apparent. An infection may remain localized, or it may spread through the blood or lymphatic vessels to become systemic (bodywide). Microorganisms that live naturally in the body are not considered infections. For example, bacteria that normally live within the mouth and intestine are not infections.[140] The organism uses that person's body to sustain itself, reproduce, and colonize. These infectious organisms are known as pathogens. Examples of pathogens include bacteria, viruses, fungi, and prions. Pathogens can multiply and adapt quickly. Some infections are mild and barely noticeable, but others are severe and life-threatening, and some are resistant to treatment. Infection can be transmitted in a variety of ways.

		These include skin contact, bodily fluids, contact with feces, airborne particles, and touching an object that an infected person has also touched. How an infection spreads and its effect on the human body depend on the type of agent. The immune system is an effective barrier against infectious agents, but colonies of pathogens may grow too large for the immune system to fight. At this stage, infections become harmful.[141] **Source of Infection** The person, animal, object or substance from which an infectious agent passes to a host. Source of infection should be clearly distinguished from source of contamination, such as overflow of a septic tank contaminating a water supply, or an infected cook contaminating a salad.[142] **Infectious Agent** Infectious agents is a term that is generally used to describe and encompass any material that can cause an infection that can lead to a disease. These types of materials are largely Bacterial but also largely comprised of Viral, Fungal, Rickettsias, Prions and Parasites. Vulnerability and prevalence depends mostly on geography and climate but in a laboratory setting, almost any agent is habitable under artificial means such as climate and humidity control.[143] **Infectious Disease** Infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; the diseases can be spread, directly or indirectly, from one person to another. Zoonotic diseases are infectious diseases of animals that can cause disease when transmitted to humans.[144]

		Nosocomial infection A nosocomial infection is contracted because of an infection or toxin that exists in a certain location, such as a hospital. People now use nosocomial infections interchangeably with the terms health-care associated infections (HAIs) and hospital-acquired infections. For a HAI, the infection must not be present before someone has been under medical care. One of the most common wards where HAIs occur is the intensive care unit (ICU), where doctors treat serious diseases. About 1 in 10 of the people admitted to a hospital will contract a HAI. They're also associated with significant morbidity, mortality, and hospital costs. As medical care becomes more complex and antibiotic resistance increases, the cases of HAIs will grow. HAIs can be prevented in a lot of healthcare situations.[145] Patient care is provided in facilities which range from highly equipped clinics and technologically advanced university hospitals to front-line units with only basic facilities. Despite progress in public health and hospital care, infections continue to develop in hospitalized patients, and may also affect hospital staff. Many factors promote infection among hospitalized patients: decreased immunity among patients; the increasing variety of medical procedures and invasive techniques creating potential routes of infection; and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control practices may facilitate transmission. [146]
74.	**INFESTATION**	For persons or animals, the lodgement, development and reproduction of arthropods on the surface of the body or in the clothing. Infested articles or premises are those that harbour or give shelter to animal forms, especially arthropods and rodents.[147]
75.	**MORBIDITY RATE**	Morbidity refers to the unhealthy state of an individual. For example, a morbidity rate looks at the incidence of a disease across a population and/or geographic location during a single year.[148]

76.	**PATHOGENICITY**	Pathogenicity refers to the ability of an organism to cause disease (ie, harm the host). This ability represents a genetic component of the pathogen and the overt damage done to the host is a property of the host-pathogen interactions. Commensals and opportunistic pathogens lack this inherent ability to cause disease. However, disease is not an inevitable outcome of the host-pathogen interaction and, furthermore, pathogens can express a wide range of virulence. Virulence, a term often used interchangeably with pathogenicity, refers to the degree of pathology caused by the organism. The extent of the virulence is usually correlated with the ability of the pathogen to multiply within the host and may be affected by other factors (ie, conditional). In summary, an organism (species or strain) is defined as being pathogenic (or not), and depending upon conditions, may exhibit different levels of virulence.[149]
77.	**PREVALENCE RATE**	The proportion of individuals in a population having a disease or characteristic. Prevalence is a statistical concept referring to the number of cases of a disease that are present in a particular population at a given time, whereas incidence refers to the number of new cases that develop in a given period of time.[150] The total number of persons sick or portraying a certain condition in a stated population at a particular time (point prevalence), or during a stated period of time (period prevalence), regardless of when that illness or condition began, divided by the population at risk of having the disease or condition at the point in time or midway through the period in which they occurred.[151]
78.	**RESERVOIR (OF INFECTIOUS AGENTS)**	The Reservoir for Infectious Agents is the principal habitat where a specific infectious agent lives and multiplies. The reservoir is necessary for the infectious agent either to survive, or to multiply in sufficient amount to be transmitted to a susceptible host. Examples may include primates (including human beings), the reservoir of pathogens such as hepatitis A virus, hepatitis B virus, Polio virus (all 3 types), Bordetella pertussis, Corynebacterium diphtheria, etc.[152]

