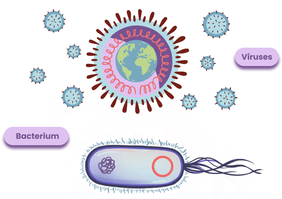
Viruses vs. Bacteria

Viruses and bacteria are both pathogens but their biology is very different. Bacteria are living cells that carry out biological processes, such as copying their DNA, making proteins, and metabolizing. Viruses are not cells that carry out these processes and therefore are not considered even"alive" (This is an ongoing debate). Viruses must infect cells in order to reproduce. They can be thought of as parasites that take over cells, and then turn these cells into virus-making factories.

These differences are why antibiotics can not kill viruses. Some antibiotics work by damaging bacterial cell structures. Since viruses are not cells, they do not have cell structures. Other antibiotics work by targeting important cellular processes needed to keep the cell alive, such as copying DNA or making proteins. Since viruses do not do this on their own these antibiotics won't stop their reproduction.



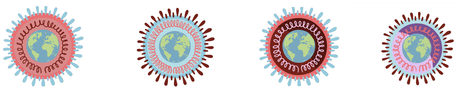
Terminology

COVID-19 stands for "coronavirus disease 2019." It is the current name used to describe the symptoms associated with the illness caused by the new coronavirus SARS-CoV-2 which stands for "severe acute respiratory syndrome coronavirus 2."

In Latin, "corona" translates to "crown." Coronaviruses have a unique pattern of proteins on their surface, which they use these to attach to cells. These proteins look like a "crown" around coronaviruses.

SARS-CoV-2 is in the same family of viruses that caused the SARS ("severe acute respiratory syndrome") outbreak in 2002-2003.

The genome (DNA or RNA) of a virus can change, or mutate, over time. Viral genomes can mutate quite frequently compared to human genomes. Mutations lead to variants, or different strains, of viruses. Sometimes mutations allow a virus to change which host it can infect, and to move from animals to humans. Coronaviruses linked to outbreaks like SARS, MERS (Middle East Respiratory Syndrome), and COVID-19 originated in animals as well. Mutations in their genomes then allowed these viruses to jump to humans.



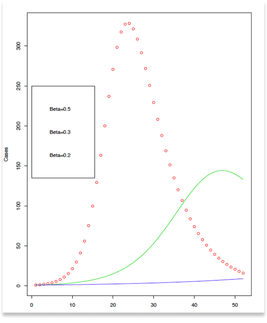
Mutating Viruses

Mutation Rate (...)

Immunity

Immunity is protection a person has from a pathogenic illness. This protection relies on the immune system knowing how to fight off the pathogen that causes the illness. Immunity is acquired through infection or through vaccination.

As mentioned before, some viruses mutate quickly and form new strains. This change in DNA can mean that the viruses become different enough so that the immune system cannot defend itself against them. The immunity from the first infection was only specific to that first strain, and may not work against mutated strains.

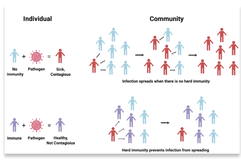


Infectiousness tells us how easily a virus spreads from a sick person to a healthy person.

Deadliness tells us how likely a pathogen is to cause death.

Infectiousness

Deadliness



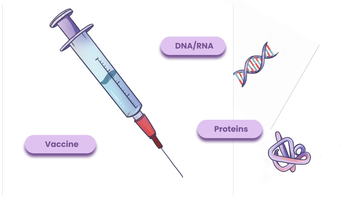
Herd Immunity

Herd immunity is when a majority of the people in a community are immune to an infection. This stops a pathogen from spreading and protects even people without immunity since they are less likely to get exposed to the pathogen. Herd immunity develops as people recover from the infection, or through vaccination.

What is a vaccine, when does one get vaccinated?

Vaccines are effective in protecting an individual from a pathogen. They provide immunity to an individual, so that if exposed to a pathogen you will not get infected and fall ill. However, a vaccine is not possible for all pathogens or it might not provide complete immunity. If a virus mutates very quickly, it can make the development of a vaccine more difficult. The vaccine has to account for the frequent changes in the genome to be effective. That is why there is a flu shot for every flu season.

Even though you can get immunity through the disease itself, vaccination is preferred to prevent people from getting sick. For example, this is why you will get a vaccine as a young child against Tetanus, which is very deadly. Here you will get vaccinated early on and renew the vaccination every 5-10



What's in a Vaccine?

A vaccine is a biological preparation that provides immunity to a particular infectious disease. A vaccine typically contains a component that resembles a pathogen and is often made from weakened or killed forms of the pathogen, its toxins, or one of its surface proteins. The goal of a vaccine is to train the immune system to learn how to fight off an infection.

An alternative form of vaccine for some viruses can contain the virus's genome, like DNA. This DNA is used by human cells to make viral proteins. The immune system then attacks these viral proteins the same way it would attack the real virus. This means the immune system has now developed the antibodies against that specifife virus to fight off the virus in the future.

Vaccine Development

There is an urgent need for a vaccine against SARS-CoV-2, but the development of vaccines usually takes several months if not years. The reason for that is that each vaccine has to go through clinical trials which test both the effectiveness and safety of a vaccine. This includes trial runs on a sample population. For more information, click right on Biorender!

The good news is that there are several vaccines in development for SARS-CoV-2. In addition, scientists are working on treatment methods. This would not prevent the infection, but lower the deadliness or the symptoms when sick.

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Vaccines