		Human reservoirs Many common infectious diseases have human reservoirs. Diseases that are transmitted from person to person without intermediaries include the sexually transmitted diseases, measles, mumps, streptococcal infection, and many respiratory pathogens. Because humans were the only reservoir for the smallpox virus, naturally occurring smallpox was eradicated after the last human case was identified and isolated. **Animal reservoirs** Humans are also subject to diseases that have animal reservoirs. Many of these diseases are transmitted from animal to animal, with humans as incidental hosts. The term zoonosis refers to an infectious disease that is transmissible under natural conditions from vertebrate animals to humans. Long recognized zoonotic diseases include brucellosis (cows and pigs), anthrax (sheep), plague (rodents), trichinellosis/trichinosis (swine), tularemia (rabbits), and rabies (bats, raccoons, dogs, and other mammals). **Environmental reservoirs.** Plants, soil, and water in the environment are also reservoirs for some infectious agents. Many fungal agents, such as those that cause histoplasmosis, live and multiply in the soil. Outbreaks of Legionnaires disease are often traced to water supplies in cooling towers and evaporative condensers, reservoirs for the causative organism
79.	**SUSCEPTIBLE**	A person or animal not possessing sufficient resistance against a particular pathogenic agent to prevent contracting infection or disease when exposed to the agent.[153]
80.	**SUSPECT**	In infectious disease control, illness in a person whose history and symptoms suggest that he or she may have or be developing a communicable disease.[154]

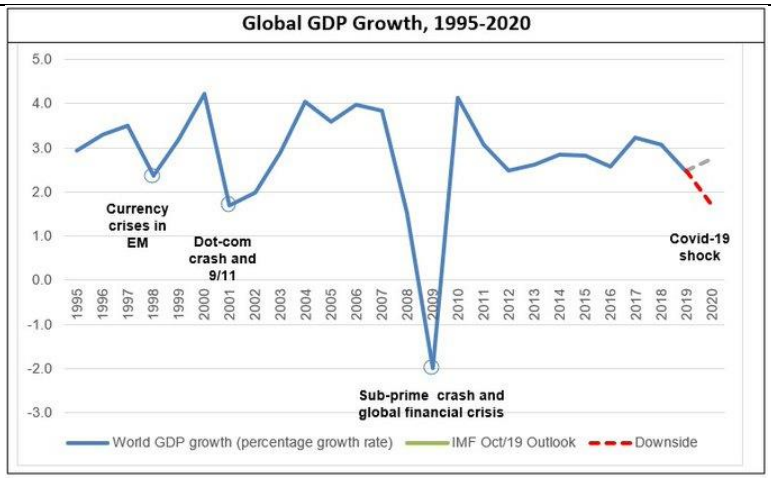
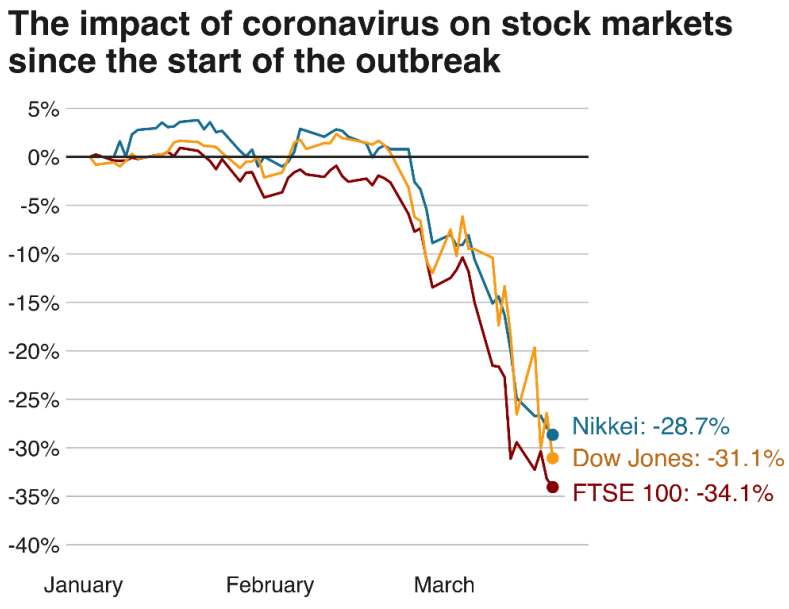
81.	**VIRULENCE**	Virulence may be described as the "intrinsic nastiness" of a pathogen, that is, its ability to avoid host defenses and cause damage to the host either locally, at the site of infection or at distant points through the production of circulating toxins or by stimulating host cytotoxic reactions.[155]
82.	**MINISTRY OF HEALTH & WELFARE**	The Ministry of Health & Welfare of India is the custodian of health policy in India.  DR. HARSH VARDHAN **HON'BLE CABINET MINISTER**  SHRI ASHWINI KUMAR CHOUBEY **HON'BLE MINISTER OF STATE**
83.	**MÉDECINS SANS FRONTIÈRES(MSF)/ DOCTORS WITHOUT BORDERS**	Doctors Without Borders/ Médecins Sans Frontières (MSF) is an international, independent, medical humanitarian organisation that delivers emergency aid to people affected by armed conflict, epidemics, natural disasters and exclusion from healthcare. MSF offers assistance to people based on need, irrespective of race, religion, gender or political affiliation. Their actions are guided by medical ethics and the principles of neutrality and impartiality.[156]

84.	**UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT**	President John. F. Kennedy created the United States Agency for International Development by executive order in 1961 to lead the US government's international development and humanitarian efforts. USAID leads international development and humanitarian efforts to save lives, reduce poverty, strengthen democratic governance and help people progress beyond assistance as mentioned on their website. [157]
85.	**WORLD BANK**	The World Bank is an international organization dedicated to providing financing, advice, and research to developing nations to aid their economic advancement. The bank predominantly acts as an organization that attempts to fight poverty by offering developmental assistance to middle- and low-income countries.[158]
86.	**THE GLOBAL FUND TO FIGHT AIDS, TUBERCLOSIS AND MALARIA**	The Global Fund is a partnership designed to accelerate the end of AIDS, tuberculosis and malaria as epidemics. As an international organization, the Global Fund mobilizes and invests more than US$4 billion a year to support programs run by local experts in more than 100 countries. In partnership with governments, civil society, technical agencies, the private sector and people affected by the diseases.[159]
87.	**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS)**	The world's largest multidisciplinary scientific society and a leading publisher of cutting-edge research through its Science family of journals, AAAS has individual members in more than 91 countries around the globe. The AAAS seeks to "advance science, engineering, and innovation throughout the world for the benefit of all people." To fulfill this mission, the AAAS Board has set the following broad goals: • Enhance communication among scientists, engineers, and the public; • Promote and defend the integrity of science and its use;

		• Strengthen support for the science and technology enterprise; • Provide a voice for science on societal issues; • Promote the responsible use of science in public policy; • Strengthen and diversify the science and technology workforce; • Foster education in science and technology for everyone; • Increase public engagement with science and technology; • And, Advance international cooperation in science.[160]
88.	**THE COALITION FOR EPIDEMIC PREPAREDNESS INNOVATIONS (CEPI)**	CEPI is a innovative global partnership between public, private, philanthropic, and civil society organisations. Working together to accelerate the development of vaccines against emerging infectious diseases and enable equitable access to these vaccines for people during outbreaks.[161]
89.	**CONSORTIUM OF UNIVERSITIES FOR GLOBAL HEALTH (CUGH)**	A consortium of colleges and universities that builds collaborations and exchange of knowledge and experience among interdisciplinary university global health programs working across education, research and service. It is dedicated to creating equity and reducing health disparities, everywhere.[162]
90.	**THE GLOBAL HEALTH NETWORK**	The Global Health Network is a digital platform that aims to advance research by providing a mechanism that facilitates collaboration and resource-sharing in global health research.[163]
91.	**INFECTIOUS DISEASES SOCIETY OF AMERICA (IDSA)**	The Infectious Diseases Society of America (IDSA) is a community of over 12,000 physicians, scientists and public health experts who specialize in infectious diseases. Our purpose is to improve the health of individuals, communities, and society by promoting

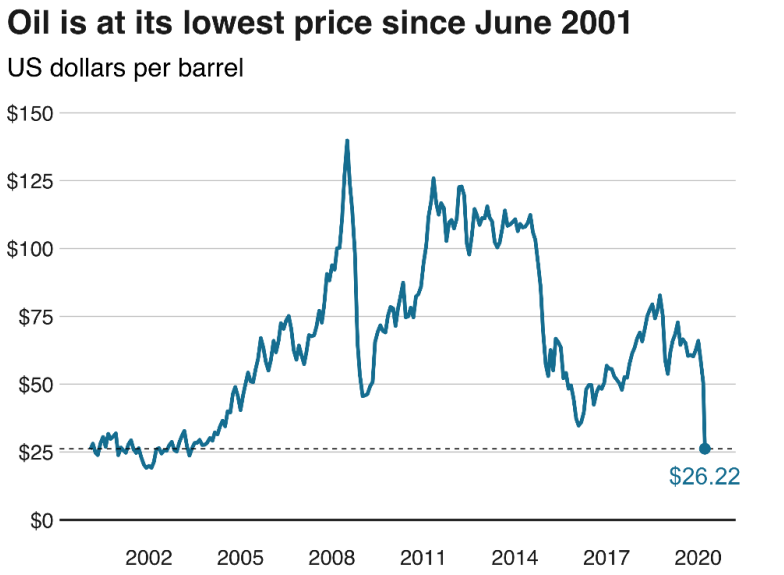
		excellence in patient care, education, research, public health, and prevention relating to infectious diseases.[164]
92.	**INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES**	International Society for Infectious Diseases mission is to support health professionals, non-government organizations, and governments around the world in their work to prevent, investigate, and manage infectious disease outbreaks when they occur. ISID has a particular focus in countries that have limited resources and which disproportionately bear the burden of infectious diseases.[165]
93.	**GBCHEALTH**	GBCHealth is a coalition of companies and organizations committed to investing their resources to make a healthier world for their employees, for the communities in which they work and for the world at large. GBCHealth serves as a hub for business engagement on the world's most pressing health challenges.[166]
94.	**GLOBAL HEALTH COUNCIL**	The Global Health Council (GHC), formerly the National Council of International Health, is a U.S.-based, nonprofit membership organization that was created in 1972 to identify priority world health problems and to report on them to the U.S. public, legislators, international and domestic government agencies, academic institutions and the global health community. GHC is the world's largest membership alliance dedicated to saving lives by improving health throughout the world. The Council works to ensure that all who strive for improvement and equity in global health have the information and resources they need to succeed.[167]
95.	**GLOBAL HEALTH TECHNOLOGIES COALITION**	The Global Health Technology Coalition (GHTC) is an advocacy organization consisting of a variety of stakeholders focusing on research and development (R&D) of new health technologies and promoting policies that will accelerate the development of new tools. **GHTC's focused on three core functions:** • Education: The coalition educates policy makers, the global development community, and other stakeholders about the importance of supporting

		global health R&D activities. • Advocacy: At the international level, the coalition works to ensure global leaders continue to keep R&D as a part of the global health conversation. Specifically, GHTC targets the WHO, United Nations, G7, G8, and G20 meetings. • Convening: The coalition works to bring together relevant stakeholders to build greater support for global health R&D. Member organizations exchange ideas and develop a shared advocacy strategy and policy position.[168]
96.	**BILL & MELINDA GATES FOUNDATION**	The Bill & Melinda Gates Foundation (Gates) is a funding organization based in Seattle, Washington USA. Guided by the belief that every life has equal value, this innovative group works to help all people lead healthy, productive lives. In particular, this foundation focuses on improving people's health and on giving them the chance to lift themselves out of hunger and extreme poverty. The valuable resources shared help empower people for success. The Bill & Melinda Gates Foundation works with organizations around the world that are using innovative methods to improve healthcare. The main mission is to help ensure that advances in health are created and shared with those who need them most. The three priority areas are to: • Discover new insights to fight serious diseases and other health problems affecting developing countries. • Develop effective and affordable vaccines, medicines, and other health tools. • Deliver proven health solutions to those who need them most.[169]

97.	**INSTITUTE FOR HEALTH METRICS AND EVALUATION (IHME)**	The Institute for Health Metrics and Evaluation (IHME) is an independent global health research center at the University of Washington that provides rigorous and comparable measurement of the world's most important health problems and evaluates the strategies used to address them. IHME makes this information freely available so that policymakers have the evidence they need to make informed decisions about how to allocate resources to best improve population health.[170]
98.	**ECONOMIC IMPACT ON WORLD ECONOMY**	 *(Source: https://www.weforum.org/agenda/2020/03/coronavirus-covid-19-cost-economy-2020-un-trade-economics-pandemic/)*  *(Source : https://www.bbc.com/news/business-51706225)* The World Bank and IFC's Boards of Directors approved today an increased $14 billion package of fast-track financing to assist companies and countries in their

efforts to prevent, detect and respond to the rapid spread of COVID-19. The package will strengthen national systems for public health preparedness, including for disease containment, diagnosis, and treatment, and support the private sector.

IFC, a member of the World Bank Group, will increase its COVID-19 related financing availability to $8 billion as part of the $14 billion package, up from an earlier $6 billion, to support private companies and their employees hurt by the economic downturn caused by the spread of COVID-19.[171]

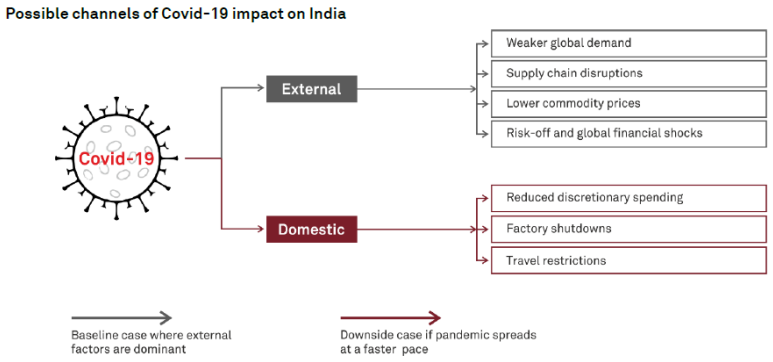
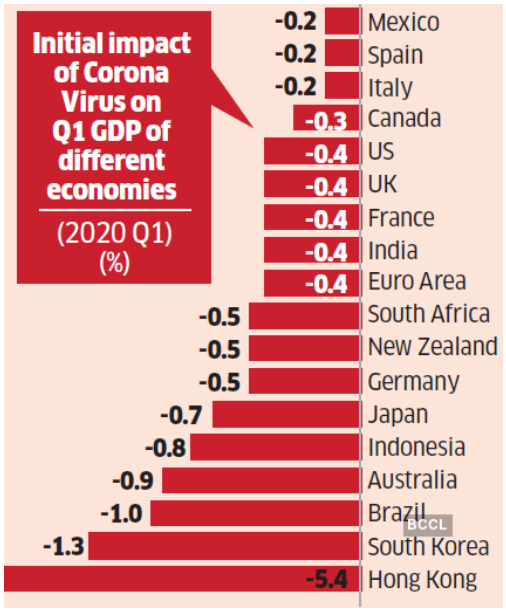


(Source : https://www.bbc.com/news/business-51706225)

(Source: https://www.bbc.com/news/business-51706225/)

		Apart from the tragic human consequences of the COVID-19 coronavirus epidemic, the economic uncertainty it has sparked will likely cost the global economy $1 trillion in 2020 according to the UN's trade and development agency, UNCTAD. One "Doomsday scenario" in which the world economy grew at only 0.5 per cent, would involve "a $2 trillion hit" to gross domestic product.[172]
99.	**ECONOMIC IMPACT OF COVID-19 ON INDIAN ECONOMY**	In India's case, three factors will lead to more problems during the economic slowdown. The first has to do with India's workforce pyramid, with 93% of over 400 million workers largely employed in unorganised and informal sectors. According to the Periodic Labour Force Survey data (2017-18), 93 million workers are engaged in casual work, comprising about a quarter of the total workforce. As Covid-19 wreaks havoc, the casual workers would be the worst affected.[173] Economists have warned that if India faces an out-of-control epidemic like Italy, for example, then the impact is likely to be more severe.[174] Adding fuel to this fire is the novel Coronavirus that is sending tremors down Indian trade markets dependent on China for imports. **Raw materials and spare parts** Nearly 55% of electronics imported by India originate from China. These imports have already slid down to 40% in light of the coronavirus outbreak and subsequent lockdown. As a countermeasure, India is considering the promotion of indigenous production in a bid to reduce dependency on a single market. Additionally, China is India's third-largest export partner for export of raw materials like organic chemicals, mineral fuels, cotton, etc.; and a lockdown of the countries is likely to lead to a substantial trade deficit for India. **Pharmaceuticals** The toll on the pharmaceutical industry is of significant concern for India, mainly as 70% of active

		pharmaceutical ingredients (API) are imported from China. These active pharmaceutical ingredients are essential to a large number of pharmaceutical manufacturing companies in the country. As COVID-19 is rapidly making its way through India, medication is going to be the number one consumer demand, and because there aren't nearly enough APIs to manufacture drugs, the subsequent traders and the market are witnessing skyrocketing prices. The prices of vitamins and penicillin alone already see a 50% surge. **Tourism** India is big on cultural and historical tourism, attracting domestic and foreign nationals throughout the year. It does not come as a surprise that a large number of confirmed COVID-19 cases in India include foreign tourists. But with visas being suspended and tourist attractions being shut indefinitely, the whole tourism value chain, which includes hotels, restaurants, attractions, agents, and operators is expected to face losses worth thousands of crores. Experts believe the tourism industry is likely to take a massive hit, and it could end up crippling the industry for the foreseeable future. **Aviation** After the Government of India indefinitely suspended tourist visas, airlines are said to be working under pressure. Nearly 600 international flights to and from India were canceled for varying periods. Around 90 domestic flights have been canceled, leading to a sharp drop in airline fares, even on popular local routes. Private airport operators have requested the Government to grant permission to impose a nominal passenger facilitation charge on airfares to cover the increased operating cost.[175]

		 *(Source : https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/03/the-covid-19-fallout.html)*  *(Source:https://economictimes.indiatimes.com/markets/stocks/news/indias-2020-q1-gdp-growth-may-fall-40-bps-on-covid-19/articleshow/74504635.cms)*
100.	**RESPONSE OF NATION-STATE AND MULTILATERAL LEADERS AND REPRESENTATIVES**	*"That is why today, I am calling for an immediate global ceasefire in all corners of the world. It is time to put armed conflict on lockdown and focus together on the true fight of our lives."* **UN Secretary General António Guterres** *"We envisage a slowdown in the global economy to under two per cent for this year, and that will probably cost in the order of $1 trillion, compared with what people were forecasting back in September,"* **Richard Kozul-Wright, Director, Division on Globalization and Development Strategies at UNCTAD.**

		*"There was a strong hope of (economic recovery) in the last quarter of the current fiscal. However, the coronavirus epidemic has made the recovery extremely difficult in the near to medium term."***The Federation of Indian Chambers of Commerce and Industry (Ficci)** *"There is actually an essential trade-off between flattening the curve, from the health policy perspective, and the consequent impact of that on the economy,"***Krishnamurthy Subramanian, chief economic advisor to the Indian government** *"The pandemic is accelerating… we need to attack the virus with aggressive and targeted tactics."* **Tedros Adhanom Ghebreyesus, Director General of the WHO** *"America will again and soon be open for business. Very soon. A lot sooner than three or four months that somebody was suggesting."* **President Donald Trump** *"Exercise restraint by staying at home and not stepping out as much as possible during the Coronavirus pandemic"* **Prime Minister Narendra Modi** *"Keeping in mind economic challenges arising out of Coronavirus pandemic, government has a decided to constitute COVID-19 Economic Response Task Force led by Finance Minister"* **Prime Minister Narendra Modi** *"Go home and stay home!"* **Prime Minister Justin Trudeau** *"I know the damage that this disruption is doing and will do to people's lives, to their businesses and to their jobs."* **Prime Minister Boris Johnson** *"We will continue to act decisively to developments as they unfold and fight this crisis,"* **Charles Michel, President of the European Council**

		"we continue to win time against this epidemic" **President Emmanuel Macron** *"Wuhan is a heroic city, and people of Hubei and Wuhan are heroic people who have never been crushed by any difficulty and danger in history,"* **President Xi Jinping** *"We would have seen many more cases outside China...if it were not for the (Chinese) government's efforts and the progress they have made to protect their own people and the people of the world,"* **Tedros Adhanom Ghebreyesus, Director General of the WHO**
101.	**Janata Curfew**	Addressing the nation, PM Narendra Modi made an appeal to people across India. He urged all countrymen to follow 'Janata Curfew' on Sunday, 22nd March, from 7 AM to 9 PM. PM Modi urged people not to move out of their homes on 22nd March. He also urged the state governments, organisations like the NCC and NSS, which are led by youth, civil society and other organisations to actively encourage citizens to follow 'Janata Curfew' and stay inside their homes.[176]
102.	**G-20 Response (Press Statement)**	An Extraordinary Virtual G20 Leaders' Summit was convened on 26 March 2020 to discuss the challenges posed by the outbreak of the COVID-19 pandemic and to forge a global coordinated response. Earlier, PM had a telephonic conversation with the Crown Prince of Saudi Arabia on this subject. The extraordinary G20 Summit was a culmination of the Finance Ministers and Central Bank Governors Meeting and G20 Sherpas Meeting on the COVID-19 pandemic. At the meeting, G20 Leaders agreed to take all necessary measures to contain the pandemic and protect people. They also supported strengthening of the WHO's mandate in the fight against pandemics, including delivery of medical supplies, diagnostic tools, treatments, medicines and vaccines.

		Leaders also committed to use all available policy tools to minimize the economic and social cost of the pandemic and to restore global growth, market stability and strengthening resilience. G20 countries committed to inject over USD 5 trillion into the global economy to counter the social and economic impact of COVID-19. Leaders also agreed to contribute to the WHO led COVID-19 Solidarity Response Fund on a voluntary basis. Prime Minister Modi thanked the King of Saudi Arabia for convening this extraordinary session of G20. In his remarks, PM noted the alarming social and economic cost of the pandemic, He added that 90% of the COVID-19 cases and 88% of deaths were in G20 countries even as they share 80% of world GDP and 60% of world population. He called on the G20 to come out with a concrete action plan to fight the global pandemic. PM Modi underscored the need to put human beings at the centre of our vision of global prosperity and cooperation, freely and openly share the benefits of medical research and development, develop adaptive, responsive and humane health care systems, promote new crisis management protocols and procedures for an interconnected global village, strengthen and reform intergovernmental organisations like WHO and work together to reduce economic hardships resulting from COVID-19 particularly for the economically weak. PM Modi called on the Leaders to help usher in a new globalization, for the collective well-being of humankind and have multilateral fora focus on promoting the shared interests of humanity. At the end of the Summit, a G20 Leaders' Statement was issued which called for a coordinated global response to fight the pandemic, adopting measures to safeguard the global economy, minimising trade disruption and steps to enhance global cooperation.[177]

103.	**Indo-Pacific Response (Press Release)**	Foreign Secretary Shri Harsh Vardhan Shringla participated on 20 March 2020 in a telephonic conference call initiated by U.S. Deputy Secretary of State Stephen Biegun for discussions among some countries in the Indo-Pacific region on issues related to countering COVID-19. The teleconference included senior representatives from Australia, the Republic of Korea, Vietnam, New Zealand, and Japan. The participants shared their assessments of the current situation with respect to COVID-19, and discussed ways to synergize their efforts to counter its spread. Foreign Secretary Shringla briefed the participants on the proactive steps taken by India both nationally and in the region under the Prime Minister's leadership. He conveyed India's desire to regularly share its perspectives with partners in the region and to work together with others to counter this challenge. The participants are expected to continue the conference call on a weekly basis, covering issues like cooperation on vaccine development, challenges of stranded citizens, assistance to countries in need and mitigating the impact on the global economy, etc.[178] The conference also included senior representatives from Australia, Korea, Vietnam, New Zealand, and Japan.[179]
104.	**SAARC Response (Press Statement)**	• In view of the continuing spread of COVID-19, now declared a pandemic by the World Health Organization (WHO), Leaders of the South Asian Association for Regional Cooperation (SAARC) convened via videoconference on Sunday, March 15, 2020, at the invitation of Prime Minister Narendra Modi. • The meeting enabled Leaders to share assessments of the current situation relating to this pandemic, consider best practices, and identify cooperative measures and approaches for each country to minimize and mitigate the spread of the disease while averting public panic and

		minimising possible economic impacts. Joining the Indian Prime Minister at this videoconference were Their Excellencies the Presidents of Afghanistan, Maldives and Sri Lanka; the Prime Ministers of Bangladesh, Nepal and Bhutan, the Minister of State for Health of Pakistan, and the Secretary-General of SAARC. • Leaders expressed appreciation for this initiative, recognizing the importance of regional cooperation in meeting this common challenge. As Prime Minister Modi underscored, the SAARC region could set an example to the world, for regional coordination to address complex cross-border challenges. He sugggested in this context the establishment of a SAARC Emergency Response Fund for COVID-19, with an initial US $ 10 million contribution from India. India also proposed follow-up discussions between medical professionals of the SAARC region, as well as trade and economic officials, to further assess the impact of this pandemic. India also offered to deploy its specially-constituted Rapid Response Teams of medical and other professionals, and testing equipment, to any SAARC partner country. Support was also offered for capacity-building including through online training modules, establishment of a repository of best practices of dealing with COVID-19 at SAARC Disaster Management Centre, and a website with information in each of the SAARC languages. India also offered to share its software for Integrated Health Information for Disease Surveillance. • Looking ahead, India also offered support by the Indian Council for Medical Research (ICMR) for a platform of SAARC States to share ideas for diagnostic and the therapeutic intervention for epidemics.

		• The Heads of State and Government of the SAARC countries welcomed these ideas and reiterated the value of continuing to work closely together against the COVID-19 pandemic.[180]
105.	**WHO Solidarity Fund**	Coronavirus disease (COVID-19) Solidarity Response Fund will raise money from a wide range of donors to support the work of the World Health Organization (WHO) and partners to help countries respond to the COVID-19 pandemic. The fund, the first-of-its-kind, enables private individuals, corporations and institutions anywhere in the world to come together to directly contribute to global response efforts, and has been created by the United Nations Foundation and the Swiss Philanthropy Foundation, together with WHO. Funds will go towards actions outlined in the COVID-19 Strategic Preparedness and Response Plan to enable all countries – particularly those most vulnerable and at-risk, and with the weakest health systems – to prepare for and respond to the COVID-19 crisis including rapidly detecting cases, stopping transmission of the virus, and caring for those affected.[181]

For further reading and information

- **ICMR VRDL Labs List**https://icmr.nic.in/sites/default/files/upload_documents/COVID_19_Testing_Laboratories.pdf

- **The Epidemic Diseases Act 1897**
https://indiacode.nic.in/bitstream/123456789/10469/1/the_epidemic_diseases_act%2C_1897.pdf

- **Doctor's Note: What does having the coronavirus feel like?**
https://www.aljazeera.com/indepth/features/doctor-note-coronavirus-feel-200323065512541.html

- **Coronavirus mutations: Much ado about nothing**
https://edition.cnn.com/2020/03/07/health/coronavirus-mutations-analysis/index.html

- **Government of India Ministry of Health & Family Welfare Directorate General of Health Services (EMR Division)**
  https://www.mohfw.gov.in/DraftGuidelinesforhomequarantine.pdf

- **Mining coronavirus genomes for clues to the outbreak's origins**
  https://www.sciencemag.org/news/2020/01/mining-coronavirus-genomes-clues-outbreak-s-origins

- **An updated guide to the coronavirus drugs and vaccines in development**
  https://www.statnews.com/2020/03/19/an-updated-guide-to-the-coronavirus-drugs-and-vaccines-in-development/

- **RNA vaccines are coronavirus frontrunners**
  https://www.chemistryworld.com/news/rna-vaccines-are-coronavirus-frontrunners/4011326.article

- **The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned?**
  https://academic.oup.com/ije/advance-article/doi/10.1093/ije/dyaa033/5748175

- **What coronavirus lockdowns have meant around the world**
  https://www.theguardian.com/world/2020/mar/18/what-a-coronavirus-lockdown-might-mean-for-london

- **Hand Hygiene: Why, How & When?**
  https://www.who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf

- **Coronavirus: sequencing the DNA of patients screened for coronavirus might save lives**
  https://theconversation.com/coronavirus-sequencing-the-dna-of-patients-screened-for-coronavirus-might-save-lives-133834

- **The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak.**
  https://www.ncbi.nlm.nih.gov/pubmed/32113704

- **The Global Economic Impacts of COVID-19**
  https://www.csis.org/analysis/global-economic-impacts-covid-19

- **Live Tracking of COVID-19 Cases and Casualties**
  https://www.worldometers.info/coronavirus/

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The defining feature of VIF lies in its provision of core institutional support which enables the organisation to be flexible in its approach and proactive in changing circumstances, with a long-term focus on India's strategic, developmental and civilisational interests. The VIF aims to channelise fresh insights and decades of experience harnessed from its faculty into fostering actionable ideas for the nation's stakeholders.

Since its inception, VIF has pursued quality research and scholarship and made efforts to highlight issues in governance, and strengthen national security. This is being actualised through numerous activities like seminars, round tables, interactive dialogues, Vimarsh (public discourse), conferences and briefings. The publications of VIF form lasting deliverables of VIF's aspiration to impact on the prevailing discourse on issues concerning India's national interest.

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